

A
DICTIONARY
OF
PRACTICAL SURGERY,

COMPREHENDING

ALL THE MOST INTERESTING IMPROVEMENTS, FROM THE EARLIEST
TIMES DOWN TO THE PRESENT PERIOD;

AN ACCOUNT OF THE INSTRUMENTS AND REMEDIES EMPLOYED IN
SURGERY;

THE ETYMOLOGY AND SIGNIFICATION

OF THE

PRINCIPAL TERMS;

AND NUMEROUS REFERENCES TO ANCIENT AND MODERN WORKS,
FORMING A CATALOGUE OF SURGICAL LITERATURE, ARRANGED ACCORDING
TO SUBJECTS

THE SEVENTH EDITION.

REVISED, CORRECTED, AND ENLARGED.

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BENCH; ETC. ETC. ETC.

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PREFACE

TO THE

SEVENTH EDITION.

THE utility of this DICTIONARY to students, and all classes of medical practitioners, has obtained for it in this country a larger share of patronage than perhaps was ever conferred upon any other book of surgery; while its translation into the French, German, and Italian languages, and several republications of it in America, may be taken as proofs of its being deemed worthy of considerable notice in various other parts of the world. Speaking of the opinion, entertained of this compendium of surgical knowledge in the United States, Dr. Reese observes:—"It has long been esteemed a standard work, is adopted as a text-book in our Universities, Colleges, and Schools of Medicine generally, and finds a place in the library of every surgeon in the country." (*Pref. to Amer. Ed.*) The diligent and enlightened Germans were not only the first to undertake and complete a translation; they have bestowed still greater attention upon my humble endeavours to promote the cultivation and diffusion of surgical science; for they have followed up their translation by a series of well-executed engravings, expressly designed to illustrate the nature of the diseases, accidental injuries, and curative methods, treated of in this Dictionary. (See *Chirurgische Kupfertafeln*, 4to. Weimar, 1820—1829.) Of these valuable plates, the publication of which I regard as an honourable compliment to my surgical labours, many numbers have been brought out at an extremely moderate price; and it is with real pleasure that I recommend them to the notice of every surgeon who is a German scholar, as being one of the most useful collections of surgical and pathological plates ever offered to the profession.

In preparing this edition, which comprehends an account of all the principal modern improvements in surgery, I have conscientiously endeavoured to deal fairly and impartially with every individual, whose name I have had occasion to mention, whose suggestions form subjects of consideration in the ensuing pages. My aim has been truth, wherever I could find her; and in every situation, where any glimpse of her beautiful figure presented itself, I have ardently courted her, regardless of the name, school, or country on which she might deign to shed her glory. By steadily adhering to this principle; by zealously marking what the book of nature and the field of experience unfolded; by renouncing all obsequious submission to every other kind of authority; and by taking the liberty of sometimes thinking and judging for myself; I trust, that the most likely plan has been adopted of maintaining the character of this book, and raising my own reputation.

In particular, it affords me peculiar gratification to have had an opportunity, in this seventh edition, of bringing under the notice of British surgeons the meritorious transactions of their brethren in the United States, where the same zeal for the advancement of surgery, and the same just estimate of its value to society, are exemplified as in the mother country. In operative surgery, the surgeons of no nation have exceeded them in decision, coolness, enterprise, and boldness; and however doubtful I may individually be, respecting the real good likely, on the whole, to result to mankind from certain extraordinary achievements with the scalpel, which, as will be seen in the course of this work, have been performed in America, I give the surgeons of the United States, as I do to many surgeons in my own country, France, and Germany, who are smitten with the love of similar proceedings, the credit of being actuated by the zealous hope of being able by such means to extend the efficiency of surgery to cases of the most desperate kind. Far be it from me to censure, or discourage, these performances, if kept within the limits prescribed by reason and moral considerations, and not applied to examples in which the chances of a natural cure, poor as they may be, are at least equal to those presented by the operation itself, and which, if it fail, is sure to bring the life of the sufferer to an abrupt termination. Here a very severe and perilous operation, at all events, can only be justified on the principle, that the agony which the patient is enduring from the disease, and must continue to endure, if the operation be not attempted, makes his life, in this condition, of no real value. Let me hope, that the enthusiasm for operations (the art of performing which may be acquired by any one who has nerves of the right kind, and is a good anatomist, in a very short time) will not lead to the neglect to become acquainted with the more common duties of the surgical practitioner; nor to the omission to study profoundly all the leading rules and principles of surgery. It is likewise to be hoped, that it will not occasion any forgetfulness of the vast importance of medical surgery, by which the necessity for mutilating the human body may often be completely obviated. It is also my sincere prayer, that the present increasing rage for operations may never throw into the shade the various physiological and pathological views of the whole subject of surgery, without which it would immediately descend to the rank of only a mechanical art, instead of meriting the name of a science.

* This edition will not only be the means of diffusing the knowledge of what has been done in operative and other parts of surgery by European and American surgeons, but it will prove that, however right Dr. Reese may have been in complaining of my not having formerly done full justice to the surgeons of the United States, it was not from any desire on my part to keep their transactions concealed, but simply from the fact, that I did not then possess the information, that has since reached me, of their praiseworthy exertions.

In bringing out this Dictionary in its present state of improvement, I beg to declare myself deeply indebted to the surgeons of almost every country; but especially to those of Great Britain and Ireland, France, Germany, Italy, and the United States. For many valuable communications I feel obliged to Sir Astley Cooper, Sir Benjamin Brodie, Mr. J. G. Crosse, M. Velpeau, Professor Regnoli, my colleague Professor Quain, and my esteemed and talented pupil Mr. Thomas Morton, of University College. The doctrines and practice of the

celebrated Dupuytren I have explained and considered with all the attention which so high an authority deservedly claims; and I will add that, as many of his observations appear to me the best ever delivered on certain parts of surgery, the introduction of them into this extensively circulated book may be an important advantage to the profession and the public. The following estimate of the character of this Dictionary is from the pen of Dr. Reese:—

“As, in every species of human science, our highest attainments are but an approximation towards perfection, so in the science of surgery, each succeeding year demonstrates, that all that is known of the principles, or practice of our art, is but the prelude to still higher exhibitions of science and skill, alike honourable to the profession, and valuable to the cause of humanity. To condense and arrange all the novel and interesting facts, which clinical experience is furnishing, and upon which alone the edifice of true science can be erected, is a task worthy of the immense labour which Mr. Cooper has bestowed on each succeeding reprint of his Dictionary, and one to which he has proved himself entirely adequate. The extensive and multiplied resources, to which he has access, furnish him with facilities possessed by few; and in availing himself of these, he has exhibited an industry, and, for the most part, an impartiality, worthy of all praise.”

According to my usual plan, I annex the notice of a few things, which were either inadvertently omitted in the articles to which they relate, or communicated to me after such articles had been printed.

S. COOPER.

Woburn-Place, Russell Square.
Nov. 12. 1838.

A D D E N D A.

AMPUTATION. The following notice I find in *Reese's American edition of this Dictionary*. The proposed operation, I apprehend, will be objected to, as far more painful and tedious than the flap-amputations, commonly performed at University College Hospital:—

[A mode of amputating the thigh with two flaps (observes Dr. Reese) was proposed a few years since by Professor J. B. Davidge, of the University of Maryland, which combines several important advantages.

The first incision is made with the large knife on the outside and inside of the thigh through the integument, so as to surround the limb, with the exception of an inch or more in the centre above and below. The surgeon having calculated the size of the flaps required, which are to be as long as the semi-diameter of the limb, makes with a scalpel a second and third incision through the skin, in form of the letter V, commencing above the centre of the space left vacant on the superior and inferior surface, and continued until its diverging extremities reach the ends of the semicircular cuts first mentioned. The flaps of integument are then dissected back until they equal in length a little more than the semi-diameter of the limb, to allow for the retraction that may occur. A circular incision is then made through the muscles down to the bone with the large knife. The bone is then denuded for an inch or two, the retractor employed, and the bone sawn off at the edge of the divided flesh. The arteries are then secured, the muscles drawn down, the ligatures so arranged as to come out of the superior and inferior angles of the wound, and the flaps are brought together and kept in place by adhesive straps, supported by a cross bandage, roller, &c. By this amputation the bone is cut off an inch or more within the actual face of the stump, and the flaps of integument having the angle cut out above and below, do not present that unnecessary and inconvenient lump or puckering, formed at the angles after the common circular amputation. I have seen this operation performed by Dr. Davidge and others, with singular success. The stump heals by the first intention, without any of the delays which are often encountered with the common flap-operation; and I prefer it for the arm as well as the thigh, unless the limb be much emaciated. *Reese.*]

In flap-amputations of the leg, it appears to me, that the anterior flap of integuments should be made longer, and the posterior flap of the integuments and muscles of the calf, about one third shorter than is generally done. By this

means, the front of the tibia will be better covered, and the frequency of exfoliation diminished; while there will also be the advantage of the surface of the wound being considerably lessened below, where matter is disposed to form and lodge.

In the United States, amputation of the upper jaw was first performed by Dr. David L. Rogers, of New York. (See *OSTEOSARCOMA*.) Amputation, or excision of the clavicle, was there performed for the first time by Dr. Mott, in 1829. In the twenty-first volume of the *Med. Chir. Trans.* are the particulars of a similar operation executed by Mr. Travers. Other cases I have noticed in the article *BONES, EXCISION OF*. In Mr Travers's case, the operation was performed on account of a tumour of the clavicle. "A crucial incision was made through the integument and platysma myoides, one limb of which was nearly in the line of the clavicle, and the other at right angles; and the flaps and fascial coverings successively dissected down to the external basis of the tumour. The pectoralis and deltoid muscles were then carefully detached from their clavicular origin, avoiding the cephalic veins, and the fibres of the trapezius and cleido-mastoid muscles divided on a director. One considerable vessel, in the situation of the transversalis humeri, required a prompt ligature. The circumference of the tumour was now well defined, though it was found to be firmly imbedded, and adherent on its posterior aspect. Disarticulation of the scapular extremity of the bone was next effected without difficulty; and the mobility, thus communicated to the mass, facilitated the completion of the operation. A director was now worked beneath the bone, as near to the sternal articulation as was practicable, and, with a pair of strong bone nippers, thus introduced, it was completely and clearly divided. The subclavius muscle, and a part of the rhomboid ligament, were now detached from the tumour, and the mass being well raised by an assistant, while the edges of the wound were kept wide apart by metallic retractors, the cervical prolongations of the tumour were separated from their remaining connections by a few touches of the scalpel, without injury to the subclavian vessels." The loss of blood did not exceed twelve ounces. The case terminated so favourably that there was scarcely any falling forward of the shoulder, nor any restriction of the motions of the arm. The young gentleman elevates it perpendicularly over his head, extends it horizontally, carries and rotates it behind the trunk, and performs the same extent and variety of circumduction, and with equal promptitude and power, as the parallel movements of the opposite

atm. The production of bone, from the truncated sternal extremity of the clavicle, extends at least two inches, and terminates beneath the centre of the cicatrix in a firm ligamentous band, adherent to the skin. (See *Med. Chir. Trans.* vol. xxi. p. 135; &c.)

ANCHYLOSIS. On this subject, I meet with the following observations in *Reese's American edition of this Dictionary*:—

[A highly interesting operation has been performed by Professor Mott, for the cure of permanent anchylosis, or rather "immobility of the lower jaw," which had existed for ten years. A report of this case is published in the *American Journal* for Nov. 1829; but as the disease and operation are of so novel and interesting a character, Dr. Mott, at my request, has politely furnished me with the following description of the case, which cannot be unacceptable to the profession, and I therefore insert it here:—

"A young man, twenty-one years of age, from North Carolina, called, with the lower jaw almost immovably fixed to the upper. No motion in a downward direction could be discovered, nor was the most powerful effort with the hand upon the chin able in the slightest degree to alter its situation. He had been in this deplorable state for ten years. Unable to chew a mouthful of food, or even open the jaws for its reception, his food had to be introduced through a small opening, occasioned by an irregularity of the bicuspid teeth on the right side. On the left side, just within the angle of the mouth, a very firm band, of more than ligamentous hardness, was to be seen and felt, reaching from this point along the alveolar ridge to the coronoid process.

"Along the whole course of this adhesion to the gum of the lower jaw, there was not a vestige of a tooth, and he stated that from this part the jaw had been formerly separated, with the teeth attached to it. This morbid adhesion had been several times freely divided; it was cut from within the mouth in different directions, but never permitted the least motion of the jaw.

"From the circumstance that he could give a little lateral motion to the jaw, I thought that his mouth might yet be opened, and the deformity removed. I then made an incision from the angle of the mouth on the left side through the cheek, nearly to the coronoid process, dividing the firm cicatrix within completely. The jaws being relieved by dividing all the adhesions between them, a piece of very broad tape was placed between the teeth by a probe and spatula, and tied some distance below the chin. To the loop thus formed I applied all the strength I could command, but not the least yielding of the jaw could be discovered.

"I then applied the principle of the screw and lever, by an instrument prepared for the purpose, composed of two steel plates about three inches in length. When applied to each other, they were of a wedge-shape. To the large end was attached a screw, which, when turned, caused the thin extremity of the plates to expand. This instrument enabled me to open the mouth completely.

"With considerable difficulty this vice was insinuated between the range of teeth of the left side, and along their whole course. It was then secured, by turning the screw; and such

was the report that attended the yielding of the lower jaw, that several present thought it was broken, but the noise was like that attending the laceration of ligaments rather than such as attends the fracture of a bone. The mouth was immediately opened to a sufficient extent.

"The wound was closed with the interrupted suture and adhesive plaster; to prevent the adhesion of the cheek to the jaws internally, pieces of sponge were interposed. The patient was enabled to chew his food, and to converse and articulate distinctly, as the result of the operation; and he entirely recovered."

Dr. Mott has since repeated the operation, with the same success, on a gentleman from Louisiana.

In the *North Amer. Med. and Surg. Journal* for April, 1828, Dr. J. Rhea Barton has published a most successful operation performed on a case of anchylosis at the hip-joint, attended with very great deformity, after it had existed for more than eighteen months. The object of the operation was to substitute an artificial joint for the loss of the natural articulation at the hip, and it is most honourable to Dr. Barton, and alike gratifying to the profession and to humanity, to record, that it has been most completely successful. An abridged account of this novel and most interesting exhibition of consummate surgical skill is given in the Appendix to the late Philadelphia edition of *Cooper's First Lines*, of 1828. It was performed on a sailor at the Pennsylvania Hospital, in Nov. 1826. (See **ANCHYLOSIS**.)

In Dr. Francis's edition of *Denman's Midwifery* is described a peculiar affection of the hip-joint, in some respects novel and important. It is in effect an anchylosis, and is denominated "a displacement of bone without fracture or dislocation," inducing a morbid change in the form and cavity of the pelvis, such as might wholly defeat the process of natural labour. The patient, an adult subject, fell on the right hip; the injury done to the external parts was comparatively slight; but an inflammatory action took place in the bottom of the acetabulum, which caused total absorption of the bone, and the protrusion of the head of the thigh-bone itself into the cavity of the pelvis. Nor was the diseased action limited to these changes; large deposits of osseous matter were made within the pelvis surrounding the absorbed acetabulum; and the head of the thigh-bone was by the same material augmented to more than double its original size. The neck of the bone and also both trochanters were considerably increased in bulk. The capacity of the pelvis was diminished about two inches in its superior and lateral portion.—*Reese.*]

ANEURISM. With respect to Brasdor's method of operating for certain aneurisms, Dr. Reese introduces the annexed observations:—

[In the *Medical Repository* for 1823, vol. vii. No. 4. p. 404., Dr. David L. Rogers, then resident surgeon of the New York Hospital, has published a paper, entitled, *Observations on Aneurisms*, in which this operation is contended for as being applicable to the carotid artery, and to this alone. He is wrong, however, in giving the projection of this operation to Desault; for, although it is described in his works by Bichat, yet it was proposed by Brasdor. And as this seems to be a controverted point, I have taken some pains to trace the

progress of this improvement, and find that the operation was first proposed by Brador nearly half a century ago; so that the projection of the plan unquestionably belongs to him. Bichat next gave directions for its performance in his edition of Desault, and here the error of Alphon Burns probably originated, which has been since repeated by so many. Deschamps was the first who performed the operation in a case of femoral aneurism; then Sir A. Cooper repeated it on the external iliac; then Mr. Home's case occurred: all of which were unsuccessful. Mr. Wardrop's first trial of it for a carotid aneurism was made in 1825, by tying the vessel on the anti-cardial side of the sac, with complete success. Mr. Wardrop's second trial was not so fortunate, and, as will be perceived, it is questioned whether the artery was tied at all. Mr. Lambert next operated (as will be seen in this article) without success; and Dr. Bushe and Dr. Evans's cases were the only successful instances I can find, so that the former of these is the second; and the latter the third, in which Brador's method has succeeded. Dr. Mott's case is therefore the fourth successful instance on record, and certainly the only one in which it has been attempted in America. So much light has been elicited on this dark subject by the cases alluded to, that there can be little doubt that the operation on the distal side of the aneurism will now rescue from the grave many valuable lives, which would otherwise be lost to the world, and abandoned as beyond the resources of our art.—Reese.]

Subsequently to the period when the article ANEURISM was corrected, Mr. Liston, in a case of subclavian aneurism, situated very close to the outer edge of the right scapular anticus, took up the right subclavian and right carotid at their origins; by which measure it was hoped, that the innominate would become completely plugged up with coagulated blood, and the former vessels have a better chance of being permanently closed, than if a ligature had been applied to the much larger vessel, the innominate itself. The suggestion was made by Mr. Quain. In fact, previously to the patient's death from hemorrhage, on the tenth day after the operation, the innominate became perfectly blocked up with solid blood; the ligature had come away from the carotid, and was found lying loose in the wound, with the two orifices of the artery above and below separated by an interval of more than an inch, and permanently closed. The ligature on the subclavian had not separated; but the root of that vessel, on the side towards the heart, was closed; and the hemorrhage had taken place from an ulcerated opening in the portion of the artery on the distal side of the ligature. My friends, Sir Astley Cooper, Mr. Vincent, and some other surgeons of great experience, have noticed that, when secondary hemorrhage occurs, after operations for aneurism, it is most frequently produced by ulceration of the vessel on the distal side of the ligature.

The following passage I find in the *American edition of this work*:

[In cases of aneurism of the thigh, it is not always practicable to decide with absolute certainty whether the disease is situated in the femoral artery, or in the profunda; and even when it obviously originates with the former, the latter is often deeply involved, particularly when the disease has been of long standing. Many un-

successful cases have been reported; and I know of one which has failed in the hands of a distinguished surgeon, the aneurismal tumour still remaining, although the femoral artery was tied above the tumour. In this case the disease is, no doubt, seated in the profunda.]

Many surgical writers and teachers have inculcated the doctrine, that, when the aneurism is situated in the thigh, the ligature must always be applied below the bifurcation, lest the circulation of the limb should suffer. A distinguished surgeon of Philadelphia preferred opening the sac of a femoral aneurism, and applying his ligature below the profunda, rather than venture to tie the artery higher up. The operation failed, however, and the tumour still remains. That such fears are wholly groundless, may be confidently asserted from analogy, furnished as we are with the knowledge that the innominate, the common iliac, and even the aorta itself, may be obliterated, and yet the anastomosing vessels continue the circulation. But Dr. Whitridge, an accomplished surgeon of Charleston, S. C., has afforded a demonstration in a case of aneurism in the thigh from a gun-shot wound, in which he tied the femoral artery just below Poupert's ligament, and of course above the point at which the profunda goes off. This case has been completely successful, and the patient recovered without any sensible interruption in the circulation, and without any untoward symptoms.

The cases in which the femoral artery divides high up, which Professor Godman has shown are by no means unfrequent, may account for the occasional failures of this operation, and should not be lost sight of by the judicious surgeon. As a general rule, however, applicable to all other cases, when the aneurism is situated immediately below the bifurcation, and in the vicinity of the profunda, it is safer, and also better surgery, to apply the ligature above. The action of the profunda may endanger the success of the operation, and the most profound surgeon may sometimes mistake the seat of the disease.—Reese.]

Besides the examples of ligature of the internal iliac, referred to in the present work, I find another, in which this operation was successfully performed, for the cure of a gluteal aneurism, by Professor White the younger, of Berkshire Med. Institution, in the United States. This case, which is alluded to by Dr. Reese, is published in the second number of the *American Journ. of Medical Science*.

According to Dr. Reese, Professor Bushe tied the common iliac, in a child less than two months old, for a congenital aneurism of one of the labia. The child recovered from the operation, but perished a few weeks afterwards from abscesses of the knee-joint.

With regard to axillary aneurisms, it appears that Professor Gibson (to whom I am under great obligations for several favours) cured a case of this description, occasioned by the reduction of an old luxation of the humerus, by tying the subclavian artery. (*American Journ.* vol. ii. p. 136.)

The particulars of Mr. Perry's example of varicose aneurism in the thigh are published in vol. xx, of the *Med. Chir. Trans.* When I the patient with Mr. Perry, in the St. Mary-lebone Infirmary, I expressed my belief, that the symptoms indicated a communication between the

femoral artery and vein. I mention this, as it is not stated in Mr. Perry's paper.

On the subject of carotid aneurism, Dr. Reese informs us, that the late Dr. Bushe tied the common carotid for the cure of an aneurism, situated in the *foyces*, with complete success; and he adds, that "Professor Pattison, when resident in Baltimore, cured an immense aneurism of the internal maxillary by tying the trunk of the carotid. I witnessed this operation, and saw the successful result." (See *Amer. edit. of this Dict.* part i. p. 140.)

From some remarks, contained in the article ANEURISM, it will be seen, that apprehension is sometimes entertained, that, though one carotid may be tied without dangerous disturbance of the functions of the brain, the ligation of both carotids would produce such consequence; yet Mr. Liston's late operation on the roots of the right subclavian and carotid, proves that suddenly cutting off the direct supply of blood to the brain, through the carotid and vertebral arteries of one side, does not have this dreaded effect.

In relation to the practice of tying an artery on the distal side of an aneurism, Dr. Reese observes, that "It affords me high gratification to record, that Professor Mott, of New York, has lately performed this operation for the first time it has been attempted in America, by tying the carotid artery for aneurism of the arteria innominata, involving the subclavian and root of the carotid. This is the first time in America in which aneurism has been treated by tying the artery on the anti-cardial side of the tumour. The report of the case, and its successful result, is contained in the *American Journal of the Medical Sciences*, No. x. for February, 1830. Since that report was published, the patient has died, and the tumour having been removed, fully establishes the success of the operation. I have had an opportunity of examining the preparation, and found the carotid carefully obliterated and impervious above the aneurismal sac, although the ligation was applied very high on that vessel. The death was occasioned by the displacement and distortion of the trachea and larynx, which are seen lying on the side of the neck, and in no wise connected with the operation, but was the consequence of the long existence of the disease before the operation was submitted to."

Reese.

Since the article aneurism was printed, the arteria innominata has been tied by Mr. Lizars; but with the same unfortunate success, as has followed all other examples of this operation. Under these circumstances, ought the practice to be continued? I think not, especially with the evidence in favour of tying the carotid. See ANEURISM.

ANUS, ARTIFICIAL. Alf. Velpeau, *Mém. sur les Anus contre Nature dépourvus d'Épéron*, &c., 8vo. Paris, 1836.—In this tract, several cases are detailed, explaining a new operation for such cases. In one of them, in which M. Velpeau was assisted by Dr. Mott, the whole fistula was inclosed within an ellipsis, in order to accomplish the excision of it by means of a double semi-lunar incision, but extending obliquely from the sides towards the centre, and so as not to implicate the bowel, or, at all events, its mucous membrane. M. Velpeau then introduced four sutures, two lines apart, with the precaution not to let them enter the abdomen or the intestine. Then an

incision, two inches and a half long, was made through the skin, subcutaneous cellular tissue, and aponeurosis of the external oblique muscle on each side, and about twelve or fifteen lines on the outside of the wound. The parts having been well washed, the threads were tied, and a dossil of lint placed in the lateral wounds to keep their edges asunder, until the other dressings were applied. Thus M. Velpeau's plan is to leave the deep or intestinal circumference of the fistula untouched; to pass the threads without touching the bowel; to make a long incision on each side of the fresh cut surface of the fistula, an inch or two from it; to apply dressings which make no pressure on the abdomen; to give an aperient every evening; and to restrict the patient to low diet.

ARTERIES.—"Professor Jamieson, of Baltimore, in a valuable paper on traumatic hemorrhage, published in the *American Med. Recorder* for January, 1829, has detailed a number of experiments performed on inferior animals, in some of which he passed a seton through large vessels, with a view of obstructing their circulation, and thus effecting their gradual obliteration. His success was certainly encouraging; and Dr. Webster, of Philadelphia, has repeated these experiments with similar results. The latter gentleman, in the late Philadelphia edition of *Cooper's First Lines*, has introduced some highly interesting and practical remarks on this subject, in a note on the subject of aneurism; to which reference may be had, as containing hints of the most invaluable importance.

"Future experiments, however, will be necessary to enable the surgeon to arrive at definite conclusions on this most interesting subject."—Reese.

ARSENIC. In the last edition of this work, the remarks on this deleterious substance were less copious than in the present. Dr. Reese, in his notice of what I formerly stated, observes "There can be little doubt, that arsenic is the basis of the active ingredients of most of the popular nostrums of the day which are set forth in our public papers as infallible remedies for the cure of cancerous affections, as they are termed; and hence the manifold evils which we often witness from such practice. So long ago as in 1786, Dr. Rush favoured the public with an exposition of the nature of the famous cancerous powder of Dr. Martin; its base was arsenic; though, like the specifics of our own time, it was alleged to be of a vegetable nature. The consequences arising from applications of this character might be noticed at greater length than our author has seen fit to do; and the caution to be deduced from facts of this sort might operate more forcibly if they were better understood. The external application of arsenic ought to be had recourse to only after the severest scrutiny into the peculiar character of the case and constitution affected. Even in small quantities it has produced apoplexy, mental aberration, organic lesion of the stomach, paralysis, loss of motion, enlargement of the joints, fatal petechiæ, &c. Arsenic, in fact, may be enumerated among that class of poisons which induces nearly the same effects externally applied as well as when taken inwardly. The experiments of Brodie, as well as those of other philosophers, demonstrate, that its influence on the system is no less rapid and dangerous when had recourse to as an external application to denuded surfaces than when applied

directly to the stomach. Another peculiarity of its action deserves also farther to be stated: According to Professor Francis (*Lectures on Forensic Medicine*), in some cases, even while favourable anticipations from the operation of this powerful agent locally applied are indulged, of a sudden the general health yields, and death ensues rapidly and unexpectedly; an occurrence of much consideration in the investigations of the juridical physician." (Rees.)

BONE, ATROPHY OF. *Obs. on some of the Forms of Atrophy of Bone*, by Thomas Blizard Curling. — Local atrophy is generally the result of pressure, or friction, as exemplified in the effects of aneurism, and other tumours on the bone, and in the change taking place in the size and shape of the head of the dislocated humerus, if not reduced. Of such alteration, there are some excellent specimens in University College Museum. Mr. Curling notices also the local atrophy of bone from mechanical injury, and refers to the two thigh-bones signed by Cheselden, in his *Osteographia*, taken from the body of a soldier, who had been shot in the right groin, and died soon afterwards of dropsy. The right femur is represented as much wasted, and to have been less than half the weight of the other.

The author likewise adverts to the atrophy of bones consequent to a suspension of their functions; and to that induced by deprivation of the nervous influence, as sometimes exemplified in cases of injury of the spinal cord. Mr. Curling adduces instances of these facts, and refers to a case, recorded by Mr. Travers, in which the union of a fractured leg, that was paralysed from a fracture of the lumbar vertebra, failed to proceed, whilst a broken humerus in the same patient united perfectly in the usual period. (*On Constitutional Irritation*, vol. ii. p. 436.)

Although the ligation of the femoral artery in a fracture of the leg complicated with hemorrhage, is well known not to interrupt the nutrition of the bone, or the union of the fracture (see FRACTURES; and Travers, *Op. cit.* p. 436); yet, it appears from Mr. Curling's investigations, that, if the supply of blood to a bone by its nutrient artery be obstructed, a species of atrophy will ensue. Thus, in the thigh-bone, if fractured below the entrance of this artery, the walls of the portion of such bone below that point will be found thinned, and the cancelli expanded. Such change, however, is not observed in bones recently fractured, nor in those long united, nor in bones fractured during the period of growth. Mr. Curling concludes with some interesting remarks on fracture of the neck of the femur. (See *Med. Chir. Trans.*, vol. xxi.)

BROCHOCHELE. In the American edition, which came into my hands after most of the articles in the letter B had been printed, the following passage occurs: —

[The prevalence of goitre in different parts of the United States is stated by our author, and several American writers have described the disease as existing in various parts of our country, whose geological features very widely differ in many respects. In Vermont, in New York, in Pennsylvania, and Ohio, the disease is by no means unfrequent. Professors Barton and Gibson, of Philadelphia, have communicated many valuable observations on this disease. More recently, Professor Francis, of New York has made a series of

observations on goitre as it appears in the western part of the state of New York. From the communication with which he has politely favoured me, the following abstract is prepared. I may add, that, agreeably to the facts deduced from the changes which our country undergoes in the progress of improvement, we have the strongest reasons to infer that, as the climate and cultivation are meliorated, the instances of the existence of this disease will doubtless become less frequent.

However frequent cases of goitre may have formerly been in the state of New York, the fact is certain, that they are much more rare at present. Even the representations of the late Dr. Dwight, relative to the great prevalence of the disease, though among the most recent with which we have been favoured, are to be received with allowance. That, in particular portions of our western country, repeated examples are to be found, may be known by any accurate observer. But "in the village of Utica (says Dr. Francis), which contains between 4 and 5000 inhabitants, no case of bronchocoele could be pointed out, and this village occupies the site of old Fort Schuyler, on the Mohawk, the vicinity of which has been referred to as the spot where goitre was peculiarly prevalent. I am strengthened in the accuracy of this statement relative to the almost total disappearance of goitre in this neighbourhood, by the testimony of Dr. Coventry. A similar remark may be made with regard to the former frequency of the disease throughout the extensive region from Utica to Buffalo. The late Uriah Tracy, in his excursion through this country some years since, was led to believe that bronchocoele prevailed in the old settlements as well as the new, and thought it incidental to the country at large. In my late visit, I made special inquiry as to the present condition of the health of the inhabitants, and am persuaded that the instances of goitre are much more rare, than at the period of Mr. Tracy's observations. The number of cases, which came under my notice during the tour, were twenty-three. These were at Herkimer, Manlius, Syracuse, Onondaga, Batavia, Williamsville, and Buffalo; and I saw more cases in the neighbourhood of Buffalo than at any other place. In other parts of the state the disease may be seen, particularly in the county of Alleghany."

To assign a satisfactory cause for this disease is difficult, perhaps impossible. Dr. Barton has endeavoured to show that goitre and intermittent and remittent fevers have one common origin, and argues this opinion from the simultaneous prevalence of these diseases, from the frequency of glandular affections where intermittents abound, and from the opinion that persons afflicted with goitre are exempt from intermittents, though in the midst of these diseases. Dr. Coventry inclines to ascribe it to drinking water impregnated with alum. Dr. Dwight advocates the more current opinion, that these affections originate from the lime contained in the water drank in those regions. Dr. Francis ascribes the production of the disease chiefly to humidity, and hence it prevails most in the vicinity of lakes and rivers where vegetation abounds. He says, it increases with the rainy seasons, and is diminished when the weather becomes cold and dry, and hence argues the reason of its disappearance as the country becomes cleared. He however does not altogether reject the agency of certain waters in aggravating; if not producing the disease.

Of the twenty-three cases examined by Dr. Francis, two only were in male subjects, and one of them an adult Indian, in Niagara county. He saw it in an infant but a few months old, and he subscribes to the opinion that it often depends on constitutional causes, and is sometimes hereditary.

In Onondaga county, Dr. Francis learned that goitre prevailed among sheep, and Foderé gives us a similar fact of its occurrence among dogs. The doctrines of Hunter and others, in considering the sexual functions connected with this disease, are sustained by its greater prevalence among women, and also according to Dr. F., by some well-known facts connected with parturition.

Dr. Coventry has removed several cases of goitre by the simple expedient of the patient wearing the murate of soda about the neck. The recent plan of Mr. Holbrook, of employing steady pressure, has been tried in this country with some success. The efficacy of burnt sponge has often been seen, but instances of its failure are not unfrequent. The iodine has been used of late years with the best effects, and Dr. Congdon, of Buffalo, has reported its entire success in a number of cases.

Dr. Francis informs me, that in a subsequent journey through this state, he found a number of interesting cases, and that the disorder in every instance afflicted the female sex, and, in eight or ten cases, it was obviously associated with the function of menstruation and parturition. The left portion of the gland was most frequently the seat of the disease, but in no instance was it connected with idiocy. He reports one instance of the entire cure of a formidable case which occurred in a young married female, who upon leaving the neighbourhood of Catskill, and removing to the southern states, after a residence of three years, was entirely relieved of her goitre.

I can add my own testimony to the value of the iodine, having witnessed its success in a number of cases, which had resisted the other remedies ordinarily employed.

The operation of removing the gland by the knife has been performed in this country with success, but is seldom advised, and will not often be repeated. — *Reese.*

BRONCHOTOMY. Into the article on this operation, as it stood in the 6th ed., Dr. Reese introduces the annexed remarks:—

[There is no inconsiderable diversity of opinion among eminent surgeons as to the propriety of performing bronchotomy in cases of croup; and those who oppose the operation very plausibly allege, that in the membranous stage of croup no advantage can result from the operation, however favourable the condition of the sufferer may be in other respects. The views of the celebrated Cheyne would seem to put beyond doubt the inutility of the operation as already noticed by our author, because it is inadequate to the removal of the artificial membrane which is effused in the advanced stage of croup and tracheitis. I am not prepared from my own experience, wholly to decide the difficulty. We have evidence sufficient, I think, to justify an occasional recourse to this exercise of surgical skill; but there is still another means of relief, not stated by our author, that may truly be introduced here, which will often render this operation unnecessary, even in those cases in which it is confidently recommended by some, and

certainly ought to be fully tested before we avail ourselves of so doubtful a remedy.]

In that stage of croup which has been aptly termed the fatal stage, from its so generally proving such, and which is characterised by the existence of the membrane, the vitriolic emetics have been introduced with decided success.

This practice was first introduced by Professor Francis, of New York, in 1813; and since the report of his success, has become very generally adopted in this country, and with singular success. I have now in my possession a specimen of an entire membrane lining the trachea, detached and thrown up under the powerful emetic action of the blue vitriol, after venesection, blisters, calomel, polygala, senega, and all the approved remedies, had been tried ineffectually.

I regret that the limits assigned me preclude my inserting the interesting detail of the cases reported by Dr. Francis, in his valuable paper published on this subject, and have to content myself with referring to the *New York Med. and Phys. Journ.*, vol. iii. p. 58. *et seq.*, only remarking, that in the almost hopeless state in which the sequela of inflammation are so threatening, calomel, in large doses, is among the most efficient auxiliaries to which we can have recourse. "After the existence of the membrane," observes Dr. F., "and when the powers of life are on the wane, it is a judicious and sometimes an available resource;" and he admits, that in the cases in which he found the vitriolic emetics successful, their agency was probably favoured by that potent mercurial.

I find a similar practice has been adopted by Dr. Hoffman, of Vienna, who first used the vitriolic emetics in 1820; and so highly does he estimate them, that he declares their action to be a specific in this stage of croup. This is unquestionably saying too much in their behalf; yet certainly they are entitled to high consideration, and ought never to be omitted in these almost hopeless cases. — *Reese.*

CÆSAREAN OPERATION. By Mr. Knowles, of Birmingham.—Case of deformity of the pelvis from mollities. Incision made in the linea alba, and ten inches in length. The child and mother both saved. (See *Trans. of Proc. Med. and Surgical Association*, vol. iv. p. 376.) She was 36 years of age, and had previously been delivered of several children.

Professor Gibson, of the University of Pennsylvania, has performed this operation, a second time, with success upon the same woman, who recovered without a single bad symptom, and eight weeks after the operation, the infant was in excellent condition. (See *Philadelphia Med. Examiner*.) For an account of this woman's first labour, in which cephalotomy was performed, see *North American Med. and Surg. Journ.*, No. xiv. Oct. 1831.

In the last American edition of this Dictionary, I find some interesting matter, relative to extra-uterine conceptions. The following case is pronounced by Dr. Reese to be unique in its kind. It occurred in the practice of Drs. Cotton and Harlow, of Georgia, and was communicated to Professor Francis, of New York. The subject was a negro-woman, aged 30 years. On the night of the 23d of Jan. 1819, she was taken in labour. Her labour pains ceasing, she was attended for a few days for dropsical symptoms. On

the 4th of February, she was again taken in labour, but the pains soon ceased. In five weeks she died. On the *post mortem* examination, Drs. Harlow and Cotton first drew off from the abdomen three and a half gallons of turbid offensive fluid. On opening the abdomen, the first thing that presented itself was the child extended across the abdomen; its head in the right, its feet in the left, hypochondriac regions; its back immediately behind the mother's umbilicus. The child was as large as either of these practitioners had ever seen at birth, and perfectly formed. *The furis was of the usual size, about six inches in length, and inserted into the fundus uteri, without the intervention of a placenta.* The uterus was about the size of an orange; its coats very much thickened and indurated, with a small quantity of a thin glassy fluid within its cavity. The abdominal viscera were all diseased, save the bladder. The liver retained its original shape and position, but looked more like a mass of glue than organised animal matter. The bowels adhered together in one uniform mass from the stomach down to the rectum. (See *New York Med. and Physical Journ.* vol. i.)

"The case of extra-uterine foetus, in which Dr. Mac Knight, of New York, operated with success, is often referred to. (See *Land. Med. Society's Trans.*, vol. iv.) This interesting case (says Dr. Reese) confirms the views of those who believe in the entire production and perfection of the human foetus *extra uterum*. (*Thacher's Med. Biography.*) But, even this operation is not entitled to the epithet *Cæsarean*, and therefore does not detract from the claims of Dr. Richmond," who in 1827 performed the first operation in the United States of opening the uterus itself; and this with success. (See *Western Journ. of Med. and Physical Sciences* for April, 1830.) In America, gastrotomy has been performed for the removal of extra-uterine foeti several times with success. Mr. Wm. Baynham, of Virginia, as early as 1791, performed this operation, and by removing the foetus, which had lain in the abdomen ten years, preserved a woman who was sinking into the grave with hectic fever. In 1799, he repeated the operation on a servant woman of Mrs. Washington, Fairfax county, Virginia. (See *New York Med. and Phys. Journ.* vol. i.) In the same work, Dr. J. Augustine Smith, now Professor of Anatomy in the University of New York, has published a case, in which he performed the same operation in 1808 with the most satisfactory result.

In the *New York Med. and Phys. Journ.* vol. ii. 1823., are some cases of *Cæsarean* operations: two of them were self-performed; and the other accomplished by an ignorant female accoucheur. The recoveries must therefore be considered as extraordinary escapes. One of these cases is that reported by Mr. Duncan Stewart. (*Edinb. Med. Essays*, vol. v.); another is that recorded by Moseley (*On Tropical Diseases*). Dr. Richmond of Newton, Ohio, reports a successful case of *Cæsarean* operation, performed in 1827. The mother recovered in four weeks. The necessity for it arose from malformation of the os lincæ and vagina. This is the first and only instance of the successful performance of the *Cæsarean* section in the United States. (See *Reese's Amer. ed. of this Dictionary*.)

CLUB-FOOT. In the article **TENDONS**, I have noticed the operation of dividing the tendon

of Achilles, as a means of restoring the foot to its proper position in certain examples of this deformity. A great deal has been published on the subject of machinery for club-feet; but as Dupuytren justly observes, the history of such cases was left very defective in consequence of no anatomical examination having been made of the parts affected. In the most frequent congenital distortion of the foot, termed by the ancients *varus*, the point of it is turned inwards, and the dorsum downwards, so that the patient walks on its outer edge, and sometimes even upon the dorsum itself. The second much less frequent variety is that called *valgus*, in which the foot is turned outwards. There is also a third variety, in which the point of the foot is drawn backwards, and the position of the whole foot is so reversed, that the patient walks entirely upon the instep. Dupuytren looks upon a dislocation of some of the bones of the tarsus, together with a subsequent change in the arrangement of the ligaments and muscles, as the essential cause of the deformity. All the external appearances of club-foot were well described by Scarpa; but, according to Dupuytren, no writers have called attention to the affection of the nutrition of the limb, and its atrophy. "The deformity (says he) may be restricted to one foot, or extended to both. In the first case, if the infant be examined shortly after birth, the affected foot will usually be found rather smaller than the other; but the two limbs are of the same length. When both feet are implicated, they are in general equally developed. In proportion as the time from the period of birth becomes longer, the atrophy becomes more and more evident, and the cause of it is very explicable. In fact, the child from instinct, as it were, bears upon the sound foot, on which all the weight of the body is thrown. The result is that its nutrition is more active; while the deformed foot, remaining comparatively inactive, must on the contrary dwindle away.

"But this atrophy is of two kinds, which have hitherto been confounded, though they should be discriminated: 1. Atrophy, according to the diameter of the limb; 2. Atrophy according to its length. The first kind chiefly affects the muscles, and hence the slenderness and weakness of the limb; the second extends both to the muscles and the bones; but its action on the skeleton is the most serious and important; for the atrophy of diameter may always be removed by exercise of the muscles, when the club-foot has been rectified; while nothing can correct the shortened state of the limb." Though the shortening of the muscles and tendons is generally less in degree than that of the bones, yet it seems to Dupuytren that it should be taken into consideration: "Thus (says he) the tendon of Achilles, at the age of 20, has lost so much of its length, that even after the natural direction of the foot has been restored, the patient in order to be able to bear on the ground, is obliged to wear a high-heeled shoe." Hence Dupuytren insists on the prudence of beginning the treatment of club-feet very early, in consequence of the greater facility of the cure. In a very young infant, the foot may be rectified by the mere hand, and without pain; but, at the age of 10 or 12 years, machinery becomes necessary, and, at a later period, it fails; for nothing will then restore the length of the limb, nor even its shape and complete functions. (*Dupuytren, Chir.*

t.iii. art.6.) Occasionally, a club-foot undergoes a spontaneous cure; of which an instance is recorded by Dr. Holtz. (*Repertoire d'Anat. et de Physiologie.*)

The cure of club-feet by division of the tendon Achillis, in cases otherwise irremediable, is one great improvement in modern surgery. Indeed, the division of other tendons for the relief of the permanent contraction and shortening of muscles, is now occasionally practised with decided success. (See TENDONS.)

DISLOCATION. An instance of a compound dislocation of the sternal end of the clavicle backwards, is related by Mr. Tyrrell. (See *St. Thomas's Hospital Reports*, vol. i. p. 261.) It was caused by the fall of a heavy mass of earth, which drove the sharp end of a pickaxe against the chest. When the finger was introduced into the wound, the great pectoral muscle was found torn from the clavicle, and the finger could be passed as far outwards as the coracoid process, and inwards to the trachea. The greater part of the interarticular cartilage remained in its place. There was emphysema below the clavicle and over the sternum, and difficulty of breathing. The shoulders were brought back with straps attached to a backboard, and the bone readily resumed its place. The elbow was brought forward and bound to the side. The case terminated well.

Sir Astley Cooper informs us, that the dislocation of the os humeri on the dorsum of the scapula is most readily reduced by bending the elbow, putting the hand behind the neck, and then inclining the lower end of the humerus backwards.

Mr. John Macdonnell has published the case of a simple and complete Dislocation of the Astragalus from the Os Calcis and Navicular Bone, upon the Dorsum of the latter, without Disturbance of the Relations between the Fibula, Tibula, and Astragalus, and without Fracture of any of these Bones. (See *Dublin Journ. of Med. Science*, vol. xiv. p. 235, &c.)

FINGERS, PERMANENT CONTRACTION OF. Under this head, I have introduced the opinion of Dupuytren on the cause of such contraction, viz., that the bands hindering the extension of the finger were produced by a permanent contraction of portions of the palmar fascia. The same view was adopted by the late Mr. Henry Cline, and, as would appear from an extract taken from his lecture, and published in one of the volumes of the *Lancet Medical Gazette*, even prior to the period when Dupuytren taught the corresponding doctrine. The former had also anticipated the latter in the practice naturally dictated by such contemplation of the cause of the deformity. MM. Goyraud and Velpereau, however, object to the explanation of the subject given by Dupuytren; because the digital slips of the palmar fascia terminate in, and are fixed to the base and sides of the root of each finger, whilst the diseased band is situated in the middle of the finger, and is often prolonged to the third phalanx. They both occur, therefore, in assuming this contraction to be the transformation of a part of the subcutaneous cellular tissue in front of the phalanges, into a fibrous band. Mr. Goyraud also believes, that this is the ordinary case, and that the contraction of the palmar fascia is an exception. The treatment, recommended by M. Goyraud, consists in making a longitudinal incision through the skin, over each

band, when extended; to separate the lips of the wound; to detach the fibrous cords by dissection, and to cut across them when thus detached from their connections. (See *Gaz. Méd.* No. xxxi. and xxxii. Août, 1835.) Sir Astley Cooper passes a narrow knife under the cord, which is cut through without dividing the skin.

HERNIA. In the first volume of the *Transactions of the Medical and Surgical Association*, my friend, Mr. James, of Exeter, has inserted an interesting paper on the signs which distinguish the sac in hernia. Amongst others, not perhaps adverted to by writers, he mentions the possibility of dragging down more of the intestine. "It (says he) we have opened the sac, I believe I may affirm, that it will rarely happen that we cannot draw down some further portion, a very good practice too on many accounts; while, if we have not, this will be manifestly impossible."

"Another point, which has not been adverted to, is the very size of the tumour, which offers, as it appears to me, a highly important indication; for, if it be small intestine, it must, if exceeding the dimensions of an ordinary knuckle, present the appearance of a convolution, supposing the sac has been opened; or, if great intestine, it must exhibit its characteristic appearance of bands." (P. 151.)

Dr. O'Beirne is the author of some original observations on the primary causes of strangulation, and on what he considers to be an improved mode of performing the taxis in cases of intestinal hernia. The latter consists first in the introduction of a gum elastic tube into the sigmoid flexure of the colon, and retaining it there while the taxis is tried. Secondly, if this fails to diminish the size and dimensions of the hernial tumour, a syringe is attached to the tube, and emollient enemata thrown up, the same process being repeated until the bowels are sufficiently freed of their solid and fluid contents, and then the tube is again introduced, without the syringe being attached to it.

Dr. O'Beirne informs us, that he has employed this treatment, and seen it employed by others, during the last eight years, with the most gratifying results. Some of the cases alluded to, with an exposition of the principles on which they were treated, appeared in February 1833, in his work entitled *New Views of the Process of Defecation*, &c., and others were afterwards recorded in the *Lancet Med. and Surgical Journ.* It is Dr. O'Beirne's doctrine, that the abdominal openings are perfectly inactive in the production of strangulation, and that the causes of this state exist in the protruded parts themselves. He argues, that when the protrusion takes place, a current of flats is impelled into the protruded intestine, "which becomes so distended as to be driven (the sac alone being interposed) against the firm margins of the ring; and often with such force, as considerably to dilate the latter. The distention is of course resisted by the ring, and, according to the situation of the hernia, either by a strong or a weak fascia; but, below this point, the bowel being opposed by little more than common integuments, yields readily, and becomes rapidly enlarged to a size so disproportionate to that of the opening through which it descended, that it is no longer capable of repassing into the abdomen. There is at the same time another cause operating to prevent its return; for the great expulsor mus-

cles, although they soon cease to act simultaneously, or, with the same force, still act so as to direct and maintain a constant current and pressure of flatus against the strangulated gut. There are reasons for believing, also, that the bowel is more or less enlarged above, as well as below the ring, so that the latter lies imbedded in a hollow formed by the sac and the intestine. In this way, pressure from within, and resistance from without, unite in causing the margins of the herniary opening, although totally inactive *per se*, to produce a much greater degree of constriction of the sac and the intestine, than they could possibly produce if they really possessed the activity attributed to them by many." Dr. O'Beirne differs from Mr. Geoghegan, in believing that, when a knuckle of intestine becomes strangulated, air may still pass into and out of the bowel so constricted, in consequence of the existence of a narrow channel of communication between the protruded bowel and that within the abdomen. That this is frequently the case, I think all practical surgeons will admit; but whether it is constantly the case, seems to me questionable. Be this as it may, Dr. O'Beirne contends that the cavity of the strangulated gut is not obliterated, but permits air to pass freely into and out of it; that all the portion of the small intestines within the abdomen and the whole of the cæcum and colon are dilated, and also afford free passage to the air; and that the rectum is contracted, and alone opposes the escape of this elastic substance. If previous to or during strangulation, the bowels should be loaded with solid and fluid feces, so as to prevent the passage of flatus, or the success of the first introduction of the tube, Dr. O'Beirne insists on the necessity of persevering with the aid of repeated enemata. The gum-elastic tube used by him is sixteen inches in length, and the syringe about seven inches long and one in diameter. The tube should be made stiff by immersion in cold water; made straight, and then a few inches of it are to be well oiled. It is to be introduced as the patient lies on his left side, and passed up inch by inch, and in the course of the rectum. If stopped, it may be slightly withdrawn, and afterwards passed gently upwards. But, if it cannot be got further up without much force, the syringe is to be attached to it, and fluid thrown up in a strong unbroken column, by an assistant against the point of resistance, while the surgeon urges the tube firmly upwards. Many other interesting observations on this practice have been inserted by Dr. O'Beirne, in the *Dublin Journ. of Med. Science*, vol. xiv. art. 7.

LITHOTOMY BY THE RECTUM. Performed by Mr. Dawson of the Liverpool Infirmary, on a little boy three years and a half old. The case, a sacculated calculus, bulging downwards, so as to be felt through the upper wall of the rectum. "A gum-lancet, having its anterior edge rounded and very keen, was laid flat on the finger, which, thus armed and oiled, was introduced through the anus, so as to reach a point a short distance beyond the recto-vesical pouch, when its edge was turned upwards, and a decided cut made by drawing the instrument from behind forwards in the median line, through the walls of the pouch, and up to the stone, on the hard surface of which the edge of the lancet was distinctly felt to grate." After a second cut, the calculus was displaced by

the finger, and fell into the rectum, whence it was withdrawn with Pellier's double silver wire. For four days, urine was discharged from the rectum. On the tenth day, four ounces of urine passed in a full stream through the penis, and after this no urine was voided from the rectum. The child recovered favourably from the operation. (See *Trans. of Med. and Surgical Provincial Association*, vol. ii. p. 301. To the references at the end of the article LITHOTOMY, add *The Surgical Anatomy of the Perinæum* by Thomas Morton, late House Surgeon in University College Hospital, 8vo. Lond. 1838.)

LOWER JAW, EXCISION OF THE ENTIRE. (Case by John G. Perry. The disease necrosis, with several sinuses opening around the chin.) One of these having been laid open, the entire case of new bone was found to be dead, and in a great measure separated from the periosteum. The removal of the bone was, therefore, determined upon. An incision was made, along the basis of the jaw, from a short distance in front of the right masseter muscle to the corresponding point on the left side. The exposed bone was divided with a saw and cutting forceps, as near as possible to the angles of the wound, and the insulated portion removed. On the following day, the portion remaining on the right side, which had somewhat descended from the loss of the support of the central part, was removed without difficulty. At the end of three weeks, the remaining segment was taken away. After the cure, the patient was able to masticate solid food with the aid of the tongue, which rubs the morsel against the upper teeth; but, as there is no reproduction of bone, the lower teeth are almost useless, and they do not meet the upper. (See *Med. Chir. Trans.* vol. xxi. art. 17.)

MAMMARY DISEASES OF. (J. F. G. Neveu-mann, *De Mammarum Morbis Curandis Commentatio*. 12mo. Rostochii, 1838.)

NECROSIS. (George Gulliver, Exp. Enquiry into the Agency ascribed to the Absorbents in the Removal of the Sequestrum. See *Med. Chir. Trans.* vol. xxi. art. 1.)

OPHTHALMY. (Frederick Tyrrell, On a Successful Plan of arresting the Destruction of the Transparent Cornea from acute purulent Inflammation of the Conjunctiva.) This important Communication to the Royal Medical and Chirurgical Society of London was made by Mr. Tyrrell, subsequently to the period when the corrections of the article OPTHALMY in this edition were finished. The principal blood-vessels of the cornea are derived from those of the conjunctiva, but it also receives a trifling supply on its inner surface from the vessels of the serous membrane which lines it. In acute purulent ophthalmia, the cornea is found by Mr. Tyrrell to mortify from a strangulation of its blood-vessels; and that this strangulation is produced by the chemosis or the elevation and tension of the conjunctiva covering the sclerótica. Having ascertained this, he did not fail to resort to means calculated to relieve without delay the tension of the conjunctiva in this state of chemosis, and, for this purpose, he tried the effect of a free division of it, made with due regard to the course of its principal blood-vessels. His plan consisted in raising and securing the upper eyelid, as in the operation for extraction of a cataract, and in then making free incisions into the sclerotic portion of the conjunctiva, and the subjacent loaded cel-

ular membrane, without injury to any other texture. He deems it essential that the incisions extend close to the margin of the cornea, where the tension and pressure are the greatest, and that the direction of the wounds correspond to the intervals between the insertions of the recti muscles, so that the principal vessels of the sclerotic conjunctiva may not be injured. Mr. Tyrrell recognises an analogy between this practice and that of making incisions for the relief of severe phlegmonous inflammation of the cellular tissue in other parts, where he has often seen gangrene arrested by making incisions through the skin and loaded cellular membrane, so as to relieve the tension and pressure which were impeding the circulation. Mr. Tyrrell's plan differs essentially from the old one, in which the incisions in the conjunctiva, for the relief of chemosis, were made in a direction corresponding to the margin of the cornea, and frequently extended completely around it; whereby vessels passing to the corneal portion of the conjunctiva must have been in a great measure, if not entirely, divided, and the supply of blood to that texture and the cornea more or less cut off. (See *Med. Chir. Trans.* vol. xxi. p. 414, &c.) In University College Hospital, the practice has been tried with success; and my colleague Mr. Quain, who has resorted to it in various instances, makes the most favourable report to me of its results. I feel disposed, therefore, to look upon it as an improvement which reflects considerable credit on the gentleman who is the author of it, and who has given a very scientific account of the principles on which its usefulness is founded.

VARICOCELE, AND VEINS, VARICOUS. To the information contained under these heads, I deem it right to add the following more particular statements on certain points:—

“Breschet's plan of pinching the veins, whether of the cord, or of the extremities, by forceps con-

structed for the purpose, has frequently answered, and has not often been followed by the severe and dangerous symptoms of phlebitis. The parts included in the forceps, not excepting even the vein itself, having sloughed, the ulcer heals. M. Sanson has constructed forceps for the same purpose, with blades so broad, that he keeps the sides of the veins in contact for the extent of nearly an inch. It is said to be not absolutely necessary that the vein should be included between the blades of the instrument, nor that adhesive inflammation should arise. It is sufficient that the vein be compressed, so as to stop the course of the blood, when a clot forms, which is subsequently absorbed, leading to obliteration of the cavity of the vessel.” (*J. C. Crosse.*)

The passing of needles through the varicous vein, after the ingenious manner, first practised by Mr. Benjamin Phillips, for the obliteration of arteries, has been recently tried by Lallemant, Davat, and Velpéau. The last has also passed needles beneath the vein, and twisted a ligature circularly, or in the direction of the fig. 8. under the projecting ends of each needle, so as to compress the vein. Mr. Crosse has likewise tried this plan, and, although there was suppuration in the cellular substance, neither general fever, nor phlebitis arose, the patient being quickly cured of a troublesome ulcer, and the dilated vein restored or obliterated. In University College Hospital, Mr. Liston follows the same practice, with the improvement of withdrawing the pins at the end of about forty-eight hours, whereby the sloughing and ulceration, produced by the pins being left to make their way out, as exemplified in the method adopted by the above-mentioned practitioners, are completely avoided. I consider this practice, as modified by Mr. Liston, to be, upon the whole, one of the best and safest plans for the obliteration of the channel of a vein.

DICTIONARY

OF

PRACTICAL SURGERY.



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ABDOMEN. The **BELLY.** If the pelvis be reckoned as part of the abdomen, the latter may be said to extend from the diaphragm, which forms its upper boundary, down to the levatores ani, and, from the transversus muscles in front, to the spine, quadratus lumborum, and iliacei behind. Thus comprehensively viewed, the abdomen appears to contain and protect all the organs of digestion situated below the oesophagus, together with the urinary and internal organs of generation. However, when a surgeon speaks of the cavity of the abdomen, he generally means the space inclosed within the great sac of the peritonaeum, and, with this restriction, neither the kidneys nor the pelvic viscera are strictly within the abdomen. Anatomists divide the abdomen into different *regions*, the terms allotted to which are so frequent in the language of surgery, that some account of them in this Dictionary seems indispensable. In fact, without the knowledge of them, the pathologist can neither direct his inquiries with precision, nor communicate clearly the results of his investigations to others. (See *Dr. Quain's Anatomy*, p. 583, ed. 2.) The middle of the upper part of the abdomen from the ensiform cartilage down to a line drawn directly across, from the greatest convexity of the cartilages of the ribs on one side to the greatest convexity of the cartilages of the ribs on the other, is called the *epigastric region*. The spaces at the sides of the epigastric region are termed the *right and left hypochondria*, or *hypochondriac regions*. The *umbilical region* extends from the navel upwards to the line forming the lower boundary of the epigastric region, and downwards to a line drawn across from one anterior superior spinous process of the ilium to the other. The middle space, below the last line, down to the os pubis, is named the *hypogastric region*. The part of the abdomen, situated on the outside of the umbilical region to the right and left, or externally and posteriorly, with respect to the perpendicular lines, drawn on each side from the greatest convexity of the cartilage of the seventh true rib, is termed the *lumbar region* or *loin*. On each side of the hypogastric region is situated the *inguinal space*, or *groin*, with the *iliac fossa*. The *epigastric region* contains the middle part and the pyloric extremity of the stomach, the left lobe of the liver, the hepatic vessels, the lobulus spigelii, the pancreas, the coeliac axis, the semilunar ganglia, the

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norta, the vena cava, and the crura of the diaphragm. The *left hypochondrium* contains the large end of the stomach, the spleen and narrow extremity of the pancreas, part of the colon, the renal capsule, and the upper portion of the kidney. The *right hypochondrium* contains the right lobe of the liver, the gall-bladder, part of the duodenum, some of the ascending colon, the renal capsule, and upper portion of the kidney. The *right lumbar region* contains the ascending colon, the lower half of the kidney, and part of the jejunum. The *left* contains the descending colon, the lower half of the kidney, and part of the jejunum. In the *hypogastric region* are the convolutions of the ilium, the bladder in children, and, in adults, both the bladder and the uterus, if distended. The *right iliac fossa* contains the caecum, the ureter, and spermatic vessels, and the *left iliac fossa*, the sigmoid flexure of the colon, the ureter, and the spermatic vessels.

Although the upper boundaries of the abdomen are completely determined internally by the diaphragm, they remain quite undefined externally. The diaphragm being a moveable partition between the chest and the abdomen, alternately ascending and descending in respiration, must by such changes have the effect of occasioning a corresponding enlargement or diminution of one of these cavities at the expense of the other. Without attention to this fact, mistakes in diagnosis would be very frequent. A sword, entering at the same point, and in the same direction, may penetrate the thorax, or the abdomen, or both cavities, according to the position of the diaphragm at the moment of the injury.

The functions of the abdomen essentially require that its capacity should be continually varying; and had its cavity been circumscribed by an osseous case, like that of the cranium, or by a construction like that of the parietes of the chest, such an arrangement would have been totally incompatible with the offices of the abdominal viscera. So convinced is Cruveilhier of the facility with which the abdomen accommodates itself to the varying quantity of its contents, that he regards the doctrine as perfectly erroneous which refers the irreducible state of some herniae to insufficiency of space within the peritonaeum. "What," says he, "can we suppose a cavity incapable of receiving the bowels again, which will allow of

eight or ten pounds of victuals and drink being suddenly introduced into it? and which, in tympanites, often becomes distended in a short time to twice or thrice its natural dimensions?" According to the judgment of this distinguished pathologist, the obstacle to reduction depends either upon adhesions, or a disproportion between the viscera and the passage through which they protrude, arising from hypertrophy of the omentum, or mesentery; or the altered relations of the peritonæum, drawn down by the displaced intestines. But though this explanation, so far as it goes, seems correct with reference to the causes of the impossibility of reduction, Cruveilhier's view should not lead us to forget, that certain cases every now and then present themselves where the viscera admit of reduction; but their return into the abdomen is followed by so much pain and indisposition, that the plan of keeping them there is unavoidably renounced.

In the treatment of several diseases and injuries of the abdomen, the surgeon cannot proceed one step with safety to his patient without the light of anatomy. Hernia, wounds, paracentesis, abscesses, are all so many cases where a surgeon, deficient in anatomical knowledge, would be likely to adopt very inefficient measures, or commit the most fatal mistakes. A surgeon, acquainted with the structure and extent of the sheath of the rectus, would have no difficulty in selecting the most advantageous place for the puncture, when matter collects within that investment of the muscle; and the practitioner, aware of the exact course of the epigastric artery, would never run any risk of wounding it either in tapping a dropsical patient, attempting to take up the external iliac artery, or dividing the stricture in inguinal and crural herniæ.

On being first consulted, surgeons, as well as physicians, too often neglect to institute a careful examination of the external parts of the body. Thus, either from carelessness or mistaken delicacy, they deprive themselves of the most simple, ready, and sure means of recognising the nature of the patient's complaint. Some diseases of the chest and abdomen are strikingly expressed on the surface; either in a permanent change of configuration, or in a temporary alteration of the natural movements, or both. (*Forbes, in Cyclop. of Pract. Med., art. Abdomen, Exploration of.*) When obstinate constipation, great pain, nausea, and vomiting occur, let the surgeon always be sure, that these symptoms are not dependent upon hernia, the usual situations of which should be carefully explored. The methods of exploring the abdominal regions are three, viz. inspection, manual examination, or palpation, as it is termed, and percussion. The assistance of the sight and touch alone is not what the practitioner should always be content with; for as there is more or less gas within the alimentary canal, and considerable arterial trunks pervade the abdomen, the sense of hearing may be exerted with as much success in the investigation of diseases of this part of the body, as in that of diseases of the chest. The parietes of the abdomen being capable of relaxation, the viscera may be felt directly through them; and, as Cruveilhier justly remarks, this is the only visceral cavity admitting of such exploration. Frequently, by means of palpation, tender, enlarged, or indurated points may be de-

tected. In the first instance, however, a careful inspection of the surface of the abdomen should always be made. The practitioner should consider whether it is more bulky, or of less size than natural. Swelling and tension, combined with pain, and a small frequent pulse, characterise acute peritonitis. In some cases, a circumscribed swelling points out the seat of the disease—the organ affected. How essential the knowledge of the various regions of the abdomen, and of the contents of each of them, will here be for the formation of a correct opinion, must be sufficiently manifest. In pregnancy, retention of urine, and encysted dropsy, the swelling has an oval, or protuberant form; in ascites, a broader, more expanded shape. In lead colic, the parietes of the abdomen seem retracted, or drawn inwards. When palpation is instituted, the abdominal muscles should be relaxed, and the patient's mind diverted from his case. The pressure should be made gently and gradually; for when it is too forcible and abrupt, the examiner's touch is confused, the patient is put to pain, and his muscles contract. According to Cruveilhier, it has even been known to occasion the death of children by lacerating the liver, or the spleen in a state of enlargement. In fact, this rude mode of palpation conveys to the surgeon no information which can be relied upon; for the uneasiness, or pain experienced, or the change of countenance, may be more owing to the roughness or force of the pressure, than to any disease in the region of the abdomen subjected to examination. In certain cases, like ascites, the exploration should be made, if possible, while the patient is standing up, because, in this position, the fluid gravitates and renders the parietes of the abdomen tense, so that the fluid is more plainly distinguished.

The presence of gas, or liquids, may be detected by percussion; that of liquids, or any foreign body, being made manifest by the dull dead sound, and the perception of fluctuation by the hand applied to the point opposite that which receives the percussion.

In diseases and injuries of the abdomen, the diagnosis is often attended with considerable obscurity. It might be supposed, that as the soft and yielding parietes of this cavity facilitate the manual examination of its viscera, the detection of any painful point about them, and the slightest change of their shape or volume, nothing would be more easy, than to trace disease in this part of the body through its different stages with great precision. But, as Cruveilhier remarks, this is far from being the fact. The vast number of organs contained in the abdomen, their great moveableness, the frequency of their displacement, the multitude of their diseases, the particular character of their vitality, which sometimes lets them attain a very serious state of disease, unattended by any urgent pain; and lastly, the difference of thickness of the parietes of the abdomen in different individuals, are undoubtedly the circumstances accounting for the frequent difficulty in the diagnosis. In surgical, as well as in medical cases, the same uncertainty is experienced. Thus punctured wounds of the abdomen are treated on general principles, because the practitioner seldom knows exactly what viscera are injured. The same observation is applicable to contusions of the abdomen. A man who had a hernia received the

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kick of a mule on the belly: severe colic and vomiting ensued; several surgeons believed that these symptoms arose from the hernia being strangulated, and recommended an operation. Cruveilhier objected to this proposal, which, however, was carried into execution: the patient died, and on opening the body, the small intestine was found torn completely across. In the North London Hospital a young man died this spring (1836), from the kick of a horse on the abdomen. During the four or five days which he lived after the accident, he frequently vomited, and the belly became considerably swollen. Effusion of blood, or of the intestinal contents, was foretold; but, until the post mortem examination took place, the exact nature of the injury remained doubtful. A laceration of the small intestine was then detected, attended with effusion of its contents. The man died of peritoneal inflammation.

Abdomen, Abscesses of the, may take place either in its cavity or its parietes, and may be acute or chronic. In fatal examples of peritonitis, a seropurulent fluid is often found in the cavity of the abdomen. In some instances, the pus is circumscribed by adhesions, which are produced by coagulable lymph, and separate the abscess from the rest of the general cavity of the peritonæum. In other cases, purulent effusion in the abdomen is the consequence of the bursting of an abscess of some of the viscera, or of perforation of the small intestine by ulceration.

Chronic tumours of the mesentery, which, in scrofulous children, sometimes terminate in suppuration, diseases of the ovary, and other abdominal viscera, bringing on the formation of matter, may be followed by purulent extravasation. Dr. Seymour, in his work on *Diseases of the Ovaries*, relates the case of a young woman, who, after suffering hectic fever, the cause of which was not apparent, suddenly complained of acute pain in the abdomen, and in a few hours expired. On opening the body, a large quantity of pus was found effused in the peritoneal cavity from an abscess of the right ovary. Dr. Tweedie met with an ovarian abscess of the size of an orange, where the prominent symptoms were uncontrollable vomiting and sympathetic fever. (*Cyclop. of Pract. Med. art. Abscess.*) I have seen several instances of ovarian cysts, which had become inflamed after tapping, and secreted a puriform fluid. A woman had an ovarian tumour, supposed to be an ovarian dropsy. After death, the cyst was found to contain twenty pints of well-formed pus. (*North Amer. Med. Journ.* 1826.)

Occasionally, however, salutary adhesions are produced between the viscera, and ulceration taking place, an outlet is obtained for the matter through the bladder, anus, or vagina. Thus in the case of a woman, who had had for a long while pains in the right lumbar region, supposed to proceed from suppuration of the kidney, because pus was voided with the urine, the right kidney was found after death in the natural state; but there was an abscess in the right ovary, which was adherent to the bladder, into which the pus had passed through an ulcerated communication. In another patient, who had voided pus by the anus, the right kidney was suppurated, and adherent to the colon, with which it communicated by a preternatural aperture. For many years, a woman had a hard tumour of considerable size in the abdomen: at length, the

pain of it became intolerable; and just at the moment when her death was apprehended, an immense quantity of pus was suddenly discharged from the vagina. The pain abated; the swelling of the belly subsided; merely the remains of the induration were now perceptible; and the woman's health was perfectly re-established. (*See Lassus Pathologie Chir. t. i. p. 138.*)

In one case, an abscess communicated with the cæcum, to which and the parietes of the abdomen, the omentum had become firmly adherent. In this manner, a circumscribed cavity was formed, containing ill-conditioned pus, and three or four seeds of fruit, covered by earthy incrustation. (*Abercrombie on Dis. of the Stomach, &c. p. 338.*)

Abscesses of the liver are more common in hot than temperate climates. Frequently, the liver becomes adherent to the neighbouring parts, and then the matter may be discharged through the parietes of the abdomen, or into the colon, stomach, duodenum, or gall-bladder; from which latter the pus may descend by the biliary duct into the bowels, and be discharged *per anum*, an instance of which is recorded by Malpighi. Abscesses of the liver have been known to make their way through the diaphragm into the pleura, or into the air cells of the lungs, so that the pus was coughed up. Andral refers to one case, where an abscess of the liver communicated with the vena cava, and to another, where it burst into the pericardium. (*Anat. Pathol. t. ii. p. 601.*) At the request of the late Dr. Pinckard, I examined the body of a woman, in whose liver there were nearly three pints of pus; the case was remarkable on account of the gall-bladder having been annihilated, with the exception of a trivial portion of its fundus, which is now in my possession.

The kidney may be the seat of acute or chronic abscess. Sometimes the quantity of matter is small, and the texture of the organ but little changed. In other examples, the suppuration may be so copious that none of the original structure of the kidney is left, excepting its capsular investment, which is expanded into a cyst of considerable size, and filled with pus. I attended with Mr. Baker, of Staines, an old man, who had symptoms somewhat like those of stone, and one of whose kidneys was found after death converted into a cyst containing about a pint of purulent fluid. As Andral observes, renal abscesses are sometimes so large, that they may be felt through the parietes of the abdomen. (*Anat. Pathol. t. ii. p. 633.*)

Abscesses of the kidney may burst in the loins, or make their way into the peritoneum, the ureter, or the colon.

Abscesses between the peritoneum and abdominal muscles, or between the layers of these muscles, or under the integuments of the abdomen, are attended with considerable variety, according as they happen to be chronic, or acute; circumscribed, or diffused; small, or extensive. Those of the acute or phlegmonous kind, from stabs and contusions, are noticed in the article WOUNDS. As for chronic abscesses of the parietes of the abdomen, they should be opened in an early stage.

Hard indigestible substances, after being swallowed, are not unfrequently discharged from abscesses in some of the abdominal regions. (*See De La Grange, in Museum der Heilkunde, b. iv. p. 154: a fish-bone, which had been swallowed,*

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found in the abscess; *Petit, Traité de Mal. Chir.* t. ii. p. 226.; an awl, without a handle, extracted from an abscess of the abdomen; and many other analogous cases.)

Encysted tumours are occasionally formed between the peritonæum and abdominal muscles, and attain an immense size, before they burst; a remarkable specimen of which is described by Gooch, (*Chir. Works*, vol. ii. p. 144, &c. 8vo. Lond. 1792.) In this case, the spontaneous opening in the navel was enlarged with caustic, and the cyst extracted; but, before a cure could be effected, it became necessary to make a depending opening, and introduce a seton.

Abdomen, Pulsations in the. From the article *Aneurism*, the reader will understand, that, though it be the common nature of this disease to be attended with throbbing, it is not every pulsating tumour that is an aneurism. The cases, usually called abdominal or epigastric pulsations, often furnish a proof of the correctness of the preceding remark. The authors, who have treated of the latter affection with the greatest discrimination, are Dr. Albers, of Bremen, and Mr. Allan Burns, of Glasgow, two gentlemen, whose high reputation and useful labours will long survive the termination of their meritorious lives. Some of the pulsations, here referred to, are the consequence of organic disease, and capable of demonstration by dissection; while the rest are not attended with any such appearance, and have therefore been regarded as nervous. The pulsation is not always produced by the impulse communicated to a solid tumour, or substance between the hand and the artery, but was conceived by Mr. Burns to be sometimes dependent on a nervous affection of the vessel itself. (*On Diseases of the Heart*, p. 263.) Hippocrates refers to three patients, affected with extraordinary pulsations in the abdomen. As one of these cases seemed to depend upon obstructed menses, it was probably not the result of any organic disease. (*Hippocratis Opera Omnia*, ex edit. Fascin. Francof. 1621. lib. v. sect. 7. p. 1144.) In order to remove a difficulty in believing, how an artery, not affected with aneurismal enlargement, can communicate to the superincumbent parts such movements as are frequently remarked in cases of abdominal pulsations, a fact pointed out by Mr. Hunter should be remembered: in speaking of the actual dilatation of an artery, he says, that when the vessel is "covered by the integuments, the apparent effect is much greater than it really is in the artery itself; for, in laying such an artery bare, the nearer we come to it, the less visible is its pulsation; and when laid bare, its motion is hardly to be either felt or seen." (*On the Blood*, &c. p. 175. 4to. Lond. 1794.) And this observation will apply to all tumours and indurations situated over a large artery. In the epigastric region of a certain patient, Tabernanus felt not only a pulsation, but a tumour as large as the fist, with all the other usual symptoms of an aneurism. On opening the body after death, he was therefore surprised to find, instead of this disease, a considerable scirrhous tumour in the middle of the mesentery, so closely connected to the large vessels, as to compress the aorta, by the pulsations of which it had been lifted up. (*Obs. Anat. ed. 2. No. 9.*)

Mr. London, of Leamington, sent me the particulars of a case, where the pulsations of the aorta

against a diseased liver, extending across the epigastrium, and occasioning a well-defined tumour at the pit of the stomach, had been mistaken by several practitioners for an aneurism of the aorta, which vessel was found after death perfectly sound.

I once visited with Mr. Miller, of Keppel Street, a thin old man for retention of urine, where the tumour, formed by distended bladder above the pubes, was attended with regular and strong pulsations, corresponding to those of the arteries. I am not aware, that any similar case is upon record.

With regard to pulsations in the left hypochondrium, Bonetus cites several cases, the tenour of which is to prove, that the celiac artery and mesenteric vessels must have been affected, as they were found after death dilated and filled with black blood. (*Sepulchretum Anatomicum*, lib. i. sect. 9. Obs. 9, 25, 27, 30, 38, 42, 44, 45, and 46.) The conjecture of Bonetus and others, however, respecting the frequency of abdominal pulsations from dilatation of the celiac and mesenteric arteries, by no means coincides with the results of modern observations. Mr. Wilson, whose dissections were numerous, met with only one instance of true aneurism, affecting any of the branches of the aorta, distributed to the abdominal viscera. This was an aneurism of the left branch of the hepatic artery. (*Lectures on the Blood, and on the Anatomy, Physiology, and Surgical Pathology of the Vascular System*, &c. p. 379. 8vo. Lond. 1819.) Bontius was present at the opening of an inhabitant of Batavia who had been afflicted three years with a disease, the exact nature of which could never be made out during life. When the hand was applied above or below the navel, a pulsation was felt like that of the heart, or an artery, and as forcible as the motion of a child in the womb. It was synchronous to the pulsation of the heart and arteries. Hence, Bontius concluded that the case was owing to some affection of the heart. The vena cava, instead of containing blood, was filled with a medullary substance, which pressing against the aorta, is supposed to have excited the extraordinary pulsations in that vessel. The heart was unusually dilated, and flabby. The two ventricles were very large, and filled with dark coloured blood. The liver was of nearly twice its natural size. The gall-bladder resembled that of a bullock, and was filled with viscid bile. (*Jacobi Bontii de Medicina Indorum*, libri iv. Lugd. 1718. Obs. 8. p. 101.)

A case is recorded by Burgraff, entitled, "Diuturna, magna, et valde molesta pulsatio in epigastrio." (*Vid. Acta Natur. Cur. Norimb.* 1740, vol. i. Obs. 131.) Burgraff suspected that the pulsation was caused by a dilatation of that considerable branch of the inferior mesenteric artery, which inosculates with the branch of the superior mesenteric. This idea, however, could not have been correct, as the patient was cured by taking, every morning and evening, $\mathfrak{℥}$ a drachm of a mass composed of equal parts of gum ammoniac, extr. centaury, minor, and Venice soap.

In an example recorded by Störk, the symptoms arose from disease of the pancreas, which weighed thirteen pounds, and contained a large cyst filled with lamellated blood. (*Annus Medicus*, Vindob. 1760, p. 245.)

A man, aged 60, complained of pain in the left side, midway between the umbilicus and crista of

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the ilium, followed by emaciation, weakness, distress of countenance, anorexia, and constipation. At length, a large pulsating tumour was discovered in the epigastric region. The case was now pronounced aneurism of the abdominal aorta. There was *no nausea nor vomiting*, except a few days before death, when a quantity of fetid blackish fluid was twice or thrice voided. *No fever*. The swelling caused a sense of constriction rather than pain, and the throbbing became more perceptible. The pulse was feeble, but *slow and regular*. After death, the stomach was found adhering to the liver, pancreas, and peritoneum; and a *cancerous tumor* occupied its internal surface from the duodenum to the insertion of the oesophagus, its coats being an inch thick. The surface of the pancreas was also diseased, and the pylorus, situated in the midst of the cancerous mass, was contracted by the thickening of the parietes of the stomach, and obstructed by numerous fungi. The liver was large, but apparently sound; the spleen small. *The aorta, the coeliac trunk, and its branches were quite natural.* (See *Journ. de Méd. par Leroux*, Oct. 1815.)

Morgagni describes the case of a woman, 44 years of age, who, after a suppression of the menses for some months, was attacked with palpitations in the epigastrium. Morgagni, on applying his hand to the part, felt a large hard body moving forcibly. At first, it was regarded as an aneurism in the abdomen; but, as there were no similar throbbings in the chest, and there was nothing extraordinary in the pulse at the wrists, Morgagni concluded that the movements in question could not depend upon the heart. Neither did he take the disease for an aneurism, because the throbbings did not correspond to the pulse. Morgagni considered the case as an hysterical spasmodic complaint, ordered the patient to be bled, and the following day the pulsations ceased. (*Morgagni, de Sedibus et Causis Morborum*, t. ii. Epist. 39. 18.)

Senac has spoken of these abdominal pulsations as occurring in hypochondriacal and chlorotic patients; and, as they frequently subside, without leaving any vestige behind, he sets them down as nervous affections. (*Traité des Mal. du Cœur*.) De Haen had under his care a hypochondriacal patient, affected with pulsations in the abdomen; which, with other complaints, were dispelled by means of brisk opening medicines. (*Heilungs Methode, übersetzt von Plattner*. Leipz. 1782. b. ii. s. 29.)

Abdominal pulsations are described by Zuliani, as a symptom of hypochondriasis and hysteria. (*De Apoplexia*, Lips. 1790, p. 79.) They also happen in certain febrile diseases. (*Versuch über den Pemphigus und das Blasenfeher*, von C. G. C. Braune. Leipz. 1795. s. 23.; and *Dr. R. Jackson on the Fevers of Jamaica*, 8vo. Lond. 1791.)

Thilenius observed a flatulence of the stomach, which, in some patients, was attended with pulsations at the *scrobiculus cordis*. (*Med. Chir. Bemerk.* Frankf. 1789. s. 211—217. My friend, Mr. Hodgson, in speaking of pulsations in the epigastrium, which are not the consequence of organic disease, and occur in irritable hypochondriac subjects, states his opinion, that, in some instances, these pulsations are a consequence of distension of the stomach with air, which is thrown against the abdominal muscles by the pulsation of the great blood vessels; and in such cases, the throbbing is

diminished by the eructations. (*On the Diseases of Arteries and Veins*, p. 96.)

Dr. Albers details some cases which fell under his own notice. A young woman, whose menses were upon her, and who had been for some days constipated, was seized with frequent fainting fits and febrile symptoms, occasionally voiding from the bowels a quantity of dark matter, each evacuation of which was followed by a swoon. One morning at five o'clock Dr. Albers was sent for, as it was feared the patient was about to die. She was extremely exhausted, and the fainting fits followed each other with hardly any intervals. She could just say, "I feel a throbbing in the belly;" and when Dr. Albers applied his hand to the part, he felt a violent pulsation, extending from the ensiform cartilage down to about the bifurcation of the aorta. The action of the heart was weaker than natural; the pulse at the wrist very small, but not quicker than it had been on the preceding day, and not synchronous to the throbbing in the abdomen. Dr. Albers confesses that, at first, he took the case for an aneurism. Dr. Meyerhoff was of the same opinion. Another physician, however, Dr. Weinhold, entertained doubts of the complaint being aneurismal, saying, that he recollected having read similar cases in Morgagni. These gentlemen decided to persevere in the employment of opening medicines and clysters, combining opium with the former. Under this plan, the pulsations in the abdomen and tightness of the chest diminished in a few days. The stools were at first of the colour of chocolate, but afterwards resumed their natural appearance. The throbbings, in a weakened form, however, were perceptible for six weeks longer. The patient at length got quite well, and was remaining so four years afterwards.

A man, about 40, severely afflicted with hypochondriasis, great oppression of the chest, constipation, and tension of the abdomen, tendency to fainting, &c., complained to Dr. Albers, that he felt as if his heart had fallen down into his belly, where he was annoyed with an incessant throbbing. Indeed, when Dr. Albers, examined the abdominal parietes, he could feel a very strong pulsation, and, what is curious, could trace it not only along the track of the aorta, but in the course of the left iliac artery. The pulse at the wrist, which was small, frequent, and hard, did not correspond with the abdominal pulsations. For several days, the evacuations from the bowels had been as black as pitch. After the employment of gentle purgatives all the complaints quickly abated, though the throbbings were feebly perceptible for nine months afterwards.

The next case, which Dr. Albers met with, is very interesting. A robust sailor, whose bowels were so constipated, that hardly the strongest purgative could affect them, was seized with constant pain in the left hypochondrium. With this complaint were soon joined great pain in the back, and a sensation as if something alive moved about in the belly from one side to the other, and thence extended up to the neck, followed by the vomiting of a greenish matter. At the same time, he felt in the left side a pulsation, which he took for that of the heart, and which continued throughout his illness. The pulse at the wrist was natural, and synchronous with that in the abdomen. In the beginning of the disorder the patient was obliged to sit with his body inclined forward, as no other

posture could be endured. For the first week, opening medicines afforded so much relief, that he was sometimes quite free from pain for six or eight hours. After a time, a round swelling formed in the left hypochondrium, reached to the navel, and attained with incredible quickness the size of a child's head. Indeed, it could now be traced beyond the umbilicus to the right side. The motions were quite of a dark colour, or else red blood and a puriform matter were discharged. Sometimes the blood voided was of a bright red colour, sometimes it was dark, coagulated, and mixed with bile. The patient was at length worn out with febrile symptoms, and died. On opening the body, Dr. Albers found a swelling in the middle of the mesentery, the texture of which cannot be easily described, and the circumference of which was 16 French inches. The stomach was filled with coagulated blood. The spleen, pancreas, and liver were sound; but the gall-bladder was of prodigious size, and contained thick viscid bile. The coeliac axis, the coronary artery of the stomach, and the mesenteric artery were preternaturally dilated, and full of dark-coloured blood. Dr. Albers speaks of them, however, only as being in an enlarged, not an aneurismal state; and he thought it highly probable, that it was one of these vessels by which the pulsations had been occasioned.

Dr. Albers had also seen these abdominal pulsations in a paralytic female; and in a lunatic, who was afterwards seized with apoplexy. He likewise met with a married woman, the mother of several children, in whom these throbbings took place invariably at the commencement of pregnancy, and were a surer sign of this state than other common effects. After the third month, however, they used to cease altogether. (*J. F. Albers, über Pulsationen in Unterleibe*, 8vo. Bremen, 1803.)

In any persons not very fat, and lying upon their backs, the pulse of the aorta can easily be felt, if strong pressure be made a little to the left of the median line, about half way between the navel and scrobiculus cordis. In certain instances, the pulsation is painfully felt by the patient himself. In many cases of this kind, particularly in nervous individuals, the sense of pulsation is merely the effect of preternatural action of the heart; while, in other examples, it is the effect of the pressure of some hard substance upon the descending aorta, determining a disproportionate quantity of blood to the head, "and giving to the hand placed on the abdomen, and sometimes even to the eye, the appearance of a beating so near the surface, as to lead inexperienced observers to conclude that the aorta is morbidly dilated." According to Dr. Parry, the most common causes are collections of feces in the colon, requiring repeated and active purgatives, which must bring away almost incredible discharges of stercoraceous matter before the aortal pulsation subsides. (See *Parry's Elements of Pathology*, &c.; and the *Medico-Chir. Journ. and Review*, vol. i. p. 157.)

I once attended with the late Mr. Ransden, a boy in Christ's Hospital, who had a considerable abscess in the lumbar region, attended with distinct and forcible pulsations, corresponding to those of the aorta.

Three or four years ago, I was also consulted by Mr. Gilbertson, of Egham, in a case, where an

enormous abscess in the epigastric region was accompanied by pulsations as strong and synchronous with those of the heart as the throbbings of an aortic aneurism.

According to Mr. Allan Burns, a beating is generally felt about the pit of the stomach, in the advanced stage of chronic inflammation of the heart: in this case, when the pericardium is closely adherent to the latter organ, it is corrugated at every contraction of the ventricles, and the diaphragm and liver are elevated. The ventricle, however, having completely emptied itself, is again distended, and, in proportion to the degree of dilatation, the liver and diaphragm descend, whereby an impulse is communicated in the epigastric region. (*On Diseases of the Heart*, p. 263.) This valuable writer cites the remark of Morgagni (Epist. 17. art. 28.), that sometimes in hypertrophy of the heart, this organ descends so far as to push the diaphragm into the hypochondrium, and pulsate in that situation, so that the disease is mistaken for an aneurism of the coeliac artery. In Mr. Burns' work a memorable case of this description is related. An erroneous judgment is the more likely to be formed in such examples, because the pulsations of the heart and tumour are not exactly simultaneous; for it is not the heart which is felt directly beating, but the liver, which, by the action of the heart, is thrown forwards. Hence the palpable interval between the stroke of the heart and the movement of the liver.

Preternatural pulsation about the epigastrium is stated by Mr. A. Burns to be sometimes occasioned by encysted tumours, attached either to the lower surface of the diaphragm, or formed between the layers of the pericardium towards the diaphragm, as happened in an instance recorded by Lancisi.

Another cause specified by Mr. A. Burns, is enlargement of the vena cava, or of the right auricle of the heart. Senac describes a case, in which the vena cava was as large as the arm, and there had been a violent pulsation in the epigastrium.

The next cause, enumerated by the same gentleman, is increased solidity of the lungs, more especially of their lower acute margins, where they overlap the pericardium. In this case, the pulsation is about the scrobiculus cordis.

Mr. A. Burns notices several other causes of epigastric or abdominal pulsations, already spoken of in the foregoing part of this article, indurations of the pancreas, scirrhus of the pylorus, tumours in the mesentery, or any solid increase of substance about the abdominal aorta, or its principal branches; and, lastly, a peculiar affection of the vascular system itself.

The following observations by Dr. Albers on the criteria between various abdominal pulsations and those of aneurism, appear interesting:—An internal aneurism originates gradually, and the pulsations increase in strength by degrees. Other abdominal pulsations, on the contrary, begin suddenly, and are most violent in the beginning, abating after they have lasted some time.

In an aneurism, the pulsation is synchronous with the stroke of the artery at the wrist; but this is not regularly the case with other pulsations.

Should the patient be affected with melancholia, hypochondriasis, hysteria, or other nervous com-

plaints, void blood from the stomach, or a black matter from the bowels; should there be any hardness or swelling of the abdominal viscera discoverable by the touch, the probability is that the pulsations are not owing to an internal aneurysm.

With the exception of cases, in which these pulsations are owing to mechanical impediments to the circulation, Dr. Albers believes that they are mostly a symptom of some nervous affection. He also thinks, that the surprise, excited by these throbbings, arises only from their strength and situation; other analogous, strong pulsations, as, for instance, those of the heart, or of the carotids, being common enough in hypochondriacal and hysterical persons. The same gentleman adverts to the increased action, which, in inflammation and fevers, is often more conspicuous in some parts of the sanguiferous system, than others.

See Ueber Pulsationem im Unterleibe. Bremen, 8vo. 1803. Obs. on some of the most frequent and important Diseases of the Heart; on Aneurism of the Thoracic Aorta; on Preternatural Pulsation in the Epigastric Region, &c. By Allan Burns, p. 262, &c. 8vo. Edinb. 1809.

ABSCCESS (from the Latin *abscessus*). A collection of purulent fluid in the texture or substance of any part of the body capable of suppuration. If the pus is not within the tissue, but merely poured out into some regular and natural cavity of the body, where it forms an accumulation, the case is said to be one of *purulent effusion*, or of *suppuration* in the particular cavity affected, whether lined by a mucous, a synovial, or a serous membrane. When, however, the purulent matter is formed by a mucous membrane, where it invests any surface, passage, or duct, from which it is promptly voided externally, without producing any accumulation, the patient is said to have a purulent discharge. Familiar examples of this are seen in gonorrhœa and purulent ophthalmia.

When purulent matter is confined, and not infiltrated through the structure of an organ, it constitutes an *abscess*, the boundary of which is formed either by the tissue of the organ itself, or by what is termed an *accidental tissue*. In both cases, the formation of the boundary is accomplished by the effusion of coagulable lymph, which, in the former, produces the union and consolidation of the tissues of the organ in immediate contact with the pus, and thus prevents its diffusion; in the latter it forms a more or less perfect membrane over the whole of the surface from which the purulent secretion has taken place; and hence the pus being enclosed, as in a shut sac, the abscess is sometimes said to be *encysted*.

The cysts of abscesses have the power of absorption. In this manner, the occasional dispersion and subsidence of an abscess, without either bursting, or being opened, is accounted for. The cysts must evidently be also secreting surfaces; for, after the pus has been discharged, the cavity is soon filled with purulent fluid again.

Abscesses cannot be produced in certain textures. Thus, they cannot take place in the dense structure of fibrous or cartilaginous tissue, nor in that of serous membranes. When pus is discharged from these tissues, it is effused either upon their surfaces, or into the cavities which they invest; but abscess never forms in their proper substance. It is the prevailing doctrine, that abscess

can take place only in parts into which cellular tissue enters as one of their constituents; and that this tissue is more frequently the seat of abscess than any other. John Hunter explained, that abscess is more common in superficial than deep-seated cellular tissue.

For an account of the tendency of abscesses to make their way to the surface of the body, or into a passage lined by mucous membrane; the theory of suppuration; qualities of pus; the general symptoms and treatment of abscesses; and other topics relating to this interesting subject; see SUPPURATION.

It is a contested point, whether an abscess can ever take place unpreceded by inflammation. Although John Hunter has a section in his work on the blood, entitled "Collections of Matter without Inflammation," yet his doctrines are decidedly in favour of suppuration being an effect of inflammation. At the present day, I believe the best pathologists would mostly concur on this point with Hunter. Thus Dupuytren affirms, that an abscess is never a primary disease, but invariably the effect or termination of a more or less intense and extensive inflammation of the living tissues. "Whenever," says he, "suppuration is observed in any part of our organization, whatever may be the qualities of the matter, we may be sure that some kind of irritation, acute or chronic, apparent or concealed, must have existed, or must yet exist, either in the situation occupied by the purulent collection, or in some remote part which communicates with this point, and is the source from which the matter is derived." Dupuytren maintains that this proposition is founded on the most accurate pathological investigations, and admits of no exception, whatever may have been asserted respecting collections of pus, supposed to be the result of substances absorbed and circulated for a time in the vascular system. Whether abscesses form slowly or quickly, whether they attain a considerable size or remain within narrow limits, or whether they contain pus of one quality or another, inflammation of more or less intensity, according to circumstances, seems to Dupuytren, and I may say, to the greater number of modern pathologists, to be always being concerned in their production. To this subject, however, I shall return in considering particularly the process of *suppuration*, under which head the formation, symptoms, and treatment of abscesses generally will be described. (See also ANTRUM, ANUS, BUBO, EMPYEMA, HYPOPIUM, LUMBAR ABSCESS, MAMMARY ABSCESS, PHLEBITIS, SCROFULA, and WHITLOW.)

ABSORPTION. That nature has fully provided for the due execution of this important function, is a truth of which no doubt is entertained: it must be immediately manifest to every person who reflects upon the mutation which is continually taking place in the particles of every texture of the animal body; upon the gradual and harmonious removal of the old matter in proportion as the new is deposited by the seceding arteries; or upon the impossibility of accounting for the changes produced by growth in the size and figure of different organs, and, indeed, of the whole body, without constantly bringing into the explanation this interesting process, of which numerous, and even the most essential, particulars, it is true, yet remain obscure. But besides these

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considerations in proof of absorption, many others must strike the contemplative physiologist. By the action of the secreting and exhalant arteries, the whole mass of blood would soon be so lessened, that life would unavoidably cease if the sanguiferous system were not duly replenished in some way or another. The undiminished quantity of blood in the circulation, notwithstanding the constant deductions from it by secretion and exhalation; the regular fullness of the blood vessels, notwithstanding the incessant drain from them; and the constant supply of materials for the numerous secretions; all imply the existence of a certain function, one principal design of which is to counteract the effect, which, without it, would be rapidly and fatally produced upon the quantity of blood in the system. As M. Magendie observes, whenever any substance, in the form of a liquid, gas, or vapour, is put, for a certain time, in immediate contact with an external or internal surface of the body, it is *absorbed*; that is to say, it passes into the blood vessels, mixes with the blood, circulates with it, and thus occasions either salutary or noxious effects upon the system. This is particularly exemplified in the action of certain poisons: a drop of pure hydrocyanic acid, put on a dog's tongue, causes the animal's death in a few seconds, in consequence of being transmitted with the blood to the brain. Food, drink, medicines, and even air itself, only become useful to us, after having been absorbed. Many diseases, some of a very dangerous nature, are contracted by absorption. In fact, our existence is so inseparably connected with this function, that the suspension of it for an instant would produce almost immediate death. (See *Journ. de Physiol. Expér. t. i. p. 1.*)

The uses of the absorbent system are far more numerous than would at first be supposed by a person only superficially acquainted with physiology and the phenomena of disease. If we wish to have a just comprehension of all the various purposes, which this system fulfils in the animal economy, we must take the same enlarged view of the subject as Mr. Hunter did. We must contemplate all the modifications of absorption, and its effects both in health and disease, in the nutrition and growth of the body, as well as in its emaciation, or atrophy, and the diminution, or even total removal, of parts of it which are diseased or useless.

First, According to Mr. Hunter's explanation, the absorbents take up extraneous matter, in which is included nourishment. (*On the Blood, &c. p. 439.*) By extraneous matter, we are here to understand matter not originally contained within any texture of the body, not constituting any part of its natural structure, but introduced from without. Thus, the absorption of mercury, arsenical paints, and lead, cantharides, and other substances, applied to the skin, furnish examples of the absorption of extraneous matter, which are also illustrated by the effects of the venereal, venereal, vaccine, and several other poisons. Sometimes the passage of the poison into the system, and its pernicious operation, happen so rapidly, that suspicions are entertained, that it must have a shorter access to the circulation, than through the lymphatic vessels, their glands and trunks. This has been proved to be the case, when animals are exposed to hydrocyanic acid, the nux vomica, the

poison of certain snakes, the *upas tiente*, &c. How far this opinion is true will be hereafter considered. Such is the rapidity with which the poisons of *upas tiente*, *nux vomica*, and *St. Ignatius's bean*, are absorbed, and carried into the sanguiferous system, that in twenty seconds after being put into the cavity of the peritoneum, their action reaches the spinal marrow. (See *Magendie, Journ. de Physiologie Expér. t. i. p. 18.*)

Secondly, As Mr. Hunter has noticed, the absorbents take up superfluous and extravasated matter, whether natural or diseased. Thus, the removal of the solid particles of the body, after they have become unfit to continue longer in their respective situations and textures,—an action that is reciprocal with the deposition of new matter by the secreting arteries; and the incessant regulation of the quantity of serous fluid in the cavities of the abdomen, chest, pericardium, and tunica vaginalis, so that, though the arteries unremittingly secrete this fluid, the absorbents prevent its redundant accumulation, and combine with the blood vessels in maintaining a continual renovation of it; are examples of the absorption of natural, but superfluous matter. On the contrary, the dispersion of extravasated blood, of the fluid of ascites and anasarca, of coagulating lymph, or air, effused in the cellular tissue; and of an infinite number and variety of swellings and thickenings of parts; are instances of what Mr. Hunter has termed the absorption of superfluous diseased matter, or, as I should say, of superfluous matter from disease.

Thirdly, Mr. Hunter enumerates the absorption of fat. No doubt can exist respecting the continual change, which is taking place in the quantity of adipous matter in the body, according to the state of the health, the degree of exercise, fatigue, or labour, to which the body is exposed, the disturbed or undisturbed condition of the mind, and the effects of different kinds of regimen and diet on the whole system. Perhaps it may be inquired, why Mr. Hunter should distinguish this absorption from that of other superfluous matter in the body. The reason does not appear in his writings; unless we receive as such the observation, that he did not consider the fat and earth of bones, as true animal substances, as they have no action within themselves, and no principle of life. However, this would not be very consistent, because other superfluous matter, comprised in the second classification, especially the fluid secreted by serous membranes, and the fluid of anasarca, are likewise quite destitute of the living principle. At the same time, I admit, that the absorption of fat may be entitled to distinct consideration, on other grounds; for sometimes its absorption seems to be retarded in a much greater degree than that of other substances in the body; or, at all events, its absorption does not keep pace with that of its secretion, so that, although the muscles and other organs remain of their usual bulk, the fat may acquire the thickness of several inches. On the other hand, the absorbents sometimes act upon it with a quickness that does not always extend at the same time to other parts of the body. Thus, in fever, nearly all the fat may be absorbed in the course of a few days; yet the size of the muscles may have undergone but little reduction.

Fourthly, Mr. Hunter enumerates the species of

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absorption, by which a waste of parts is produced, and in consequence of which the muscles become smaller, the bones lighter, &c. These cases we find exemplified in the ordinary course of nature; for, in old age, such changes happen in the bones and muscles, and also in other organs, like the absorbent glands, which become so diminished, that some writers erroneously assert that they entirely disappear. Whenever the action of a muscle is long prevented by disease of a joint, a fractured bone, or other causes, it always dwindles away in a greater or less degree, and the limb, compared with the sound one, will be found to be considerably reduced. The absorption of fat, by which the bulk of parts is also lessened under various circumstances of disease, I believe, is not generally restricted to a particular limb, or part, like the absorption which affects the muscles in similar cases. Thus, when a patient becomes hectic from disease of the hip-joint, the muscles of the thigh and leg, on the same side as the disease, undergo a remarkable diminution of their bulk, while those of the sound limb are little, or not at all altered; but, the fat of the whole body is rapidly absorbed, and the greatest universal emaciation prevails.

Before the period of Mr. Hunter's inquiries, the knowledge of all the different purposes of absorption, by whatever organs it was supposed to be performed, whether by lymphatics or veins, was certainly very limited, in comparison with the more extensive information which now prevails, and which is, in a great measure, the fruit of his industrious researches. Speaking of the lymphatic vessels, which he considered, with the generality of physiologists, as the true instruments of absorption, he says: "From a further knowledge of these vessels, we shall find that they are of much more consequence in the body than has been imagined, and that they are often taking down what the arteries have built up; removing whole organs, becoming modellers of the form of the body in its growth; and removing many diseased and dead parts, which are beyond the power of cure."

As these vessels are productive of a great variety of changes in the animal economy, which are very dissimilar in their intention and effect, Mr. Hunter considered them in two general points of view: first, as they absorb matter, which is not any part of the body itself; secondly, as they absorb the body itself. The first of these uses, the absorption of matter, which is no part of the machine, he observes, is well known, and of two kinds; first, that of exterior matter, comprising every thing applied to the skin, and also the chyle; the other interior, comprehending that of many of the secretions, the fat, the earth of bone, &c. These kinds of absorption take place principally for the nourishment of the body; but they also answer other purposes, and are very extensive; for, besides their salutary effects, they are frequently the cause of disease in a thousand forms.

In the second of the above-mentioned views, Mr. Hunter considers the absorbents as removing parts of the body itself, and here he again views them in two lights. The first is, where only a wasting is produced in the whole body, or some particular part of it; to which mode of absorption he applies the epithet *interstitial*, because it consists in the removal of particles of the body out

of the interstices of parts, which yet remain, and still form a perfect whole. This kind of absorption has always been admitted, or supposed, whether performed by the veins, or the lymphatics. It is often carried further than the mere wasting of the part; for, it may proceed till not a vestige of such part is left, as is sometimes exemplified in the total decay of a testicle. *Interstitial absorption*, therefore, may be understood in two senses.

The second view, taken by Mr. Hunter, embraces that kind of absorption by which whole parts of the body are removed, and which is sometimes a natural, sometimes a diseased, process. It is a view of which he particularly claims the discovery. In the natural process, he says, the absorbents are to be considered as the modellers of the original construction of the body. No alteration can take place in the original formation of many of the parts, either in the natural growth or the formation arising from disease, without the action of the absorbents, which always have a considerable share in the production of the changes. This he terms *modelling absorption*, the principle of which is as extensive as any in the animal economy. Bones and numerous other parts cannot be formed without it. A part, which is of use in one stage of life, but becomes quite useless in another, is thus removed, as is exemplified in the thymus gland, the ductus arteriosus, and the membrana pupillaris. In some cases the absorption of whole parts in consequence of disease leads to dissimilar effects; one is a sore, or ulcer; and Mr. Hunter therefore calls the process, by which it is produced, *ulcerative absorption*. In other cases, no ulcer is caused, although whole parts are removed. Both these forms of absorption, he thinks, might be named *progressive*.

The removal of a whole solid part of the body, or, as Mr. Hunter expresses it, "that power which the animal economy has of taking a part of itself into the circulation, by means of the absorbent vessels, whenever it is necessary," is unquestionably one of the most curious facts which can present themselves to the notice of the physiological inquirer. In Mr. Hunter's time, the doctrine was a new one; but he informs us that he had long been able to demonstrate its truth, and that he received the first hints of it from the waste of the sockets of the teeth, and of their fangs at the period of their being shed.

"It may be difficult at first to conceive how a part of the body can be removed by itself; but it is just as difficult to conceive, how the body can form itself;" yet they are both equally facts. Without dwelling on the exact mode in which such changes happen, he gives it as his belief, that "whenever any solid part of our bodies undergoes a diminution, or is broken in upon, in consequence of any disease, it is the absorbing system which does it."

"When it becomes necessary, that some whole living part should be removed, it is evident that nature, in order to effect this, must not only confer a new activity on the absorbents, but must throw the part to be absorbed into such a state as to yield to this operation." (See *Hunter on the Blood*, &c. p. 439—442.) For an account of *ulcerative absorption*, vide *ULCERATION*.

With regard to the difficulty in conceiving, how tubes, so small as the lymphatics, can take up solid

substances, Bichat argues that the distinction between the solids and the fluids can only be said to prevail when they form a mass; but, that when reference is made to their separate elements, they do not differ from one another. This, he says, is so perfectly true, that the very same elementary constituent will alternately enter into the composition of a solid and a fluid, just as the elements of water are the same, whether it be in the liquid or frozen state. Now, as the absorption of solid substances takes place by the removal of these elementary principles, or atoms, no greater difficulty can present itself in understanding how this may be effected, than in conceiving how fluids may be absorbed. (See *Anat. Gén.* t. ii. p. 92.)

The source of the lymph is less certain than that of the chyle; for, even at the present day, M. Magendie, influenced by the possibility of injecting the lymphatics from the arteries, and by the uniform nature of the lymph, and its analogy to the blood, professes a belief, which was common many years ago, that it is not formed by the decomposition of the old particles of the body, nor by fluids absorbed from various surfaces; but that it is composed of the thinner parts of the blood, which, instead of returning by the veins to the heart, pass into the lymphatics, and are conveyed to that organ through the thoracic duct. The lacteals certainly have little disposition to take up any thing but chyle; but, as Dr. Bostock has explained, "the lymphatics are capable of absorbing a great variety of substances, differing from each other most widely in their nature, so that it would almost appear as if, by a certain mode of application, any substance might be forced into them. Nor (says Dr. Bostock) is this conclusion affected by the hypothesis of M. Magendie; for, although we might agree with him in supposing that, in the ordinary operations of the system, the veins are the principal, or even the sole instruments in removing the materials of which the body is composed, yet we have unequivocal evidence, that, when certain poisonous or medicinal agents are applied to their extremities, they may be received, or forced into them, and conveyed into the circulation. The case of metallic or other medicinal substances that are taken up by the lymphatics, may appear to be less difficult to explain, because the absorption is generally produced by friction or some mechanical process, which may be supposed to force the substance into the mouths of the vessels, or to produce an erosion of the epidermis, which may enable the substances to come into more immediate contact with the mouths of the vessels. We may also imagine that, when the component parts of the body are brought into close approximation with their capillary extremities, they are then taken up in the same way that the chyle is absorbed from the intestines." (*Elem. Syst. of Physiol.* vol. ii. p. 583.) Many physiologists have little difficulty in conceiving how fluids can be taken up by the lymphatics, but rather stagger at the notion of this being also the case with the hardest solids. Others, however, accommodate their creed to both hypotheses, reconciling themselves to them by the argument that, if the minute capillary arteries can secrete this dense, hard matter, the small lymphatics can remove it. One example is not more difficult to comprehend than the other. Yet, such reasoning throws little light on the questions, how are the

solids prepared for absorption, and in what manner are they taken up? These, in fact, remain completely unanswered.

"What (inquires a judicious physiologist) are we to conceive of the intimate nature of this operation? If solution of the substance be necessary, we are at a loss to find a proper solvent; many of the substances are insoluble in water, or in the serous fluid which is found in the vessels; while, on the other hand, it is perhaps not easy to conceive how the substances can be absorbed without being previously dissolved, and still more so, how the solids can have their texture broken down, and enter the vessels, particle by particle, as it were, and be suspended in the lymph in a state of extreme comminution?" These difficulties some physiologists, including Bichat, endeavour to diminish by arguing that the lymphatics must be supposed to act only upon the elements of every texture, and, that on this principle, the absorption of solids is as readily intelligible as that of fluids, the same elements frequently contributing to the composition of both.

While parts retain the vital principle, they resist the action of the absorbents. Dead matter is more easily acted upon by the absorbents than living; and, in fact, "no part can be absorbed until its texture is destroyed, and, consequently, until it is deprived of life. No substance can possibly enter the absorbents, while it retains its aggregation, so that it necessarily follows, that the preliminary step to the absorption of the body is its decomposition." (*Bostock, Elem. Syst. of Physiol.* vol. ii. p. 585.) This able physiologist afterwards explains, that by the death of a part, preceding its absorption, is here signified, only "that it is no longer under the influence of arterial action. It therefore ceases to receive the supply of matter which is essential to the support of all living parts, and the process of decomposition necessarily commences." A better account of the subject appears to be that, which, dismissing all metaphysical and chemical reflections upon the supposed death and decomposition of parts, previously to their absorption, represents the absorbents as acting directly upon the individual atoms, particles, or elements of the various textures. We know nothing about the vitality of these atoms, or elements, in their separate capacity; supposing them to possess it, we know nothing of the moment when they part with it previously to their entrance into the absorbent system; just as we are completely ignorant both of the manner in which such elementary materials acquire the vital principle, and of the exact moment when they become thus endued.

In the foregoing observations, the lymphatics have been presumed to be the true instruments of absorption; by which is meant, not merely that they contain lymph, and transmit it into the venous system, a fact of which no doubt is entertained by any class of physiologists; but, that such lymph really produced by the operation of these vessels upon the various kinds of matter presumed to be taken up by them, and to consist of all the old particles of every texture of the body, the fat, the earth of the bones, and the superfluous quantity of many different secretions, naturally undergoing continual renovation, besides the chyle which is taken up by the lacteals, and conveyed to the thoracic duct, or common trunk of both descriptions

of vessels. To this view of the subject, some physiologists of eminent talents do not accede, and even if it should hereafter be decidedly proved, that the lymphatics possess the power of absorption, the tendency of numerous experiments performed by MM. Magendie, Fodera, and others, is to show that, at all events, they are not the only absorbents, and that the veins are actively concerned in the function. It appears also from various observations and experiments, that substances may enter directly into the blood vessels, and thus get at once into the circulation, or else be conveyed from the surface on which they are placed, through it and the contiguous tissues, into the blood by what M. Magendie terms *imbibition*. In both these modes, it is inferred that absorption does not necessarily require any action or assistance of the lymphatic vessels themselves, the commencement of which, upon every surface and in every texture, by innumerable orifices or mouths, is not regarded by some distinguished physiologists of the present day, as a doctrine by any means well established. Of course, what Hunter would explain on this principle, they would refer to imbibition, in which the absorbed matter passes through the textures of parts into the circulation, or else gets more directly into the blood vessels.

ACETATE OF LEAD. See LEAD.

ACETATE OF MORPHIA. See MORPHIA.

ACETIC ACID. *Distilled Vinegar*; contains five per cent. of acetic acid, and, when mixed with farinaceous substances, is frequently applied to sprained joints, and, in conjunction with alcohol and water, makes an eligible lotion for many cases, in which it is desirable to keep up an evaporation from the surface of inflamed parts. Vinegar was once considered useful in quickening exfoliations, which effect was ascribed to its property of dissolving phosphate of lime. Its good effects on burns and scalds were taken particular notice of by Mr. Cleghorn, a brewer in Edinburgh, whose observations were deemed by Mr. Hunter worthy of publication. (See *Med. Facts and Obs.* vol. ii.)

Diluted vinegar is alleged to be the best lotion for freeing the eye from any small particles of lime which happen to have fallen into, and become adherent to it, or the inside of the eyelids. (See *A. T. Thomson's Dispensatory*, p. 8. ed. 2.)

Distilled vinegar is sometimes employed as a styptic for stopping hemorrhage from the nose. With this view, it may be used either as an injection, or a lotion, in which lint is dipped, and introduced up the nostril. It is often used to lessen the disagreeable smell of sick rooms. Acetic acid is one of the most certain applications for the destruction of warts and corns, care being taken not to injure the surrounding skin with it. (*Brande's Manual of Pharmacy*, p. 9. 8vo. Lond. 1825.)

The pyroigneous acid, which is merely strong acetic acid impregnated with empyreumatic oil and bitumen, is commended by Mr. Buchanan, of Hull, as an ingredient in applications to the ear for the relief of certain cases of deafness. (See *Illustrations of Acoustic Surgery*, 8vo. Lond. 1825.)

ACHILLES, *Tendon of*. See TENDONS.

ACTUAL CAUTERY. A heated iron, formerly much used in surgery for the extirpation and cure of diseases. Its shape was adapted to

different cases, and the instrument was often applied through a canula, in order that no injury might be done to the surrounding parts. *Actual* cauteries were so called in opposition to other applications, which, though they were not really hot, produced the same effect as fire, and consequently were named *virtual* or *potential cauteries*. The actual cautery is still in common use upon the Continent; and by foreign surgeons we are not unfrequently criticised for our general aversion to what they distinguish by the appellation of an *heroic* remedy. Pouteau, Percy, Dupuytren, Larrey, Roux, Delpech, and Maunoir, are all advocates for the practice; and the latter gentleman, when he was in England, took the opportunity of reminding British surgeons of their error, in abandoning, as most of them do, the employment of heated irons. (See *Obs. on the Use of the Actual Cautery*, *Med. Chir. Trans.* vol. xiii. p. 364, &c.) The few cases, in which the actual cautery is occasionally used by British surgeons, are noticed in the articles HEMORRHAGE, JOINTS, URINARY FISTULÆ.

ACUPUNCTURE (from *acus*, a needle, and *pungo*, to prick). The operation of making small punctures in certain parts of the body with a needle, for the purpose of relieving diseases, as is practised in Siam, Japan, and other oriental countries, for the cure of headaches, lethargies, convulsions, colics, &c. (See *Phil. Trans.* No. 148.; and *Wilth. Ten. Rhyme, de Arthritide, Mantissa Schematica*, &c. 8vo. Lond. 1683.) Dr. Elliotson has tried acupuncture extensively, and his experience coincides with that of Mr. Churchill, confirming the fact that, as a remedy for chronic rheumatism, it answers best where the disorder is seated in fleshy parts. He also finds, that one needle, allowed to remain an hour or two in the part, is more efficient than several, used but for a few minutes. (See *Med. Chir. Trans.* vol. xiii. p. 467.) Neuralgia is a disease in which the practice may deserve trial. Local paralysis is another. In a modern French work, it has been highly commended; but the author sets so rash an example, and is so wild in his expectations of what may be done by the thrust of a needle, that the tenor of his observations will not meet with many approvers. For instance, in one case, he ventured to pierce the epigastric region so deeply, that the coats of the stomach were supposed to have been perforated: this was done for the cure of an obstinate cough, and is alleged to have effected a cure! But, if this be not enough to excite wonder, I am sure the author's suggestion to run a long needle into the right ventricle of the heart, in cases of asphyxia, must create that sensation.

See *Berthoz, Mém. sur les Maladies Chroniques, et sur l'Acupuncture*, p. 305—309. 8vo. Paris, 1816. *Churchill on Acupuncture*, 1824; *Dantù, Traité de l'Acupuncture*, 1826.

ADHESIVE INFLAMMATION. That kind of inflammation by means of which parts of the body adhere or grow together. Also, the process by which recent incised wounds are united, without any suppuration, and frequently synonymous with union by the first intention. (See INFLAMMATION and UNION by the FIRST INTENTION.)

AGARIC. A species of fungus, growing on the oak, and formerly celebrated for its efficacy in stopping bleeding. (See HEMORRHAGE.)

ALBUGO (from *albus*, white). A white opacity of the cornea, not of a superficial kind, but

affecting the very substance of this membrane. See *LEUCOMA*.

ALUM, Sulphate of alumina. Ten grains of alum, made into a bolus with conserve of roses, may be given thrice a day in internal hemorrhages, gleet, leucorrhæa and other cases demanding astringent remedies. In a relaxed state of the urinary passages, or want of power of the sphincter vesicæ, small doses of alum are said to have been of service. Alum is employed as an ingredient in many astringent lotions, gurgles, injections, and collyria. Dr. Groshuis, a Dutch physician, first recommended its use in colica pictorum, and Dr. Perceval subsequently joined in the advice. The principle, on which it acts, is that of decomposing the common preparations of lead, and converting them into sulphates, which are comparatively innoxious. Burnt alum is a principal ingredient in many styptic powders.

ALVINE CONCRETIONS. See *INTESTINAL CONCRETIONS*.

AMAUROSIS (from ἀμαύρω, to darken). *Gutta serena. Suffusio nigra.* Germ. *Schwarze Staar*. That diminution or total loss of sight, which immediately depends upon a morbid state of the retina and optic nerve, whether this morbid state exist as the only defect, or be complicated with other mischief; whether it be a primary affection, or a secondary one, induced by previous disease of other parts of the eye. (Beer.) All those imperfections of vision which depend upon a morbid condition, whether affecting structure or function, of the sentient apparatus proper to the organ. (Travers' *Synopsis of the Dis. of the Eye*, p. 293.) All affections of the nerves of vision, which produce either complete or partial loss of sight, whether this arise from obvious or inferred organic disease, or from a diminution or loss of sensibility in the eye, which cannot be traced to change of structure, or any other evident cause. (*Journ. of Foreign Med. and Surgery* vol. iv. p. 166.) Obscurity of vision, depending on a more or less insensible state of one or several of the nervous parts, which assist in forming the optic apparatus: it is a disease, therefore, arising from causes entirely different from those which prevent the rays of light from entering or passing through the eye. (Wm. Mackenzie on *Dis. of the Eye*, p. 897, ed. 2.) Any great imperfection or loss of vision existing independently of any change in the natural transparency of the parts anterior to the retina, or of any manifest varicose enlargement of the vessels of the choroid, or of any material alteration in the configuration of the eye-ball. (R. Middlemore on *Dis. of the Eye*, vol. ii. p. 242.) This definition does not embrace so many cases as several of the others.

The definition of amaurosis, given by Mr. Lawrence, is correct and comprehensive; namely, the imperfection or loss of sight, which results from affection of the nervous apparatus belonging to the eye, whether that affection be seated in the retina, the optic nerve, or the sensorium; whether it be idiopathic or primary, sympathetic or secondary; whether it consist in vascular congestion, or organic change, or simply in functional disturbance. (*On Dis. of the Eye*, p. 487.) By the expression *gutta serena*, is usually signified the complete or fully developed form of amaurosis, that in which the patient has little or no power of distinguishing light from darkness.

Amaurosis then does not uniformly take place as an independent disorder; but not unfre-

quently presents itself as a symptomatic effect of some other disease of the eye: a fact, exemplified in hydrophthalmia, cirsophthalmia, glaucoma, &c. And, as Mr. Wardrop observes, amaurosis, in its usual acceptation, signifies a symptom of disease, as well as a distinct affection. (*Essays on the Morbid Anatomy of the Human Eye*, vol. ii. p. 165. 8vo. Lond. 1818.) With respect to the mere name of the kind of disease here implied by amaurosis, its correctness will remain the same, whether the iris be moveable or immoveable; whether the pupil be preternaturally enlarged, or contracted; and whether it be perfectly clear and transparent, or more or less turbid; for the name only refers to the morbid state of the retina and optic nerve, and not to the condition of the sight in general. When the long established name of *amaurosis* is received with this precise meaning, there will not be the slightest danger of confounding the disease with other affections of the eye. However, when it is wished to make out the different forms and kinds of amaurosis, the appearances of the iris and pupil are considerations of great importance. (See Beer's *Lehre von den Augenkrankheiten*, b. ii. p. 420, &c. Wien, 1817.)

Genuine uncomplicated amaurosis, consisting of a mere diminution or loss of sight, without the appearance of any other defect, is one of the most uncommon forms of the complaint. In it, merely the vital properties of the optic nerve and retina are affected, and, after death, nothing preternatural can be traced in these parts. In short, the case is one in which the functions of the retina are imperfect or destroyed, the eye appearing in other respects sound.

This simple unmixed form of amaurosis is subdivided by Beer into that amaurotic weakness of sight, or blindness, which depends upon the sensibility of the optic nerve and retina being too highly raised, and into another case, the proximate cause of which is peculiarly and entirely referrible to depression of such sensibility. The first example is much less common than the second. Mr. Lawrence conceives, however, that they who divide amaurosis into two kinds, *that with increased, and that with diminished sensibility of the retina*, enumerate as symptoms of the former various kinds of impaired vision, some of which rather denote the period of excitement in disease of the retina, than the more advanced stage, ordinarily designated as amaurosis. (*On Dis. of the Eye*, p. 508.) With reference to some amaurotic patients, who are annoyed by the bright light of day, Mr. Middlemore also observes, that it would seem as if the sensibility of the retina were increased, although the power of vision is greatly diminished; but, he adds, this is usually nothing more than an early symptom of only some few varieties of amaurosis; it does not continue so as to constitute one of its latter symptoms. (*On Dis. of the Eye*, vol. ii. p. 257.)

Amaurosis does not constantly attack both eyes at the same time; frequently one is attacked some time after the other, and it is not unusual even for one eye to remain sound during life, while the other is completely blind. This depends, in part, upon the disposition to the disease in one eye being quite local, and in part upon the causes giving rise to the complaint extending their operation only to the eye affected. Where, also, the origin of amaurosis seems to depend altogether upon constitutional

causes, one eye is not unfrequently attacked much sooner than the other; though, in these examples, it is more rare to find the eye, which does not suffer at first, continue perfectly unaffected. (Beer, b. ii. p. 422.) As a general observation, Mr. Wardrop thinks it may be remarked, that when only one eye is at first amaurotic, from a sympathetic affection, there is little danger of the other eye becoming blind; but that when amaurosis is produced by any organic change in one eye, the other is very liable to be sympathetically affected. (*Essays on the Morbid Anatomy of the Human Eye*, vol. ii. p. 190.) Mr. Middlemore represents amaurosis as commonly attacking one eye first, and not commencing in the other until vision in the one first attacked is either much impaired or totally destroyed. "It is (says he) by no means an usual occurrence for amaurosis to take place in each eye at the same time, and to advance in both with an equal progress." Still, he admits, that this matter will be mainly determined by the nature of the cause producing the amaurotic affection. (*On Dis. of the Eye*, vol. ii. p. 251.) Indeed, since amaurosis may arise from affections of the sensorium, optic nerve, or retina, we can understand how it happens that it sometimes appears in both eyes at once; that it may be confined to one, or that, having taken place in one, it may in the other also, after a longer or shorter interval. (Laurence, *Op. cit.* p. 489.)

Amaurosis may not completely hinder vision, a diminished power of seeing often remaining during life. Hence the division of cases into *perfect* and *imperfect*; which latter, however, sometimes attain a degree in which the patient is only just able to distinguish light, the direction of its rays, and its degree.

Imperfect amaurosis, besides being characterised by a considerable weakness of sight, approaching to actual blindness (*Amblyopia Amaurotica*), is mostly complicated with a greater or lesser number of other morbid effects. Amongst the most important of these, is a defective interrupted vision (*visus interruptus*). For instance, when the patient is reading, single syllables, words, or lines cannot be seen, unless the eye be first directed to them by a movement of the whole head, and greater or lesser portions of other objects are, in the same manner, indistinguishable. Sometimes, amaurotic patients can see only the upper or lower, or the left or the right half of objects. (*Visus dimidiatus*; *Amaurosis dimidiata*; *Hemiotopia*; *Hemiotopia*.)

Sometimes, when the patient shuts one eye, he can only distinguish the halves of objects; but, if he open both eyes, he sees every thing in its natural form. In this case, one eye is sound, and only some fibres of the nerve of sight are injured in the other. (See *Schmucker's Vermischte Chir. Schrift.* 1816, ii. p. 12.)

In some not very uncommon cases of imperfect amaurosis, the patient cannot see an object, unless it be held in a particular direction before the eye; but, when the eye or head is moved in the least, he loses all view of the thing, and cannot easily get sight of it again. (Beer, *Lehre von den Augenkrankheiten*, b. ii. p. 424.) Patients who may be said to be entirely blind, sometimes have a small part of the retina which is still susceptible of the impression of light, and is usually situated towards one side of the eye. This obliquity of sight was long ago pointed out by the late Mr. Hey, as common in the present disease. (See *Med. Obs. and*

Inquiries, vol. v.) Richter mentions, that, in one man, who was, in other respects, entirely bereft of vision, this sensible point of the retina was situated obliquely over the nose, and so small, that it was always a considerable time before its situation could be discovered: he adds, that it was so sensible, as not only to discern the light, but even the spire of a distant steeple. The centre of the eye seems to be first and most seriously affected. Hence, the generality of patients, in the early stage of imperfect amaurosis, see objects, which are laterally situated, better than such as are immediately before them. (*Anfangsgr. der Wundarzn.* b. iii. kap. 14.)

One of the most common symptoms of a beginning amaurosis, is an appearance in the patient's fancy, as if gnats, or flies were flying about before his eyes. (*Visus Muscarum*, *Myodesopsia*.) Sometimes, transparent, dark-streaked, circular, or serpentine diminutive bodies appear as if flying in greater or lesser numbers before the eyes, often suddenly ascending, and as quickly falling down again, and chiefly annoying the patient and confusing his sight when he looks at strongly illuminated or white objects. The substances, thus appearing to fly about before the patient's eyes, are termed *Musce volantes*; *Mouches volantes*. (Beer, *Lehre*, &c. b. ii. p. 424.) If what obstructs the sight be a single black speck, it receives the name of *scotoma*.

This illusive perception, of various substances being in rapid motion before the eye, gradually increases; the substances themselves become less and less transparent, and, at length, are so connected together, that they form a kind of network, or gauze, by which all objects are more or less obscured. This is another symptom of amaurosis, it clinically called *visus reticulatus*. The network commonly has the peculiarity of being black in very light situations, or when white substances are before the eye; while, in dark places, it is quite shining, and, as it were, of a bluish white hue, like silver, though sometimes of a red-yellow, golden colour.

A not uncommon symptom of imperfect amaurosis is the patient's seeing every object indistinctly in a rainbow-like, sometimes tremulous, and generally very dazzling light; while, in the dark especially, blue or yellow flashes, or fiery balls seem suddenly to pass before his eyes when the eyelids are shut, and excite considerable alarm. (*Visus lucidus*; *Marmoryge Hippocretis*; *Photopsia*.)

In imperfect amaurosis, the sensibility of the retina may be so augmented, that the patient shuns all light places, particularly those in which the light is strongly reflected into the eye, and, in order yet to discern in some measure large objects, he feels himself obliged always to seek shady, darkish situations, or to screen his eyes, out of doors, with a green shade, or green glasses. This state is termed by Beer, *Lichtscheue*. (*Photophobia*.) Under these circumstances, it sometimes happens, that the patient, for a very short time, for example, a few moments, or (what is uncommon) for a more considerable period, is able of himself to discern the smallest objects in a weak light, more plainly and accurately than the best eye can hardly do in a good light. Yet, excepting at such period, the patient, with the above degree of light, is not capable of seeing even larger objects. This infirmity of sight receives the name of *oxyopia*.

Sometimes, in the early stage of amaurosis, all

objects seem covered with a dense mist; while, in other instances, this mist first presents itself as a simple, continually increasing scotoma, and rarely in the form of a network, or gauze; but to the patient, when his blindness commences with the *visus nublatus*, the mist usually appears for a day or two of a light grey colour, and then for another day or two very black, every thing appearing as if looked at through a dense sooty smoke. (Beer, *Lehre von den Augenkrankheiten*, b. ii. p. 422-26.)

To an eye affected with imperfect amaurosis, all objects frequently appear indistinct, but double. (*Visus duplicatus*; *Diplopia*.) When the disease comes on gradually, the patient sometimes sees double, with both eyes. Schmucker once cured a major of hussars, who saw the three lines of his squadron double; and he attended another gentleman similarly afflicted. Such cases, he conceives, are brought on by a violent distension of the vessels of the choroides, where, he thinks, varices may easily arise, in consequence of the weak resistance of that membrane. In this manner, the filaments of the retina suffer pressure, and the rays of light are broken. Under these circumstances, if prompt assistance be not afforded, total and frequently incurable blindness may be the consequence. Schmucker met with an irremediable amaurosis of this kind, in a young man, twenty-six years of age. When the patient made application for advice, he had been blind a year. Before he lost his sight, he remarked, that, after any violent emotion, his sight at first grew weak, and that objects afterwards appeared double. When his circulation was at all hurried, he saw black spots before his eyes, and at length was quite blind. The vessels of the choroides were as large as if they had been injected with wax, and every kind of surgical assistance proved ineffectual. (*Vermischte Chir. Schriften*, b. ii. p. 12. &c. 8vo. Berlin, 1786.) In some cases, double vision only occurs, when the patient looks at objects with both eyes, and it ceases as soon as he shuts either the diseased or the sound eye. In the last of these circumstances, double vision originates from the deviation of the unsound eye from the axis of sight; but, in the first instance, it arises from the morbid state of the retina itself of the diseased eye. For the purpose of distinguishing both these examples of diplopia from every other species of symptomatic double vision, Beer applies to them the name of *diplopia nervosa*. A degree of squinting, *strabismus*, therefore, is a common symptom of incipient amaurosis, particularly when only one eye is affected; for this always deviates more or less from the axis of vision. It is owing to this loss of correspondence, that persons, affected with an imperfect amaurosis of one eye, often mistake the relative distance of objects, and frequently see them reflected. (*Travers's Synopsis*, p. 170.) It is less usual for imperfect amaurosis to be accompanied with what Beer terms obliquity of the eye (*Lusitas*); either a paralysis, or a ceaseless, irregular action of one or more of the muscles of the organ, being evidently a condition of this symptomatic appearance. (See Beer, *Lehre von den Augenkrankheiten*, b. ii. p. 427.)

Beer has often met with patients labouring under imperfect amaurosis, who could plainly distinguish all objects which were not very small; but saw them of a different colour from their real one; for instance, yellow, green, purple, &c. *Visus color-*

atus eruptia.) He had under his care an amaurotic woman, who at midday could discern even the smallest objects in a strong light, but they all appeared yellow, though no marks of jaundice were perceptible.

Sometimes, in the early stage of amaurosis, all objects appear distorted, bent, shortened, and, in rarer instances, inverted. (*Visus disfiguratus*; *Metamorphosis*.) Thus the flame of a candle appears very long, but all awry. This is said by Beer to be constantly an unfavourable omen, as the cause of it lies in the brain itself.

Imperfect amaurosis is sometimes attended with considerable shortsightedness (*Myopia*), and sometimes with the opposite affection (*Preshyopia*), an infallible proof that essential changes have happened either in the transparent media or in the muscles of the eye.

Many patients, when first attacked with amaurosis, every where testify a partiality to a great quantity of light, employing several candles at night, and sitting in the day-time with their backs against a sunshiny window, in order to let whatever they are reading have a very strong light upon it. This symptomatic appearance of incipient amaurosis is termed by Beer, *Lichtthunger*.

Amaurosis may take place in an instant, even so as to be attended with entire blindness; or it may come on quickly, that is, it may be complete in a few days or weeks; or, lastly, what is most frequently the case, it may be produced gradually, and several years elapse before it attains its utmost degree; circumstances of great moment in the diagnosis and treatment.

The type, which the disease assumes in its course and development, is also subject to great variety, and claims the utmost attention; for amaurosis may either be *permanent* or *temporary*. It is sometimes *intermittent*, making its appearance at regular or irregular intervals. In certain examples, it prevails at particular times, commonly all day, till a certain hour; or from one day till the next; or at a stated time every month. The attacks sometimes take place at indeterminate periods. In particular cases, another morbid affection is associated with the impairment of sight. Richter mentions a man, who became blind at twelve o'clock in the day, when the upper eyelid used to hang down paralytic. The attack always lasted twenty-four hours. On the following day, at twelve o'clock, the sight used to return, and the patient then suddenly regained the power of raising the upper eyelid. He would continue thus able to see for the next twenty-four hours. Whenever he took bark, the disease was regularly doubled; that is to say, the man then alternately remained blind forty-eight hours, and recovered the power of seeing for only twenty-four. In another patient, cited by the same writer, the aqueous humour, during the blindness, always became discoloured, whitish, and turbid; but its transparency regularly returned on the cessation of the attack. According to Richter, *periodical* amaurosis commonly depends upon irritation affecting the digestive organs, the stimulus of worms, or irregularity in the menstrual discharge. Sometimes it is plainly a symptom of a confirmed ague, the patient being attacked with an ordinary intermittent, and blind during each paroxysm, but always regaining his sight as soon as each fit is over (*Anfangsgg. der Wundarrn.* b. iii. kap. xiv.) Beer believes, that periodical

amaurosis is chiefly observed in chlorotic, hemorrhoidal, hysterical, and hypochondriacal subjects. Day-blindness (*Cæcitas Diurna*; *Nyctalopia*) and night blindness (*Cæcitas Crepuscularis*; *Hemeralopia*) are nothing more than cases of periodical amaurosis. To these cases, Richter's etiology will not apply; the causes being entirely of another kind. But sometimes the frequently recurring form of the disease confines itself to no determinate type; and, on account of its irregularity, it is then termed by *V. R.*, *Amaurosis Vaga*, which, he says, is principally met with in persons liable to hysteria, hypochondriasis, convulsions, or epilepsy. Periodical amaurosis, after remaining cured a certain time, often becomes permanent. (*Beer, Lehre, &c. b. ii. p. 429.*)

The amaurosis, commencing with morbid irritability of the retina and photophobia, is described by Beer as having two stages: during the first, the patient never becomes blind; the eyesight not being lost till the end of the second stage. The disease always forms with great quickness, so that the limits between the two stages are frequently very indistinct.

The first stage commences with a peculiar sensation of fulness in the eyeball, joined with continually increasing, violent, and annoying luminous appearances, and a remarkable weakness of sight. These symptoms are soon followed by a stupifying, constantly increasing headache, during which the power of vision manifestly diminishes, without the slightest defect being perceptible, either in the eye itself, or its surrounding parts. The patient, however, is always of an athletic constitution, or has symptoms of general or local plethora, or a phlogistic diathesis. This observation coincides with the view which I entertain of this part of the subject, namely, that the amaurosis beginning with irritability of the organ and photophobia, originates generally from an inflammatory affection of the retina. A different opinion, however, is sometimes expressed. "This condition of photophobia, (says Mr. Middleton) is wholly unconnected with retinitis, and, although it is relieved by protecting the eye from bright light, does not restore to the organ perfect vision: the sight is, in fact, impaired in a greater or lesser degree, although from the degree of intolerance of light which is present, it might be inferred, that the sensibility of the retina was increased in a manner which was wholly inconsistent with the existence of impaired and cloudy vision." (*See R. Middlemore on Dis. of the Eye, vol. ii. p. 257.*)

Upon the advance of the disorder into its second stage, the headach becomes irregular, being less violent at some periods than others; the patient feels as if there were before his eyes a thick net, or gauze, which, in a bright light, appears quite black, but, in the shade, fiery and stinging. This net or gauze, when there is any temporary determination of blood to the head and eyes, as in straining at stool, is immediately rendered considerably more dense; and when such determination of blood is often repeated, or long maintained, the density at length remains much greater than before, and consequently, the patient suddenly grows more blind, and is very quickly entirely bereft of vision. This complete loss of sight, in the second stage, if efficient assistance be not given, is ultimately produced by the progress of the disease, even without any accidental determination of blood, though never

quite suddenly. Al power Determining the light is abolished, under incessant stupifying headaches, which are sometimes weaker, sometimes stronger, and attended with a sensation as if the dimensions of the eye were increased, and, indeed, it really feels harder, than in the healthy state.

Sometimes amaurosis originates with symptoms of weakness and diminished irritability. The sight is cloudy, and the patient finds that he can see better in a light than a dark situation. He feels as if some dirt, or dust, were upon his eyes, and is in the habit of frequently wiping them. His power of vision is greater after meals than at the time of fasting. His sight is always plainer, for a short time after the external use of tonic remedies, such as hartshorn, cold water, &c. Richter informs us of a person who was nearly blind, but constantly able to see very well, for the space of an hour after drinking champagne wine. He also mentions a woman entirely bereft of sight, who was in the habit of having it restored again, for half an hour, whenever she walked a quick pace up and down her garden. He likewise acquaints us with the case of a lady, who had been blind for years, but experienced a short recovery of her sight, on having a tooth extracted. (*Anfangsgr. &c. b. iii. kap. 14.*)

Whether the benefit arose from the stimulus of the operation, as Richter seems to imply, or from the removal of an irritating cause, doubts may be entertained. A similar fact is recorded by Mr. Travers, who says, that he has seen an incipient functional amaurosis distinctly arrested by the extraction of a diseased tooth, when the delay of a similar operation had occasioned gutta serena on the opposite side two years before. (*Synopsis, p. 299.*)

When the disorder is accompanied with diminished sensibility in the eye in general, Beer coincides with Richter, respecting the temporary improvement of the sight after a nourishing meal, or drinking spirituous liquors; or when the patient's mind is elated with joy or anger, though such melioration of sight, it is true, is but of very short duration. (*Also Vetch on Dis. of the Eye, p. 137.*) On the other hand, it may be remarked, that every thing which tends to depress the passions and spirits, augments the imperfection of sight. Where marks of increased sensibility prevail, the above-mentioned circumstances exercise a transient disadvantageous operation; the patient carefully retires from every strong light, and frequently shelters his eye with his hand, &c. (*Lehre von den Augenkr. b. ii. p. 430.*) Mr. Travers also knows patients, whose vision is benefited in a high degree, and others, in whom it is much deteriorated, by the quickened circulation of a full meal, and a few glasses of wine. The former, he says, are persons of spare and meagre habits; the latter, plethoric. (*Synopsis of the Diseases of the Eye, p. 157.*)

According to Beer, this amaurosis, originating with diminished sensibility of the organ, usually comes on very slowly, and does not exhibit the two very different stages peculiar to the opposite case. It also invariably commences with the visus reticulatus, or nebulosus, without any alternation with a blinding glare of light; and the eyesight is sometimes considerably better, and sometimes weaker, which always depends upon the accidental operation of the above internal or external circumstances. The melioration of the eyesight never

continues long, while the diminution of it not only remains, but gets worse and worse. It is not at all uncommon for this species of amaurosis to make its appearance as a night blindness, because common artificial light is much too feeble to make due impression upon the diminished sensibility of the optic nerve, and consequently these patients always show a partiality to a strong light. To such weak-sighted individuals, the flame of a candle, or the moon, appears as if covered by a dense veil, with an expanded halo round it of various colours. There is no complaint made of pain in the head or eyes; and no sensation of fulness or weight is experienced in the eyeball; much less are there any signs of the disease in the structure and form of the eye, or in the action of its irritable textures; but, when it has been long complete, it is usually conjoined with a debilitated habit.

Amaurosis either presents itself as a genuine uncomplicated affection, or, at least, with the appearance of such a form of disease of the eye, depending solely upon a morbid state of the optic nerve, and cognizable by a diminution, or complete abolition, of the power of vision; or the disease is co-existent with other diseased appearances, either in the eye, its vicinity, or some others organs at a distance from the eye, or in the general constitution. These appearances merit the most earnest consideration, because they are for the most part connected with the cause of amaurosis. According to this statement, then, there is a *genuine local amaurosis*, and a *complicated amaurosis*, which last may be either *local or general*, or of both descriptions together, and therefore named by Beer, *perfectly complicated*. (Vol. cit. p. 431.)

In the simple uncomplicated species of amaurosis, all morbid appearances are absent, which might be produced in the amaurotic eye by any preternatural change in the texture, form, or state of that organ. Hence we are obliged to trust almost exclusively to the patient's assertion, that his sight is bad, or quite gone; and not unfrequently it is necessary, especially in judicial cases, to employ political artifices, in order to determine whether such assertion be true, particularly when the patient affirms that the blindness is restricted to one eye. Secondly; when amaurosis is indeed nearly or quite formed in one eye, a slight degree of strabismus is at most perceptible, arising from the circumstance of the patient's not fixing the eye affected upon any object. This degree of strabismus is noticed by Ackermann and Fischer as the surest sign of amaurosis. (See *Klinische Annalen von Jena*, st. i. p. 144.) And it is particularly pointed out by Richter as an invariable attendant upon amaurosis. The patient, says he, not only does not turn either eye towards any object, in such a manner that the object looked at is in the axis of vision, but he does not turn both his eyes towards the same thing. This was regarded by Richter as the only symptom which we can trust, where implicit confidence should not be put in the mere assurance of the patient that he cannot see, while all the coats and humours of the eyes present their natural appearance. (See *Lehrbegriff der Wundarznei*, b. iii. kap. 14.) This observation is interesting to the military surgeon, amaurosis being a common affliction of soldiers, many of whom, however, endeavour to avoid service by pretending to labour under a disqualification which they well know does not necessarily produce any very consi-

derable alteration on the natural appearance of the eye. Thirdly; while the disorder is only in the stage of amblyopia, the patient always complains of continually multiplying muscæ volitantes, or of the visus reticulatus, or nebulosus. Fourthly; luminous forms appear before the eyes, especially in the dark, even when the patient is entirely blind. Fifthly; the decrease of vision goes on to complete blindness, without any material interruption or retrogression. Sixthly; when only one eye is quite blind, and the eyesight on the other side is perfectly undisturbed, there is one infallible symptom of this amaurosis, namely, if the sound eye be very carefully covered, the pupil of the blind one immediately expands, and the iris becomes quite motionless, notwithstanding the diseased eye be exposed to the strongest light possible. However, this criterion is mostly wanting, because the amaurosis, unattended with any perceptible defect, except loss of vision, is seldom confined to one eye, but usually affects both. (See *Lehre von den Augenkr.* b. ii. p. 481-82.)

Mr. Travers divides amaurotic affections into two classes, the *organic* and the *functional*. The first comprehends alterations, however induced, in the texture or position of the retina, optic nerve, or thalamus. The second includes suspension or loss of function of the retina and optic organ, depending upon a change, either in the action of the vessels, or in the tone of the sentient apparatus.

As causes of organic amaurosis, this author enumerates: 1. Lesion, extravasation of blood, inflammatory deposition upon either of its surfaces, and loss of transparency of the retina. 2. Morbid growths within the eyeball, dropsy, atrophy, and all such disorganisations as directly press upon, or derange the texture of the retina. 3. Apoplexy, hydrocephalus, tumours or abscesses in the brain, or in or upon the optic nerve or its sheath, and thickening, atrophy, absorption, or ossification of the latter. As causes of functional amaurosis, Mr. Travers specifies: 1. Temporary determination; vascular congestion, or vacuity, as from visceral or cerebral irritation; suppressed, or deranged, or excessive secretions, as of the liver, kidneys, uterus, mammae, and testes; various forms of injury and disease; and hidden translations of remote morbid actions. 2. Paralysis idiopathica, suspension or exhaustion of sensorial power from various constitutional and local causes; from undue excitement or exertion of the visual faculty; and from the deleterious action of poisons on the nervous system, as lead, mercury, &c. From this description, says Mr. Travers, it will be understood, that organic, and many forms of functional amaurosis are incurable; and the functional, by continuance, lapses into the organic disease.

I particularly recommend to those who wish for further information on this part of the subject, to consult Mr. Middlemore's account of the pathological condition of the retina, optic nerve, brain, certain nerves, and various parts of the system, in explanation of the causes of amaurosis. (*On Dis. of the Eye*, vol. ii. p. 247.)

Functional amaurosis is subdivided by Mr. Travers into, 1st, the *Symptomatic*, or that which is only a symptom of some general disease, or disorder of the system; as, for example, plethora, or debility: 2dly, the *Metastatic*, or that produced by the sudden translation of the morbid action from another organ of the body; as, for example, from

the skin, the testicle, &c.: 3dly, the *Proper*, or that which depends upon a peculiar condition of the retina; as, for example, the *visus nebulosus*, *muscae volitantes*. (*Synopsis*, p. 139—155.)

Mr. Lawrence does not consider the expression *functional* amaurosis to be of any practical utility; he argues, that the exact limits of the changes termed organic have not yet been determined. "We apply the epithet *functional* to those diseases which produce no changes recognizable after death. But we cannot infer from these cases, that no alteration had existed during life. The state of an organ, necessary to the correct execution of its function, is a living, not a dead condition; it requires, not merely a certain organization as we find after death, but a supply of healthy blood in a certain quantity, a natural state of nervous influence and sympathy, and perhaps other circumstances, not clearly understood. If all these conditions are combined, can we consider it possible, that the function should be disordered, or interrupted? If one or more should be altered, or wanting, can the disease be properly regarded as simply *functional*? Vascular congestion is an obvious deviation from the normal state of a part. If the retina, or any other organ, be said to be functionally disordered when its vessels appear twice as numerous and large as in the normal condition, the expression must be employed too loosely to convey any clear information." (*On Diseases of the Eye*, p. 489.) Mr. Middlemore conceives, that the existence of irritation in some parts of the intestinal tube produces some change in the vascular department of the apparatus immediately subservient to vision, and that it does not excite an imperfection of vision by means of some undefined and indefinable irritation of a more or less protracted duration, which leaves the various organic conditions of the separate parts of that apparatus unaltered and unaffected; but, that it is not of a nature to induce any permanent change in the organic matter of parts, is proved by the perfection, with which vision returns in many cases immediately after the temporary amaurotic attack. So far, then, it appears to Mr. Middlemore, that there is a certain similarity between *functional* or *sympathetic* amaurosis, and *organic* or *structural*; but it must not be forgotten, that the former may, by continuance and establishment, terminate in the latter. (See *Middlemore on Diseases of the Eye*, vol. ii. p. 245.) It seems to Dr. Mackenzie, that amaurosis always results from an *organic cause*. The notion of a *functional* amaurosis, he conceives, must have arisen from the facts, that this disease is sometimes sympathetic, or arises in consequence of derangement of some remote organ; and that it is occasionally sudden in its attack, and, on the other hand, instantaneous in its departure. In sympathetic amaurosis, Dr. Mackenzie considers it as indisputable, that the loss of sight must depend on some organic change in the optic apparatus. Take, for example (says he), the amaurosis which arises from the presence of worms in the bowels. This result is only occasional: the brain of perhaps not more than one out of a hundred affected with worms, is so susceptible of disease, that the irritation communicated to it from the bowels, through the great sympathetic nerve, is sufficient to excite it to that morbid condition which causes dilatation of the pupils and loss of vision; but, that the amaurosis, in these cases, is the consequence of any

thing else than a certain morbid condition of the optic apparatus, seems to Dr. Mackenzie a proposition which scarcely deserves a serious refutation. Neither does he admit, when amaurosis occurs suddenly as a disease of relation, that it is independent of organic derangement in the optic apparatus, however indubitable it may be, that the first link in the chain of causes has existed in some remote part of the body. (*On Diseases of the Eye*, ed. 2. p. 902.) After all, however, with the qualifications and particulars annexed by Mr. Travers to his definition of the varieties of functional amaurosis, I see a perfect agreement between him and Mr. Lawrence in the pathological view of the subject: and the only question relates to the propriety of applying the term *functional* to particular forms of amaurosis. The least objectionable divisions of the amaurosis seem to the latter surgeon to be three, according as the disease proceeds from *affection of the sensorium*, or of the *optic nerve*, or of the *retina*, though he acknowledges, that the evidence during life leaves us sometimes in doubt, whether the case ought to be referred to one or another of these heads. Amaurosis (says he) may be induced by causes acting immediately on the nervous apparatus of the eye, such as excessive exertion of the organ, or a stroke of lightning; it may arise secondarily from sympathy between the nervous structure of the eye and some other previously affected organ, as from irritation of the stomach, or of the nerve of the fifth pair; or it may be a symptom of affection of the sensorium, more or less general. Hence, the distinction of the complaint into *idiopathic*, *sympathetic*, and *symptomatic*. (See *Lawrence on Dis. of the Eye*, p. 489.)

On the whole, genuine local amaurosis, that is to say, a diminution or total loss of the eyesight, unattended with any other apparent local or constitutional defect, may be said to be a rare case, the disorder being usually more or less complicated.

To the local complications, says Beer, belong cataract; glaucoma; a general varicose state of the eyeball (*exophthalmia*); exophthalmia; atrophy of the eye; spasms in the organ and surrounding parts; paralysis of one or more muscles of the eye (*ophthalmoplegia*); paralysis of the eyelids; ophthalmia in general, and internal ophthalmia in particular; a scorbutic bloodshot appearance of the eye (*Hypocma Scorbuticum*); and, finally, wounds or contusions of the eye, or adjacent parts. With these cases should also be mentioned that important disease, fungus haimatodes of the eye. From this simple enumeration of local complications, one may see how frequently amaurosis is only a symptomatic effect of another disorder of the eye, with which it is conjoined, and how often it is connected with the same common causes, which pertain to another or several other diseases of the eye.

Amongst the general complications, Beer enumerates those which are purely nervous: impairment of the health in various forms by infection, contagion, or miasmata; a bad habit of body; typhoid fevers, the amaurotic effect of which upon the eye the author of this work has frequently noticed; asthma; internal and external hydrocephalus; organic defects of the abdominal viscera; worms; chlorosis; consumption; old ulcers of the legs; organic disease of the brain and skull; complaints arising from pregnancy; hemorrhage.

&c. In these general complications, the casual connection between amaurosis and some remote disease of another organ, or of the whole constitution, cannot be mistaken; and we often see the disease of some other distant part from the eye suddenly or gradually diminish, and immediately appear again as a sympathetic action in the form of amaurosis, of which the most remarkable instance presents itself after the sudden healing of old ulcers of the legs. (*Beer, Lehre von den Augenkr.* b. ii. p. 433.)

One may consider as the only really inseparable symptom of amaurosis, that weakness of sight (*Amblyopia*), or that complete blindness, in which neither with the unassisted nor assisted eye the least defect can be perceived in the structure and shape of the affected organ. But how rarely this essential symptom is met with alone, and how frequently it is obscured by some other defect in the structure and form of the eye, is proved by daily experience.

The incidental symptoms of amaurosis may consist in the faulty size and shape of the pupil. In many cases, the pupil is very much dilated, immoveable, and possesses its natural black colour, and usual transparency. This is the state of numerous cases, but there are many exceptions. Sometimes, according to Richter, in the most complete and incurable cases, the pupil is of its proper size, and even capable of free motion (*Turbés, Recueil Périodique*, &c. t. ii. p. 319.); and, occasionally, it is actually smaller and more contracted than natural. This aperture often continues extraordinarily large in the strongest light; but, in some instances, it is unusually small in every kind of light. (*Arrachard, Recueil Périod.* &c. t. i. p. 273. — *Richter, Anfangsgr.* &c. b. iii. p. 424. *Beer, Lehre*, &c. b. ii. p. 435.) According to the latter writer, the pupillary edge of the iris rarely has its primitive shape, being generally more or less angular; either at some indeterminate point; or above and below, so as to resemble in some measure the pupil of the cat race; or towards the nose, or temple, so as to have some similitude in its form to the pupil of ruminating animals.

Frequently, not only the size and shape of the pupil are faulty, but its position is unnatural, being inclined either upwards or downwards, or outwards or inwards, but, most commonly, in a diagonal line between inwards and upwards; and in these cases the pupillary margin of the iris never describes a regular circle, but is more or less angular. (*Beer*, vol. cit. p. 436.)

The pupil of an eye, affected with amaurosis, frequently does not exhibit the clear shining blackness which is seen in a healthy eye. When the disease is an effect of hydrocephalus, and occurs in a young subject, the pupil presents its natural black hue; but in elderly subjects, it is rarely the case that some degree of glaucoma does not accompany amaurosis. (*Mackenzie*, ed. 2. p. 908.) In general, the pupil is of a dull, glassy, hornlike blackness, which symptom alone is frequently enough to apprise a well-informed practitioner of the nature of the disease. It is, in the words of Mr. Travers, "little more than the healthy appearance of the humours in the eye of a horse." (*Synopsis*, p. 146.) Sometimes the colour of the pupil has an inclination to green; while, in other examples, this aperture seems to be dense, white, and, so that the complaint might easily be

mistaken for the beginning of a cataract. This error, into which inexperienced surgeons are liable to fall, may generally be avoided by attention to the following circumstances. The misty appearance is not situated close behind the pupil, in the place of the crystalline lens, but more deeply in the eye. Nor is it in proportion to the impairment of sight, the patient being quite blind, while the misty appearance is so trivial, that, if it arose from the opacity of the crystalline lens, it could at most only occasion a slight weakness and obscurity of vision; at the same time, Richter acknowledges, that it must be more difficult to avoid mistake when a beginning amaurosis is accompanied with this cloudiness of the eye, and, consequently, when the degree of blindness seems to bear some proportion to the degree of mistiness in the pupil. However, in this case, he maintains that the true nature of the disease may generally be known by comparing the ordinary symptoms of the two diseases. (*Anfangsgr.* b. iii. p. 14.) And, according to Beer, when the pupil is of a true dark gray, or greenish gray colour, a lateral inspection of the eye will show plainly enough that the cloudiness is in the vitreous humour, or behind it. Sometimes the pupil appears reddish, quite red, or of a yellowish white colour (*Lehre von den Augenkr.* b. ii. p. 436.); while, in other cases, the interior of the eye, a good way behind the pupil, seems white, and a concave light-coloured surface may be observed, upon which the ramifications of blood-vessels can be plainly seen. In particular instances, this white surface extends over the whole back part of the eye, while, in other cases, it only occupies a half or a small portion of it. This peculiar appearance has been ascribed to a loss of transparency in the retina itself, and a consequent reflexion of the rays of light. (*Haller, Element. Physiol.* t. v. p. 409.) Mr. Travers inclines to the opinion, that it arises from a deficient secretion of the choroid pigment, a preternatural adhesion betwixt the choroid coat and the retina, and a discoloration, or resplendent appearance of the latter from this cause. (*Synopsis*, p. 148.)

A whiteness behind the pupil sometimes originates from the diseased mass, which, in fungus hæmatodes of the eye, grows from the deeper part of this organ, and gradually makes its way forward to the iris, attended with total loss of sight. Putting out of present consideration the change of colour within the eye, produced by fungus hæmatodes, the other palish changes behind the pupil are not confined, as Kieser supposes, to very old cases of amaurosis, because the alteration is described by Schmeucker as taking place especially in examples the formation of which was quite sudden. (*Vermischte Chir. Schrift.* b. ii.); and Langenbeck has recorded cases, in which the same appearance happened in the early stage of the disease. (*Neue Bibl.* b. i. p. 64, &c.)

The strongest criterion between amaurosis and incipient cataract, and one most to be depended upon in practice, is the difference which the flame of a candle exhibits in the two affections. In incipient cataract, it appears as if it were involved in a generally diffused thin mist, or white cloud, which increases with the distance of the light; but, in amaurosis, a halo, or iris, appears to encircle or emanate from the mist, the flame seeming to be split when at a distance. (*Stevenson on the Nature, &c. of Amaurosis.* Lond. 1821.)

If the pupil is *very much* dilated, if its mobility is *nearly* destroyed, if scintillations are present, and if the patient has recently been exposed to the operation of circumstances calculated to induce atonic amaurosis; then the decision that the case is of the latter kind is free from difficulty. (See *R. Middlemore on Dis. of the Eye*, vol. ii. p. 270.) This gentleman is satisfied, that the only circumstances, which can render it difficult to distinguish cataract from amaurosis, are, when mere atony of the retina, or atrophy of the optic nerve, commences, and especially when either of these morbid states supervenes to a cloudy state of the pupil; and, in every such instance, where the slightest doubt exists, he recommends the eye not to be actively exerted.

For additional observations on the distinctions between incipient cataract and amaurosis and glaucoma, see *Cataract and Glaucoma*.

Besides the above appearances in the pupil itself, and in the pupillary margin of the iris, Beer adverts to several important phenomena with respect to the motion of the iris. Sometimes the iris moves inertly, and frequently not at all, though the light be strong, and the upper eyelid be rubbed over the eyeball. While, in other examples, a very moderate light will bring on such a rapid contraction of the iris and closure of the pupil as are never witnessed in a healthy eye.

We have also the authority of Richter for asserting, that, in particular instances, the iris not only possesses the power of motion, but is capable of moving with uncommon activity, so that, in a moderate light, it will contract and nearly close the pupil. (*Anfangsgr. der Wundarzn.* b. iii. p. 424. ed. 1795.)

Two or three remarkable instances of the active state of the iris, in cases of amaurosis, were some years ago shown to me by Dr. Albert, then staff surgeon at the York Hospital, Chelsea, and I have since seen other similar cases. Most of the patients in question had not the least power of distinguishing the difference between total darkness and the vivid light of the sun, or a candle placed just before their eyes. Jannin sometimes found the pupil capable of active motion in this disease, and Schmucker twice noticed the same fact. An example of complete amaurosis, with perfect motion of the irides, is recorded by Mr. Lawrence. It was attended by violent pains in the head, and proved incurable. (*On Diseases of the Eye*, p. 494.)

Such cases, Mr. Travers thinks, can only be explained by concluding the organ to be sound, and the cause of the amaurosis remote, or external to it. Thus, says he, in a case of circumscribed tumour, compressing the left optic nerve, immediately behind the ganglion opticum, although the blindness was complete, the iris was active. In two young ladies, in whom the eyes, as in the former case, were perfect, and the blindness complete, the iris was even vivacious; and there was the strongest presumptive evidence, from the symptoms, that the amaurosis was in the cerebral portion of the nerve. (*Synopsis*, p. 188.) Sometimes when the retina of each eye is equally insensible to light, and the amaurosis of both eyes complete, the iris of each eye will be differently acted upon by the light, so that one pupil will be larger and its motions more lively than those of the other. Mr. Middlemore has seen several persons, who had

amaurosis in a decided form in one eye, and only in a very slight degree in the other, in whom the mobility of the pupil, as tested in various ways, was much more considerable in the most diseased eye. The irritability of the iris, and the sensibility of the retina to light, do not, therefore, always correspond. (See *R. Middlemore on Dis. of the Eye*, vol. ii. p. 255.)

In some anomalous cases, when the strength of the light is suddenly increased, the pupil expands with more or less celerity.

It is observed by Mr. Travers, that if the retina be opaque, compressed, or unsupported, the iris mechanically disordered, or the ciliary nerves palsied, the pupil is inactive, independently of the state of vision. In the first of these cases, it is evident that the sight will be lost; but we continually see useful vision combined with the second and third, as after operations, in which the iris has been half destroyed, or has become preternaturally adherent, or in malformations, where it is half wanting; and in paralysis of the ciliary nerves, accompanying ptosis. (*Synopsis*, p. 188.)

Frequently, in amaurosis, when the sight of only one eye is lost, and the other retains its full power of vision, not the slightest defect can be discovered so long as the patient keeps both of them open; but, the instant the sound eye is completely covered, the iris becomes perfectly motionless, its pupillary margin assumes an angular shape, and the pupil expands, being sometimes evidently drawn towards the edge of the cornea. (Beer, *Lehre von den Augenkrankh.* b. ii. p. 438.) This demonstrates the difference between the independent and the associated action of the iris.

Besides the above appearances of the pupil and iris, amaurosis is attended with other characteristic phenomena, which occur under certain circumstances, in the form, texture, and state of other parts of the eye, and adjoining organs. Thus, the patient often complains of a peculiar troublesome dryness of the eye, or of a sensation as if the eyeball were about to be pressed out of its socket; and, indeed, says Beer, one may sometimes hear a grating noise, and distinguish a fluctuation in the orbit behind the eyeball, when this organ is pressed upon by the finger, or moved in various directions, though neither its circumference be enlarged, nor any tendency to exophthalmia be really present. Nor is it very uncommon to find the affected eye preternaturally hard, soft, or even quite flaccid; but it is less common to find the dimensions of the globe of the eye increased, or the organ affected with atrophy. (Beer, vol. cit. p. 438.)

However, in organic amaurosis, a peculiar bluish gray tint of the sclerotic coat is frequently remarkable; and sometimes even a degree of bulging on one or more sides of the eye, or simply a loss of sphericity, its sides appearing flattened. A turgescence of the superficial vessels, especially of the long fasciculi of conjunctival veins, is likewise another symptom, frequently observed in organic amaurosis. (See *Travers's Synopsis*, p. 146.)

In this work are given the particulars of a dissection, in which a case of amaurosis was attended with a collapse of the retina from absorption of the vitreous humour.

Some of the principal morbid effects of amaurosis have been already described in speaking of

the several defects of vision, which accompany an amaurotic weakness of sight. Besides these, however, there are others meriting attention. For instance, the patient feels in the eye and surrounding parts an irksome sensation, without any actual pain, and complains of a remarkable sense of fullness or weight in the organ. Amaurotic patients are also frequently attacked with sudden violent giddiness, usually ending in a considerable diminution of the eyesight, and sometimes in severe general headache. Occasionally they fancy that small atoms of dust are lodged under the eyelids, and are fearful of moving these parts, or the eye. It is also well known, that many persons become amaurotic while labouring under severe hemiplegia, extending from, or to, the diseased eye; while, on other occasions, the most violent pains are confined, particularly to the region of the eyebrow, and have the appearance of being strictly periodical. In certain other cases, the pain wanders, and shoots in every direction about the eyebrow. These painful feelings often precede the amaurotic blindness a considerable time, and often first take place when one or both eyes are already blind; but the pains and loss of sight are not unfrequently produced together. Lastly, some patients are met with, in whom the worst pains only last until the amaurosis is perfectly formed, when they gradually and permanently cease. In all these painful cases of amaurosis, the pain and the blindness chiefly depend upon the same cause, and one is seldom the occasion of the other. Sometimes amaurotic patients experience such violent pain, that they lose their senses, and grow delirious; but, in these cases, if we can credit the assertion of Beer, important morbid changes in the bones of the skull, or the brain itself, are invariably noticed after death. (See *Lehre von den Augenkr.* b. ii. p. 439.) In some amaurotic patients, lethargic symptoms may be remarked; in others, restlessness; and, more rarely, delirium in all its degrees, either as a transient or permanent affection.

According to the observations of Mr. Travers, pain in the forehead and temples is a precursory symptom of amaurosis, diminishing in proportion as the dimness increases. When the amaurosis is perfect it usually ceases altogether, if the disease has its seat in the eyeball. But, when the pain is severe, remits imperfectly, and is quickly repelled worse by exercise, it is usually connected with organic disease of the brain. In this case, derangement and torpor of the prime viæ, loss of strength and flesh, disposition to stupor, occasional confusion of intellect, inaptitude to exertion, and paralysis of one or more muscles, will be concomitant symptoms. (*Synopsis*, &c. p. 167.)

Paralytic appearances may precede amaurosis, either in the vicinity of the eye, or in the muscles of the face, or in a distant situation, as the extremities. Sometimes they accompany the disease, and sometimes closely follow the weakness of sight, being not unfrequently the forerunners of a fatal attack of apoplexy.

In the same way, convulsive symptoms may be conjoined with amaurosis; and when they first appear, the complete stage of the latter disease, Beer pronounces them a very unfavourable omen for the patient's life.

Thus, when in a case of perfect amaurosis, several of the other senses are affected; when the

hearing, and then the smell and taste, are lost, and afterwards the memory and other intellectual powers fail, the patient's speedy dissolution may be expected. (See *Lehre von den Augenkrankh.* b. ii. p. 441. Wien, 1817.)

In some cases, the cause is of a local, direct, and mechanical nature; such as the pressure of a tumour on the optic nerve. In others, it is of a local, but vital kind; such as a plethoric, or congested state of the blood-vessels of the brain, or eye. In a third set of cases, the cause is general, or constitutional; such as exhaustion, consequent to profuse or continued loss of some of the fluids of the body. (See *Wm. Muckenzie on Dis. of the Eye*, p. 901, ed. 2.)

Age cannot be considered a predisposing cause of amaurosis in the same degree that it is of cataract; for there are many more blind persons who have been deprived of their sight by amaurosis in their best days, than old persons thus attacked. Amaurosis spares no age—not even the newborn infant. Mr. Lawrence concurs in this statement, adding his belief, however, that amaurosis is most frequent ~~in~~ after the middle period of life, especially about the cessation of menstruation in females, and the corresponding age in the male. (*On Diseases of the Eye*, p. 517.)

The following statement, in relation to this part of the subject, appears correct:—"There are certain ages, at which, from particular circumstances, amaurosis is most commonly witnessed, and for the most part merely as a functional, or sympathetic affection. In the first place, it may be congenital, with or without being evinced by any defect in the form, or the magnitude of the eye, or any of its parts, although the globe generally acquires under such circumstances a rolling or unsteady motion. Amaurosis may be produced by hydrocephalus, which disease occurs most frequently in children; by convulsions; and by the irritation connected with dentition, or by the presence of worms in the stomach or intestines. These are the circumstances associated with very early life, with which amaurosis is most commonly connected. At the period of puberty, it is sometimes induced by vitiated habits, and by certain conditions of, and changes in, the genital system. Again, the period of pregnancy and suckling are favourable to its origin; the former, by the pressure of the gravid uterus on the large venous trunks; and the latter, by enfeebling the system generally, and very probably also by over-exciting and deranging that sympathy which exists between the uterus, the mammae, and the retina, and with the precise nature of which we are not fully acquainted. The final cessation of menstruation is the next season at which amaurosis is most likely to take place; and, lastly, extreme age is a strong predisposing cause of amaurosis." (See *Middlemore on Dis. of the Eye*, p. 252.)

Four forms of congenital organic amaurosis are noticed by Mr. Travers. One, in which the eye is preternaturally small, soft, and even flaccid; the iris tremulous, and not influenced by belladonna; and the globe affected with tremor, and not subject to the control of the will. A second, depending on a deficiency of the pigmentum nigrum; the organ is tremulous, strong light produces uneasiness, and vision is dazzled and confused. The vessels of the choroid give the interior of the eye a deep red tinge. A third case

is that in which the sclerotica so encroaches upon the cornea, that the latter is scarcely wider than the pupil. In the fourth kind of congenital amaurosis, described by Mr. Travers, the eyes move in concert, as if attracted by a faint perception of light; but the infant is blind: no marks of organic derangement can be seen; but the disease may be connected with a morbid state of the thalami, or optic nerve. (*Synopsis*, p. 153, 154.)

Neither do sex and race affect the frequency of the complaint; but dark eyes are sometimes alleged to be more disposed to amaurotic blindness than such as are light-coloured. According to Beer's experience, for every gray or blue eye affected with amaurosis, there are five-and-twenty or thirty brown or black ones thus diseased. L. Winslow, Weller, and Sanson likewise regard dark eyes as most subject to amaurosis. In this country, I believe, it is found, that the mere colour of the eye has not the influence here represented in predisposing to amaurosis. (See *R. Middlemore on Diseases of the Eye*, vol. ii. p. 252.)

More frequently than cataract, amaurosis is found to be a true hereditary disease:—this is so much the case, that most of the members of a family, for more than one generation, may lose their sight from amaurosis at a certain period of life. Beer was acquainted with more than one family in which this happened; and, what merits attention, the women of one of these families, down to the third generation, became completely and permanently blind from amaurosis on the cessation of the menses, while all the others, who had had children, were unaffected. But the males of this unfortunate family, who, as well as the females, have very dark-brown eyes, all seem to be weak-sighted, though none of them are yet blind. (*Lehre von den Augenkrankheiten*, b. ii. p. 443.)

In women, especially those with black eyes, the time when the menses stop is considered by Beer, a likely period for the commencement of amaurosis.

According to the same writer, patients whose piles used to bleed periodically for a long time, but are now suddenly stopped, and whose eyes are dark, are very liable to amaurosis.

One of the less common causes of amaurosis is idiosyncrasy, in relation to this or that sort of nutriment or medicine, or this or that particular state of the body. Here is to be reckoned the amaurotic weakness of sight, or the perfect amaurosis, which comes on at the very commencement of pregnancy, and subsides after delivery, but always attended with dyspepsia and insuperable vomiting. This species of amaurosis, however, should be carefully distinguished from that which sometimes first originates in the final months of pregnancy, and chiefly from strong and long-continued determination of blood to the head and eyes, particularly when the bowels are at the same time loaded, and the patient constipated. This latter case usually continues till after delivery; or, if the labour be tedious, difficult, and attended with considerable efforts, the blindness may first attain its complete form at the time of delivery, and not afterwards subside.

Beer saw a young Jewess, who, at the very beginning of her first three pregnancies, which followed each other quickly, regularly lost her

sight, becoming completely amaurotic between the third and fourth months, and, on the two first occasions, she continued blind till after delivery; but, in the third instance, the power of vision never returned at all. (See also *Démours, Traité des Mal. des Yeux*, t. i. p. 380.) Beer twice had under his care another woman, who was attacked with amaurosis whenever she drank chocolate; but, upon leaving off that drink, she never afterwards had any complaint in her eyes.

The abuse of narcotic poisonous substances may induce amaurosis; as opium, hyoscyamus, belladonna, &c. Lead will do the same thing. Dilatation and a fixed state of the pupil follow the mere application of some narcotics to the skin; a circumstance of which we take advantage in the treatment of several diseases of the eye; but, it does not usually happen that belladonna and hyoscyamus, the substances employed in this way, produce any other effect than a degree of obscurity and dazzling, such as a great influx of light through a much dilated pupil might occasion. Taken internally, however, these and some other poisons of the same class, as stramonium, dulcamara, white hellebore, tobacco, opium, &c. cause more or less complete insensibility of the retina, along with mydriasis, or myosis. The blindness is often a very obstinate symptom, continuing a long while after disturbance of the intellectual functions has ceased. (See *Mackenzie on Dis. of the Eye*, p. 956. ed. 2.)

One not infrequent cause of amaurosis is hysteria and hypochondriasis, with which must be mentioned disease of one or more of the abdominal viscera, especially the liver. (Beer, *Lehre*, &c. b. ii. p. 444—46.)

According to Richter, the remote causes of amaurosis may be properly divided into three principal classes, the differences of which indicate three general methods of treatment.

The first class of causes depends upon an extraordinary plethora and turgidity of the blood-vessels of the brain, or of those of the optic nerves and retina, upon which last parts a degree of pressure is thereby supposed to be occasioned. A considerable plethora, especially when the patient heats himself, or keeps his head in a depending position, will frequently excite the appearance of black specks before the eyes, and sometimes complete blindness. A plethoric person (says Richter), who held his breath, and looked at a white wall, was conscious of discerning a kind of network, which alternately appeared and disappeared with the diastole and systole of the arteries.

Richter thinks it likely, that the disease is thus produced, when it proceeds from the suppression of some habitual discharge of blood, from the neglect to be bled according to custom, the stoppage of the menses, and the cessation of hemorrhage from piles. In the same manner, the complaint may be brought on by great bodily exertions, which determine a more rapid current of blood to the head. Richter informs us of a man, who became blind all on a sudden, while carrying a heavy burden up stairs. He tells us of another man, who laboured excessively hard for three days in succession, and became blind at the end of the third day. Pregnant women, in like manner, are sometimes bereft of their sight during the time of labour. Schmucker has recorded a remarkable instance of this in a strong young woman,

thirty years old, and of a full habit. Whenever she was pregnant, she was troubled with violent sickness, till the time of delivery, so that nothing would stop in her stomach. She was bled, three or four times, without effect. Towards the ninth month her sight grew weak, and, for eight or ten days before parturition, she was quite blind. The pupil of the eye was greatly enlarged, but retained its shining black appearance. She recovered her sight immediately after delivery, and did not suffer any particular complaints. Schmucker assures us, that he has been three times a witness of this extraordinary circumstance. (*Vermischte Chr. Schriften*, band ii. p. 6. ed. 1786.) Richter speaks of a person, who lost his sight during a violent fit of vomiting. Schmucker acquaints us, that it is not uncommon for soldiers, who are performing forced marches in hot weather, to become suddenly blind.

Beer also coincides with Schmucker, Richter, and others, in regarding, as a frequent cause of amaurosis, repeated and long-continued determinations of blood to the head and eyes, produced by various circumstances, viz. by pregnancy; a tedious and difficult labour; lifting and carrying heavy burdens, especially with the arms raised up; all kinds of work, in which the eyesight and intellectual faculties are intensely exerted, with the head bent forwards, and the abdomen compressed, as is the case with shoemakers, tailors, &c.; every sudden stoppage of natural or preternatural long-established discharges of blood, as that of the menses, lochia, or hemorrhoids; the omission of habitual venesection at some particular season of the year; severe and obstinate vomiting, forced marches in hot, dry weather; scrofulous and other swellings of considerable size in the neck, pressing upon the jugular veins, and obstructing the return of blood from the head; the use of a pediluvium, or warm bath, the water of which is of high temperature; hard drinking; violent gusts of passion; frequent and obstinate constipation; and hard straining at stool. These causes are more likely to occasion amaurosis, in proportion as the individual is young and plethoric. The causes of that amaurosis which is characterized in its first stage by increased sensibility of the eye, and intolerance of light, are referred by Professor Beer to circumstances, which produce a long and repeated determination of blood to the head and eyes. (*Lehre von den Augeskr.* b. ii. p. 446 and 483, &c.)

Mr. Lawrence regards amaurosis, in its most frequent and important form, that which is seated in the eye itself, as generally the result of inflammation of the nervous structure; including under that phrase all degrees of increased vascular action, whether designated as fulness, turgescence, determination, congestion, or as inflammation in its more limited sense; and the usual consequence of inflammatory disturbance, that is, organic change, permanently destroying the function of the part. When, says he, we advert to the structure of the retina, we must suppose that it would be liable to such affections: we find it composed of minute ramifications of the *arteria centralis retinae*, and, on this network of vessels, the nervous pulp is expanded. The state of the retina, when examined after death, in amaurotic eyes, accords with these views; it exhibits those changes which long-continued inflammatory disturbance would produce; it has been found thickened, opaque, spotted, buff-

coloured, tough, and, in some cases, even ossified. The preceding doctrine is, however, judiciously qualified by its restriction to the disease as seated in the eye itself. The retina and optic nerve, Mr. Lawrence admits, with other surgeons, may be disordered sympathetically, as the stomach may be disordered, without any change visible on dissection.

The second class of causes are supposed to operate, by weakening either the whole body, or the eye alone, and they indicate the general or topical use of tonic remedies. In the first case, the blindness appears as a symptom of considerable universal debility of the whole system; in the second case, it is altogether local. Every great general weakness of body, let it proceed from any cause whatsoever, may be followed by a loss of sight. Amaurosis is sometimes the consequence of a tedious diarrhoea, a violent cholera morbus, profuse hemorrhage, and immoderate salivations. (See *Travers's Synopsis*, p. 144.) Richter informs us of a dropsical woman, who became blind on the water being let out of her abdomen. According to the same author, no general weakening causes operate upon the eyes, and occasion total blindness, so powerfully and often as premature and excessive indulgence in venereal pleasures. Mr. Lawrence does not coincide in some of the foregoing views. "Those," says he, "who have considered amaurosis to arise from debilitating causes, have considered that debility and atony of the nerve may be produced by all those circumstances which debilitate the system generally, such as loss of blood from profuse hemorrhage, diarrhoea, copious salivation, &c. I have never seen amaurosis produced by such causes. That great anxiety and grief may favour the occurrence of amaurosis, I am inclined to allow; for it is not improbable that severe impressions of that kind may produce inflammatory excitement in the brain or eyes; but I think we cannot, without more direct proofs, admit the influence of debilitating causes generally in the production of amaurosis. The most clear instance of any directly debilitating cause producing amaurosis, is that of protracted suckling."

The causes, which operate locally in weakening the eyes, are various. Nothing has a greater tendency to debilitate these organs than keeping them long and attentively fixed upon minute objects. But, however long and assiduously objects are viewed, if they are diversified, the eye suffers much less than when they are all of the same kind. A frequent change in the objects which are looked at, has a material effect in strengthening and refreshing the eye. The sight is particularly injured by looking at objects with only one eye at a time, as is done with telescopes and magnifying glasses; for, when one eye remains shut, the pupil of that which is open always becomes dilated beyond its natural diameter, and lets an extraordinary quantity of light into the organ. The eye is generally very much hurt, by being employed in the close inspection of brilliant, light-coloured, shining objects. Amongst the occupations enumerated by Mr. Travers as particularly exposing persons to amaurosis, are those of needleworkers, writers, draughtsmen, inspectors of linen and scarlet cloths, and of new bank notes; money counters; smiths; stokers in iron-furnaces and glass-houses; tavern-cooks; watchmakers, engravers, philosophical instrument makers, sea officers, &c. (*Synopsis*, p. 144.) They

are greatly mistaken, says Richter, who think that they save their eyes, when they illuminate the object which they wish to see in the evening with more lights, or with a lamp that intercepts and collects all the rays of light, and reflects them upon the body which is to be looked at. Richter mentions a man, who, in the middle of winter, went a journey on horseback, through a snowy country, while the sun was shining quite bright, and who was attacked with amaurosis. He speaks of another person, who lost his sight in consequence of the chamber in which he lay being suddenly illuminated by a vivid flash of lightning. A man was one night seized with blindness as his eyes were fixed on the moon. Richter also expresses his belief, that a concussion of the head, from external violence, may sometimes operate directly on the nerves, so as to weaken and render them completely paralytic.

Beer corroborates the foregoing statement; for, he says, amongst the most frequent causes is to be considered every abuse of the eyesight, especially in dark-eyed persons, as a long and close inspection of one object, particularly with a microscope, when the thing examined is very brilliant, or reflects back much light into the eye. Hence, the view of jewels at night, and long journeys through snowy countries, &c. are conducive to the disease. In this respect, every kind of employment which strains the eyes much, and requires a strong reflected light, must be considered injurious. (See also Travers's *Synopsis*, p. 144.) Thus reverberating lamps, like Argand's; the view of a white wall illuminated with the sun's rays; and looking a long while at the moon, or more especially the sun, with the unassisted eye, are circumstances likely to bring on the disease. That a flash of lightning, especially when it suddenly wakes a person in the night-time out of a sound sleep, may produce an amaurotic amblyopia, in an irritable eye, or even perfect blindness, is a well known fact; and it is on the same principle, that going suddenly out of a dark bedroom, immediately after waking in the morning, into an apartment that commands an open extensive prospect, must be hurtful to an irritable eye, though the bad effects may only come on slowly. Here is also to be included every kind of over-irritation of the eye by light, as happens to typhoid patients, when they lie with their eyes open all the day in a large sunny chamber.

The cause of amaurosis is often suspected to depend upon local or constitutional debility, proceeding from impairment of the nerves in general, or of the nerves of the head, especially those of the forehead and eyebrow; either in consequence of falls from a considerable height, or of concussion with the weight of the whole body upon the heels; blows on the head; concussions or contusions of the eyeball. Some of the cases of amaurosis from blows on the temple or the eye, observed by Mr. Travers, were attended with signs of disorganization; some were superficially inflamed; and others presented no external appearance of injury. It is not always the eye on the struck side of the head, that is affected. (*Synopsis*, &c. p. 152.) If we are to believe Beer, considerable direct weakness, leading to amaurosis, may arise from cholera, long-continued diarrhoea, salivation, and the incessant spitting of tobacco smokers; bleedings; injudicious tapping of the abdomen; excessive indulgence in venery, and the misemployment of issues. A general debility, which has the worst effect on the eyes, may also

arise from long trouble, especially when the diet is poor and bad; also from a deficiency of proper food, long watching, or violent and sudden fright. The amaurosis following typhus, without any unusual irritation of the eye by light, Beer refers to general debility. (*Lehre von den Augenkr.* b. ii. p. 449.)

Like nervous deafness, amaurosis sometimes follows typhus and scarlet fever, and the various forms of acute constitutional disease. Mr. Travers has several times met with it as a consequence of infantile fevers. He observes, that it is also sometimes a consequence of chronic wasting diseases, in which organic changes interrupt the nutrition of the system. He has seen a rapid and severe salivation, instituted for a remote affection, and where no disease had previously affected the eyes, terminate in gutta serena of both. (*Synopsis*, p. 155.)

The susceptibility of the retina is conceived by Mr. Middlemore to be capable of being at once directly depressed, without going through the process of inflammation, in the same way as the nervous power of other parts of the system may be lowered or taken away by powerfully depressing and rapidly enervating agents. (*On Dis. of the Eye*, vol. ii. p. 247.)

With regard to the doctrine, that certain forms of amaurosis are diseases of debility, Mr. Lawrence expresses his disbelief in its correctness, and asserts that the only successful treatment of amaurotic affections is found, with few exceptions, to be variously modified antiphlogistic. (*On Diseases of the Eye*, p. 507.) Whether the amaurosis resulting from typhoid fevers, of which I have seen several instances, proceed from debility, or from too great a determination of blood to the head, may admit of dispute; but I conceive, that, in many of such cases, tonic treatment is clearly indicated, if not for the eye itself, certainly for the generally enfeebled state of the health, with which the amaurosis is connected. Yet the doctrine, that fulness and congestion of the vessels originally lead to the amaurotic affection, may be more correct, than the theory which refers the blindness simply to weakness. However, as the amaurosis generally does not show itself till an advanced stage of fever, or that of great debility, and as it only recedes as the patient regains strength, it can hardly be considered as a case, in which any other treatment than tonic can be availing.

The third class of causes consists of irritations, most of which are asserted to lie in the abdominal viscera, whence they sympathetically operate upon the eyes. The observations of Richter, Scarpa, and Schmucker, all tend to support this doctrine. Many amaurotic patients are found to have suffered much trouble, and long grief, or been agitated by repeated vexations, anger, and other passions, which have great effect in disordering the bilious secretion, and the digestive functions in general. Richter tells us of a man, who lost his sight, a few hours after being in a violent passion, and recovered it again the next day, upon taking an emetic, by which a considerable quantity of bile was evacuated. A woman is also cited, who became blind, whenever she was troubled with acidities of the stomach. (See *Aufangs. der Hündgrün.* b. iii. kap. 14.) However, according to Beer, if the case from worms be excepted, imperfect amaurosis seldom depends upon disorder of the gastric organs (*Lehre von den Augenkr.* b. ii. p. 456.); a very important difference from the statements of Schmucker, Richter, and Scarpa.

The close sympathy between the stomach and the eyes is well illustrated by a case referred to by Mr. Lawrence, where an amaurosis, with fixed pain over the eyebrow in a child, was not relieved by purging and other depletive measures: an emetic was at last given; and, under its action, a bead was rejected from the stomach, and the amaurosis immediately disappeared.

Amaurosis sometimes proceeds from mechanical irritation. A small shot pierced the upper eyelid, and lodged at the upper part of the right orbit, between the eyelid and eyeball, so that it could be felt externally. The patient shortly afterwards became blind in the left eye; but recovered his sight after the excision of the shot. (*Anfangsgr. der Wundarzn.* band iii. p. 439.) Injuries, or mere irritation of the branches of the fifth pair of nerves, have sometimes been followed by amaurosis.

Several constitutional disorders, especially gout, are sometimes thought to be concerned in the production of amaurosis. But whoever reads Beer's history of what he terms gouty amaurosis, will naturally doubt the correctness of the name. Mr. Lawrence affirms, that he has never seen gout or rheumatism occasion any tendency to affections of the nervous structure of the eye. It is not because amaurosis sometimes occurs in gouty or rheumatic constitutions, that the affection of the sight is necessarily of a gouty or rheumatic origin; for the fact merely proves, that such constitutions are not exempt from the risk of being attacked by disorders of the eye. Neither has Mr. Lawrence seen any cases, in which the origin of amaurosis could be referred to syphilis.

Respecting the causes of amaurosis, the following remarks by Beer claim attention. Various swellings in the orbit, as, for instance, encysted tumours, tophi, hydratids in the sheath of the optic nerve, may and must gradually produce complete amaurosis by their pressure upon the optic nerves and retina. Some of these cases are usually characterised by a protrusion of the eye from its socket. (See *Exophthalmia*.) Cases depending upon atrophy of the optic nerves are recorded by Dr. Monteith. (See *Wetter's Manual*.) Mr. Langstaff has some interesting specimens of enlargement in front of the third ventricle, the parietes of which bulge so as to press upon the optic nerves, and thus to account for the amaurosis under which the patients laboured.

In the same manner, different morbid changes in the brain itself, and in the bones of the cranium in particular, may be the direct cause of amaurosis; for example, hydrocephalus internus, caries, and exostoses at the basis of the skull.

Just as amaurosis is frequently a pure symptomatic effect of various disordered states of the constitution, so may different morbid changes, occasioned in the eye by those states of the health, become the proximate cause of amaurosis, as cirsophthalmia, fungus haimatodes, dissolution of the vitreous humour, glaucoma, &c.

One case, very analogous to amblyopia senilis, is believed to depend upon a diminution of the pigmentum nigrum, which secretion, in some individuals earlier and more considerably, in others later and in a slighter degree, recedes with other secretions of a different nature. (See Beer's *Lehrsan den Augenhr.* b. ii. p. 451, &c.) Mr. Middlemore is certain, that he has met with cases

in which a diminution in the quantity of the choroid pigment was the sole defect in the eye, and constituted the adequate and efficient cause of impaired vision. Cases of this description, he says, are for the most part attended by a contracted pupil, and great intolerance of light; and vision, though seriously impaired, is seldom destroyed. (*Op. et vol. cit.* p. 273.)

I think with Mr. Travers, that the history and concomitant appearances of amaurosis will often denote whether the case is *organic* or *functional*. "For example, diseased changes in the situation or texture of the eyeball, or in the brain, a hemiplegia, or partial paralysis, with other signs of apoplectic or hydrocephalic pressure, whether resulting from an injury of the head, or otherwise, or an acute deep-seated inflammation, whether accompanied by a visible opacity or not, point out the organic nature of the affection. I have seen (continues Mr. Travers) such an amaurosis produced by abscess in the cerebral substance, and by the medullary fungus of the cerebrum. On the other hand, I have known the following distinct sources of irritation produce functional amaurosis, viz. a wound of the scalp, caries of the skull, abscess and curies of the antrum maxillare, with excessive cedema of the integuments of the lids and cheek, a large abscess under the masseter and muscles of the cheek, and an abscess at the extremity of a molar tooth, while the crown of the tooth was sound. In all these cases, it is to be understood, that the eye was sound, and the orbit was untouched by the disease of the parts in the vicinity, to which the amaurosis was clearly attributable. In like manner, an excessive use, or rather abuse, of the visual faculty, the disordered functions of the stomach, liver, uterus, &c., sudden and alarming depletion, excessive or obstinately suppressed secretions, difficult dentition, the presence of worms in the intestinal canal, and the deleterious effects of noxious agents upon the organ, or the system, are sufficiently obvious causes of the functional amaurosis." (*Synopsis*, &c. p. 142.) In general, recent cases afford a greater prospect of cure than others of long standing; and the same may be said with respect to examples, in which the eyesight is merely lessened and not completely extinguished.

In general, every amaurotic weakness of sight, and every completely formed amaurosis, are attended with the greatest probability of cure, where they began suddenly and were quickly developed. (Beer, *Lehre von den Augenkr.* b. ii. p. 454—456.) This observation perfectly coincides with the account given by Schruucker, who says that many of these suddenly forced cases fell under his notice, and were more easy of cure, than when the disorder had come on in a more gradual way. (See *Vermischte Chir. Schriften*, b. ii.) It also agrees with what Mr. Travers has stated, namely, that slow and steadily progressive causes of amaurosis are more to be apprehended in the result, that is, are less tractable, than either the sudden, or the rapidly advancing disease, supposing all to be alike free from unequivocal signs of organic change. (*Synopsis*, p. 208.)

Respecting suddenly produced cases, Mr. Lawrence holds out less encouragement, than the preceding authorities. The prognosis, he says, is doubtful, and rather unfavourable than otherwise,

as to the complete recovery of vision, if the affection, even in its most recent state, should have produced complete insensibility of the retina. He thinks we should speak doubtfully of the result in the case of complete insensibility to strong light, even if it had only lasted twenty-four hours. He considers it difficult to say in what number of days, or weeks, we should give up all hopes of recovery. In the supposed case of total insensibility, or even of a near approximation to it, there would be more ground for apprehension, than hope, at the end of a week, though sight is sometimes restored under these circumstances; but the lapse of a few weeks, without improvement, makes the case hopeless.

If amaurosis be partial, and the case seen early, Mr. Lawrence says a complete cure may be expected. He thinks favourably of the event, when amaurosis takes place in conjunction with chronic internal inflammation, or when it is evidently caused by active congestion in the head or eye; for that can be removed by suitable treatment. A similar judgment is delivered by Mr. Middlemore: when the case is recent, takes place in young persons, and is evidently produced by vascular plethora, he says the prognosis is favourable, because the remaining degree of vision proves, that no important structural change has yet occurred, and the plethora state of the system can be removed. (See R. Middlemore on *Dis. of the Eye*, vol. ii. p. 273.)

When one eye has been completely bereft of sight by amaurosis, and the surgeon can find out little or no cause for the infirmity, there is strong reason for apprehending that the other eye will, sooner or later, become blind. To this fact the exceptions are rare.

According to Beer, the idea entertained by some writers is not built upon experience, that amaurotic patients, in whom the iris is still moveable, and the pupil not much dilated, are more easily and frequently cured than others, in whom the iris is perfectly motionless, and the pupil exceedingly dilated. For sometimes, during the treatment, or even spontaneously, the iris, after being quite unmoveable, recovers its power of motion, yet the patient may not, at the same time, regain the slightest degree of vision; and, on the other hand, many cases of perfect amaurosis are cured, without the iris recovering any of its mobility, and the pupil remains dilated during the remainder of the patient's life. (*Lehre von den Augenkr.* b. ii. p. 458.) Richter also states that an amaurosis may be cured, which is attended with a pupil extraordinarily dilated, and entirely motionless; and sometimes the disorder proves incurable, notwithstanding the pupil is of its proper size, and capable of motion. The pupil sometimes recovers its moveableness, in the course of the treatment, although nothing succeeds in restoring the eyesight. (*Anfangsgr. der Wundarzn.* b. iii. p. 424. 8vo. Gott. 1795.) However, the continuance of the perfect mobility of the pupil is set down by Mr. Middlemore as a favourable symptom, but he would not pronounce a case hopeless, in which its mobility was entirely lost. (See *Middlemore on Dis. of the Eye*, vol. ii. p. 262.)

In some rare instances, amaurotic blindness has been cured by some apparently accidental, or indeed morbid effect, without any assistance from art: by hemorrhage from the nose, an internit-

tent fever, a blow on the head, &c. Beer operated successfully upon both eyes of a patient with cataracts, which had been previously depressed too far against the retina, so that their pressure gave rise to amaurosis, which, after continuing eight years, was suddenly removed by the patient's accidentally falling out of bed, and pitching upon the top of his head. (*Lehre von den Augenkr.* b. ii. p. 458.)

The following observations, made by Beer respecting the prognosis, cannot fail to prove interesting. There is a species of amaurosis which gradually diminishes of itself; for instance, that which arises from hard drinking, or the effect of narcotic poisons, belladonna, opium, hyoscyamus, &c.

Sometimes imperfect amaurosis goes away without any assistance from art, in consequence of the accession of some other disease, as an eruption, a discharge of matter from the ear, bleeding from piles, return of the menses, &c.

In most cases, when the surgeon is so fortunate as to cure amaurosis, there still continues, for life, a considerable degree of amblyopia, more especially if the amaurosis has been complete.

Sometimes, by successful treatment, vision is in a great measure, or even entirely, restored in one eye, yet the other remains completely blind; or one eye sees again much sooner than its fellow, although they were both affected together with an equal degree of blindness.

It often happens that, though a material degree of vision returns in the course of the treatment, the faculty is restricted to a circumscribed point of the retina, so that the patient is enabled to see objects plainly only when they are held in a particular direction before him; while, in other directions, they are either quite invisible, or very indistinct. (*Beer, Lehre von den Augenkr.* b. ii. p. 459, 460.)

Amaurosis, following an injury of the supra-orbital nerve, ordinarily resists every endeavour made to relieve it, and thus whether it come on directly after the blow, or some weeks subsequently to the healing of the wound of the eyebrow; but it is not always incurable. One cure is recorded by Valsalva. (*Dissert.* 2. § 11.) Additional instances are reported by Hey (*Med. Obs. and Inq.* vol. v.); by Larrey (*Mém. de Chir. Militaire*, t. iv. p. 181.). Dr. Hennen met with one or two cases of amaurosis from wounds of the supra-orbital nerve. the perfect division of the nerve produced at first no alleviation of the complaint, but after some time the eye partially recovered. (*Principles of Military Surgery*, p. 366.) According to Mr. Wardrop, it is only when this nerve is wounded or injured, and not divided, that amaurosis takes place; for the blindness may sometimes be cured by making a complete division of the trunk nearest its origin. (*Morbid Anatomy of the Human Eye*, vol. ii. p. 180.) Dr. Mackenzie conceives, that we should regard with doubt the alleged occurrence of purely sympathetic amaurosis from slight injuries of the fifth pair of nerves, and he suspects that, in all such cases, there is, in addition to the external injuries, either concussion of the eyeball, or disease within the cranium. (*On Dis. of the Eye*, p. 125. ed. 2.) No doubt this has sometimes been the fact; but not always. The origin of sympathetic amaurosis from irritation of other filaments of the fifth nerve,

and the experiments of Vicq. d'Azyr, tend to prove the reality of amaurosis from the cause in question. Vicq. d'Azyr exposed and lacerated the frontal and superciliary branches of the fifth pair in various animals, and found that the injury was followed by amaurosis. (*Journ. Compl. des Sciences Méd.* t. 44. p. 201.* Paris, 1832.)

Perfect, inveterate amaurosis, attended with organic injury of the substance constituting the immediate organ of sight, says Scarpa, is a disease absolutely incurable. *Imperfect, recent amaurosis*, particularly that which is *periodical*, is usually curable, for it is mostly dependent upon causes which, though they affect the immediate organ of sight, are capable of being dispersed, without leaving any vestige of impaired organization in the optic nerve or retina.

When amaurosis has prevailed several years in persons of advanced age, whose eyesight has been weak from their youth; when it has come on slowly, at first with a morbid irritability of the retina, and then with a gradual diminution of sense in this part, till total blindness was the consequence; when the pupil is motionless, not circular, and not much dilated; when it is widened in such a degree that the iris seems as if it were wanting, and the margin of this opening is irregular and jagged; and when the bottom of the eye, independently of any opacity of the crystalline lens, presents an unusual paleness, like that of horn, sometimes partaking of green, and reflected from the thickened retina, the disease may be generally set down as incurable. Kiesel joins Scarpa in representing this alteration as an unfavourable omen, adding, that it only takes place in examples of long standing, and, that when it is considerable, the disease is incurable. Langenbeck differs, however, from both these authors, and particularly from Kiesel, assuring us, not only that he has often seen this discoloration of the bottom of the eye in the early stage of amaurosis, but seen patients in this state soon cured. The cases which he has published, in proof of this statement, I have read with care, and find them completely satisfactory. Langenbeck agrees with other writers in imputing the appearance to a morbid change of the retina, and the treatment, which he prescribes, consists in the internal exhibition of the oxyuriate of mercury in small doses, and friction with mercurial ointment on the eyebrow and temple. (See *Langenbeck's Neue Bibl. jur. de Chirurgie*, b. i. p. 64—69, &c. Göttingen, 1815.)

Cases, attended with pain all over the head, and a continual sensation of tightness in the eyeball; or preceded by a violent, protracted excitement of the nervous system, and then by general debility, and languor of the constitution, as after masturbation, premature venery, and hard drinking; or connected with epileptic fits, or frequent spasmodic hemierania: or which are the consequence of violent, long-continued, internal ophthalmia, may be set down as incurable. Nor can any cure be expected, when amaurosis proceeds from a direct blow on, or violent concussion of, the eye; foreign bodies in the eyeball; lues venerea, or exostoses about the orbit; or when it is conjoined with a manifest change in the figure and dimensions of the eyeball. The same judgment is applicable to complete amaurosis from long exposure of the eye to vivid light, or to causes which have been pro-

tracted in their injurious effects upon the retina. (See *R. Middlemore*, vol. ii. p. 274.)

Recent, sudden cases, in which the pupil is not excessively dilated, and its circle remains regular, while the bottom of the eye is of a deep black colour; cases unaccompanied with any acute, continual pain in the head and eyebrow, or any sense of constriction in the globe of the eye itself; cases which originate from violent anger, deep sorrow, fright, gastric disorder, general plethora, or the same partial affection of the head, suppression of the menses, habitual bleedings from the nose, piles, &c., great loss of blood, nervous debility, not too inveterate, and in young subjects, are generally curable. Amaurosis is also mostly remediable, when produced by convulsions or the efforts of difficult parturition; when it arises during the course, or towards the termination of acute or intermittent fevers; and when it is periodical. (Scarpa, *Osservazioni sulle Malattie degli Occhi*, cap. 20. Vener. 1802.) If amaurosis take place from the free administration of mercury, from protracted suckling, from profuse diarrhoea, or from a state of general debility, induced by other causes, the prognosis must depend upon our capacity to remove the debilitated state of the constitution, or its causes. In some cases, this is easy; in others, impossible. (See *R. Middlemore*, *Op. cit.* vol. ii. p. 273.)

According to Mr. Travers, it is rather the degree, than the nature and origin of the symptomatic functional amaurosis, that should in most cases influence our prognosis; yet the latter circumstances, it is equally clear, afford more or less encouragement, in proportion as the pre-existing states of disease ordinarily admit of relief, or not. Thus, says he, the amaurosis from gastric diseases, from plethora, from irritation, are all of them removable, and, if treated at an early period, remediable. Whereas paralysis, the sequel of fever, or of epilepsy, or severe constitutional diseases, whether acute or chronic, or depending upon habitual cerebral congestions combined with organic visceral disease, or induced by the operation of noxious agents on the system, is a hopeless form of the malady. (*Synopsis*, p. 296.) I may remark, however, that various examples of recovery from amaurosis, induced by fevers, have fallen under my own notice.

In general, when the treatment proves successful, the return of vision is accompanied with a regression of the same characteristic effects, which were disclosed in the gradual advance of the disorder, viz. appearances as if there were before the eyes flashes of light, a cobweb, network, mist, or flaky substances. (Weer, *Lehre von den Augenkr.* b. ii. p. 460. Wien, 1817.)

Upon the commencement of the cure, there is also a return of the obliquity of sight; one of the most constant symptoms of imperfect amaurosis. This is a circumstance which Hey took particular notice of: he says, that it was most remarkable in those persons who had totally lost the sight in either eye; for in them the most oblique rays of light seemed to make the first perceptible impression upon the retina; and, in proportion as that nervous coat regained its sensibility, the sight became more direct and natural. (See *Med. Obs. and Inq.* vol. v.)

TREATMENT OF AMAUROSIS.

When amaurosis is to be fundamentally cured, not upon empirical, but scientific principles, all the causes of the disorder must be ascertained, and, if possible, removed, as in the treatment of every other complaint. How often, however, it is impossible to accomplish either the one or the other of these objects, must be clear enough from the preceding observations. Amaurosis is sometimes merely a symptom of another disease, and then attention must be directed to the primary malady, as illustrated in apoplexy, hydrocephalus, depressed fractures of the skull, and disorder of the intestinal or uterine functions.

If no particular circumstances can be assigned as the cause of amaurosis, the surgeon should act with great caution, and constantly bear in his mind, first, the constitution, sex, and age of the patient; secondly, his ordinary employments, and general mode of living; and thirdly, the principal morbid appearances under which the disease originated and was developed. (*Beer, Lehre von den Augenkr.* b. ii. p. 462.)

The directions of Mr. Middlemore for tracing the cause of amaurosis deserves notice. The surgeon should first investigate the condition of the eye and the eyelids; he should observe, whether the upper lid drooped, whether there was any degree of strabismus, and whether the sympathetic and associated movements of the eyes were unaltered; he should then notice the state of the cornea, its clearness, and its form; the state of the pupil, its size, its figure, its degree of motion, and also the distance of the iris from the cornea, as well as its colour and the general appearance of its texture, and whether it be convex or concave, or preserve its natural place; the state of the humours in reference to their transparency, and particularly notice whether any deep-seated buffy or dusky cloudiness were present, and whether the eyeball were increased in vascularity, or changed in colour, figure, size, or consistence. Mr. Middlemore further recommends the effect of belladonna on the pupil to be noticed; and the eye to be examined under its influence, if any influence at all be produced by it, and in various degrees of light, and in connection with the pupil of the opposite eye. The state of the pupil is to be observed at the moment when the lids of both eyes are suddenly separated, and also when the lids of the sound eye are closed, and those of the diseased one separated. Each pupil is also to be examined separately, so as to ascertain its extent and facility of motion.

Mr. Middlemore advises inquiry to be made into the patient's habits, temperament, disposition, and state of mind; whether any visceral disease be present, and what its nature; whether there be any temporary disorder in the alimentary canal; whether the patient is suffering, or has been recently suffering from gout, rheumatism, scrofula, or syphilis; whether he has passed through any severe mercurial treatment; whether he has suffered from apoplexy, epilepsy, paralysis, severe fever, inflammation, or concussion, or other injury of the brain; how long the disease has existed; what remedies have been tried, and what their effect. (*See R. Middlemore on Dis. of the Eye*, vol. ii. p. 255.)

In that species of amaurosis which arises from

causes inducing the disease, by means of a preternatural fullness and dilatation of the blood-vessels of the brain, or eye, the indication is to lessen the quantity of blood and general plethora, and determination of blood to the head and organ affected. For this purpose the patient may be bled in the arm, or temporal artery. The evacuation is to be repeated as often as seems necessary, and it will be better to begin with taking away from sixteen to twenty ounces. The efficacy of bleeding, in the cure of particular cases, is strikingly exemplified by numerous well-authenticated observations. Richter informs us of a woman who, on leaving off having children, lost her sight; but recovered it again by being only once bled in the foot. A spontaneous hemorrhage from the nose also cured a young woman, who had been blind for several weeks. (*Anfangsgr. der Wundarz.* b. iii. p. 442.)

That bleeding is sometimes hurtfully and wrongfully practised in amaurotic cases, is a fact which admits of no doubt. Mr. Travers particularly refers to one description of cases, where the lancet does harm: these are cases of undue determination of blood to the organ, which are especially common after deep-seated chronic inflammation or distress from over-excitement, by which its vessels have lost their tone; an effect decidedly increased by depletion. In one interesting case of this kind, a gradual, but perfect recovery, followed a regulated diet, and a course of the blue pill, with saline aperients. (*Synopsis*, p. 159.) All cases of direct debility and proper paralysis of the retina (says Mr. Travers) are aggravated by loss of blood, and the great prevailing mistake in the treatment of amaurosis, is the indiscriminate destruction of blood. (*Synopsis*, p. 303.)

When, in addition to general bleeding, topical is also necessary, leeches may be applied to the temples, or cupping glasses to the back of the neck, or temples. Besides bleeding, purgatives, blisters, bathing the feet in warm water, low diet, repose of the organs, &c. are proper.

In some cases, the foregoing means fail in producing the desired benefit, even when followed up, as far as the pulse and strength will allow. Here the continuance of the disease may depend, either upon the stoppage of some wonted evacuation of blood, or else upon some other cause of the first class. In the first of these cases (says Richter), experience proves that the disease will sometimes not give way before the accustomed discharge is re-established. A woman, who (as this author acquaints us) had lost her sight, in consequence of a sudden suppression of the menses, did not recover it again till three months after the return of the menstrual discharge, notwithstanding the trial of every sort of evacuation. He also tells us of another woman, who had been blind half a-year, and did not menstruate, and to whose external parts of generation leeches were several times applied. As often as the leeches were put on (says Richter), the menses in part recommenced; and, as long as they made their appearance, which was seldom above two hours, the woman always enjoyed a degree of vision. (*Anfangsgr. der Wundarz.* b. iii. p. 443.)

For the amaurosis arising from suppression of the menses, Scurpa recommends leeches to the pudenda, bathing the feet in warm water, and afterwards exhibiting an emetic, and laxative pills,

made of rhubarb and tartrate of antimony, combined with gummy and saponaceous substances. If these means fail in establishing the menstrual discharge, he says great confidence may be placed in a stream of electricity, conducted from the loins across the pelvis, in every direction, and thence repeatedly to the thighs and feet.

For the amaurosis proceeding from the stoppage of habitual bleeding from piles, Scarpa recommends leeches and fomentations to the hemorrhoidal veins, then an emetic, and afterwards the same opening pills. (*Osservazioni sulle principali Malattie degli Occhi*, cap. 19.)

When the disease does not originate from the stoppage of any natural or habitual discharge of blood, and does not yield to the evacuating plan, Richter thinks the surgeon justified in concluding that the preternaturally dilated vessels have not regained their proper tone and diameter, and that topical corroborant remedies, particularly cold water, ought to be employed. In this kind of case, he is an advocate for washing and bathing the whole head with cold water, especially the part about the eyes: a method, he says, which may often be practised, after evacuations, with singular and remarkable efficiency.

The principle on which Mr. Lawrence directs the treatment, is that of putting a stop to vascular excitement, with the view of preventing the permanent injury of altered structure, and impaired function of the retina. Hence he is a zealous advocate for the antiphlogistic treatment in the early stage of amaurosis. "But," says he, "if this treatment be not found to remove the change which has been produced in the retina, we must have recourse to mercury, which appears to be as decidedly beneficial in these cases, as in iritis, or general internal inflammation. The remark which I made respecting the use of mercury in those affections, applies also to the present case, namely, that its good effect mainly depends upon the promptitude with which it is employed. The alterative form is insufficient; we give it with the view of arresting inflammation in the structure, which is the very seat of vision; that structure is easily changed by the inflammatory process; our only remedy is to push the mercury in a decided manner, and if we do so, we shall put a stop to the affection." When the amaurotic affection depends on vascular plenitude of the retina, and that peculiar action of its capillary system of vessels which is disposed to bring on organic changes, Mr. Middlemore is also an advocate for mercury, which, for the purpose of stopping such action, and producing an absorption of effused or deposited matter, he directs to be employed freely, so as to affect the mouth. But, he observes, if the amaurotic symptoms are not at all relieved, when the gums have become sore, its use is not to be continued: on the contrary, if any improvement occur, the constitution should be kept under the influence of mercury by the administration of two grains of the submuriate with a small quantity of opium, once or twice a day. (*R. Middlemore on Dis. of the Eye*, vol. ii. p. 277.) Instead of discontinuing mercury, if no amendment take place directly the gums are sore, he advises the patient to be kept at least two or three weeks well under the influence of the medicine; for, unless this be done, it has not had a fair trial. When the antiphlogistic treatment, and a fair trial of mercury have failed, Mr. Lawrence

contents himself with recommending such management as is most conducive to general health; as a residence and frequent exercise in a pure air; plain nutritious diet; mild aperients, with the occasional use of an active purgative; and repose of the affected organ. He mentions also a trial of a seton, or repeated blisters behind the ears, or at the side or back of the neck. As already stated, however, he does not wish it to be supposed, that all amaurotic patients require to be bled and salivated. Amaurosis, he says, often comes on in a slow and very insidious manner in persons of enfeebled constitution: the organ suffers from habitual excessive exertion at the same time that the general powers are depressed by residence in confined dwellings, bad air, sedentary occupations, unwholesome diet, costiveness, and the other injurious influences of such causes. If we should see a thin, pallid, and feeble woman, who had destroyed her health by close confinement to needle-work, and whose eyes were beginning to fail, the same active measures would by no means be admissible. We should empty the alimentary canal, perhaps take a little blood by cupping, or by leeches to the temples, and then use mercury in the alterative form, together with mild aperients. A few grains of Plummer's pill may be given every night, or every second night, and the bowels may be kept open with electuary, castor oil, or rhubarb and magnesia, taken occasionally. The blue pill may be taken in combination with aloes, or colocynth. It may be necessary, says Mr. Lawrence, to persevere with the mercury, slowly increasing the dose until a slight influence is visible in the mouth. A nutritious but temperate diet, good air and exercise, and repose of the affected organ, are important auxiliaries, and a succession of moderate-sized blisters may be advantageously combined with these means. Thus, observes Mr. Lawrence, the same principles regulate our treatment; but it is modified in degree, according to the violence of the symptoms, and the patient's strength. In the latter description of cases, after mild antiphlogistic means, and clearing the alimentary canal, he admits that it may be expedient to combine tonics with aperients, or rhubarb with bark, columba, or cascarrilla; and to allow a little porter and wine.

We come now to the consideration of that species of amaurosis which is regarded as the effect of some unnatural irritation. Here, according to the precepts delivered by Richter, we should endeavour to discover what the particular irritation is, and then endeavour to effect its removal. Sometimes the irritation is both discoverable and removable, and still the blindness continues. In this circumstance, Richter thinks that the surgeon should endeavour to obviate the impression which the irritation has left upon the nerves, by the use of anodynes; or else try to remove the torpor of the nerves by stimulants. Now, according to Schmucker, Richter, and Scarpa, curable imperfect amaurosis commonly depends on some disease, or irritation in the gastric system, complicated with general nervous debility, in which the eyes participate. Hence it appears to them that the chief indications are, to free the alimentary canal from all irritating matter, improve the state of the chylopoietic viscera, and invigorate the nervous system in general, and the nerves of the eye in particular.

For an adult, Scarpa directs three grains of antimonium tartarizatum to be dissolved in four

ounces of water, and a spoonful of this solution to be given every half hour, until nausea and copious vomiting are produced. The next day some opening powders are exhibited, consisting of an ounce of the supertartrate of potash, and one grain of antimonium tartarizatum, divided into six equal parts. The patient takes one of these in the morning, another four hours afterwards, and a third in the evening, for eight or ten days in succession. They create a little nausea, rather more evacuations from the bowels than usual, and perhaps, in the course of a few days, vomiting. If the patient, during their use, should make vain efforts to vomit, complain of bitterness in his mouth, loss of appetite, and no renovation of sight, the emetic, as at first directed, is to be prescribed again. This is to be repeated a third and fourth time, should the morbid state of the gastric system, the bitter taste in the mouth, the tension of the hypochondria, the acid eructations, and the inclination to vomit, make it necessary. The first emetic often produces only an evacuation of an aqueous fluid, blended with a little mucus; but, if it be repeated a few days after the resolvent powders have been administered, it then occasions a discharge of a considerable quantity of a yellow, greenish matter, to the infinite relief of the stomach, head, and eyes.

The stomach having been emptied, the following aperient pills are ordered.

Rk Gum. Sagapen.	} an. ʒj
Galban.	
Sup. Venet.	
Rhei optim. ʒss	
Turt. Finet. gr. xvi	
Suc. liquerit. ʒj	fiant pilulæ gran. quinque.

Three are to be taken every morning and evening for a month or six weeks.

When the state of the stomach has been improved, and the restoration of sight partly effected, such remedies must be employed as strengthen the digestive organs, and excite the vigour of the nervous system in general, and of the nerves of the eye in particular. With this intention, Scarpa prescribes bark and valerian in powder, and wholesome broths, with a moderate quantity of wine, and proper exercise in a salubrious air. For exciting the action of the nerves of the eye, the vapour of liquor ammoniac, properly directed against the eye, he says, is of the greatest service. This remedy is applied by holding a small vessel, containing it, sufficiently near the eye to make this organ feel a smarting, occasioned by the very penetrating vapours with which it is enveloped, and which cause a copious secretion of tears, and a redness, in less than half an hour after the beginning of the application. It is now proper to stop, and repeat the application three or four hours afterwards.

The operation of these vapours may be promoted by other external stimulants, applied to such other parts of the body as have a great deal of sympathy with the eyes. Of this kind are blisters to the nape of the neck; friction on the eyebrow with the anodyne liquor; the irritation of the nerves of the nostrils by sternutative powders, like that composed of two grains of turbeth mineral, and a scruple of powdered betony leaves; and, lastly, electricity. The external use of strychnia would here deserve trial in the manner presently specified.

The imperfect amaurosis, suddenly brought on in consequence of the body being excessively heated, or of exposure to the sun, or by violent anger, in plethoric subjects, requires general and topical evacuations of blood, and the application of cold washes to the eyes and whole head. Scarpa then prescribes an emetic, and afterwards antimonial purgatives. By means of bleeding and an emetic, Schmucker often restored the eyesight of soldiers, who had lost it in making forced marches. In amaurosis suddenly occasioned by violent anger, an emetic is the more strongly insisted upon after bleeding, as the blindness thus arising is always attended with a bitter taste in the mouth, tension of the hypochondria, and continual nausea. Richter mentions a clergyman, who became completely blind, after being in a violent passion, and whose eyesight was restored the very next day, by means of an emetic, given with the view of relieving some obvious marks of bilious disorder.

Scarpa's treatment of imperfect amaurosis brought on by fevers, deep sorrow, great loss of blood, intense study, and forced exertions of the eyes on very minute or brilliant objects, consists also in removing all irritation from the stomach, and afterwards strengthening the nervous system in general, and the nerves of the eye in particular. In the case originating from fevers, the emetic and opening pills are given; then bark, steel medicines, and bitters; while the vapour of the liquor ammoniac is applied to the eye itself.

When the disorder has been brought on by grief, or fright, the stomach and intestines are emptied by means of antimonium tartarizatum and the opening pills; and the cure is completed by giving bark and valerian; applying the vapour of liquor ammoniac to the eyes; ordering nourishing easily digestible food; diverting the patient's mind, and fixing it on agreeable objects, and recommending moderate exercise. The amaurosis from fright is said to require a longer perseverance in such treatment, than the case from sorrow. (*Scarpa's Osservaz.* cap. 19.)

In this country, this free use of tartarized antimony, which has proved so efficacious on the Continent, has not been found to answer. Mr. Travers states, that he does not recollect an instance of decided benefit from it, though he has often tried it fairly. He agrees, however, in the indication, as he remarks, that the removal of an irritating, or oppressing cause, will often effect a sudden and marked relief, as by clearing the intestinal canal of vitiated secretions, restoring the digestive functions, or taking away blood where the necessity is indicated. In gastric cases, for which emetics have been particularly recommended, he prefers a long-continued course of the blue pill, with gentle saline purgatives, and tonic bitters. (*Synopsis*, p. 299—304.)

Beer is another high authority against the use of emetics, even in the amaurosis from disorder of the gastric organs. Emetics, which never operate without some violence, he says, are to be most carefully avoided in plethoric individuals, or those who have a manifest determination of blood to their heads and eyes, or any acceleration of the circulation. The caution here given must be observed, even though emetics may on other accounts seem advisable; and, according to Beer, the determination of blood and the state of the system here mentioned, are commonly attendant upon this species of amaurosis.

Indeed (notwithstanding the testimony of Schmuëker, Richter, and Scarpa, in favour of emetics), Beer positively affirms that the violent operation of an emetic frequently converts this sympathetic amaurotic weakness of sight into complete blindness. Although I apprehend, that Beer may here be somewhat prejudiced against emetics, candour obliges me to add, that, in this country, their efficacy in the present disease is by no means equal to the representations of Richter and Scarpa. When there is less tendency to vomiting, but the case is attended with an oppressive sense of weight about the stomach, frequent eructations, as if arising from rotten eggs, an inflated belly, tense hypochondria, and confined bowels, Beer found that clysters and tolerably brisk purgatives were always of the greatest service, both in regard to the general complaints, and the amaurotic weakness of sight; the removal of the offensive matter from the alimentary canal being immediately followed by a cessation of the determination of blood already mentioned. Lastly, when this amaurosis originates altogether from the presence of worms in the bowels, common anthelmintics are to be prescribed. In all these cases, says Beer, mere local treatment is quite inapplicable, and may do mischief. (*Beer, Lehre von den Augenkr. b. ii. p. 517—21.*)

The third species of gutta serena, or that which arises from debilitating causes, is of two kinds; in one, the disease is the consequence of a general weakness of the body; in the other, it is the effect of debility, or atony confined to the retina.

Scarpa regards the incomplete amaurosis from general nervous debility, copious hemorrhage, convulsions, and long-continued intense study, especially by candlelight, less as a case of real amaurosis, than a weakness of sight from a fatigued state of the nerves, especially of those constituting the immediate organ of sight. When this complaint is recent, in a young subject, he is an advocate for emptying the alimentary canal with small repeated doses of rhubarb, and then giving tonic cordial remedies. At the same time, the patient is to abstain from every thing that has a tendency to weaken the nervous system, and, consequently, the eyesight. After emptying the stomach and bowels, it is proper to prescribe the decoction of bark with valerian, or the infusion of quassia with the addition of a few drops of sulphuric ether, to each dose, with nourishing, easily digestible food. The aromatic spirituous vapours (mentioned in the article *Ophthalmia*) may then be topically applied; or, if these prove ineffectual, the vapour of liquor ammoniac. The patient must take exercise on foot, horseback, or in a carriage, in a wholesome dry air, in warm weather, and avail himself of sea-bathing. He must avoid all thoughts of care, and refrain from fixing his eyes on minute shining objects. The impression of vivid light on the retina is to be moderated by means of flat green glasses. (*Saggio di Oculica, cap. 19.*)

One case of temporary palsy of the retina from over-excitement, mentioned by Mr. Travers, yielded to blistering the forehead, and a gentle salivation excited by calomel joined with opium. (*Synopsis, p. 164.*) Another case, brought on by the use of telescopes and sextants, gave way to a copious bleeding, brisk purgative with jalap and calomel, blisters to the temples, and a course of mercury. (*Opusc. p. 166.*)

Mr. Travers remarks, that the amaurosis from depletion is sometimes mistaken for the opposite case, viz. that from plethoric congestion: this is owing to the coincidence of a dilated and immovable pupil, *muscae*, and a deep-seated pain in the head, with occasional vertigo, and its frequent occurrence in a corpulent habit. By a cautious use of tonics (says Mr. Travers) it is relieved; by whatever lowers, or stimulates, whether diet or medicine, it is decidedly aggravated. In this form of amaurosis, vision is further enfeebled by the loss of as much blood as flows from two or three leech-bites. (*Synopsis, &c. p. 160.*)

When the weakness is confined to the eye, Richter thinks corroborant applications alone necessary. Bathing the eye with cold water, says he, is one of the most powerful means of strengthening the eye. The patient should dip in cold water a compress, doubled into eight folds, and sufficiently large to cover the whole face and forehead, and this he should keep applied, as long as it continues cold. Or else he should frequently apply cold water to his eyes and face with his hand, on a piece of rag.

The eye may also be strengthened by repeatedly applying blisters of a semi-lunar shape above the eyebrows, just long enough to excite redness. Richter likewise speaks favourably of rubbing the upper eyelid, several times a day, with a mixture of the tinctura lyttæ and spiritus serpilli. (*Anfangsgr. der Wundarz. b. iii. p. 452.*)

Here the endemic application of strychnia deserves to be remembered.

In the amaurosis suddenly formed by exposure to vivid light or lightning, we may clear out the alimentary canal with an active dose of calomel and jalap. Blisters may then be applied above the eyebrows; and if these fail, electricity, or the external use of strychnia may be tried. (See *Middlemore on Dis. of the Eye, vol. ii.*) In such cases, Magendie would probably rub an ammoniated ointment over the frontal nerve.

In amaurosis from the gradual effect of any exposure of the eye to vivid light, or of hard study by light of lamps or candles, the foregoing treatment would, I think, be less likely to answer. Here a slow inflammation of the retina has probably been going on, followed by structural changes, the only chance of removing which must depend upon depletion, mercury, and perfect rest of the organ. (See *Mackenzie on Dis. of the Eye, p. 928.*)

In periodical amaurosis, attended with serious impairment or loss of vision, returning daily, weekly, or monthly, or at irregular intervals, the eye being little or not at all affected in the intermediate periods, the best means of cure are bleeding, purgatives, and counter-irritation. This treatment is especially applicable to hemeralopia.

In amaurosis excited by dentition, the gums may be divided, mild laxatives and small doses of syrup of poppies given, and the child put into a warm bath. If amaurosis depend upon the irritation of a carious tooth, this should be extracted.

For amaurosis from a purulent wound, or laceration of the supra-orbital nerve, the best plan is to make a free division of it.

Of late, strychnia has been employed as a remedy for amaurosis. It seems to Mr. Middlemore that its use should be confined to cases, in which the retina is in a state of atony from some cause acting

directly upon its texture, or upon its texture through the medium of the general debility of the system. At all events, he is of opinion, that it should not be resorted to when there is much vascular fulness either of the system, or the retina, or a tendency to inflammation. Its effects are likewise to be most carefully watched. An atonic state of the retina, or of some part of the nervous apparatus of the eye, productive of amaurosis, when unconnected with a full plethoric habit of body, determination of blood to the head, or any tendency to apoplexy, or any structural change either in the retina, or its immediate nervous relations, may be treated by means of strychnia, particularly if tonics and general stimulants have been already unsuccessfully tried. The bowels are to be first freely opened, and aperient medicine occasionally given during the use of strychnia. Mr. Middlemore puts a narrow blister above the eyebrow of the affected eye, or above each eyebrow, if both eyes are involved; and after the cuticle and serum have been removed, sprinkles a small quantity of strychnia upon the raw surface, commencing with the fourth of a grain upon each side. If vision be not improved, this quantity may be gradually increased to two grains; the part is also dressed with savine cerate. The strychnia is applied only once in twenty-four hours, and the eyebrow is preferred as the place for its action, on account of the probable special effect of the strychnia upon the supra-orbital nerve, in addition to its other more general influence. If strychnia excite great local uneasiness, it may be blended with a little flour, or powdered opium. Mr. Middlemore observes, that if the patient should become sensible of occasional flashes of light before the eye, soon after the commencement of this treatment, there would be great encouragement to persevere; but that if vision should be not at all influenced, or improved, after the strychnia had been tried a fortnight in sufficiently powerful but not imprudent quantities, it ought to be discontinued. Strychnia appears to him to be well adapted to the case of miners, whose eyes are affected with incomplete amaurosis, and who have been accustomed to follow their employment by means of a very feeble light; and also to cases of impaired sensibility of the retina, occasioned by too great a delay in curing congenital cataract. (See *Middlemore on Dis. of the Eye*, vol. ii. p. 282.)

Strychnia has also been prescribed as an internal remedy for amaurosis.

Cat-eye amaurosis is a case particularly described by Beer; it rarely advances to complete blindness, and occurs chiefly in very old persons. Sometimes, however, it takes place in young subjects, and even in children. Beer alleges that it is always confined either to thin, dwindled, old, gray-headed subjects, in whom the exchange of organic matter is carried on but tardily, or else to young subjects, who are unhealthy, and disposed to consumption, hectic adults, emaciated children, and as a consequence of severe injuries of the eye. While this amaurosis is not perfectly formed, the iris retains its mobility, and the pupil is neither preternaturally dilated nor contracted; but, when once the patient is quite bereft of vision, the motions of the iris are slow, and the pupil larger than in a healthy eye in an equal degree of light. At the bottom of the eye, far behind the pupil, a concave pale gray, bright yellowish, or

variegated reddish opacity, is developed. By this the eyesight is not merely weakened, but rendered quite confused, since all objects, and especially smallish ones, appear to be confounded together, particularly when the patient tries to inspect closely any determinate body. The further the disease advances, the brighter and more visible is the bottom of the eye, the paler is the colour of the iris (a thing very conspicuous in dark-eyed persons); and when once the amaurosis is complete, so that no susceptibility of the impression of light is left, then, upon an attentive examination of the eye, one can mostly perceive, at the troubled deeper part of the eye, a slender vascular plexus, which merely consists of the ordinary ramifications of the central artery and vein. In a half-darkened place, such an eye presents a shining yellowish, or reddish appearance, but only in certain positions of the eyeball; and, in this respect, it is somewhat similar to the eye of a cat, whence Beer chooses to term the complaint cat-eye amaurosis. The disorder is also not accompanied with any other essential morbid appearances, except the decline of vision, or complete blindness. (*Lehre von den Augenkr.* b. ii. p. 496.) Beer, in fig. 1, tab. 4. of his second vol. has given, from nature, an admirable representation of this remarkable species of amaurosis. The differences in the appearances at the bottom of the eye, in this case, from those presented in the early stage of fungus hematodes of that organ, will be best understood by referring to the article *Fungus Hematodes*. On this point, however, I may here briefly state, that, in cat-eye amaurosis, there is no projection, but, on the contrary, a concave depression in the axis of vision. Cat-eye amaurosis may be known from incipient cataract, by the opacity being more deeply situated, and having a shining pearly lustre. (See *Journ. of Foreign Med.* vol. iv. p. 168.)

Beer observes, that the causes of this species of amaurosis are so obscure, that whatever is offered upon the subject can be received only as conjecture. A suspicion is sometimes entertained, that a deficiency of the pigmentum nigrum, and of the tapetum of the uvea, is concerned in the production of this form of blindness.

The prognosis cannot but be very unfavourable; for, as the surgeon is ignorant of causes, he cannot know what means ought to be adopted for their removal. It is fortunate, however, that this amaurosis rarely attains its highest degree, but almost constantly remains in the form of a more or less considerable amblyopia.

Just as little is yet known respecting any well-regulated mode of treatment; but the disease may sometimes be kept from getting worse, by the careful employment of such general remedies, regimen, and diet, as are calculated to improve the health. However, in the most fortunately managed cases, Beer never knew a step made towards the removal of the disease. (*Lehre von den Augenkr.* b. ii. p. 497, 98.)

An *Amaurosis* is described as produced by certain vegetable bitters, by lead, and by particular articles of food. But the reality of such cases is doubted by Mr. Lawrence. (*Op. cit.* p. 491.)

Symptomatic amaurosis in individuals affected with hysteria, hypochondriasis, epilepsy, and convulsions, is rarely permanent, and usually subsides as

soon as the spasmodic, epileptic, or convulsive attack is over. However, the complaint may begin at two periods, viz. either during such an attack, or (what is more uncommon) afterwards, and it never loses its symptomatic character. The pupil, which is much dilated, always remains perfectly clear, and of a shining blackness, even when the disease has induced entire blindness; but a slight dull pain in the forehead, especially about the eyebrow, constantly preceding and accompanying the blindness, generally lasts a good while after the amaurosis has completely subsided.

As this amaurosis is merely a symptomatic effect of the above general disorders, its removal must entirely depend upon the success, with which their treatment is conducted. (*Beer, Lehre von den Augenkr. b. ii. p. 506—10.*)

With respect to *rheumatic amaurosis*, we do not in this country recognise any distinct form of amaurosis entitled to the name of rheumatic, though Beer has minutely described such a case. No doubt a certain proportion of amaurotic patients suffer from rheumatism; but I agree with those pathologists, who do not acknowledge rheumatism as having been clearly proved to be a cause of amaurosis.

Gouty amaurosis.—According to Mr. Travers, gout attacks the eye through the medium of the stomach. Vomiting occurs, with pain in that organ, on the subsidence of an inflammation in the extremities, and is succeeded by violent pain in the head. The loss of sight, he adds, is sudden and permanent. (*Synopsis, &c. p. 163.*) The gouty amaurosis, described by Beer, is perhaps badly named: at all events, there are some circumstances in its history, which must create doubts about its dependence upon gout. "We can admit," says Mr. Lawrence, "that the nervous structure of the eye may be diseased in the rheumatic and gouty, as well as in other persons; but it will require clearer evidence than we possess at present to show, that there are distinct gouty and rheumatic amauroses." (*Lawrence, Op. cit. p. 491.*) When we find Beer describing one form of gouty amaurosis as taking place only in dark-eyed slender maiden ladies, who have suffered from scrofula in their childhood, or from other severe diseases at a later period, and whose menses are irregular, or have ceased, we must regard his evidences of gouty amaurosis as vague and fanciful.

When amaurosis follows the healing of old sores, Beer recommends the formation of them again, by applying to the cicatrix strong mustard cataplasms, and the murate of soda; and, if the new ulcers cannot be made to discharge properly, he recommends issues on the legs or thighs. These plans are to be aided by such medicines as act specifically upon the skin, like antimonials, especially the sulphur auratum antimoniali. Beer also speaks favourably of sulphur baths; and in cases complicated with debility, administers tonics. (*See Lehre von den Augenkr. b. ii. p. 556—63.*) When amaurosis has followed the sudden healing of ulcers, or the disappearance of an eruption, or the suppression of some customary evacuation, Mr. Milledmore is an advocate for counter irritation by means of a seton or issue. (*On Dis. of the Eye, vol. ii. p. 279.*)

When amaurosis proceeds from disease of the retina, or their sheaths, it comes on slowly, rarely attacks both eyes together. It com-

mences with a black cloud, which grows more and more dense, and with a troublesome, alarming perversion and disfigurement of every object, without the least painful sensation in the eye or head. The patient merely complains of a slight sensation of dull pressure at the bottom of the orbit, as if the eyeball were about to be forced from its socket, of which displacement, however, there is not yet the smallest appearance. In the very beginning of the disease, the pupil is already considerably dilated, and the pupillary edge of the motionless iris presents angles at several points, the pupil sometimes representing an irregular pentagon, or hexagon. By degrees, though very slowly, a glaucomatous change of the vitreous humour ensues, and afterwards of the lens itself; the only species of glaucoma which Beer has ever noticed quite unattended with a varicose affection of the blood-vessels of the eye. At last, the globe of the eye becomes perceptibly smaller than natural; but a complete atrophy does not ensue.

When amaurosis proceeds from disease of the skull or brain, it usually attacks both eyes together, or at least one soon after the other, the blindness also commencing very slowly, with appearances as if every object looked at were perverted or disfigured. However, there is no black cloud, but rather an obscurity or confusion of every object. The disease in this stage is also accompanied with frequent giddiness, ugly luminous spectra, and, for the most part, with aversion to light, uncommonly lively motions of the iris, a contracted pupil, angles in the upper and lower portions of the pupillary margin of the iris; an evident turgescence of the blood-vessels of the eye gradually augmenting with most violent headache into actual exophthalmia; frequent convulsive motions of the eyes and eyelids, and strabismus of one or both eyes, ending in a true deviation of one or both these organs from their natural positions. Under these symptoms, vision is afterwards entirely abolished; and the headache, though subject to remissions, grows so much worse, extending back to the spine, that the patient is often nearly frantic, and, indeed, after a time, a destruction of the external senses happens, followed by that of the intellectual faculties. The first of the external senses which is lost is always the hearing, which infirmity is next followed by loss of the smell, or taste, or both these senses together; and then the memory, and other intellectual powers decline. In this stage of the disorder, the eyeball not unfrequently protrudes from the orbit; a pathognomonic symptom, to which Beer attaches great importance, because it is an infallible criterion of a diseased state of the bones of the orbit, of the parts which invest this cavity, and of the optic nerve and dura mater, in the sella turcica. In such cases, complete mania now usually follows, and this sometimes in its most violent form, unless the patient happen to be first carried off by paralytic symptoms; life, under these circumstances, never lasting any considerable time.

The cause of both these forms of amaurosis lies in certain morbid changes in the structure of the optic nerve and its investments, or in diseased alterations of the bones of the cranium, the dura mater, and the brain. But, how these changes arise, is not so easy of explanation. The morbid changes in the structures above mentioned, which Beer had

himself ascertained by dissection, consist in a real induration of the optic nerves, and an adhesion of them to their sheaths, while within the skull these ash-coloured, gray, very much diminished nerves presented no vestige of medullary structure even as far as their origin from the brain. On the contrary, the optic thalamus presented externally its natural appearance. The retina seemed to have lost its pulpy matter, was tough, not easily torn, and appeared to consist but of a vascular membrane. In one example, although both eyes had been completely deprived of sight together, Beer found only the retina and optic nerve of the left side in this state of atrophy as far forwards as the point of union in the sella turcica. On the other hand, the optic nerve of the right eye was hard, without being in the least dwindled, and was closely adherent to its external coverings. Anteriorly to their decussation, nothing at all preternatural in either nerve could be discerned. But the left corpus striatum was so indurated, that a very sharp, strong scalpel was required for its division, though in colour and shape it was perfectly natural. On this side, also, the plexus choroides was entirely wanting. In three amaurotic patients of this kind, Beer found hydatids between the coverings of the optic nerve; and where such hydatids lay, the medullary matter seemed to have been displaced by their pressure. With the utmost care, he could not trace the ophthalmic ganglion.

Raw also found on the optic nerve a large hydatid, which had produced amaurosis. (*Obs. Anat. Rarior. Obs. 2.*) In Mr. Heavyside's museum, there was a preparation of the optic nerve of an amaurotic eye, where a tumour of considerable bulk had grown from the neurilema. (See *Wardrop's Essays on the Morbid Anatomy of the Human Eye*, vol. ii. p. 157.) In this work are specified examples of various other morbid changes of the optic nerve, especially calculous concretions within it, the presence of a viscid, muddy, gray fluid, in the thickened neurilema, instead of pulp, atrophy of the nerve, &c.

To the present description of cases, Beer refers the instance recorded by Haller (*Opusc. Pathol. Obs. 65. p. 172.*) in which a calcareous mass was found betwixt the membrane of Ruysch and the vitreous humour. According to Beer, there is preserved in the pathological and anatomical museum of the general hospital at Vienna, an eye, distended with a similar osseous mass, without the capsule of the lens being at all affected. Examples, in which the amaurotic blindness arose from abscesses in the brain, are reported by Ballonius (*Paradigmata Hist. 7.*) by Pelargus (*Med. Jahrg. iii. p. 198.*), Peyronie (*Mém. de l'Acad. Royale de Chir. t. i. p. 212.*), Schaarschmid (*Berlin Nachrichten*, 1740. No. 26.), Langenbeck (*Neue Bibl. b. i. p. 61.*) and Mr. Travers (*Synopsis*, 143.). The latter author has recorded an instance in which a firm lardaceous tumour, of the size of a garden bean, situated on the same side as the blindness, compressed the optic ganglion and nerve at origin from it. (*Synopsis*, p. 151.) I have seen a case of amaurosis, in which a medullary tumour, large as a middling-sized apple was found in the anterior lobe of the brain, attended with protrusion of the eye, and vast destruction of the bones. I was consulted in 1835, for a case of amaurosis in a young lady, 14 years of age, the daughter of a physician. The pupils were remarkably large and

of a clear black colour. She died suddenly, and a tumour, formed in the anterior lobe of the brain, was found to have been the cause of the blindness, and of her death. Mr. Travers has seen amaurosis produced by a medullary fungus of the brain. A case, occasioned by disease of the thalamus, is related by Villeneuve (*Journ. de Méd. continué*, 1811, Févr. p. 98.); another of a tumour of the thalamus on the same side as the blindness, is recorded by Ford (*Med. Commun. vol. i. No. 4.*); and other swellings in various parts of the brain are described in *Ephem. Nat. Cur. Dec. 3. Ann. 9. and 10. Obs. 253.*; *De Huen's Ratio Medendi*, P. 6. p. 271.; *Journ. des Savans*, 1697; *Muzell's Wahrnehm.* b. ii. No. 13.; *Plater, Obs. lib. 1. p. 108.*; *Thomann, Annalen für 1800*, p. 400, &c.; *Wardrop's Essays on the Morbid Anatomy of the Human Eye*, vol. ii. p. 174, &c.

The morbid alterations of the bones of the skull mostly happen at its basis, and not only may caries take place, but still more frequently exostoses of various forms, which are sometimes so small that they are first detected by the bone giving the feel of a rough grater. At the same time they are so sharp, that, if the finger be passed rudely over them, it will be painfully hurt. In these cases, the bones of the cavity of the skull are always found extremely thin; the diploe is almost entirely wanting, and the parietes of the orbit are preternaturally diaphanous, and in some places imperfect. Beer speaks of a lady's skull, who had been completely blind, and for some weeks previously to her death insensible, in which instance scarcely any part of the cavity of the skull could be touched without risk of the fingers being hurt by spiculae. Once in an amaurotic boy, who, for a short time before his death, was so insane, that he used to devour his own excrement, Beer found at the side of the sella turcica a long considerable spicula, which passed directly through the optic nerves at the place of their decussation. A case of amaurosis, produced by a spicula of bone injuring the opposite side of the brain, is related by Anderson. (See *Trans. of the Society of Edinb. vol. ii.*) Sometimes the ethmoid bone has been found carious (*Ballonius, Paradigmata*, No. 7.); sometimes other parts of the cranium. (*Mursinna, Beobacht. b. i. No. 6.*; *Schnucke's Vermischte Schrift. b. ii. p. 12.*) Sometimes the medullary substance of the brain itself is as soft as pap, while the cortical substance is full of blood-vessels, and unusually firm, the convolutions being hardly distinguishable.

Many of the causes of amaurosis are of such a nature as to render the disease totally incurable. Of this description is fungus hæmatodes, in which the structure of the retina and optic nerve is changed in a remarkable manner, the whole cavity of the eyeball becoming filled with a substance resembling medullary matter, and the optic nerve changed in its form, colour, and structure. (See *Wardrop's Essays on the Morbid Anatomy of the Human Eye*, vol. ii. p. 156. 8vo. Lond. 1818.)

On the authority of Ecker, one case is upon record, where the cause of amaurosis depended upon an aneurism of the central artery of the retina. (*Pinel, Nosographie Phrös. t. ii. p. 122.*)

In another instance, the macula lutea, which is naturally a yellow spot near the centre of the retina, was found black. (*Mém. de la Société Méd. d'Emulation*, an. 1798.)

Magendie states, that he has seen the retina transformed into a fibrous membrane; though Andral suspects that the change could not have happened in the nervous expansion itself, but rather in the very fine cellular substance between it and the choroid coat. (*Anat. Pathol.* t. i. p. 272.) An osseous capsule also, sometimes produced within the eye, and usually regarded as an ossification of the retina, he offers good reasons for setting down as really an ossification of the cellular tissue between the retina and choroid tunic. (*Op. et vol. cit.* p. 297.)

Bonetus, in his *Sepulchretum Anatomicum*, lib. 1. sect. 18., describes various cases which were thought incurable: after death, the blindness in one instance was found to be occasioned by an encysted tumour, weighing fourteen drachms, situated in the substance of the cerebrum, and pressing on the optic nerves near their origin. In the second, the blindness was produced by a cyst, containing water, and lodged on the optic nerves, where they unite. In a third, it arose from a caries of the os frontis, and a consequent alteration in the figure of the optic foramina. In a fourth, the cause of the disease was a malformation of the optic nerves themselves. Mr. Lawrence refers to a specimen in Mr. Langstaff's museum, exhibiting the eyes, optic nerves, and part of the basis of the brain of a man, who had been amaurotic for twenty-eight years. The sclerotics, cornea, iris, pupil, choroid coat, and retina, are perfectly healthy. The optic nerves, in their whole extent, from the globes backwards, are shrunk into white cords, not larger than a small crow-quill. At the point of union, they merely lie together without being joined, and each proceeds to its own side of the brain. Where they sweep round the crura cerebri, they are gradually confused and lost. (See *Lawrence on Dis. of the Eye*, p. 500.) Fractures of the skull at the anterior part of its basis may cause pressure on one, or both optic nerves, or on their union, or may otherwise injure them. (See *Case in Sir B. Brodie's Paper on Inj. of the Brain*, in *Med. Chir. Trans.* vol. xiv.) These nerves may be variously affected by disease of the bone, or its membranous coverings, in the same situation; or, in the orbit, such disease may have a venereal origin, and be indicated by the simultaneous existence of other symptoms referrible to the same cause. (See *Lawrence on Dis. of the Eye*, p. 498. Also *Case by Wilson*, in *Trans. of Soc. for Improvement of Med. & Chir. Knowledge*, vol. iii.) In some of the instances, in which no apparent alteration can be discovered in the optic nerve, the late Mr. Ware conjectured that a dilatation of the anterior portion of the circulus arteriosus may be the cause of the affection. The circulus arteriosus is an arterial circle, surrounding the sella turcica, formed by the carotid arteries on each side, branches passing from them to meet each other before, and other branches passing backwards, to meet branches from the basillary artery behind. The anterior part of the circulus arteriosus lies directly over, crosses, and is in contact with, the optic nerves; and just in the same way as the anterior branches lie over the optic nerves, the posterior ones lie over the nervi opticores oculorum. Hence Mr. Ware attempted to refer the amaurosis itself, and the paralytic affection of the eyelids, and muscles of the eyes, sometimes attendant on the complaint, to a dilatation of the anterior and posterior branches of the circulus arteriosus. The fre-

quently diseased state of the trunk, or small branches of the carotid arteries at the side of the sella turcica, is noticed by Dr. Baillie in his useful work on *Morbid Anatomy*, and he says the same sort of diseased structure is also found in the basillary artery and its branches. (See *Ware's Chir. Obs. on the Eye*.)

In 1826, M. Magendie related to the French Academy of Sciences various facts exemplifying the remarkable influence of the fifth nerves over all the senses; and, with respect to the sense of sight, he finds that the action of the eyeball and optic nerve cease immediately they are completely deprived of the influence of those nerves. The state of the eye is produced that has the greatest analogy to amaurosis. Indeed, when the fifth nerves are divided in an animal, it is instantly bereft of sight on the side on which the nerve has been cut, notwithstanding the eye retains at the moment all the physical conditions necessary for vision. It is not to be supposed, however, that the fifth nerves perform the function usually referred to the optic ones. To perceive the light, and to see, as Magendie remarks, are, experimentally speaking, two different things. An animal, whose fifth nerves have been divided, does not see, neither is it conscious of the daylight, or of the strongest artificial light; yet it decidedly perceives the impression of the rays of the sun, when they fall directly on the eye. Hence, a healthy, sound condition of the optic nerve, on the one part, and of the fifth nerve on the other, is essential to perfect vision; and M. Magendie therefore deems it highly probable, that there are two kinds of amaurosis; one depending on a particular affection of the optic nerve, and retina; the other on disease of the fifth nerve, and the defect of its influence on the organ of vision. These reflections led him to make trial of a combination of acupuncture and galvanism for the cure of certain cases of amaurosis. Thus, in one case, having introduced one needle into the frontal nerve, and another into the upper maxillary one, he brought the needles into repeated contact with the two poles of a voltaic pile. In a fortnight, the patient had received considerable benefit from the plan. Other facts are also recorded in favour of this treatment. (See *Journ. Expér. de Physiol.* t. vi. p. 156. *et seq.*)

Trinka de Kyzowitz, Historia Amauroseos, Svo. Vindob. 1781. *W. H.*, in *Practical Obs. in Surgery, and Med. Obs. and Inquiries*, vol. v. *Schumacher's Wahrnehmungen*, b. i. p. 273. *Richter's Anfangsgründe der Wundarzneikunst*, b. iii. *De Wenzel's Manuel de l'Oculiste*, ou Dictionnaire Ophthalmologique, Svo. Paris, 1808. *Vermischte Chirurgische Schriften von J. L. Schumacher*, b. ii. Berlin ed. 2. 1786. *D. G. Kreser*, Ueber die Natur, Ursachen, Kennzeichen und Heilung des schwarzen Staars, Svo. Gott 1811. *Langenbeck*, Neue Bibl. für die Chirurgie, b. i. Hannover, 1815. *J. Beer*, Lehre von den Augenkrankheiten, b. ii. Svo. Wien, 1817. *James Wardrop*, Essays on the Morbid Anatomy of the Human Eye, vol. ii. Svo. Lond. 1818. Remarks on Ophthalmia, &c. by *James Ware*. Inquiry into the Causes preventing Success in the Extraction of the Cataract, &c. by the same. *N. Scapula*, Osservazioni sulle Malattie degli Occhi Venez. 1812. *Prick* on the Diseases of the Eye, by *Wetbank*, Svo. Lond. ed. 2. 1824. Some scattered remarks in the posthumous work on the Diseases of the Eye, of the late *J. C. Saunders*, &c. *J. Stevenson*, on the Nature, &c. of the different Species of Amaurosis, Svo. 1821. *Travers's Synopsis of the Diseases of the Eye*, &c. Svo. Lond. 1820. *Lawrence on Diseases of the Eye*, Svo. Lond. 1831. *Richard Middleton*, on Diseases of the Eye, vol. ii. p. 242. &c. Svo. Lond. 1835. *H. Markenzie* on Diseases of the Eye, p. 187. Svo. Lond. 1835. *Dr. Jacob*, in *Cyclop. of Pract. Med.* part i. *Fuchs's* Treatment of Deafness and Amaurosis by Strychnia applied to a blistered Surface behind the Ear, *Lancet*, 1834-35, vol. i. p. 917. *R. Liston*, on the same subject, in *Med. Gazette*, vol. v. p. 541. and 575. He blistered the temples, and began with a quarter of a grain

of strychnia on each side, gradually increasing the quantity to one grain and a half, which brought on headach, vertigo, debility, nausea, and tremblings. See also articles *Cataract*, *Diplopia*, *Fungus Hæmatodes*, *Hæmeralopia*, *Hæmiopia*, *Nyctalopia*, *Sight*, *Defects of*, &c.

AMBE (from ἀμβη, the projecting edge of a rock). An old chiralurgical machine for reducing dislocations of the shoulder, and so called because its extremity projected like the prominence of a rock. Its invention is referred to Hippocrates. The ambe is the most ancient mechanical contrivance for the above purpose; but it is not at present employed. Indeed, it is scarcely to be met with in the richest cabinets of surgical apparatus. It is composed of a piece of wood, rising vertically from a pedestal. With the vertical piece is articulated, after the manner of a hinge, a horizontal piece, with a gutter formed in it, in which the luxated limb is laid and secured with straps. The patient places himself on one side of the machine; his arm is extended in the gutter, and secured; the angle, formed by the union of the ascending piece, and by the horizontal branch, is lodged in the armpit, and then the horizontal branch is depressed. In this way extension is made, whilst the vertical part makes counter-extension, and its superior part tends to force the head of the humerus into the articular cavity. But there is nothing to fix the scapula, and the compression made by the superior portion of the vertical piece of the machine tends to force the head of the humerus into the glenoid cavity, before it is well disengaged by the extension.

AMBLYOPIA (from ἀμβλῦς, dull, and ὤψ, the eye). Hippocrates means by this word, in his Aph. 31. Sect. 3. the dimness of sight to which old people are subject. Modern writers generally understand by amblyopia incomplete amaurosis, or the weakness of sight attending certain stages and forms of this disorder.

AMMONIÆ MURIAS. AMMONIA MURIATA. *Sal Ammoniac.* Its chief use in surgery is as an external discutient application. (See *Lotio Ammon.* *Muriatæ cum Aceto*).

Mr. Justinond recommends the following application to milk-abscesses: R Ammoniac Muriatis ℥j. Spiritus Roris marini lb.j. Misc. Linen rags, wetted with the lotion, are continually applied to the part affected. There can be little doubt of the utility of this lotion in dispersing the induration left after mammary abscesses; but while these cases are accompanied with much pain, tension, and inflammation, emollient fomentations and poultices are to be preferred. For ruhescient purposes, pure ammonia is extracted from the decomposition of muriate of ammonia by means of the soda contained in soap. A plaster is made by combining ℥j of soap with ℥ij of common litharge plaster; and when nearly cold, adding ℥j of muriate of ammonia in fine powder. From this nearly ℥j of ammonia in a pure state is slowly evolved, and exerts its action on the skin. (See A. T. Thomson's *Elem. of Materia Med.* p. 957. ed. 2.)

If muriate of ammonia be mixed with its weight of powdered nitre, and dissolved in six or eight parts of water, it produces a very cold lotion, which may be used, as a substitute for ice, in cases of strangulated hernia.

AMPUTATION. The operation of cutting off a limb, or other part of the body, as the breast, penis, &c.

Such an operation frequently becomes indispensably proper, on the principle of sacrificing a branch, as it were, for the sake of taking the only rational chance of saving the trunk itself. Indeed, the suggestion of this measure, in cases of mortification, where there is no chance of the parts recovering, may be said to be derived from nature herself, who, by a process to which I shall advert in speaking of *mortification*, detaches the dead from the living parts; this separation is followed by cicatrization, and the patient recovers.

The necessity for amputation has always existed, and ever will continue, so long as the destructive effects of injuries and diseases of the limbs cannot be obviated in any other manner. As Graefe observes, there was once a period (I should say, about forty years ago) when the operation was more frequently practised than at present, and this fact is to be imputed less to the caprice of surgeons, than to the imperfection of the means which used to be employed for the relief of local diseases. For then aneurisms of the limbs, and some other cases, at present treated with success, were always deemed incurable without amputation. Boucher, Gervaise, Faure, and Bilguer inveighed against the frequent performance of amputation on the field of battle; yet their arguments must prove of little value, unless a path were at the same time traced, which would conduct us to the method of remedying the circumstances which form the necessity for the operation. When this condition is fulfilled, and more effectual modes of treatment are devised, as, for instance, with respect to the gunshot wounds specified by Bilguer, then the necessity for amputation in such cases would cease of itself. (*Normen für die Ablösung grösserer Gliedmassen*, p. 13. 4to. Berlin, 1812.)

As the author of another valuable modern work has said, it is an excellent observation, founded on the purest humanity, and justified by the soundest professional principles, that to *save one limb is infinitely more honourable to the surgeon, than to have performed numerous amputations, however successful*; but it is a remark, notwithstanding its quaintness, fully as true, that it is much better for a man "to live with three limbs, than to die with four." (*Hennen on Military Surgery*, p. 251: ed. 2.) To this saying should be added the reflection, that some unfortunate beings, influenced by a relish for life, have been known to submit to the loss of all their legs and arms, and yet recover. In the Hôtel des Invalides at Paris, mutilated objects are in recollection, who had lost all their thighs and arms, so that, unless assisted, they could not stir, and it was necessary to feed and wait upon them, like new-born infants. (*Morand, Opusc. de Chir.* p. 183. and *Graefe, Op. cit.* p. 23.)

The amputation of limbs was anciently practised under many disadvantages. The best way of making the incisions was unknown; the ignorance of the old surgeons about the right method of stopping hemorrhage was the death of a large proportion of the patients who had courage to submit to the operation; the mode of healing the wound by the first intention was not understood, or not duly appreciated; and the instruments employed were as awkward and clumsy, as the dressings were irritating and improper.

Modern practitioners have materially simplified all the chief operations in surgery: an object

which has been accomplished, not merely by letting anatomical science be the main guide of their proceedings; not simply by devising more judicious and less painful methods; not only by diminishing the number, and improving the construction, of instruments; but also, in an essential degree, by abandoning the use of a multitude of external applications, most of which were useless or hurtful.

The Greek, Roman, and Arabian practitioners amputated limbs with feelings of alarm, and, in general, with the most melancholy results; while modern surgeons proceed to the operation completely fearless, well knowing that it mostly proves successful: hence, as Graefe justly remarks, nothing can be more evident, than that the patient's safety must depend very much upon the kind of practice. (See *Normen für die Ablösung grösserer Gliedmassen*, p. 1.) By practice is here implied the mode in which the operation is performed, the way in which the wound is dressed, and the whole of the after-treatment.

But much improved as amputation has been, it cannot be dissembled, that it is an operation at once terrible to bear, disagreeable to behold, and sometimes severe and fatal in its consequences, while the patient, if saved, is left for ever afterwards in a crippled, mutilated state. Hence it is the surgeon's duty never to have recourse to so serious a proceeding, without a perfect and well-grounded conviction of its necessity. Amputation should be generally regarded as the last expedient to which a surgeon ought to resort; an expedient justifiable, as a late writer says, only when the part is either already gangrenous, or the seat of so much injury, or disease, that the attempt to preserve it any longer would expose the patient's life to the greatest danger. (*Dict. des Sciences Méd.* t. i. p. 472.)

Although this amounts to a confession, that the cure of some local disorders is not within the limits of our art, yet, on the other hand, it furnishes a proof, that surgery may be the means of saving life under circumstances which, without its assistance, would infallibly have a fatal termination. The operation is adopted as the safest measure, the cause is removed for the prevention of consequences. (*Graefe, Op. cit.* p. 14.)

Nothing can be more absurd, or more misapprehended, than the censures sometimes passed upon amputation, because the body is mutilated by it, &c. Although the objection prove the limitation of human knowledge and ability, it must be very unfair on this account to throw blame on surgery, or the practitioner who thus saves the patient's life. For, without dwelling upon the fact, that a humane surgeon would never amputate through a mere love of operating, and without urgent cause, one may simply ask, Are all diseases in their nature curable? Does not the surgeon cure such as are curable, without mutilation? And are not cases, which were in the beginning remediable, often first brought to the surgeon when, from neglect, they have become totally incurable? Is it not his duty then to employ the only means left for saving the patient? And is not the preservation of a long and happy life a compensation for the sacrifice? Would it not be just as reasonable to blame an architect, when the irresistible force of lightning or a bomb destroys his building? Indeed, is it not rather a greater honour

to surgery, that, even when death has already taken possession, as it were, of a part, and is threatening inevitable destruction to the whole, a means is yet furnished, not only of saving the patient's life, but of bringing him into a state in which he may recover his former good health? (*Brünninghausen, Erfahrungen und Bemerkungen über die Amputation*, p. 11. 12no. Bamberg, 1818.)

Though amputation is in every respect much better than in former times, and its right performance is by no means difficult, I would not wish to be thought to say, that it is always or even usually done *secundum artem*, because long opportunities of observation have convinced me of the contrary; and the reason of the knife being yet so badly handled in this part of surgery, may generally be imputed to carelessness, slovenly habits, or, what is as bad, a want of ordinary dexterity. There are several egregious faults in the method of amputating, which even many hospital surgeons in this metropolis are guilty of; but these we shall find, when we criticise them, are for the most part easily avoidable, without any particular share of skill being required. A greater difficulty is to ascertain with precision the cases which demand the operation, those in which it may be dispensed with, and the exact periods at which it should be practised. These are considerations requiring profound attention, and the brightest talents. The most expert operator (as Mr. O'Halloran observes) may not always be the best surgeon. To do justice to the sick and ourselves, we must, in many cases, rather avoid than perform capital operations, and with respect to amputation, if we consider the many cases in which it has been unnecessarily undertaken, or done at unseasonable periods, it may be suspected, that this operation, upon the whole, may have done more mischief than good. At all events, it is not enough for a surgeon to know *how* to operate; he must also know *when* to do it. (See *O'Halloran on Gangrene and Spuchelus: Preface.*)

For such reasons, I shall first take a view of some of the circumstances under which the best surgeons deem amputation necessary; though in each of the articles relative to the particular diseases and injuries which ever call for the operation, additional information will be offered. Some of these affect the bones, or joints; others, more especially the soft parts. As a general maxim, it is the rule to amputate, whenever the injury, or disease, of the parts, is such, that either primarily, or consecutively, the limb must be lost, or symptoms induced, putting the patient's life into imminent peril. (See *Dupuytren, Clin. Chir.* t. iv. p. 234.)

1. COMPOUND FRACTURES.

In a compound fracture, the necessity, for amputation is not altogether proportioned to the seriousness of the accident, but frequently depends in part upon other circumstances. For example, in the field, and on board of a crowded ship, it is not constantly in the surgeon's power to pay such attention as the cases demand, nor to procure for the patient the proper degree of rest and good accommodation. In the field, there is often a necessity for transporting the wounded from one place to another. Under these circumstances, it is proper to have immediate recourse to amputation, in numerous cases of bad compound fractures, some of which, perhaps, might

not absolutely demand the operation, were the patients so situated as to be capable of receiving all the advantages of the best and most scientific treatment in a well-ventilated quiet house, or hospital, furnished with every desirable convenience. At the same time, daily experience proves, that there are many other cases, in which it would be improper to have recourse to the knife, even under the most unfavourable circumstances of the above description. So, when a compound fracture occurs, in which the soft parts have not been considerably injured; in which the bones have been broken in such a direction that they can be easily set and kept in their proper position; or in which there is only one bone broken; amputation would be unnecessary and cruel. But, when the soft parts have been more extensively hurt, and the bones have been so badly broken, that perfect quietude and incessant care are required to afford any chance of recovery, it is a good general rule to amputate whenever these advantages cannot be obtained.

The bad air in crowded hospitals and large cities, — a circumstance so detrimental to wounds in general, — is another consideration which may seriously lessen the chances of saving a badly broken limb, and should be remembered in weighing the reasons for and against amputation.

On this part of the subject, I find the sentiments of Graefe interesting. "Besides an absolute," says he, "there is a relative, necessity for amputation: it is the most mournful, and proceeds altogether from unfavourable external circumstances, though, alas! in many cases nearly unavoidable, when life is to be preserved. In war, every bloody action furnishes proof of what has been stated. The number of the wounded is immense; the number of surgeons for the duty too limited. The supplies most needed are at a distance. In these emergencies, though the military surgeon may, from routine and genius, be able to suggest the quickest method of obtaining what is wanted, know how to avail himself of every advantage which circumstances permit, and contrive tolerable substitutes for such things as are deficient, yet this will not always do. Were we (says Graefe) here to complain of the government not providing due assistance for the defenders of our native soil, to many the remonstrance would only appear reasonable. Yet, they who manage the medical affairs of the Prussian army may not constantly have it in their power to avert the inconvenience. The general cannot foretell the number and nature of the wounds which may happen, so as to enable the medical department to take with them exactly the apparatus required, without encumbering the army with a redundancy of useless articles. The enemy, perhaps, captures the medical stores, or the rapid movements of particular corps cut us off from the principal depôts. Detachments often skirmish at remote points. The hospitals may lie several miles in the rear of the line; and, for want of means, the transport of the imperfectly dressed wounded may continue night and day. Hardly are the sufferers brought into the nearest hospital, in the most pitiful state from pain, anxiety, and cold, when an order is given to break up, and they must be conveyed still further towards their grave: and a thousand other circumstances (as Graefe observes) which deprive the wounded of the requisite attendance, and essential number of

surgeons, together with the most necessary stores, make it desirable to simplify every wound as much as possible; which, indeed, is the only means of shunning the reproach, that while we are endeavouring to save one man's limb, we let another die.

"Who doubts (says Graefe) that a soldier with a gunshot wound, complicated with a smashed state of the bones, may sometimes be saved, without loss of his limb, by employing all the means which the resources of surgery offer? But these very resources are often wanting in a campaign; and the business of dressing the patient would occupy the surgeon several hours daily, during which his useful assistance could not be extended to other sufferers. Notwithstanding the utmost care, the removal of patients from one place to another frequently makes their wounds extremely dangerous, or fatal; and we now lose many a man, who, had he undergone amputation, would have been able to bear the journey." (See *Normen für die Ablösung grösserer Gliedmassen*, p. 15, 16.)

From what I have seen of the ill effects of moving patients with bad compound fractures of the lower extremity, produced by gunshot violence, I am convinced that, as a general rule, it is better to perform amputation; but, if this be not done, and an attempt is to be made to save the member, it will be more humane, when the army is retreating, and the enemy are not savages, to leave such wounded behind, than subject them to all the fatal mischief of hastily and roughly transporting them in such a condition. It gives me particular pleasure to find the preceding sentiment confirmed by Dr. Hennen, whose knowledge and experience in military surgery entitle all his opinions to the greatest attention: in noticing what ought to be done with the wounded when the army is compelled to retreat, he says, "it then becomes the duty of a certain proportion of the hospital staff to devote themselves for their wounded, and become prisoners of war along with them; and it may be an encouragement to the inexperienced, while it is grateful to me, to observe, that I have never witnessed, nor traced, on inquiry, an act of unnecessary severity practised either by the French or English armies on their wounded prisoners."

Compound fractures of the thigh, produced by gunshot violence, too often have an unfavourable termination, especially when the accident has been caused by grape-shot, or even a musket-ball, fired from a moderate distance, and the patient is moved from one place to another after the receipt of the injury. In the military hospital at Oudenbosch, in the spring of 1814, I had charge of about eight bad compound fractures of the thigh, of which cases only one escaped a fatal termination. This was an instance in which the femur was broken a little way above the knee. Another patient was extricated by amputation from the perils immediately arising from the splintered displaced state of the bone, the serious injury of the muscles, and enormous abscesses, but was unfortunately lost by secondary hemorrhage. All these patients had not merely been struck by grape-shot, or else by balls fired from a short distance, but they had been moved from Bergen-op-Zoom into the hospital, five or six days after the receipt of the injury — the worst period possible, on account of the inflammation being then most violent. From the ill

success of these cases, many a surgeon who saw them might be inclined to think, that immediate amputation ought generally to be performed for all compound fractures of the thigh, as soon after the receipt of the injury as possible. And such is my own sentiment, whenever the accident has been caused in the violent manner above specified, or whenever the patient must be moved any distance in a waggon after the occurrence of the injury. It may be right to state, however, that I have known more than one compound fracture of the thigh cured, where the accident had not been occasioned by gunshot violence, and I have been informed of one or two successful cases, where the bone was broken by a pistol-ball. In St. Bartholomew's hospital, two compound fractures of the thigh were formerly pointed out to me, as cases likely to end favourably. However, these may only have been lucky escapes, deviations from what is common, and not entitled to any stress, with the view of affecting the general excellent rule of amputating where the thigh-bone is broken by gunshot violence.

As Mr. Guthrie has accurately observed, one circumstance which increases the danger of fractures of the femur from gunshot violence, is, that the bone is often broken obliquely, the fracture extending far above and below the point immediately struck by the ball. (*On Gunshot Wounds*, p. 189, 190.) This disposition of the thigh-bone to be splintered for several inches when hit by a ball, and the increased danger arising from the occurrence, are particularly commented upon by the experienced Schmucker, who was surgeon-general to the Prussian armies in the campaigns of Frederick the Great. (See his *Vermischte Chirurgische Schriften*, b. i. p. 39, 8vo. Berlin, 1785.) In several of the cases, under the care of the late Dr. Cole and myself in Holland, the bone was split longitudinally, to the extent of seven or eight inches.

According to Schmucker, all fractures of the middle or upper part of the femur are attended with great danger. "But (says he) if the fracture be situated at the lowest part of the bone, the risk is considerably less, the muscles here not being so powerful; in such a case, therefore, amputation should not be performed before every other means has been fairly tried; and very frequently I have treated fractures of this kind with success, though the limbs sometimes continued stiff." But (says Schmucker) if the bone be completely fractured or splintered by a ball at its middle, or above that point, I never wait for the bad symptoms to commence, but amputate ere they originate, and, when the operation has been done early enough, most of my patients have been saved. However, when some days had transpired, and inflammation, swelling, and fever had come on, I must candidly confess, that the issue was not always fortunate. Yet the operation should not, on this account, be dispensed with; for, if only a few can thus be saved out of many, some benefit is obtained, as, without this step, such few would also perish." (*Vermischte Chir. Schriften*, b. i. p. 42.) What issue of compound fractures of the thigh, after the assault on Bergen-op-Zoom, we may remark, coincides with the results of Schmucker's ample experience; for the only two patients who survived the bad symptoms proceeding directly from the fracture, were, one whose fe-

mur was broken near the knee, and another, whose limb I took off, on account of a fracture of the middle of the bone, accompanied with abscesses of surprising extent. The latter was a case, however, in which the limb ought to have been removed earlier. The following remarks, by Mr. Guthrie, I consider judicious and correct.

"The danger and difficulty of cure, attendant on fractures of the femur from gunshot wounds, depend much on the part of the bone injured; and, in the consideration of these circumstances, it will be useful to divide it into five parts. Of these, the head and neck included in the capsular ligament, may be considered the first; the body of the bone, which may be divided into three parts; and the spongy portion of the lower end of the bone exterior to the capsular ligament, forming the fifth part. Of these, the fractures of the first kind are, I believe, always ultimately fatal, although life may be prolonged for some time. The upper third of the body of the bone, if badly fractured, generally causes death at the end of six or eight weeks of acute suffering. I have seen few escape, and then not with a useful limb, that had been badly fractured in the middle part. Fractures of the lower or fifth division are in the next degree dangerous, as they generally affect the joint; and the least dangerous are fractures of the lower third of the body of the bone. Of these, even, I do not mean to conceal, that, when there is much shattered bone, the danger is great; so that a fractured thigh by gunshot, even without particular injury of the soft parts, is one of the most dangerous kinds of wounds that can occur." (*See Guthrie on Gunshot Wounds*, p. 190.)

In compound fractures, as Mr. Pott has correctly pointed out, there are three points of time when amputation may be proper. The first of these is immediately, or as soon as possible, after the receipt of the injury. The second is, when the bones continue for a great length of time without any disposition to unite, and the discharge from the wound has been so long, and is so large, that the patient's strength fails, and general symptoms foreboding dissolution come on. The third is, when mortification has taken such complete possession of the soft parts of the inferior portion of the limb, quite down to the bone, that, upon the separation of such parts, the bone or bones are left bare in the interspace.

The first and second of these are matters of very serious consideration. The third hardly requires any.

When a compound fracture is caused by the passage of a heavy body over a limb, such, for instance, as the broad wheel of a waggon or loaded cart, or by the fall of a very ponderous body on it, or by a cannon-shot, or by any other means so violent as to break the bones into many fragments, and so to tear, bruise, and wound the soft parts, that there shall be good reason to fear that there will not be vessels sufficient to carry on the circulation with the parts below the fracture, it becomes, as Mr. Pott observes, a matter of the most serious consideration, whether an attempt to save such a limb will not occasion loss of life. This consideration must be given before any degree of inflammation has seized the part, and, therefore, immediately after the accident. When inflammation, tension, and a disposition to gangrene in the limb have arisen, the period is highly dis-

advantageous for operating, and the patient's chances of being saved by amputation, under these circumstances, are much smaller than before the changes here spoken of have taken place. At the same time, there are certain examples of mortification from external causes, where, as far as one can judge from the results of later experience than that of Mr. Pott, the surgeon should not defer amputation, even though the disorder is yet in a spreading state, attended with considerable swelling and tension reaching far up the limb. This is a subject, however, which will require more explanation hereafter. (See what is presently said on *Mortification*.) Nor are the cases, to which reference is made, meant to affect the general truth of the observation, delivered by the most experienced surgeons of every age, that, when a limb is extensively swelled and inflamed, with a part of it either in a state of spreading mortification, or ready to become gangrenous, the period is so unfavourable for amputation, that very few patients, so circumstanced, ever recover after the operation. Nor is it meant to be insinuated, that, in the very cases, which form exceptions to the general rule of not amputating before the tendency to gangrene has ceased, the patient might not have had an infinitely better chance of his life, had the operation been done immediately after the first receipt of the injury, before any disposition to gangrene had had time to be produced.

The necessity of immediate or very early decision, in this case, makes it a delicate part of practice; for, however pressing the case may seem to the surgeon, it will not, in general, appear in the same light to the patient or his relations; yet suffering this point of time to pass often decides the patient's fate.

This necessity of early decision arises from the quick tendency to mortification, which ensues in the injured limb, and too often ends in the patient's death. That this is no exaggeration, says Pott, melancholy and frequent experience evinces, even in those whose constitutions, previous to the accident, were in good order; but much more in those, who have been heated by violent exercise, or labour, or liquor, or who have led debauched and intemperate lives, or who have habits naturally inflammable and irritable. This is often the case when the fracture happens to the middle part of the bones, but is much more likely to happen when any of the large joints are concerned. In many of these cases, a determination for or against amputation, is really a determination for or against the patient's existence.

That it would have been impossible to have saved some limbs, which have been cut off, no man will pretend to say; but this does not render the practice injudicious. Do not the majority of those who get into the above hazardous condition, and on whom amputation is not performed, perish in consequence of their wounds? Have not many lives been preserved by amputation, which, from the same circumstances, would otherwise most probably have been lost?

Pressing and urgent as the state of a compound fracture may be, at this first point of time, still it will be a matter of choice, whether the limb shall be removed or not; but, at the second period, the operation must be submitted to, or the patient must die.

The most unpromising appearances at first, do not necessarily, or constantly, end unfortunately. Sometimes, after the most threatening first symptoms, after considerable length of time, great discharges of matter, and large exfoliations of bone, success is ultimately obtained, and the patient recovers his health and the use of his limb.

Dupuytren relates two cases, in one of which the hand was terribly shattered by the kick of a horse; while, in the other, all the anterior part of the foot had been crushed by an iron machine. In the first case, all the parts of the hand, not broken to atoms, were preserved, the patient recovering without any severe symptoms. In the second, where the great toe was broken, and the first and second metatarsal bones comminuted, the other toes wounded, and all the integuments of the sole torn away, gangrene ensued; but, in the end, the patient recovered with the loss of only the great toe. In both these instances, Dupuytren removed all loose fragments of bone. In the last case, he was singularly favoured by the youth and good constitution of the patient. "Things," says he, "do not always end in this way: a very slight difference in these favourable conditions, or in the degree of the injuries, might perhaps have made us seriously repent of not having amputated." (*Clin. Chir.* t. iv. p. 237.)

But sometimes, after the most judicious treatment through every stage of the disease; after the united efforts of physic and surgery; the sore, instead of granulating kindly, and contracting daily to a smaller size, shall remain as large as at first, with a tawny, spongy surface, discharging a large quantity of thin sanies, instead of a small one of good matter; the fractured ends of the bones, instead of tending to exfoliate, or to unite, will remain as perfectly loose and disunited as at first, while the patient shall lose his sleep, his appetite, and his strength; a hectic fever, with a quick, small, hard pulse, profuse sweats, and colliquative purging, contributing at the same time to bring him to the brink of the grave, notwithstanding every kind of assistance: in these circumstances, if amputation be not performed, Mr. Pott asks, what else can rescue the patient from destruction?

The third and last period is a matter which does not require much consideration. Too often, the inflammation consequent upon the injury, instead of producing abscess and suppuration, tends to gangrene and mortification, the progress of which is often so rapid, as to destroy the patient in a short space of time, constituting that very sort of case, in which amputation should have been immediately performed. But sometimes even this dreadful malady is, by the help of art, put a stop to, but not until it has totally destroyed all the surrounding muscles, tendons, and membranes quite down to the bone, which, upon the separation of the mortified parts, is left quite bare, and all circulation between the parts above and those below is by this totally cut off. In this instance, whether the surgeon saw through the bare bone, or leave the separation to be effected by nature, the patient must lose his limb. (See Pott's *Remarks on the Necessity, &c. of Amputation in certain Cases*, &c. *Chir. Works*, vol. iii.)

For the consideration of a variety of complicated circumstances affecting the question of amputation in compound fracture, I must refer to *Gunshot Wounds*.

2. EXTENSIVE CONTUSED AND LACERATED WOUNDS.

These form the second class of general cases requiring amputation. Wounds without fracture are not often so bad as to require this operation. When a limb, however, is extensively contused and lacerated, and its principal blood-vessels are injured, so that there is no hope of a continuance of the circulation, the immediate removal of the member should be recommended, whether the bones be injured or not. Also, since no effort on the part of the surgeon can preserve a limb so injured, and such wounds are more likely to mortify than any others, the sooner the operation is undertaken the better.

In these cases, as in those of compound fractures, though amputation may not always be necessary at first, it often becomes so afterwards. The foregoing observations, relative to the second period of compound fractures, are equally applicable to badly lacerated wounds, unattended with injury of the bones. Sometimes a rapid mortification comes on; or a profuse suppuration, which the system can no longer endure.

For information on the proper period of amputating in traumatic gangrene, see MORTIFICATION, and the section on this disorder in the present article.

3. CASES IN WHICH PART OF A LIMB HAS BEEN CARRIED AWAY BY A CANNON-BALL.

When part of a limb has been torn off by a cannon-ball, or any other cause capable of producing a similar effect, the formation of a good and serviceable stump; the greater facility of healing the clean, regular wound of amputation; and the benefit of a far more expeditious, as well as of a sounder cure, are the principal reasons which here make the operation advisable.

This is an instance, in which some former surgeons disputed the necessity of amputation. They urged as a reason for their opinion, that the limb being already removed, it is better to endeavour to cure the wound as speedily as possible, than increase the patient's sufferings and danger, by making him submit to amputation. It must be remembered, however, that the bones are generally shattered, and reduced into numerous fragments; the muscles and tendons are unequally divided, and their ends torn and confused. Now, none of the old surgeons questioned the absolute necessity of extracting the splinters of bone, and cutting away the irregular extremities of the tendons and muscles, which operations would require a longer time than amputation itself. Besides, we should recollect, that, by making the incision above the injured part, so as to be enabled to cover the bone with flesh and integuments perfectly free from injury, the extent of the wound is so diminished, that the healing can be accomplished in one third of the time which would otherwise be requisite, and a much firmer cicatrix is also obtained. Such reflections must convince us that amputation here holds forth great advantages. It cannot increase the patient's danger, and, as for the momentary augmentation of pain which he suffers, he is amply compensated. (See Gunshot Wounds.)

4. MORTIFICATION.

Mortification is another cause, which, when advanced to a certain degree, renders amputation indispensably proper. We have noticed, that bad compound fractures, and wounds, often terminate in the death of the injured limb. Such surgeons as have determined, at all events, to oppose the performance of amputation, have pretended that the operation is here totally useless. They assert, that when the mortification is only in a slight degree, it may be cured; and that when it has spread to a considerable extent, the patient will perish, whether amputation be performed or not. But this way of viewing things is so contrary to facts, and the experience of every impartial practitioner, that I shall make no attempt to refute the assertion. While it is allowed that it would be very bad practice to amputate on every slight appearance of gangrene, it is equally a fact, that, when the disorder affects the substance of a member, the operation is generally the safest and most advantageous measure. Nay, there are, as we shall presently see, certain forms of mortification, in which the early performance of amputation is the only chance of saving our patient.

Practitioners have entertained very opposite opinions concerning the period when one should operate in cases of mortification. Some pretend, that whenever the disorder presents itself, and especially when it is the effect of external violence, we should amputate immediately the mortification has decidedly begun to form, and while the mischief is in a spreading state. Others believe that the operation should never be undertaken before the progress of the disorder has stopped, even not till the dead parts have begun to separate from the living ones.

The advocates for the speedy performance of amputation declare, that the further progress of the mortification may be stopped, and the life of the patient preserved, by cutting above the parts affected. However, according to the reports of the greater number of eminent surgical writers, this practice is highly dangerous, and undeserving of confidence. Whatever pains may be taken, in the operation, only to divide sound parts, there is no certainty of succeeding in this object, and the most skilful practitioner may be deceived. The skin may appear to be perfectly sound and free from inflammation, while the muscles which it covers, and the parts immediately surrounding the bone, may actually be in a gangrenous state. But even when the soft parts are found free from apparent distemper on making the incision, still, if the operator should not have waited till the mortification has ceased to spread, the stump will almost always be attacked by gangrene. Surgeons who have had opportunities of frequently seeing wounds which have a tendency to mortify, entertain the latter opinion. Such was the sentiment of Pott, who says that he has often seen the experiment made, of amputating a limb in which gangrene had begun to show itself, but never saw it succeed, and it invariably hastened the patient's death.

The operation may be postponed, however, too long. Mr. S. Sharp, in particular, recommended too much delay, advising the operation never to be undertaken till the natural separation of the mortified parts had considerably advanced. Mr. Sharp was

a surgeon of immense experience, and his authority carries with it the greatest weight. But, perhaps, he was too zealous in his opposition to a practice, the peril of which he had so often beheld. When the mortification has ceased to spread, there is no occasion for further delay. We now obtain, just as certainly, all the benefits of the operation, and get rid of a mass of putridity, the exhalations from which poison the atmosphere which the patient breaths, and are highly detrimental to his health. Nay, patients in these circumstances may actually fall victims to the absorption of putrid matter. However, this danger would not be so considerable as that which would arise from too precipitate an operation; and it is better to defer amputation a little more than is absolutely requisite, than run any risk of performing the operation before it is certain that the parts have lost their tendency to gangrene.

In the article MORTIFICATION, we have noticed particular cases of gangrene, where, according to Larrey's experience, the surgeon is not to wait for the line of separation being formed, but have recourse to the immediate performance of amputation. The experience of Mr. Lawrence, and several cases which I saw in the British military hospitals during the last war, tend to confirm the propriety of such practice. (See *Medico-Chir. Trans.* vol. vi. p. 156, &c.)

In an example, where a large part of the arm was deeply affected with gangrene from external violence, and the disorder was yet making rapid progress, I once recommended the performance of amputation at the shoulder-joint. On the whole, this instance was favourable to the practice; for, though the patient died at the end of a fortnight, probably he would not have lived twenty-four hours, had the operation not been done; nor was the stump attacked with mortification,—a circumstance worthy of attention, because it is a danger particularly insisted upon by the opponents of amputation under the preceding circumstances; and, had it not been for a large abscess, which formed in the back, as was supposed, from a violent blow received in the fall which produced the original injury, there were well-grounded hopes of recovery. The patient, here spoken of, was attended by Dr. Blicke, of Westminster.

There is likewise a species of gangrene, which is pointed out by Mr. Guerin as requiring early amputation. A soldier (says he) shall receive a flesh-wound from a musket-ball in the middle of the thigh, which passes through the limb apparently, on a superficial inspection, without injuring the main artery; or it shall pass close behind the femur, where the artery turns to the back part of the bone; or it may go through the middle of the bone, from behind forwards, between the condyles of the femur, into the knee-joint, and the patient shall walk to the surgeon with little assistance, be superficially dressed, and, in many cases, considered slightly wounded; yet the femoral artery and vein, in the whole of these cases, and, indeed, in many others, shall be wounded, or cut across, and the local inflammation be so slight as to obtain little attention. On the third or fourth day, the patient shows his toes discoloured, and complains of pain and coldness in the limb below the wound, the constitution begins to sympathise with the injury, and the surgeon probably thinks the case extraordinary. Perhaps

he suspects the real state of the injury; but is surprised that a wound of the femoral or popliteal artery, with so little attendant injury, could cause mortification, &c. He is anxious to do something; but mortification, or at least gangrene, having commenced, he must, according to general rule, await the formation of the line of separation. The temperature of the leg, a little above the gangrene, is good, perhaps higher than natural; he hopes it will not extend farther, and it probably does remain stationary for a little time. At last, the parts originally affected—the toes—become sphacelated, and gangrene quickly spreads up the leg as far as the wounded artery, by which time the patient dies."

For the purpose of preventing such a disaster, where the artery, or artery and vein, have been divided, Mr. Guthrie recommends the performance of amputating as soon as the gangrene is perceived to extend beyond the toes; and the swelling and slight attendant inflammation, which is marked more by the tumefaction than the redness of the part, has passed higher up than the ankle. (See *Guthrie on Gunshot Wounds*, p. 60, 61.)

Mortification of a limb, after operation for aneurism, is another exception to the general rule of not amputating till the mortification has stopped. Where also gangrene arises from the obstruction of the circulation, by an aneurism bursting, and its blood passing copiously into the cellular tissue of the limb, amputation should be performed without delay, though the mortification may not have stopped. An example of the success of this practice, I have laid before the profession. (See *Med.-Chir. Trans.* vol. xvi.)

5. DISEASED JOINTS.

Excluding from present consideration the proposal to undertake the excision of some joints which are in particular states of injury, or disease, I may observe, that scrofulous joints, with diseased bones, and distempered ligaments and cartilages, is another case in which amputation may become absolutely necessary. As Mr. Pott remarks, there is one circumstance attending this complaint, often rendering it particularly unpleasant, which is, that the subjects are most frequently young children, so as to be incapable of determining for themselves; which inflicts a distressing task on their nearest relations. All the efforts of physic and surgery often prove absolutely ineffectual, not only to cure, but even to retard, the disease in question. Notwithstanding many cases admit of cure, numerous others do not. The disease often begins in the very inmost recesses of the cellular texture of the heads of the bones, forming the large articulations, such as the hip, knee, ankle, and elbow; the bones become diseased in a manner which will be explained in the article JOINTS, sometimes with great pain and symptomatic fever; sometimes with little of either, at least in the beginning. The cartilages covering the ends of these bones, and designed for the mobility of these joints, are totally destroyed; the epiphyses in young subjects are either partially, or totally, separated from the said bones; the ligaments of the joints are so thickened and spoiled by the distemper, as to lose all natural appearance, and become quite unfit for all the purposes for which they were intended: the parts appointed for the secretion of the synovia, become distempered in like manner; all these together furnish a large

quantity of stinking sanious matter, which is discharged either through artificial openings, made for the purpose, or through small ulcerated ones. These openings commonly lead to bones which are diseased through their whole texture. When the disease has got into this state, the constant pain, irritation, and discharge bring on hectic symptoms of the most destructive kind, such as total loss of appetite, rest, and strength, profuse night sweats, and as profuse purgings, which foil all the efforts of medicine, and bring the patient to the brink of destruction. (See *Pott on Amputation*.)

In these cases, amputation is attended with more success when performed late, than when undertaken at an early period, before the disease has made great advances. This is fortunate, as it affords time for a fair trial of such remedies as are best calculated to check the progress of the disorder. (See *JOINTS*.)

Whenever the disease of a joint is likely to terminate in ankylosis, amputation should not be resorted to, as a cure will be effected without it. (See *ANKYLOSIS*.) In deciding to amputate, or not, a great deal will depend upon the state of the patient's health, and his kind of constitution, as well as upon the condition of the joint itself. Thus, Dupuytren relates the particulars of two cases of diseased elbow, with ulceration of the cartilages, abscesses, sinuses, &c. In one, where the constitution was decidedly scrofulous, the hectic disturbance severe, the emaciation great, and the strength rapidly declining, the patient, a child, could only be saved by amputation. In the other case, where the constitution was less deranged, and the strength better maintained, Dupuytren brought the disease to a conclusion by ankylosis. (See *Dupuytren, Clin. Chir. t. iv. p. 250*.)

6. EXOSTOSIS

May render amputation necessary, when the tumour becomes hurtful to the health, or insupportable, on account of its weight, or other circumstances, and cannot be removed by any of the plans specified in the article *EXOSTOSIS*.

7. NECROSIS.

Another distemper, sometimes producing a necessity for amputation, is necrosis, or the death of the whole, or of a considerable part, of the bones of the extremities, accompanied with such extensive abscesses, such disease of the soft parts, such disorder of the constitution, and prostration of strength, that every hope of a cure being effected by a natural process must be renounced. By necrosis, is here meant, not merely some disease which destroys the surface of a bone, but one which extends its depredations to the whole of the internal substance, and that from end to end. Portions of the bones die from a variety of causes, such as struma, lues venerea, deep-seated abscesses, pressure, &c.; and bones in this state, when properly treated, often exfoliate and cast off their dead parts. But, when the whole substance of a bone becomes diseased, from end to end, frequently no means will avail. In the words of Mr. Pott, the use of the scalpel, the respiratory, and the rugine, for the removal of the diseased surface of bones; or the trephine, for perforating into the internal texture of the diseased bone, and of exfoliating applications (if there be any such which merit the name), will prove in many instances unavailing,

and, unless the whole bone be removed by amputation, the patient will die. Mr. Pott's refutation of *Bilguer*, who asserts that amputation is not requisite in these instances, is a masterly and most convincing production; but I would not exactly do as the former of these writers has done, and positively affirm, that every extensive necrosis, affecting a bone nearly its whole length, must inevitably require amputation. The power of nature in restoring the bones is sometimes wonderful. (See *NECROSIS*.)

The late period, at which an extensive necrosis may follow the injury of a bone, and make amputation necessary, is sometimes almost incredible. Schmucker details the case of a captain who received a musket-ball through the left arm, four or five inches above the elbow. The bone was violently struck, but not broken; several exfoliations followed, and after more than a year's treatment, the patient appeared perfectly cured. For nine years this officer remained well; but, at the end of this time, being on a journey, he was attacked with pain and inflammation in the wounded part, and febrile symptoms. He hastened to Berlin, and put himself under the care of Theden and Schmucker, who found an abscess in the situation of the former wound, and, as an opening had been already made, the bone could be felt stripped of its periosteum. At length, a piece of bone exfoliated, and became loose, precisely under the brachial artery, which interfered with its removal. Notwithstanding the discharge, the elbow-joint continued swelled, and there were red point observable, not only above that joint, but also over the heads of the ulna and radius, indicating disease of those bones. Amputation was therefore performed by Theden, and the patient got quite well. On examining the os brachii, a splinter was found, three inches in length, and one in breadth, its edges being thin and sharp, while its centre was more than three lines thick. The bone, every where about the place where it had been struck by the ball, seemed to consist of callus without any medullary cavity, and the whole of it down to the elbow had no periosteum. The cartilage appeared also disposed to separate, and the periosteum was detached from the radius and ulna, which were likewise affected with necrosis. (See *Schmucker's Vermischte Chir. Schriften*, v. i. p. xxiii. ed. 2.)

When, in a case of necrosis, the limb breaks in the midst of the diseased part of it, followed by vast deformity, profuse suppuration, and urgent constitutional derangement, amputation is indicated. (See *Dupuytren, Clin. Chir. t. iv. p. 260*.)

8. CANCEROUS AND OTHER INVETERATE DISEASES, SUCH AS FUNGUS HÆMATODES.

Cancerous, inveterate diseases, and malignant incurable ulcers on the limbs, sometimes render amputation a matter of necessity. In treating of cancer, we shall remark, that little or no confidence can be placed either in internal or any kind of topical remedies, and that there is nothing, except the total separation of the part affected, upon which any rational hopes of cure can be built. Cancer, attended with scirrhous formation, is not frequently seen on the extremities. Every man of experience, however, must occasionally have seen, in this situation, if not *scirrhus*, as it is termed by Dr. Carswell (see his *Illustra-*

tions of the *Elementary Forms of Disease*, Fasc. 1. et 2.) medullary tumours, and other diseases quite as intractable, and which cannot be cured, except by removing the affected part. This may often be accomplished without cutting off the whole limb. But, when the disease has spread beyond certain bounds, amputation, above the part affected, is the only thing to which recourse can be had with any hope of success. Sometimes, when the operation has been delayed too long, even amputation itself will not effect a cure. In a few cases of medullary tumour, the operation has succeeded, however, and even after the disease had reappeared, a cure has now and then been achieved by another excision of the diseased parts. Yet, from what I have seen of fungus hæmatodes, I should much doubt, whether the benefit obtained by amputation would frequently be lasting, as when this disease shows itself only externally, internal organs are mostly at the same time similarly affected. (See FUNGUS HÆMATODES.)

Besides cancerous, there are other ulcers, which may render amputation indispensable. Thus, when an extensive ulcer, of any sort whatsoever, is evidently impairing the health; when, instead of yielding to remedies, it becomes larger and more inveterate; when, in short, it puts life in imminent danger; amputation should be advised. In phagedenic ulcers from syphilis, and others attacked by hospital gangrene, the operation would be improper. (See HOSPITAL GANGRENE, and VENEREAL DISEASE.)

9. VARIOUS TUMOURS.

That there are numerous swellings which destroy the texture of the limbs, rendering them useless, causing dreadful sufferings, and bringing the patients into the most debilitated state, no man of observation can fail to have seen. When such tumours can neither be dispersed, nor cut out with safety, amputation of the limb is the only resource.

Mr. Pott has particularly described a tumour affecting the leg, for which the operation is sometimes requisite. It has its seat in the middle of the calf of the leg, or rather more towards its upper part, under the gastrocnemius and solus muscles. It begins by a small, hard, deep-seated swelling, sometimes very painful, sometimes but little so, and only hindering the patient's exercises. It does not alter the natural colour of the skin, at least until it has attained a considerable size. It enlarges gradually, does not soften as it enlarges, but continues through the greatest part of it incompressibly hard, and, when it is got to a large size, it seems to contain a fluid, which may be felt towards the bottom, or resting, as it were, on the back part of the bones. If an opening be made for the discharge of this fluid, it must be made very deep, and through a strangely distempered mass. This fluid is generally small in quantity, and consists of a sanies mixed with grumous blood: the discharge of it produces little diminution of the tumour, and high symptoms of irritation and inflammation come; on and, advancing with great rapidity, and most exquisite pain, soon destroy the patient, either by the fever, which is high and unremitting, or by a mortification of the whole leg. If amputation has not been performed, and the patient dies, after the tumour has been freely opened, the mortified and putrid state

of the parts prevents all satisfactory examination; but, if the limb was removed without any previous operation (and which Mr. Pott, in his experience, found to be the only way of preserving the patient's life), the posterior tibial artery will be found to be enlarged, distempered, and burst; the muscles of the calf to have been converted into a strangely morbid mass, and the posterior part of both the tibia and fibula more or less carious.

The following case is related by Mr. Abernethy. A woman was admitted into St. Bartholomew's Hospital with a hard tumour in the ham. It was about four inches in length, and three in breadth. She had also a tumour in front of the thigh, a little above the patella, of lesser size and hardness. The tumour in the ham, by its pressure on the nerves and vessels, had greatly lessened the sensibility, and obstructed the circulation of the leg, so that the limb was very œdematous. As it appeared impossible to remove this tumour, and its origin and connections were unknown, amputation was performed. On examining the amputated limb, the tumour in the ham could only be divided with a saw. Several slices were taken out of it by this means, and appeared to consist of a coagulable and vascular substance, in the interstices of which a great deal of bony matter was deposited. The remainder of the tumour was macerated, and dried, and it appeared to be formed of an irregular and compact deposition of the earth of bone. The tumour on the front of the thigh was of the same nature as that of the ham, but contained so little lime, that it could be cut with a knife. The thigh bone was not at all diseased, which is mentioned, because, when bony matter is deposited in a limb, it generally arises from the disease of a bone. (*Surgical Observations*, 1804.)

Before the late facts and improvements, relative to the treatment of aneurisms on the extremities, these cases were generally set down as requiring amputation. Even Pott, and J. L. Petit, wrote in recommendation of such practice, and their observations on this subject are among the few parts of their writings which the enlargement of surgical knowledge, since their time, has rendered objectionable. The surgeon, to whom the honour of first correcting this erroneous doctrine belongs, is A. N. Guenault, who opposed the advice delivered by Petit. (*Haller, Disp. Chir.* vol. v. p. 155.)

I shall conclude these remarks on the cases requiring amputation, with advising surgeons never to undertake this serious operation, without consulting the opinions of other professional men, whenever their advice can be obtained. The best operators are often deficient in that invaluable kind of judgment, by which the cases, absolutely demanding amputation, are discriminated from others, in which the operation may be wisely postponed, and a chance taken of preserving the limb.

Surgeons should generally refuse to amputate limbs merely affected with stiffness or deformity. Operations, under such circumstances, termed by the French *opérations de complaisance*, are more frequently followed by fatal consequences, than amputations in more urgent cases (See *Dupuytren, Clin. Chir.* t. iv. p. 271.)

THE HISTORY OF AMPUTATION

Evinces, that the steps of surgery to perfection

are slow, and that, they even sometimes deviate from the straight path, though, upon all essential points, no retrogradation has ever taken place.

Nature has acted as the guide, and the surgeon's chief merit has consisted in obeying the hints which she herself has thrown out. As already mentioned, the following natural occurrence, no doubt, was one of the circumstances which first led to the bold practice of amputation: in consequence of disease, and grievous local injuries, whole limbs were sometimes seized with mortification. In the majority of cases, this was attended with so much constitutional disturbance, that the patients died; but, in other instances, the mortification was confined to the part; suppuration was established between the dead and living parts; the whole of the mortified limbs fell off; the suppurating surfaces healed up; and thus, by the powers of nature, the patients were restored to health. Here was clearly proved the possibility of recovery, notwithstanding the loss of a limb. The surgeon, as Brünninghausen remarks, viewed with surprise this course of nature, and hardly ventured to promote it by the feeble means formerly employed. But, as the mortified parts, previously to their detachment, caused great annoyance by their fetor, a first attempt was at length made to get rid of them, in doing which, the knife was always kept from touching the living flesh, on account of a well-grounded fear of bleeding, for the suppression of which no effectual methods were known. Such was the practice that prevailed from Hippocrates down to Celsus. (*Erfahr. über die Amp.* p. 14.)

A. C. Celsus, who lived in the reign of Tiberius, and whose book, *De Re Medica*, should be read by every surgeon, has left us a short description of the mode of amputating gangrenous limbs. (Lib. 7. c. 33.) It has been often remarked, that Celsus has left no instructions for securing the divided blood-vessels; but it has not been commonly noticed, that, in his chapter on wounds, he directs us to stop hemorrhage by taking hold of the vessels, then tying them in two places, and dividing the intermediate portion. If this measure cannot be adopted, he advises the use of a cauterizing iron. Several hints are to be met with in the writings of Celsus, from which it may be inferred, that the ligature of bleeding vessels was sometimes practised at the early age in which he lived, and this supposition is strengthened, by a fragment of Archigenes, preserved by Cocchi: on the subject of amputation, where he speaks of tying, or sewing, the blood-vessels. We are not, however, in possession of all the writings of medical authors, prior to the time of Galen, and must therefore remain in doubt upon this point. (*Rees's Cyclopædia*, art. *Amputation*.)

This anonymous writer argues, therefore, with some appearance of reason, that if amputation often proved fatal in the days of Celsus,—“*sæpe in ipso opere*,” as the expression is,—it was owing to the want of some efficacious method of compressing the blood-vessels during the operation itself.

But, admitting that the ancients were not altogether unimformed of the plan of tying arteries, it cannot be credited, that they adopted the practice to any extent; for, if they had, they would not have continued so partial to the caustery, boiling oils, and a furrago of astringent applications.

They would also never have had recourse to the barbarous method of cutting the flesh with a red-hot knife, with the view of stopping the hemorrhage by converting the whole surface of the stump into an eschar. Painful in its execution, and horrid in its consequence, as this burning operation was, it seldom proved a lasting antidote to the bleeding, which generally came on in a fatal manner, as soon as the sloughs were loose. On this part of the subject, my own ideas fully agree with those of a distinguished foreign surgeon, who says, that although the document left us may prove that the ligature was known to the ancients, and employed in cases of aneurisms and wounded blood-vessels, nay, that the arteries were secured with a needle and ligature; yet the practice could not have been extended to the operation of amputation, since, with the custom of making the incisions in the dead parts, the method scarcely admitted of being put in execution. (*Brünninghausen, Erfahr. über die Amput.* p. 29.)

The different steps of the operation, meriting particular attention, are, the choice of the part of the limb where the incisions are to begin; the measures for guarding against bleeding during the operation; the division of the integuments, muscles, and bones, which is to be accomplished in such a manner, that the whole surface of the stump will afterwards be covered with skin; tying the arteries, which should be done without including the nerves, or any other adjacent part; placing the integuments in a proper position after the operation; and, finally, the subsequent treatment of the wound.

At the period of making the incision, the ancients contented themselves with having the skin forcibly drawn upward by an assistant; they next divided, with one sweep of the knife, the integuments and flesh down to the bone, and, afterwards, sawed the bone on a level with the soft parts which were drawn upward. Celsus considered it better to let the incision encroach upon the living flesh, than leave any of the diseased parts behind. “*Et potius ex sana parte aliquid excidatur, quam ex ægra relinquatur*.” (*De Medicina*, lib. 7. c. 33.)

It appears, however, that his views extended further than those of most of his contemporaries, and even his followers, almost down to modern times. After cutting the muscle down to the bone, he says, that *the flesh should be reflected, and detached underneath with a scalpel, in order to denude a portion of the bone, which is then to be sawn as near as possible to the healthy flesh, which remains adherent*. He states that, when this plan is pursued, *the skin around the wound will be so loose, that it can almost be made to cover the extremity of the bone*. It is to be lamented, that this advice, inculcated by Celsus, should not have been comprehended, or that it should have been so neglected, as to stand in need, as it were, of a new discoverer. But, the fact is, that hemorrhage formerly rendered amputation so dangerous, that the ancient surgeons could not devote much attention to any thing else in the operation, and practitioners amputated so seldom, that we read in Albucasis, that he positively refused to cut off a person's hand, lest a fatal hemorrhage should ensue, and the patient die it himself and recovered. Over that part of the stump which the small quantity of preserved skin

would not cover, Celsus recommended compresses, and a sponge dipped in vinegar to be laid. (*De Re Medica*, lib. 7. c. 33.)

Archigenes, born at Apamia in Syria, was the disciple of Agathinus, and physician to Philip, king of that country. He repaired to Rome, where he practised physic and surgery in the reign of the emperor Trajan, about 108 years after the birth of Christ. (*Portal, Hist. de l'Anatomie et de la Chirurgie*, t. i. p. 61.) In the history of amputation, the name of Archigenes is conspicuous; for he is supposed to have been the first to apply a circular ligature to the limb: he also wetted the whole member with cold water, for the prevention of loss of blood; and it is sometimes believed that he entertained some notion of previously taking up the vessels. Dupuytren observes, however, that this is very doubtful, because it would imply such anatomical knowledge of the circulation as did not exist at the early period alluded to. Archigenes imitated Celsus in the important point of making the incisions in the sound flesh. (*Nicet. Coll. Chir.* p. 155.; *Sprengel, Geschichte de Chir.* b. i. p. 404. Halle, 1805.) Such was likewise the practice of Heliodorus, who at this early period made objections to the plan of cutting off a limb by a single stroke,—a proposal that was renewed in far later days. The same author has also spoken of amputating at the joints; a method of which he disapproves. (*Nicet. Coll. Chir.* p. 155.) However, Galen entertained a favourable opinion of it. (*Com.* 4. in lib. *de Artic.* p. 650.) Galen's precepts concerning amputation are, upon the whole, very like those of Hippocrates; for he directs only the dead parts to be cut, and the stump to be cauterized. (*De Arte Curativa ad Glauconem*, lib. 2.) By all the old writers, amputation was entirely restricted to cases of mortification; further they were afraid to go; and this precept, and all the other doctrines of Galen, may be said to have been the guide of the whole surgical profession for at least fourteen centuries.

The timid Arabians were not partial to amputation; and even in cases of mortification, generally preferred a farrago of useless applications, like Armenian bole, &c. Paulus Aegineta, like Galen, deviated from Celsus's good rule of making the incisions in the healthy parts, and only approved of making the requisite division near them. (*Lib.* 4. c. 19. p. 140.) Avicenna repeated the directions left by the Greek writers (*Can.* lib. 4. Fen. 3. tr. 1. p. 454.), and Albucasis recommended the performance of the operation with red-hot knife. (*Chirurg.* lib. i. sect. 52. p. 99.) In the middle ages, little was done for the improvement of amputation. But in the 14th century, gunpowder was invented, and soon applied to the purposes of war; so that an abundance of cases must have presented themselves, in which the wise maxim of not deferring amputation until mortification had come on, but of preventing the mischief by the operation, ought to have struck an intelligent surgeon. One might also have expected that practitioners would now have been led to make the incisions in the sound flesh. Unfortunately, the invention of gunpowder, and its immediate consequences in surgery, happened at a period when practitioners were ill qualified to profit by the new lessons of experience set before them. The writings of their predecessors furnished them with

no directions how they ought to act, and they were themselves too much confounded at the sight of the mischief for which they were consulted, to be able to form any correct opinion about causes and effects. Their first idea was, that the terrible symptoms proceeded from the parts being actually burned, and they afterwards inclined to the belief that gunshot wounds were poisoned. Hepoc, the most absurd modes of treatment were instituted, and, as Brünninghausen expresses himself, human nature groaned under a new evil, for which there were for some time no judicious plans of relief. (*Erfahr. &c. über die Amp. c.* 19.) This deplorable state was the natural result of the depression of science in general, and of the healing art in particular, in the days to which I know refer. In these middle ages, as they are called, the population of all Europe was plunged in the deepest ignorance; and whatever little knowledge remained, either of the arts, or languages, was monopolized by the priesthood, the physicians of those times, who, instead of studying the volume of nature, wasted most of their time in discussing the doctrines of Galen. Surgery itself sunk to the lowest ebb, as may be well conceived from the decrees issued by Pope Boniface the Eighth, forbidding any of the clergy to do any thing themselves which drew blood; and, of course, all the operative part of surgery was transferred to a set of illiterate, low-bred mechanics, far inferior to the worst country farriers of modern times. Yet, the clergy, who were thus scrupulously averse to soiling their own hands with blood, or hurting their own tender feelings by viewing the agony of their fellow-creatures, submitted to operations, had no hesitation in taking the chief emoluments and honours of the profession, or in turning over these poor sufferers to men more qualified to torture and murder, than give relief; and, what nearly staggers all credulity, the same professors of Christianity, who shuddered to spill a drop of blood themselves, on a proper occasion, as Haller observes, eagerly laid a hand, and acted an important part, in every sanguinary war, where it was possible for them to interfere. In these dismal days of surgery, the advice delivered by Celsus was renewed by Theodoricus, who used to administer opium and hemlock previously to the operation, for the purpose of rendering the patient less sensible of pain, and afterwards vinegar and fennel were given, with the view of dispersing the intoxicating effects of the preceding medicines. (*Chirurg.* lib. 3. c. 10.)

The renowned Guido di Caulico was the inventor of the plan of taking off limbs without bloodshed. It is better, says he, for the limb to drop off, than be cut off. This practice consisted in covering the whole membrane with pitch plaster, and applying round one of the joints so tight a band, that the parts below the constriction ultimately dropped off. (*Chirurg.* tr. 6. Doctr. 1. cap. 8.) The method of amputating, suggested by Celsus, was again revived by Gersdorf, who, after the operation, not only drew down over the stump the skin which had been retracted, but applied a hog's or bullock's bladder over the stump, so as to render all burning and stitching of the part needless. (*Feldbuch der Wundarn.* fol. 63.) Bartholomew Maggi also endeavoured to preserve a considerable flap of integuments for covering the stump. (*De Vuln. Bombard. et Scololet.* 4to.

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Bonon. 1552.; see *Sprengel's Geschichte der Chirurgie*, p. 404. 406. 8vo. Halle, 1805.)

At length, in the 15th century, when the revival of learning had commenced in Italy, medical practitioners began to think for themselves again, and they turned from compilations and scholastic nonsense, to the consideration of nature. Anatomy was cultivated with great ardour, and made brilliant progress under eminent characters of the time; De la Torre, Berongarius Carpi, Vesalius, Fallopius, Eustachius, and others, who were also for the most part very distinguished surgeons. "*In Italia scientiarum matre medici se nunquam chirurgiam abdicarunt. Seculo 15 et 16, professores medici academia Bononiensis, Patavinae, et aliarum in Italia illustrium scholarum et manu curaverunt, et consilio, et inter istos viros summi chirurgi extiterunt.*" (Haller, *Bibl. Chir.* b. 1. p. 161.) Practitioners now ventured to amputate limbs in the sound part for other incurable diseases besides mortification; but the art of stopping hemorrhage after the operation continued imperfect. Though the method of applying the ligature in cases of wounded arteries and aneurisms was understood, yet, from some unaccountable causes, the practice was never thought of in amputation. Even Fallopius knew of no other means for stopping the bleeding but the cautery. (*De Tum. prætern.* p. 665.) On the whole, the stoppage of bleeding was not attended with a degree of success, proportionate to the advances of the healing art in general. Straps, bands, and compresses were, indeed, put round the member; but, as the circulation of the blood was not yet correctly known, they were not applied in the proper places, being arranged either close to the wound, or several of them put at random round the limb. The effect of such immoderately tight, long-continued constriction could be nothing less than gangrene, and hence the actual cautery was chiefly employed. The other means for suppressing hemorrhage scarcely merit the name. Terrified at the insecurity and ill consequences, J. de Vigo (*Practica in Chirurgia copiosa*, 491. Romæ, 1514.) and Fabricius ab Aquapendente (*Op. Chir.* Venet. 1619.) disapproved of amputating in the sound flesh, and returned to the principle, inculcated by the ancients, of making the incision in the mortified parts. Others endeavoured to lessen the peril of the bleeding by the rapidity with which the limb was removed, and the instantaneous application of the cautery. For this purpose, L. Botalli invented a sort of guillotine, by means of which a limb was severed from the body in an instant (*De Curandis Vulneribus Scelopetorum*. Lugd. 1560.) while others laid a sharp axe upon the limb, and effected the dismemberment by the blow of a wooden mallet. This barbarous practice was once followed by Fabricius Hildanus, who is called by his countrymen the patriarch and ornament of German surgery, and who, previously to his acquaintance with the use of the ligature, was accustomed to amputate with a red-hot knife, the representation of which is given in his work. (*De Gangrenâ et Sphacelo*, *Op.*) Hildanus became a better surgeon, however, as he grew older, and, in the end, partly contributed to the improvement of amputation, inasmuch as he made the incisions completely in the sound parts, and adopted the method of tying the arteries, as then recently proposed by Paré; though in weak persons he still preferred the actual cau-

tery to the ligature. (*Op.* p. 814.) One of his inventions was a linen bag, or cap, for the stump; and a sort of retractor for holding back the muscles.

By many surgeons, however, the tying of arteries continued to be deemed too troublesome, and hence they persisted in the barbarous use of the actual cautery: of this number were Pignatari (*Epitome des Préceptes de Méd. et de Chir.* 8vo. Rouen, 1642.), F. Pluazom (*De Vuln. Scelopet.* 4to. Venet. 1618.), and P. M. Rossi (*Consult. et Observ.* 8vo. Francof. 1616.). Nay, so difficult was it to eradicate the blind attachment shown to the ancients, that Theodorus Baronius, a professor at Cremona, publicly declared, in 1609, that he would rather err with Galen, than follow the advice of any other person; and Van Hoorne seems even to have countenanced the detestable machine of Botalli. (*Musæum*, p. 75.)

Ambrose Paré, who flourished in the 16th century, (*Opera*. Parisiis, 1582.) and to whom I have already alluded, made some beneficial innovations in the operation of amputation. It is to his industry, good sense, and skill, that we are chiefly indebted for the abolition of cauterizing instruments, and the general use of a needle and ligature for the suppression of the bleeding. (*Lib.* 6. c. 28. p. 224.)

An anonymous writer has given the following account of the practice and opinions of this distinguished surgeon in relation to amputation. "Paré recommended to cut off the whole of the gangrenous part, if the limb be mortified; but to encroach as little as possible upon the living flesh. At the same time he laid it down as a rule, not to leave a very long stump to an amputated leg; because the patient could more conveniently make use of a wooden leg, with the stump only five finger-breadths long below the knee, than if much more of the flesh were to be preserved. In the arm, however, he left the whole of the living and healthy portion of the member, only separating the diseased part from the sound.

"In preparing for amputation, he directs the skin and muscles to be drawn upwards, and bound tight with a broad bandage, a little above the part where the incision is to be made. This fillet was intended to answer a three-fold purpose: 1st, To afford a quantity of flesh for covering the bone, and facilitating the cure. 2dly, To close the extremities of the divided blood-vessels. 3dly, To dull the patient's feelings, by pressure on the subjacent nerves. When this firm ligature has been applied, Paré directs an incision to be made down to the bone, either with a common scalpel, or a curved knife. Then, with a smaller curved knife, we are carefully to divide the muscles, or ligament, remaining between the bones of the forearm, or leg; after which, we may proceed to saw off the bone as high as possible, and to remove the asperities occasioned by the saw.

"With the assistance of a curved pair of forceps, he drew out the extremities of the bleeding arteries, either by themselves alone, or with some portion of the surrounding flesh, to be firmly tied with a strong double thread. He now loosened his bandage, brought together the lips of the wound over the face of the stump, and kept them as close as he could, without actual stretching, by means of four stitches, or sutures. If the larger tied vessels should accidentally become loose, he desires the ligature, or bandage, to be again passed round, or else, what is better, to let an assistant

grasp the limb firm with both hands, and press with his fingers over the course of the bleeding vessel, so as to stop the hemorrhage; then, with a square-edged needle, about four inches long, and a thread four times doubled, the surgeon must secure the artery in the following manner:—Thrust the armed needle into the outside of the flesh, half a finger's breadth from the vessel which bleeds, and bring it out at the same distance from the bleeding orifice; then surround the vessel with the ligature, pass it back again to within one finger's breadth of the place where it first entered, and tie a fast knot upon a folded slip of linen rag, to prevent its hurting the flesh. By this means, says Paré, the orifice of the artery will be agglutinated to the adjoining flesh so firmly, as not to yield one drop of blood; but if the hemorrhage were not considerable, he contented himself with the application of astringent powders, &c.

"Thus did this famous surgeon endeavour, by his single example and precepts, to exclude the barbarous use of hot irons in amputation. He says, he knew not of any such practice among the old surgeons; except that Galen recommended us to tie bleeding vessels, towards their origin, in accidental wounds; and he thought proper to do the same in cases of amputation. But, in an apology, at the end of his book, Paré has quoted in his own defence, a dozen authors, who employed or recommended the ligature before him; and he might have cited many more.

From the statement we have here given, it may be seen how far the best writers of almost every country have erred in ascribing the original invention of tying arteries to Ambrose Paré. Great merit, indeed, was due to him, for the part he took in extending, and even reviving, this incomparable practice: nay, it is not certain whether anyone before him had ever applied the needle and ligature in similar cases, i. e. after amputation: but how very wide of the truth Mr. John Bell's recent account of this matter is, will appear to every person who will inquire into the facts themselves; for not only were ligatures and needles in use among the ancients, but likewise the tenaculum, or hook, to lay hold of the bleeding vessels, when they had buried themselves in the muscles. We refer our inquisitive readers to Avicenna, Etius, Albucensis, Brunus, Theodoric, Guido di Caulico, John de Vigo, L. Bertapaglia, Tagualtius, Petrus Argillata, Andreas à Cruce, &c. &c., where they will find enough to satisfy them on this head." (*Rees's Cyclopaedia*, art. *Amputation*.)

I shall not here expatiate upon the ill-treatment which Paré experienced from the base and ignorant Gourmelin; nor upon the slowness and reluctance with which the generality of surgeons renounced the cautery for the ligature. These circumstances may be conceived from what has been already stated. Almost 100 years after Paré, a button of vitriol was ordinarily employed in the Hôtel Dieu at Paris, for the stoppage of hemorrhage after amputations; and Dionis was the first French surgeon, who taught and recommended Paré's method. This happened towards the close of the 17th century, while Paré lived towards the end of the 16th. (*Dionis, Cours d'Opérat.* Paris, 1707.)

As Paré, like the rest of the old surgeons, used to cut directly down to the bone, many of the stumps, which he made, must have been badly covered with flesh, and ill fitted for bearing pres-

sure. But all that I have read on the subject of amputation, impresses me with a strong conviction, that, in former times, the projection of the end of the bone, the sugar-loaf form of the stump, the frequent exfoliations, and the difficulty in healing the part, and keeping it healed, were as much owing to the mischief done with the cautery, the rude way of dressing the stump, and ignorance of the method of promoting union by the first intention, as to the mode of operating, or any other circumstance.

What, asks Brünninghausen, was the reason why the ligature of the arteries, which is now regarded by the surgeons of all civilized nations as the best, easiest, and safest method of stopping hemorrhage after amputation, should so long have remained unadopted? Besides the prejudice for the opinions of the ancients, already mentioned, another cause was, undoubtedly, the imperfect knowledge of the circulation of the blood,—a correct description of which was first delivered by the immortal Harvey early in the 17th century. (*Exercitatio Anat. de Motu Cordis et Sanguinis in Animalibus.* Francof. 1628.) For some time, this grand discovery met with violent opposition; but, after it had been acknowledged as an eternal truth, a happy application of it was made to surgery by a French surgeon, named Morell, at the siege of Besançon, in 1674, invented the field tourniquet, by means of which more certain pressure was made on the trunk of the artery. By this simple invention, founded, however, on a knowledge of the circulation, the surgeon could at option let the blood of the stump spirt out, or stop its jet entirely; and now, both during and after the operation, he was first enabled to command the hemorrhage, and coolly and judiciously employ whatever measures were indicated; for the most powerful bandages and pressure, previously in use, either stopped the circulation in the whole limb, or could not be made to have the right effect with sufficient quickness. (*Brünninghausen, Esfahr. &c. über die Amp.* p. 36.) Morell's tourniquet, however, was very imperfect; and it was not till the year 1718, that J. L. Petit, whose name shines so brightly in the history of surgery, invented the kind of tourniquet now employed.

Richard Wiseman, who is justly considered as the father of good English surgery, saw the necessity of making the incision in the sound parts, because gangrene does not always spread evenly, but frequently extends much higher up one side of the limb than the other. He deemed the actual cautery objectionable, as the sloughs were so long in being thrown off. He applied a ligature round the limb, two inches above the limits of the mortification, and, drawing up the muscles, made the incision with a large curved knife, with the back of which he scraped off the periosteum. The bag, or sort of retractor, employed by Fabricius Hildanus, Wiseman thought unnecessary, as the muscles spontaneously drew themselves up as soon as divided. He tied the blood-vessels after the manner of Paré, and deprecated all burning of the stump. After the operation, he drew the flaps over the bone, and either fastened them in this position with stitches, or a tight bandage; though he generally preferred the former, as the surest means of keeping the end of the bone from protruding. Across the stump, he laid a pledget of wax-cerate, and over this a thick layer of Armenian bole and

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other arteries, and the whole was covered with a bladder's bladder, and a roller, applied spirally from the upper part of the remaining portion of the limb, down to the extremity of the stump. On the third day, the dressings were taken off, and a dry ointment applied. (*Chirurg. Treatises*, vol. ii, p. 220. 8vb. Lond. 1690.)

From this time, amputation may be considered as being an infinitely safer proceeding than what it used to be; for, as we have explained, the ligation of the arteries was now practised and commended in Germany by F. Hildanus, in England by Wiseman, and in France by Dionis. Much, however, remained to be done. The wound was large, and suppurated long and profusely; the healing was slow; the ends of the bones perished, and, projecting far beyond the soft parts, retarded the cure so long, that the patient was not unfrequently worn out. Hence the best surgeons began seriously to consider what further could be done, with a view of lessening the exposed surface of the wound, and making a better covering of flesh for the ends of the bones.

According to Sprengel, most of the old surgeons preserved a flap of flesh, and he is therefore by no means disposed to regard our countryman Lowdham as the inventor of this method, though it is acknowledged, that the latter surgeon's practice was novel, inasmuch as the flap was formed by making an oblique incision through the integuments from below upwards. (See *James Yonge's Curæ Triumphantis e Terebintho*, 8vo. Lond. 1679; and *Sprengel's Geschichte der Chirurgie*, b. i. p. 408.) Here, if Sprengel means that many of the old surgeons endeavoured to preserve a partial covering of flesh for the bone, there can be no doubt of his correctness, because we find that they drew back the flesh before they divided it; and Cælius and some others even did more; for, after cutting down to the bone, they detached the flesh further from it upwards, previously to taking the saw; but, on the contrary, if Sprengel wishes us to believe that there were practitioners, who, previously to Lowdham, in the operation of amputation, formed what in England is usually understood by a flap, — that is, a portion of flesh, generally of a semilunar shape, and saved from one side, or both, of the member, for covering the bone, — I cannot see any reason for coinciding with Sprengel's observation. Upon the merit of Lowdham's suggestions, and the practice and principles inculcated by J. Yonge, some reflections, communicated to me by Mr. Carwardine, I insert with great pleasure, as perhaps he is right in thinking, that some former editions of this work did not do justice to the memory of the latter writer.

"At the time Yonge wrote (1679)," says Mr. Carwardine, "it was supposed impossible to heal a stump before the bone had exfoliated, and, therefore, the surgeon would venture upon an attempt at cutting the surface by the first intention. Now, this notion by the first intention was the chief object of Mr. Yonge in proposing the flap-operation; and it is to him, and not to Mr. Alunson, who wrote probably 100 years after him, that we must attribute the honour of this improvement. It is related in a letter addressed to his friend Thomas Hearne, Esq., in London, dated Plymouth, 16th Dec. 1678, and published 1679, at the end of *Curæ Triumphantis e Terebintho*. It begins

"Sir, I find by yours that you are surprised with the intimation I gave you, of a way of amputating large members, so as to be able to cure them per symphyain in three weeks; and without fouling or sealing the bone. It is a paradox which I will now evince to you to be a truth, after I have first taken notice of what you affirm, that there is a necessity of sealing the ends of those bones left bare after the usual manner of dismembering, before the stump can be soundly cured; that you never yet found it otherwise, but that, where it hath been attempted, the stumps have apostomated, and the caries come off thereby."

"Yonge then acknowledged, that it was from an ingenious brother, Mr. C. Lowdham, of Exeter, that he had the first hint thereof. He then describes the operation — the laying down the flap over the face of the stump, and sewing it by four or five stitches, &c. After this Yonge proceeds with a methodical enumeration of the advantages of this mode of operating over all others then in use, viz. that it is more speedy — the cure not occupying a fourth of the usual time — no supuration — no exfoliation — less danger of hemorrhage — not liable to break open again from slight injury — and, lastly, much better adapted to the pressure from an artificial leg, &c.

"The foregoing abstract will show (says Mr. Carwardine) how far Mr. O'Halloran's method, in which he dresses the flap and the stump as distinct surfaces, can be regarded as a revival of Lowdham's operation, or whether it has been superseded or improved upon by the mechanical ingenuity of the Dutch and French surgeons: — The apparatus of M. de la Faye and Verduin, appear to have been merely clumsy and unscientific contrivances for the suppression of hemorrhage. Garengot's operation had also for its object, to supersede the use of the ligature, which, however, after twelve years' practice, he was obliged to give up, and tie the vessels before he laid down the flap. Opinions therefore founded upon the practice of these gentlemen, I conceive cannot fairly be admitted as evidence against the flap-operation of Lowdham, which nevertheless appears sinking in the estimation of the best modern surgeons: perhaps no material advantage is gained by it over the common mode of operating in the lower extremities, as now practised — but even here, cases may occur where we are glad to resort to it: a few years since, I attended a patient in consultation with a friend at Dunmow, in Essex, where we thought it necessary to remove a man's leg for a caries of the tibia. An ulceration in front extended so high, that no integument could be saved, and the limb would have been removed above the knee, if I had not suggested the propriety of making a flap from the calf of the leg. The tibia was obliged to be sawn as high as possible, but the flap was left sufficiently long to cover the surface, and that most important object, the bend of the knee, was preserved to bear the pressure of a wooden leg. In the removal of the arm at the shoulder-joint, doubtless the advantages of making a flap from the deltoid, &c., are sufficiently established; but, in the mode of dressing, I presume, that no English surgeon will admit, that the practice of M. Larrey (perhaps the most eminent surgeon that has been formed by the wars of Bonaparte, and whose practice will be hereafter noticed) can supersede the method of Yonge (or Lowdham), who wrote 140

years before him! Larrey introduces charpie beneath the flap to prevent union by the first intention! Lowdham's object is simply to lay the flap over the wound to prevent exfoliation, and to heal the surface 'per symphysin' in three weeks." After the receipt to this communication, I looked over the copy of the *Curus Triumphalis e Terabintho*, preserved in the valuable library of the Royal Medical and Chirurgical Society, and found Mr. Carwardine's statement fully confirmed by the contents of that ancient work. At the same time, I retain the belief, that the example set by Mr. Alanson, with respect to the proper method of dressing stumps, and obtaining a speedy union of the wound, is entitled to the praise of posterity, because his advice was so well enforced that it soon produced a revolution in practice; while the correct suggestions of Lowdham and Yonge, like the hint in Celsus, of the double incision, had sunk into oblivion, or were only known to a few admirers of surgical antiquities.

Mauquest de la Mothe was one of the first who commonly used the tourniquet in amputations, afterwards drawing out the vessels with the forceps and tying them. (*Traité compl. de Chir.* vol. iii. p. 171.) Lowdham's original suggestion of amputating with a flap has been briefly noticed. About 18 years after Yonge's publication, Peter Verduin, an eminent surgeon at Amsterdam, submitted to the judgment of the profession a new kind of flap-amputation. (See *Dis. Epistolica de Nod Artuum decurandorum Ratione*, 8vo. Amst. 1696.) Two compresses were applied, one under the ham, and the other on the course of the large vessels. The thigh was wrapped in a fine linen cloth, which was sustained by some turns of a roller. This apparatus was covered with a piece of leather, six inches broad, furnished with three straps with buckles, to secure it round the part. The tourniquet was placed in the usual manner. The part, above the place intended to be amputated, was surrounded with a leather strap. The point of a crooked knife, which was made to pass as near to the back part of the bones as possible, was thrust in on one side of the leg, and made to come out on the other. The knife was then carried down, and a flap made of almost the whole calf of the leg. The operation was finished in the ordinary manner. The wound was then washed with a wet sponge, in order to clear it from the fragments of sawn bone. The leather strap, which served to secure the flesh, was next loosened, and the flap laid over the stump. The wound was dressed with lycoperdon, lint, and tow, over which was put a bladder, sustained by strips of sticking-plaster. Upon this bladder was placed an instrument, called a *retinaculum*, consisting of a compress, and a concave plate, which were made to press upon the stump, by means of two straps, which crossed each other, and were attached to the broad leather strap surrounding the thigh.

Some excellent precepts on amputation were delivered by J. L. Petit. He improved the tourniquet; and instead of the large crooked amputating knife, formerly employed, first brought into use the straight, more moderate-sized knives with sharp backs, now seen in the hands of the best surgeons, because much better calculated than crooked knives for dividing the flesh by a sawing movement, which is the only right and surgical way of attempting to cut any part of the human body. He proved

that making the division in the mortified parts was frequently followed by hemorrhage; and for the suppression of bleeding he thought it the best principle to promote the formation of a coagulum. (*Mém. de l'Acad. des Sciences*, an 1732, p. 285. See HEMORRHAGE.) For compressing the vessels, he employed an instrument which covered the stump, like Verduin's *retinaculum*, and made pressure by means of a screw. His only objection to Verduin's method was, that the extension of gangrene up the limb frequently hindered the formation of so large a flap. He laid down the valuable general maxim of always removing as much bone, and as little flesh, as possible; for which purpose, he invented what is termed the *double incision*, or dividing the business of cutting through the soft parts into two stages. At some distance below the place where he meant to saw through the bones, he first made the circular cut through the integuments down to the muscles; the skin was then pulled up so as to leave the flesh uncovered to the extent of an inch, and the muscles were now divided at the highest point of their exposure. Lastly, the flesh was held out of the way with a retractor, and the bone was sawn through high enough up to allow of its extremity being well covered with flesh and integuments. The greatest defect in the doctrines of Petit, relative to amputation, was the confidence he put in pressure, instead of the ligature. (*Traité des Malad. Chir.* vol. iii. p. 126.)

The first performance of amputation at the shoulder joint, by Le Dran, and the improvements and alterations of that operation suggested by Garengeot, De la Faye, Desault, Larrey, &c., I shall notice in a future section.

Verduin, in his method, formed only one flap. Ravaton and Vermale afterwards thought that it would be better to save a flap from each side of the limb. They were also advocates for tying the vessels, and bringing the two flaps into contact, so as to procure their speedy union, and hinder exfoliations and profuse suppuration. Vermaie, after applying the tourniquet, surrounded the part with two red threads, at the distance of four finger-breadths from each other; one at the place where the bone was to be sawn, the other at the place where the incision of the flaps was to terminate. He afterwards thrust a long bistoury down to the bone, at the fore part of the limb; turned it round the circumference, so that it might come out at the opposite part; then, directing the edge of the knife along the bone, he cut down to the inferior thread, where he completed the first flap, which, as the author says, was of a round or conical figure at its extremity. The second flap was made in a similar way on the interior side of the member. This method is essentially the same as what is often practised at the present time on the thigh and arms. (*Traité des Playes d'Armes à feu*, par Ravaton, 8vo. Paris, 1750; *De la Faye*, in *Mém. de l'Acad. de Chir.* t. v. ed. 12mo.; *Vermale, Obs. de Chir.* 8vo. Mannheim, 1767.)

The multiplicity of machines, described by Verduin, La Faye, &c., had no other end but that of keeping the flap near the offices of the vessels, so as to compress and close them. In consequence of the difficulty of making this compression precisely as required, the most considerable vessels between the two bones, when cut, generally becoming retracted, Garengeot determined to employ ligatures.

His first operation of this kind was an amputation of the arm with two flaps. The brachial artery was tied, and the patient cured without any excoriation.

Garengot operated also on a soldier dangerously wounded in the right foot by the bursting of a bomb, which fractured the interior part of the two bones of the leg, and several of the foot: the patient recovered in twenty-seven days. A single flap was made. He rightly preferred dressing and bandaging the stump to the use of the compressing machines invented by Verduin and La Faye; and his choice of a straight knife, instead of a crooked one, was equally judicious.

The preceding case dictated a truth, which will last as long as surgery itself, viz. that it is advantageous to apply the ligatures in such manner as to embrace no more than the vessel, so that they may fall off the sooner, and the parts more quickly unite. (Garengot, in *Mém. de l'Acad. de Chir.* t. v. 12mo.)

At one time, an objection frequently urged against the foregoing methods, was, that, when the fresh cut flap was immediately laid over the stump, inflammation and abscesses were apt to ensue. Hence, in 1765, Sylvester O'Halloran, a surgeon at Limerick, was led to make the experiment of deferring laying down the flap till the end of the first eight or twelve days after the operation, when it was conjectured that the risk of inflammation and abscesses would be diminished. The tenor of O'Halloran's book is apparently corroborated by the facts brought forward. Here we see one of the grand points insisted upon by our worthy countryman James Yonge, viz. the chance of an immediate union of the wound from laying down the flap without delay, suddenly given up, and because the wound could not always be healed without suppuration, it was determined that it never should do so.

Alexander Monro, senior, disapproved of the tourniquet; he secured the vessels with needles and ligatures; and was the inventor of a bandage, which has been extensively approved of, under the name of Monro's roller. (*Medical Essays of Edinb.* vol. iv. p. 257.)

Bromfield, like Le Dran, restricted amputation to a few cases; and he did not acknowledge its necessity, as a matter of course, in every case of gangrene, much less in every instance of white swelling, or caries. From a passage, which I have cited from Dr. Rees's *Cyclopædia*, it would seem that the tenaculum was known to the ancients; but Bromfield is allowed to be the first modern surgeon who employed this useful instrument. (*Chir. Cases and Obs.* vol. i. p. 41. 8vo. Lond. 1773.)

About the year 1742, the removal of thighs without bloodshed was a subject a good deal broached. A single case, recorded by Scharschmid, where a mortified thigh separated without hemorrhage, was the foundation of the scheme. The arteries were completely blocked up, and the parts insensible. (Haller, *Dis. Chir.* vol. v. p. 155.) A similar occurrence was related by Acrel (*Chir. Method.* p. 557.); and Lalouette professed himself a believer in the security from hemorrhage, on account of the vessels being filled with coagula, and therefore he also approved of letting dead parts be removed, or rather fall off, without bloodshed. (Haller, *Dis. Chir.* vol. v. p. 273.)

In cases where the projecting bone of the stump was affected with necrosis, Bagieu ventured to amputate a second time, and urged a variety of arguments in defence of the practice. (*Mém. de l'Acad. de Chir.* t. ii. p. 274.) He coincided with Le Dran and Bromfield, however, about the propriety of restricting amputation to few cases; and has related numerous examples of limbs being saved, which, according to the doctrines then in vogue, ought to have been cut off. (*Deux Lettres d'un Chir. de l'Armée*, 12mo. Paris, 1750.)

M. Louis, a French surgeon of extraordinary talents, introduced the plan of dividing the loose muscles first; and lastly, those which are closely connected with the bone. He noticed, that the muscles of the thigh, after being divided, were retracted in an unequal degree. He observed, that the superficial ones extending along the limb, more or less obliquely, without being attached to the bone, were drawn up with greater force, and in a greater degree, than others, which are deeply situated, in some measure parallel to the axis of the femur, and fixed to this bone throughout their whole length. The retraction begins the very instant when the muscles are cut, and is not completed till a short time has elapsed. Hence the effect should be promoted, and be as perfect as possible, before the bone is sawn. In amputation of the thigh, M. Louis was always desirous of letting the muscles contract as far as they could, and, for this reason, he was rather averse to using the tourniquet, as the circular pressure of this instrument in some measure counteracted what he wished to take place, and hence, at one time, he preferred letting an assistant make pressure on the artery; though he subsequently expressed his approbation of the tourniquet proposed by M. Pipelet for compressing the femoral artery. (*Mém. de l'Acad. de Chir.* vol. iv. p. 60. 4to.) Actuated by such principles, Louis practised a kind of double incision different from that of Cheselden and Petit, and different also from Alanson's method, which I shall hereafter notice. By the first stroke, he cut, at the same time, both the integuments and the loose superficial muscles; by the second he divided those muscles which are deep and closely adherent to the femur. On the first, deep, circular cut being completed, Louis used to remove a band, which was placed round the limb, above the track of the knife. This was taken off, in order to allow the divided muscles to become retracted without any impediment. He next cut the deep adherent muscles, on a level with the surfaces of those loose ones, which had been divided in the first incision, and which had now attained their utmost state of retraction. In this way, he could evidently saw the bone high up, and the painful dissection of the skin from the muscles was avoided. Louis was conscious that there was more necessity for saving muscle than skin; and he knew that, when an incision was made at once down to the bone, the retraction of the divided muscles always left the edge of the skin projecting a considerable way beyond them. Hence he deemed the plan of first saving a portion of skin, by dissecting it from the muscles, and turning it up quite unnecessary. As the bone should always be sawn rather higher than the division of the soft parts, Louis, like J. L. Petit, and most other judicious surgeons, highly approved

of the employment of a retractor. He was likewise the author of some valuable instructions for preventing the protrusion of the bone after the operation. (See *Mém. de l'Acad. de Chir.* t. ii. p. 268—410, &c. 4to.) The impartial reader, who takes the trouble to read the remarks on amputation, published by this greatest of all the French surgeons of the last century, with the exception perhaps of J. L. Petit and Desault, will be impressed at once with the force and perspicuity of his matter, and with the evident propriety of a good deal of the practice inculcated. Dupuytren often followed the maxim of dividing the skin and loose superficial muscles together.

In England, Cheselden, and not J. L. Petit, is regarded as the surgeon who revived Celsus's method, by having recourse to a double incision—that is, by cutting the skin and cellular substance first, and then, by dividing the muscles down to the bone, on a level with the edge of the skin, so that the bone might be sawn higher up, and its end be more completely covered with skin. Whether Cheselden had the priority in this improvement, I cannot presume to say; but he gave an account of it in Guter's translation of Le Dran's treatise on the operations as early as 1749, which was long prior to the appearance of Petit's posthumous writings; and Cheselden further mentions, that, during his apprenticeship to Mr. Fern, he had communicated to that gentleman his sentiments about the double incision.

In order to hinder the stump from assuming a pyramidal, or sugar-loaf shape, which sometimes happened, notwithstanding every improvement hitherto mentioned, a circular bandage was employed, which acted by supporting the skin and muscles, and preventing their retraction. This bandage, when properly applied, from the upper part of the limb downward, fulfilled in a certain measure the end proposed, though many stumps yet turned out very bad ones. Mr. Sharp was induced, therefore, to revive the ancient plan of bringing the edges of the skin together with sutures; but the pain and other inconveniences of this method were such, that it was never extensively adopted, and Mr. Sharp himself ultimately abandoned it. The cross bandage, however, which he used to put over the end of the stump, remains partially in fashion even at the present day. (*Treatise on the Oper.* p. 216.; *Critical Inquiry*, p. 268.) It is to be regretted, that an excellent modern surgeon, the late Mr. Hey, should have commended, so strongly as he has done, the use of sutures, in bringing together the edges of the wound after amputation. (*Practical Obs. in Surgery*, p. 534. edit. 2.)

The inefficiency of the method of Louis for hindering the protrusion of the bone was asserted by Valentin, who thought the object might be better attained by dividing the parts while they were in a state of tension; for which purpose he recommended changing the posture of the limb, according to the parts which he was about to cut. (*Recherches Critiques sur la Chirurgie Moderne*, 8vo. Amst. 1772.) Valentin's proposal seems never to have excited much attention; whether on account of its inconvenience, or inefficacy, I know not: certain it is, many cases present themselves, in which the posture of a limb absolutely cannot be changed during the operation, owing to the nature of the disease, or cannot be altered without extreme agony.

About the middle of the eighteenth century, arose the celebrated controversy about the propriety of amputation in general. Several surgeons now began to be convinced, with Le Dran and Bagieu, that the operation was undertaken on too light grounds; and, in particular, that many bad complicated fractures might be cured without amputation. Such was the doctrine of Boucher (*Mém. de l'Acad. de Chir.* t. ii. p. 304.), Gervaise (*Anfangsgr. der Wundarzt.* 8vo. Strasb. 1755.), and Faure (*Mém. qui ont concouru pour le Prix de l'Acad. de Chir.* vol. i. p. 100.). The latter, especially, urged the prudence of delay, in gunshot wounds, and comminuted injuries of the bones. But the writer who at this time made the greatest noise in the world, by his general condemnation of amputation, was Bilguer (*Diss. de Membrorum Amputatione*, 8vo. Hal. 1761.), whose sentiments received, however, a complete refutation from his own contemporaries, Pott (*Chir. Works*, vol. ii.), Morand (*Opusc. de Chir.* t. i. p. 232.), and De la Martinière (*Mém. de l'Acad. de Chir.* vol. iv. p. 1.), and also from later writers, to whom reference will be made in speaking of Gunshot Wounds. Even Bilguer himself was compelled to admit the necessity of amputation in cases of gangrene. (*Anweis. für die Feldwundärzten*, s. 170.)

Bilguer's colleague, the celebrated Schmucker, inclined to the same doctrines, and has detailed several cases, where limbs were not only shattered, but actually carried away by balls, yet where a cure followed without amputation. One of his maxims was, that it was better for the member to be taken off by gunshot, than by the surgeon's knife, as the ball operated on a healthy subject, the knife on a person debilitated by an hospital. (*Chir. Wahn.* th. ii. s. 493.) In a later valuable essay on this subject, he restricts amputation to shattered limbs, affected with gangrene. His mode of operating was that of M. Louis. He sanctioned joint-operations at the hip and shoulder; but condemned those of the knee and elbow, as never answering. (*Vern. Schrift.* th. i. s. 3.)

Soon after the middle of the last century, the practice of amputating at the joints began to excite increased attention; but, as this is a topic to which I must presently return, it is unnecessary now to dwell upon it. The writings of Puthod, Wohler, Brusdor, Barbet, Sabatier, Park, Moreau, and Vermandois, in relation to this subject, deserve particular notice.

I now come to Mr. Alanson, whose name is as conspicuous in the history of amputation as that of any surgeon yet mentioned. His chief objects were to hinder a protrusion of the bone, and promote union by the first intention. He rejected the band, which was formerly put round the limb for the guidance of the knife, as altogether useless, and an impediment to the quick performance of the circular incision through the skin. When the tourniquet had been applied, an assistant grasped the integuments with both hands, and drew them and the muscles firmly upwards. The operator then fixed his eye upon the proper part where he was to begin the incision, which was made with considerable facility and dispatch, the knife passing with greater quickness in consequence of the tense state of the integuments.

After the incision through the skin had been made, the assistant still continued a steady support of the parts, while Mr. Alanson separated the cel-

lular and ligamentous attachments with the point of his knife, till as much skin had been drawn up as would, with the muscles, divided in the particular way hereafter recommended, fully cover the whole surface of the wound. Then, instead of applying the knife close to the edge of the integuments, and dividing the muscles in a circular perpendicular manner down to the bone, Mr. Alanson proceeded as follows:—When operating upon the thigh, and standing on the outside of the limb, he applied the edge of his knife under the edge of the supported integuments, upon the inner margin of the vastus internus muscle, and cut obliquely through that and the adjacent muscles upwards as to the limb and down to the bone, so as to lay it bare about three or four finger-breadths higher than is usually done by the common perpendicular circular incision. He now drew the knife towards himself; then keeping its point upon the bone, and the edge in the same oblique line already pointed out for the former incision, he divided the rest of the muscles in that direction all round the limb; the point of the knife being in contact with, and revolving round the bone through the whole of the division.

According to Mr. Alanson, the speedy execution of the above-directed incision will be much expedited by one assistant continuing a firm and steady elevation of the parts, and another taking care to keep the skin from being wounded, as the knife goes through the muscles, at the under part of the limb. Mr. Alanson censures the old method of depriving the bone of its periosteum to a considerable extent, above and below the part where the saw is to pass, not only as creating unnecessary delay, but, since the periosteum serves to support the vessels in their passage to the bone, as apt to produce exfoliations above the part where the bone is to be divided with the saw. Instead of this practice, he recommends first the application of the retractor, as advised by Gooch and Bromfield; and then denuding the bone at the part where the saw is to pass, whereby the bone may be sawn off higher than is usually practised; a material object in hindering a projection of the bone, and forming a small cicatrix.

If the flesh of a stump, formed in the thigh, agreeably to the foregoing plan, be gently brought forward after the operation, and the surface of the wound be then viewed, it may be said to resemble in some degree a conical cavity, the apex of which is the extremity of the bone; and the parts, thus divided, Mr. Alanson thought the best calculated to prevent a sugar-loaf stump.

The part where the bone is to be laid bare, whether two, three, or four finger-breadths higher than the edge of the retracted integuments; or, in other words, the quantity of muscular substance to be taken out, in making the double incision; must be regulated by considering the length of the limb; and the quantity of skin that has been previously saved by dividing the membranous attachments. The quantity of skin saved, and muscular substance taken out, must be in such exact proportion to each other, that the whole surface of the wound will afterwards be easily closed, and the limb not more shortened than is required to obtain this end.

the removal of the limb, Mr. Alanson bleeding artery gently out with the end tied it as much as possible, with

a common slender ligature. When the large vessels had been tied, the tourniquet was immediately slackened, and the wound well cleaned, in order to detect any vessel, that might otherwise have remained concealed with its orifice blocked up with coagulated blood; and before the wound was dressed, its whole surface was examined with the greatest accuracy; by which means Mr. Alanson frequently observed a pulsation, where no hemorrhage previously appeared, and turned out a small clot of blood from within the orifice of a considerable artery. He is very particular in recommending every vessel to be secured that is likely to bleed on the attack of the symptomatic fever; for, besides the fatigue and pain, to which such an accident immediately exposes the patient, it seriously interrupts the desired union of the wound. He used always to cleanse the whole surface of the wound well with a sponge and warm water, as he rightly thought that the lodgment of any coagulated blood would be a considerable obstruction to the quick union of the parts.

The skin and muscles were now gently brought forwards; a flannel roller was put around the body, and carried two or three times rather tightly round the upper part of the thigh, as at this point it was intended to form what Mr. Alanson called a sufficient basis, which materially added to the support of the skin and muscles. The roller was then carried down in a circular direction to the extremity of the stump, not so tight as to press rudely or forcibly, but so as to give an easy support to the parts.

The skin and muscles were now placed over the bone in such a direction that the wound appeared only as a line across the face of the stump, with the angles at each side; from which points the ligatures were left out, as their vicinity to either angle might direct. The skin was easily secured in this posture by long slips of linen or lint of the breadth of about two fingers, spread with cerate, or any cooling ointment. If the skin did not easily meet, strips of sticking-plaster were preferred. These were applied from below upwards, across the face of the stump, and over them a soft tow-pledget and compress of linen; the whole being retained with the many-tailed bandage, and two tails placed perpendicularly, in order to retain the dressings upon the face of the stump.

Mr. Alanson censured the plan of raising the end of the stump far from the surface of the bed with pillows, as the posterior muscles were retracted by it; and he considered it best to raise the stump only about a half hand's breadth from the surface of the bed, by which means the muscles were put in an easy relaxed position. The many-tailed bandage Mr. Alanson found much more convenient than the woollen cap, frequently used in former times to support the dressings: and he observes, that, though this seems well calculated to answer that purpose, yet, if be not put on with particular care, the skin is liable to be drawn backwards from the face of the stump; nor can the wound be dressed without first lifting up the stump to remove the cap. (See *Alanson's Practical Obs. on Amputation*, 8vo. Lond. 1779.)

The chief peculiarity in Alanson's method of operating, namely, the mode in which he recommends the oblique division of the muscles to be performed, did not, however, meet with universal

approbation; and his extensive dissection of the skin from the muscles was complained of, as excessively painful. The formation of a conical wound, by following Alanson's directions, was regarded by several as impracticable. (See *Marten's Paradoxiën*, b. i. s. 88.; *Loeffler, Beyträge*, i. No. 7.; *Wardenburg. Briefe eines Arztes*, 2. b. p. 20.; *Richter, Anfangsgr.* vol. vii.; *Græfe, Normen*, &c. p. 8.; *Hey, Pract. Obs.*) In my opinion, there can be no doubt of the truth of some of the criticisms made by these, and some other writers, on the impossibility of making a wound, with a regular conical cavity, by observing the directions given by Alanson; for if the knife be carried round the member with its edge turned obliquely upwards towards the bone, it will pass spirally, and, of course, the end of the incision will be considerably higher than the beginning. But, though Alanson probably never did himself exactly what he has stated, I am sure, that his proposition of making an oblique division of the muscles all round the member, has been the source of great improvement in amputations in general. It is true, that surgeons do not actually perform the oblique incision all round the limb, by one stroke, or revolution of the knife round the bone, as Alanson says that he did; but they accomplish their purpose by repeated, distinct, and suitable applications of the edge of the instrument turned obliquely upwards towards the bone, or bones.

Amongst others, Mynors found fault with some of Alanson's instructions, and thought every desideratum might be more certainly attained by saving skin enough, and then cutting through the muscles. The first incision, however, he directed obliquely upwards through the integuments, while they were drawn up by an assistant, and he then cut down to the bone. (*Pract. Thoughts on Amputation*, 8vo. Birmingham, 1783.)*

The removal of limbs, without bloodshed, proposed by Guido di Cauliaco in the 14th century, met with modern defenders in J. Wrabetz and W. G. Plouquet. J. Wrabetz, with a ligature which was daily made tighter, took off an arm above the elbow. Into the fissure, he sprinkled a styptic powder. On the fourth day, the flesh was severed down to the bone, which was sawn through. (*Geschichte eines ohne Messer abgesetzten Oberarms*, 8vo. Freyburg, 1782.) Plouquet thought the plan suited to emaciated timid subjects; but not well adapted to the leg, or fore-arm. (*Von der Unblütigen Abnehmung der Glieder*, 8vo. Tübingen, 1786.) The only exemplification of the practice of taking off limbs without bloodshed in modern practice, is sometimes afforded in chronic mortification, where, after the separation of the dead from the living parts down to the bone by Nature herself, the surgeon saws through the exposed bone. In the North London Hospital, an upper extremity, attacked with chronic mortification, was thus removed by Mr. Liston, a little below the axilla, and the patient, a very old woman, recovered.

Some modes of performing flap-amputations, and, in particular, the suggestions and improvements made by Hey, Chopart, Dupuytren, Larrey, Lisfranc, Liston, and other modern practitioners, will be noticed in the description of the amputation of particular members. In the mean time, I shall conclude this section with mentioning the laudable attempts, made at different periods, to render the patient less sensible of the agony produced by the

removal of a limb. Theodoricus administered for this purpose opium and hemlock, and, though he was imitated by many of the ancient surgeons, few moderns have deemed the practice worthy of being continued. The inhalation of stupefying gas has been tried, and so has magnetism. M. J. Cloquet, by some preparatory means not specified by Velpeau, brought a patient into a condition, in which the removal of the breast was accomplished without her having been aware of it. (See *Velpeau, Nouv. Elém. de Méd. Opér.* t. i. p. 297.) Guidé made the experiment of benumbing the parts with a tight ligature; but a machine, devised a few years ago in England, expressly for the object of stupefying the nerves of a limb previously to amputation, seems freer from danger than some of the means adopted to bring the patient into a stupefied state. (See *J. Moore's Method of preventing or diminishing Pain in several Operations of Surgery*, 8vo. Lond. 1784.) The great reason of the latter plan being given up, is, that some patients have made more complaint of the sufferings occasioned by the process of dulling the sensibility of the nerves, than of the agony of amputation itself, without any such expedient. Yet, daily experience proves that the pressure, caused on the sciatic nerve by sitting with the pelvis in a certain position, will completely benumb the foot and leg, and this with such an absence of pain, that the person so affected is actually unaware of his foot being asleep, as it is termed, until he tries to walk.

AMPUTATION OF THE THIGH.

The thigh ought always to be amputated as low as the disease will allow; so that as little of the limb may be cut off as possible, the pain may not be greater than necessary, the surface of the wound have less extent than would otherwise happen, and the preserved portion of the limb greater power in proportion to its length. The longer it is, the better also will it be adapted to any artificial means to enable the patient to walk. (*Sabatier, Méd. Op.* p. 350. t. iii. ed. 2.) The patient is to be placed on a firm table, with his back properly supported by pillows, and assistants, who are also to hold his hands, and keep him from moving too much during the operation. The ankle of the sound limb may be fastened, by means of a strong band or garter, to the nearest leg of the table.

Here, however, through an imprudent solicitude to obtain the above advantages, let not the surgeon ever be unmindful of the great axiom in surgical operations, that all the diseased parts should be removed; and let him be assured of the truth of what Græfe inculcates, that it is more pardonable to cut away too much, than too little. (*Normen für die Abösung grösserer Gliedm.* p. 60.) At the same time, I do not agree with some modern writers, who deem it necessary to amputate beyond the limits of every abscess and sinus which may extend very far above a diseased joint or compound fracture. Many of these suppurations are only like ordinary abscesses, and finally get well, after the main disease or injury is removed, as I have often seen. Were it an invariable rule to cut off a limb above every collection of matter, sometimes five or six inches more of the thigh would be sacrificed than circumstances absolutely demanded, and the greater danger of a thigh, than

a low operation, would be encountered. However, in all cases where the bone is suspected to be unsound, or the muscles are affected with the morbid changes peculiar to fungus hæmatodes or other incurable diseases, the operation should be practised sufficiently high to take away all the distempered parts. In secondary amputations, where there has been much suppuration in the limb, and a sinus runs up, Mr. Guthrie says, that if the sinus extend only a short way between the muscles, the membrane lining it may be dissected out; but, if the matter has lain upon the bone, this will have become diseased, and amputation should be practised high enough to remove the affected part of it. (*On Gunshot Wounds*, p. 87.)

Many writers disapprove of amputating too close to the knee (*Graefe, Op. cit.* p. 60.); and Langenbeck urges one objection to it, not specified by any other author, viz. that, if the operation be done lower down than two hand-breadths above the knee, the femoral artery shrinks into the aponeurotic sheath, which it here receives from the vastus internus and triceps, and cannot be drawn out with the forceps, so as to be separately tied, without first slitting up that sheath. Hence, he recommends cutting through the muscles at the distance above the knee already mentioned. (*Bibl. für die Chir.* b. i. p. 571. 12mo. Gott. 1806.) But, when I come to look at the breadth of two adult hands, and see how much of the limb would be sacrificed, at all events, only to save a little trouble, I cannot bring my mind to concur with Langenbeck, — the remedy being worse than the alleged evil. In general, the disease obliges the surgeon to begin the incisions two or three inches above the patella, and, as Velpeau remarks, Langenbeck's direction is superfluous. (*Nouv. Élém. de Méd. Opér.* t. i. 504.)

The next thing is the application of the tourniquet. (See *TOURNIQUET*.) The pad should be placed exactly over the femoral artery, in as high a situation as can be conveniently done. When the thigh is to be amputated high up, it is better to let an assistant compress the femoral artery in the groin with his thumb, or any commodious instrument, furnished with a round blunt end, calculated for making direct pressure on the vessel without injuring the integuments. Some authors, indeed, give a general preference to this method, whether the thigh be amputated high up or low down. (*Paroisse; Opuscules de Chir.* p. 168.; *Brünninghausen, Erfahr. über die Amp.* p. 273.; *Langenbeck, Bibl. Chir.* p. 564.; *Liston, Obs. in Ed. Med. and Surg. Journ.* vol. xx. p. 43., and *Elements*, part iii. p. 362.) Were the patient, however, in a debilitated state, and unable to bear loss of blood, as there might, in this way, be considerable bleeding, by reason of the anastomoses with the branches of the internal iliac artery, I should feel disposed to employ the tourniquet whenever circumstances would conveniently admit of its application. In amputations of the thigh, the great objection to the use of this instrument is, that it impedes the free and immediate retraction of the loose muscles after they have been cut; the consequence of which is, that the surgeon cannot divide so high, as he otherwise could do, the deeper muscles, which are more fixed and attached to the bone. Yet, in order to have the bone well covered with flesh, and no danger of a sugar-loaf stump, the latter object is one of vast importance. Perhaps the

best general rule is, to abandon the application of the tourniquet in amputations performed as high as the middle of the thigh, except where the patient is remarkably weak, so that he cannot bear the smallest loss of blood, and no steady intelligent assistant is at hand, to whom the compression of the artery in the groin can be prudently confided.

Whether the right or left thigh is to be removed, it is customary, in England, for the operator to stand on the patient's right side. In France, the surgeon places himself on the outer side for either limb, which plan, when the left limb is to be removed, leaves the duty of drawing up the skin and muscles entirely to the assistant. (*Velpeau, Nouv. Élém.* 8vo. t. i. p. 507.) The great advantage of the other method seems to be, that the surgeon's left hand can be thus more conveniently and quickly brought into use, than if he were always to stand on the same side as the limb he is about to amputate. This seems to be the only assignable reason for this habit; for, when the left thigh is to be amputated, it is certainly some inconvenience to have the right limb between the operator and the one that is to be removed. But this is found less disadvantageous than not having the left hand next the wound.

Mr. Guthrie, in speaking of amputations on the two lower thirds of the thigh, observes, that "in these cases the tourniquet should be used;" but in operations high up the thigh, he joins all other surgeons in recommending the inguinal artery to be compressed against the os pubis. (*On Gunshot Wounds*, p. 202.) The utility of slackening the tourniquet completely, however, as soon as the principal vessels are secured, — a piece of advice delivered by this excellent surgeon, — I presume, cannot be right on the ground which he specifies, viz. the impediment made by the strap of the instrument to the retraction of the muscles, and the consequent difficulty, in high operations, of sawing the bone, because in common practice the bone is always sawn before any of the vessels are secured; and loosening the tourniquet entirely, while any arterial branches still require the ligature, must generally be objectionable, if loss of blood be a disadvantage. In flap-amputations, high up the limb, indeed, where the arteries are sometimes tied, before the division of the bone, the employment of a tourniquet at all is quite out of the question.

We know that it was an opinion of the late Mr. J. Bell, that the flow of blood through a large artery could not be completely stopped by pressure; and the late Mr. Hey adopted a similar notion, in consequence of seeing a case in which the application of two tourniquets to the thigh did not restrain the hemorrhage from a fungus hæmatodes of the limb. He says, the pressure of the tourniquet does not completely obstruct the passage of blood in the arteries; it only diminishes so much of the force of the current as to enable the vessels, in a sound state, to exert their natural contractile power so effectually as to prevent hemorrhage. (*Sec. Hey's Pract. Ob.* p. 257, 258 ed. 2.) Of the inaccuracy of this doctrine, no man can doubt who sees the femoral artery with its open mouth on the face of a stump not bleeding, while the tourniquet is tight, or skilful pressure is kept up, but throwing out its blood to a great distance the instant the pressure is discontinued. Nor, I apprehend, can any surgeon, who has amputated at

the shoulder, and seen how completely pressure commands the flow of blood through the open-mouthed axillary artery, join in the sentiment of John Bell and Hey upon this particular point. Here I can speak with confidence, because I have myself amputated at the shoulder, and assisted at this operation several times, and found the statements of the preceding writers perfectly and clearly contradicted. Were any further testimony required, I might cite that of Dr. Hennen, who mentions, amongst other facts, that in a shoulder-joint case, operated upon by Mr. Dease, the amount of blood, lost from the principal artery, was no more than the quantity contained between the point of pressure and the point of incision through the vessels. (*Principles of Military Surgery*, p. 257. ed. 2.) The same fact presented itself in the example, where I assisted Dr. Blicke in private practice.

Mr. Liston confirms the preceding statement, observing that pressure complete enough not only to stop the pulsation of an artery in a limb, but also to arrest completely the flow of blood, can be easily applied by means of the fingers only: and, in order to prove the correctness of this remark, he has repeatedly, when no proper assistant was at hand, compressed both the femoral and humeral arteries with the fingers of one hand, whilst, with the other hand, he removed the limb; and this, as he affirms, with the loss of much less blood than if he had followed the ordinary mode. His common practice is to let the pressure be made by an assistant, and, in one place, he declares, that he would rather trust to no very efficient assistant than put on a tourniquet. The case with which the flow of blood through the largest arteries is commanded by manual pressure, is a fact likewise attested by Dupuytren, who only employed the instrument, which he terms the compressor, in a few special cases. (See *Leçons Orales*, &c. t. iv. p. 377.; *Elements*, part iii. p. 361.; and *Ed. Med. and Surg. Jour.* vol. xx. p. 44.) The following passage explains Mr. Liston's views of this subject: "In all cases, and in all situations and circumstances, hemorrhage can be restrained during the completion of the incisions, and during the employment of means to close the cut ends of the vessels, by means of very slight, but exact pressure on the trunk of the principal vessel. (See also Dupuytren, *Leçons Orales de Clinique Chir.* t. iv. p. 382.) The point at which this should be applied should be at as short a distance as possible above the place of the incision, and at the same time above the origin of any branches which must be cut. Not the slightest pressure should be made until the instant when the incisions are about to be commenced, so that no venous congestion may take place in the limb. All the blood in the limb below the incisions must necessarily be lost. The veins are more easily compressed than the arteries; and pressure made a short time before the operation may arrest the return of blood, whilst it may not stop its influx. Thus engorgement of the lower part of the limb is produced, and the quantity of blood that must be lost is increased. For a similar reason, pressure sufficiently firm to stop arterial hemorrhage, is to be continued till the principal branches are tied, and then entirely removed; for the continuance of even slight pressure will increase the flow of blood from the surface of the stump — blood flowing in, and being arrested in its venous return, trickles out through

the open ends of the veins. If a circular band be used for the compression, such as the screw-tourniquet, it should be put on quickly, screwed up at once, and then the incisions should not be delayed one instant." The doctrines and practice of Baron Dupuytren, I will notice in the article HEMORRHAGE. Baron Dupuytren did not employ the common tourniquet, nor any kind of compressor furnished with a handle (See *Leçons Orales de Clinique Chir.* t. iv. p. 298.); he sometimes availed himself of an instrument which he termed a compressor, and which makes pressure only on two opposite points of the limb. (See *Leçons Orales*, &c. t. iv. p. 386.)

If, then, the flow of blood through an artery can easily be commanded by pressure, how are we to explain the occasional continuance of bleeding, notwithstanding the pressure of one, or even two, tourniquets? Without doubt, by the fact that the pads of these instruments, when not duly arranged, do more harm than good, by raising the band off the vessel; and perhaps, also, in Mr. Hey's example, by the additional consideration, that tumours of the fungus hæmatodes kind include a large quantity of blood, and will bleed profusely, and for a considerable time after the main supply of blood to them is cut off. The same thing happens in the disease called aneurism by anastomosis, as I have had several opportunities of witnessing, but in no instance more strikingly than in one, where, some time after Mr. Hodgson had tied the radial and ulnar arteries, Mr. Lawrence divided every part of the finger, excepting the tendons and bone, and yet a considerable bleeding went on from the further side of the wound. (See *Med. Chir. Trans.* vol. ix. p. 216.)

The application of the tourniquet is generally left too much to assistants; but, so far as my judgment extends, no operator is justified in commencing his incisions before he has examined, and fully satisfied himself that the instrument is correctly applied. Mr. Guthrie candidly tells us, that he once lost an officer, in consequence of hemorrhage during the operation, although the tourniquet was in the charge of a surgeon of ability; and the advice with which he follows this statement is worth recollecting: "In a case of this kind, where it (the tourniquet) is found of little benefit, the surgeon should not continue twisting and turning it, whilst his patient is bleeding, but quit it altogether, and compress the artery against the pubes." This maxim cannot be too highly commended.

The shape and size of the pad of the tourniquet are matters of importance. At St. Bartholemew's, the pads employed in my time were very firm, being composed of wood, or cork covered with leather, and rather thicker than the thumb, the upper surface being flat, and the lower, which was put against the thigh, being convex. They were about an inch and a half in length. Such pads answered extremely well, as I can affirm from the observation of some hundreds of amputations in that hospital. A common fault formerly was the employment of pads which were too large, and soft, and not judiciously shaped. As Mr. A. C. Hutchison remarks, the principal objection to a large pad is, that the band of the tourniquet is so much raised by it, that a considerable space is left on each side of it, where no compression is made on the limb, however closely the instrument may

be sewed, and thus there will be a risk of hemorrhage from such vessels as happen to be in these situations. The same gentleman uses a pad, which is not thicker than a finger, and places it obliquely over the artery, so as to preclude the possibility of displacement. (*Pract. Obs. in Surgery*, p. 21—23.) Mr. Guthrie says, "the pad should be firm and rather narrow, and carefully held directly over the artery, whilst the ends of the bandage, in which it is contained, are pinned on the thigh. The strap of the tourniquet is then to be put round the limb, the instrument itself being directly over the pad, with the screw entirely free. The strap is then to be drawn tight, and buckled on the outside, so as to prevent its slipping, and not interfere with the screw, which is to be turned until the pressure is sufficiently forcible to stop the circulation. If the screw require to be turned for more than half its number of turns to effect this, the strap is not sufficiently tight, or the pad has not been well applied, and they must be replaced." (*On Gunshot Wounds*, p. 204.)

In two amputations at St. Bartholomew's Hospital, I saw the tourniquet break after the soft parts had been divided; and as in one of these cases a good deal of blood was lost, because another tourniquet happened not to be in the room, and pressure on the artery in the groin was not immediately adopted, I coincide with such writers as recommend the rule of always having two tourniquets ready. Graefe even goes so far as to advise putting both of them round the limb before the operation commences (*Normen für die Ablösung grösserer Gliedmassen*, p. 48.); but, the frequency of a tourniquet breaking is not so great, as to demand such precaution; and the plan would be objectionable in thigh amputations, where it is a material advantage to have plenty of room between the place of the incision and the band which goes round the limb.

An assistant, firmly grasping the thigh with both hands, is to draw up the skin and muscles, while the surgeon, beginning with that part of the edge of the knife which is towards the handle, makes a circular incision, as quickly as possible, through the integuments down to the fascia, or, as Mr. Guthrie and Dr. Hennen recommend, even completely through it. According to Mr. Guthrie, the skin cannot be sufficiently retracted, unless the fascia be divided, which he appears to think ought rather to be drawn up with the integuments than dissected from them. (*On Gunshot Wounds*, p. 204—208.; also *Hennen's Military Surgery*, p. 263.) In this way, the necessity for all painful detachment of the skin from the fascia is superseded. However, in secondary amputations of the thigh, if the integuments are unsound, and cannot be retracted, Mr. Guthrie approves of their being dissected back. On the contrary, Langenbeck is very particular in enjoining surgeons to avoid cutting through the fascia by the first sweep of the knife, because he finds that the muscles are better held together, and can be more regularly divided, by cutting them and the fascia at the same time. (*Bibl. für die Chir.* b. i. p. 564.) Nor does M. Roux divide the fascia by the first incision. (*Mém. sur la Réunion immédiate de la Plaie après l'Amputation circulaire*, p. 9. 8vo. Paris, 1814.) While I was a student at St. Bartholomew's, the surgeons rarely or never cut through the fascia with the integuments, but aimed

at carrying the knife perfectly down to it all round the limb. This at least ought to be done without fear of doing rather more; for, as Graefe observes, if the outer layers of the muscles be here and there a little touched, this occasions less pain; than the additional strokes of the knife for dividing any portion of the skin and cellular substance not completely cut through in the first instance. Graefe also dissents from Mynors and others, who are advocates for cutting the skin obliquely instead of perpendicularly, because he finds the thin edge of the integuments, thus separated from the subjacent cellular membrane, disposed to slough. (*Normen für die Abl. grösserer Gliedmassen*, p. 102.) Whether the fascia and subjacent muscular fibres be reached or not, is also deemed by Velpeau a matter of no consequence; the only essential thing being the perfect division of the skin. (*See Nouv. Elém. de Méd. Opér.* t. i. p. 508.) In a thigh of ordinary dimensions, the first incision should be made four inches below where it is intended to saw the bone. When the thigh is bulky, the large amputation knife will be found the best. Before beginning this first cut, the arm is to be carried under the limb, till the knife reaches almost round to the side on which the operator stands. With one sweep, penetrating at least to the fascia, the knife is then to be brought round to the point where it first touched the skin. Thus, the wound is more likely to be regularly made, than by cutting first on one side, and then on the other, while the patient is saved some degree of pain, in consequence of the uninterrupted quickness with which the incision is made. At the same time, I ought to confess, that the late Sir C. Blicke, and some other surgeons, whom I have seen operate, completed the circle by two strokes of the knife, so well and expeditiously, that their capricious attachment to this plan could hardly be found fault with.

The next object is the preservation of as much skin as will afterwards, conjointly with the muscles, cut in an oblique direction, cover the end of the stump with the utmost facility. It is rather difficult to lay down any other general principles for the guidance of the surgeon in saving integuments. I am disposed to agree with several moderate writers, that the painful dissection of the skin from the muscles has been recommended and practised to a very unnecessary extent,—that is to say, unnecessary, if the division of the muscles be performed in the most advantageous manner. Graefe, one of the best surgeons at Berlin, does not dissect the skin from the muscles at all in amputating the thigh, but takes care, after making the cutaneous incision, to have the integuments and subjacent flesh very firmly drawn up before commencing the oblique division of the muscles. This retraction he also strongly advises to be done uniformly and smoothly all round the member, lest, in dividing the muscles, any irregular projection of the skin interfere with the requisite movements of the knife. (*Normen für die Abl. grösserer Gliedmassen*, p. 103.) Instead of dissecting back the skin, Dupuytren used to cut all the soft parts at once to the bone, which he next divided, after retracting the muscles. (*Dupuytren, Leçons Orales*, &c. t. iv. p. 297.) However, Langenbeck, another of the most skillful operators on the Continent, prefers detaching the integuments from the fascia for about two finger-breadths (*Bibl. für die Chir.* b. i. p. 567.); as is the common practice in the London

AMPUTATION.

Some late writers, particularly Mr. Syme, in exchanging their preference to muscle as a covering for the end of the bone, seem to forget one fact which I have often noticed, viz. that the muscular cushion, though at first thick and good, soon shrinks to a comparatively small mass. This is consonant to a general law in the animal economy, prevailing whenever the natural action of a muscle is lost or prevented. Sir Astley Cooper states, that the covering for the end of the bone must be integuments, and not muscles; for, if muscular fibres are preserved with the integuments, they will contract, and retraction of the skin covering the stump will be the result. (*Lancet*, vol. i. p. 148.) Brunninghausen also thinks skin better and more durable covering for the end of the bone than muscular fibres, which after a time dwindle away; and thence he computes the quantity of integuments which ought to be saved, by the measure of the circumference and diameter of the member. Thus, when the limb is nine inches in its circumference, the diameter is about three; therefore, one inch and a half of skin on each side is to be saved. (*Erfahr. &c. über die Amp.* p. 75.) But this author cuts the muscles perpendicularly, so that he is obliged to separate much more skin from the flesh than is necessary, when the incision through the muscles is carried obliquely upward. Mr. Hey's method of calculation, which I shall presently notice, appears more adapted to ordinary practice; and he says, "the division of the posterior muscles may be begun at half an inch, and that of the anterior at three quarters, above the place where the integuments were divided." (*Pract. Obs. in Surgery*, p. 528. ed. 2.)

Dr. Hennen, by giving an oblique direction to incisions through the muscles, obviates the need for much dissection of the integuments; and he says that, in a small limb, he has repeatedly performed the operation with one sweep of the knife, cutting obliquely inwards and upwards at once to the bone. (*Principles of Military Surgery*, p. 265. ed. 2.) This author, like Mr. Guthrie, also recommends carrying the knife through the fascia in the first circular incision; and so does Mr. C. Hutchison, who makes no mention of dissecting back the skin, but simply states, that the "integuments and fascia being divided by a circular incision, and retracted upwards, as high as is judged necessary, the superficial muscles should next be divided," &c. (*Pract. Obs. in Surgery*, p. 23. 8vo. Lond. 1816.) We are, therefore, to conclude that he joins Graefe and others in thinking the separation of the skin from the fascia unnecessary. My own observations in practice lead me to believe, that the dissection of the integuments from the subjacent parts used formerly to be carried to an extent beyond all moderation and necessity; and that, as it is a most painful proceeding, and hurtful, by forming a large loose pouch for the lodgment of matter, it ought to be abandoned by every surgeon who follows the method of sawing the bone considerably higher than the first cut through the superficial muscles. Mr. Hey, like Desault (*Œuvres Chir.* t. 21. p. 545.), is an advocate for amputating with a triple incision, and for preserving such a quantity of muscular flesh and integuments as are proportionate to the diameter of the limb. By a triple incision, he means first an incision through the integuments alone; secondly, an incision through all the muscles, made some-

what higher than that through the integuments; and thirdly, another incision through that part of the muscular flesh which adheres to the bone, made round that point of the bone where the saw is to be applied. The proper distance of these incisions from each other, he says, must be determined by the thickness of the limb upon which the operation is to be performed, making allowance for the retraction of the integuments; and of those muscles which are not adherent to the bone. Supposing the circumference of the limb to be twelve inches where the bone is to be divided, the diameter is about four inches; and, if no retraction of the integuments were to take place, a sufficient covering of the stump would be afforded by making the first incision at the distance of two inches from the place where the bone is to be sawn, that is, at the distance of the semidiameter of the limb on each side. But, as the integuments, when in a sound state, always recede after they are divided, it is useful to make some allowance for this recession; and to make the first incision, in this case, at least two inches and a half, or three inches, below the place where the bone is to be sawn. As the posterior muscles of the thigh retract a great deal in the process of healing, Mr. Hey advises their division to be begun half an inch above the place where the integuments were cut, and the anterior muscles three quarters of an inch. The integuments, says he, will retract a little both above and below the place where they were divided; but the distance from that place must be computed from the mark left upon the surface of the muscles in dividing the integuments. Thus, in fact, in a common thigh amputation, Mr. Hey deemed it necessary to detach the skin from the muscles merely to the extent of half an inch at the back part of the limb, and of three quarters in front: a very different practice from the old custom of making quite a bag of integuments, and turning them back, as the upper piece of a glove is turned down, or rather as the sleeves of a coat are turned up.

In common amputations of the thigh, Roux strongly disapproves of separating the skin far from the muscles, as a circumstance highly unfavourable to the healing of the wound by adhesion; he divides only a few of the cellular bands between the integuments and fascia; and occasionally he has imitated M. Louis in cutting through the skin and superficial muscles together. (*Mém. sur la Réunion de la Plaie après l'Amputation*, &c. p. 9.)

I believe the generality of the best operators are now convinced of the impropriety of dividing the muscles exactly in the manner directed by Mr. Alanson, viz. by letting the knife revolve uninterruptedly all round the bone, with its edge turned obliquely upwards, towards the point where it is intended to apply the saw. It is a topic, indeed, to which I have already called the reader's attention in the foregoing columns. Langenbeck says, that he is perfectly convinced of the impossibility of forming a conical wound with one stroke of a large amputating knife, and joins Mr. Hey in approving of the triple incision. (*Bibl. für die Chir.* b. i. p. 564.) The objections, first urged by Wardenburgh against Alanson's method, are mathematically correct, inasmuch as the course of the edge of the knife, in this gentleman's method, must be spiral; and the end of the incision be considerably higher than the beginning of it. Such

must be the result of performing the division of the muscles all round the limb by one continued stroke of the knife, with its edge directed obliquely upwards; for the idea of making the knife revolve in this manner, while its point is confined to an imaginary, regular, determinate circle on the bone, I believe, is now abandoned as not really practicable. Yet, with the exception of Desault, who confined himself to the triple incision, conducted on the principles of M. Louis (*Œuvres Chir.* t. ii. p. 547.), few experienced surgeons refuse to acknowledge that in this operation immense advantage does proceed from the oblique division of the muscles. The honour of bringing this method into practice, Mr. Alanson still unquestionably merits, however he may have erred in recommending the conical wound to be made with one sweep of the knife. In amputating the thigh at its upper part, Velpeau believes the oblique division of the muscles, with the edge of the knife turned upwards, to be advantageous, as, without this precaution, or the saving and turning back the skin to the extent of two inches, the sides of the wound will not admit of being brought together. (*Nouv. Élém. de Méd. Opér.* t. i. p. 508.) Nor are there many living surgeons who entertain a doubt of the excellence of the principle inculcated by M. Louis, respecting the utility of dividing the loose superficial muscles first, and then such as are deeper and adherent to the bone. In fact, a combination of this last method, with the oblique division of the muscles, not exactly by one, but several strokes of the knife, constitutes the mode of amputating at present most extensively adopted, and sometimes termed, as already mentioned, amputation by a triple incision. Thus, after the skin is cut, and as much of it retracted and saved as is deemed necessary, the operator cuts through the loose muscles of the thigh, at the edge of the retracted skin, first those on the fore part of the limb, and then such as are situated behind. For this purpose, he makes two or more sweeps of the knife, as may be found necessary, carefully directing them obliquely upwards towards the point, where he means to saw the bone. The oblique division of the muscles does not merely enable the operator to saw the bone higher up than he could otherwise do, and leave, at the same time, more muscle for covering it; extremity, but it is a preservation of sound, undetached integuments, which assuredly form the most efficient and durable covering for the stump. I say this, without precisely coinciding with Brünninghausen, who, trusting entirely to skin for covering his stumps, makes an extensive detachment of it from the muscles, and then cuts straight down to the bone. The loose muscles actually cut through now retract considerably, leaving those which are deeper and attached to the bone in a condition to be cut higher up than could have been previously done. Lastly, these are also to be divided with the edge of the knife directed obliquely upwards towards the place where the saw is to be applied. Some operators do more than this; for, after cutting down to the bone, they follow the plan of Celsus, and detach the flesh from its whole circumference upwards with a scalpel, to the extent of about another inch, in order to be enabled to saw the bone still higher up. "*Inter sanum vitiatumque partem incidenda scalpello, caro usque ad os, reducenda ab eo sana caro, et circa os subsecundanda est, ut ad quæque parte aliquid ossis nudetur.*" This

method, I think, deserves commendation, because it may have considerable effect in hindering a protrusion of the bone, if it does not, in conjunction with the foregoing method of operating, and judicious dressings, render this disagreeable event quite impossible. However, I shall never forget a poor soldier, whose thigh had been amputated in Bergen-op-Zoom, and who was brought about ten days after the operation into the military hospital at Oudenbosch under my care. Not the slightest union of any part of the wound had taken place; abscesses had formed under the fascia on every side of the stump; the loose skin was literally a large bag of purulent matter; the muscles were wasted to almost nothing, and their remains retracted, and shrinking still further away from the extremity of the bone, which protruded at least three inches beyond the soft parts. This unfortunate man had been attacked with chronic tetanus soon after the operation, and, probably, it was to the disturbance of the stump by the effects of that disease, and to the strong and continual tendency of the muscles to retract themselves, induced by this state of the system, that the deplorable state of the stump was to be attributed. He lingered nearly a fortnight in the hospital before he died; previously to which event, large abscesses, communicating with the hollow of the stump, surrounded the greater part of the pelvis. As I had every reason to believe that the operation had been skillfully done, perhaps when I say that the above mode of amputating will make a protrusion of the bone impossible, it is not exactly correct, as the occurrence may sometimes originate from causes which are quite independent of the particular way in which the operation has been executed.

The practice of detaching the bone from the circumjacent flesh to the extent of about an inch, after the other principal incisions are completed, as advised by Celsus and Louis, I have sometimes seen followed at St. Bartholomew's Hospital, and have adopted it myself on other occasions, with the decided advantage of letting the bone be sawn higher up than could otherwise have been effected. Mr. Guthrie, after the incisions down to the bone, even recommends dissecting back the muscles from it "*for the space of two or three inches, as the size of the limb, or other circumstances, may require;*" but I should be reluctant to imitate the practice to this extent, though inclined to think most favourably of it within more moderate limits. If we reckon that three inches of the member lie between the first circular cut in the skin, and the place where the knife arrives at the bone, and then take away two or three inches more of the femur, it is clear that, in many examples, we should be getting very high up the limb; and if a detachment of the muscles from the bone, to the extent of two or three inches, were thus made, it would at all events be of no service, unless the bone would admit of being sawn at this great distance from the termination of the oblique division of the muscles. However, if this were truly practicable (a point which I leave for others to discuss), it would certainly be consonant to the excellent general maxim laid down by J. L. Petit, that in amputation, as much of the bone, and as little of the flesh, should be taken away as possible. (*See Traité des Mal. Chir.* t. iii. p. 150.) When this final detachment of the deep muscles from the bone is adopted, particular care, as Roux observes, should be taken always to divide the thick aponeurosis con-

necting the triceps to the linea aspera. (*Mém. sur la Réunion de la Plaie après l'Amputation*, p. 10.)

With respect to Desault's method of amputating the thigh by a circular incision, already mentioned, he considered turning the knife obliquely upwards quite unnecessary: his plan was to cut through the muscles, layer after layer, with the precaution of retracting the first stratum before he divided the second; the latter was then cut through on a level with the flesh that had been previously divided and retracted, and so on down to the bone. This, says he, is the right way of forming a true hollow cone, of which the integuments, which were drawn up before the muscles were cut, form the base, from which are gradually continued the various layers of muscles, and the highest point of which is the bone itself. (*Œuvres Chir. de Desault, par Bichat*, t. ii. p. 547.)

Dupuytren objected to this last method as tedious and painful, on account of the repeated division of the same textures by it. Hence, he preferred cutting through the integuments and muscles down to the bone with a single stroke of the knife, sometimes perpendicularly, sometimes obliquely. The contraction of the muscles, and the retraction produced by the assistant, who grasped the limb above the incision, instantly caused the wound to assume a conical projecting form. At the base of this cone, close to the edge of the retracted skin and muscles, the knife was applied again, and the flesh here drawn up as soon as divided. By cutting the muscular strata in succession, as they presented themselves under those already divided, and retracted, Dupuytren was able to lay bare the bone six inches above the line of the first incision. The operation was rapidly completed, and the patient saved from all the agony resulting from the dissection of the skin from the muscles. (See *Leçons Orales de Clinique Chir. de M. Le Baron Dupuytren*, t. iv. p. 297.) In this plan, however, the deep muscles attached to the bone must have been cut through more than once, if the operator really made his knife penetrate to the bone at the first stroke, as is represented. The avoidance of the tedious dissection of the skin, the saving of pain, and the abridgment of the operation, were not the only considerations in favour of this method, for one still greater influenced Dupuytren, namely, that of not destroying the natural connections of the skin to the subjacent parts, and preserving the sources of its nutrition. Hence, he followed this plan in all circular amputations of parts of limbs, where there was only one bone. (*Op. cit.* t. iv. p. 351.)

All the muscular fibres, on every side, having been cut down to the bone, a piece of linen, somewhat broader than the diameter of the wound, should be torn at one end, along its middle part, to the extent of about eight or ten inches. This is called a retractor, and is applied by placing the exposed part of the bone in the slit, and drawing the ends of the linen upward on each side of the stump. In this manner, the retractor will obviously keep every part of the surface of the wound out of the way of the saw. Graefe thinks, that, in amputations of parts where there is only one bone, the unslit portion of the linen should always be applied over the anterior muscles, as these ought constantly to be most evenly kept back, so that no projection of them may interfere with the action of the saw. (*Normen für die Ablösung grösserer Glied-*

p. 105.) That meritorious surgeon, J. L. Petit, whose name I always mention with pleasure, strongly commends the use of the retractor, the ends of which he drew over the anterior muscles: he says, that he has employed this simple and natural means, but that it did not suit the taste of every body, especially of those who consider all the merit of an operation to consist in the quickness of its performance, or who think it satisfactory reasoning to say, this is not their method. (*Traité des Mal. Chir.* t. iii. p. 152.) I have seen the saw do so much mischief, in consequence of the operator neglecting to use the retractor, that my conscience obliges me to censure such surgeons as neglect to defend the soft parts by this simple contrivance. There are some who have rejected the use of the retractor, because they have seen it get under the teeth of the saw, and obstruct the action of the instrument; but this very circumstance adduced against the retractor is, when considered, the strongest one that could possibly be brought forward in its favour, as the surface of the wound itself, and particularly the edges of the skin, would, in all probability, suffer the same fate as the linen, by getting under the teeth of the saw, if no retractor were employed, in attempting to saw the bone high up, as closely as possible to the soft parts. I think no one can urge any but the most frivolous objections to the use of the retractor, and I know that many who have been with myself eye-witnesses of the mischief frequently done by the saw in amputations, are deeply impressed with an aversion to the neglect of this bandage. I have often seen the soft parts skilfully divided; and I have, in these same instances, seen the operators, directly afterwards, lose all the praise which every one was ready to bestow, by their actually sawing through one half of the ends of the muscles together with the bone. Men who have had fortitude not to utter a sigh, nor to let a groan be heard, in their previous sufferings, have now had their involuntary cries extorted from them by unnecessary, unjustifiable torture. But, besides defending the surface of the stump from the teeth of the saw, the retractor will undoubtedly enable the operator to saw the bone higher up than he could otherwise do.

Mr. Liston pronounces all kinds of retractors superfluous. Here it should be remembered, that this gentleman's practice is that of flap-amputation, to which he gives the universal preference; a method in which unquestionably the retractor may be dispensed with, as, while the saw is acting, one, or both, of the flaps can be effectually held out of the way by an assistant. (See *Edinb. Med. and Surg. Journ.* vol. xx. p. 43—45.) Here, however, I am treating of amputation by the circular incision, in which the retractor is too useful to be relinquished. Were any further authority necessary in support of the practice of employing the retractor, I might refer to that of Dupuytren, (see *Leçons Orales de Clinique Chir.* t. iv. p. 298.) whose directions for its application are the following:—If there is only one bone, it is to be placed in the angle of union of the two tails of the retractor, which are to be brought over the anterior surface of the limb, and made rather to cross one another. Thus, the retractor forms a sort of bug covering the wound, and out of the centre of which the bone passes, and becomes the more denuded in proportion as the assistant draws the retractor towards the trunk.

One proceeding, which seems fit for reprobation, and which, indeed, Mr. Almonson very properly condemned, is the practice of scraping up the periosteum with the knife, as far as the muscles will allow. Nothing seems more probable, than that this may be the cause of the exfoliations which occasionally happen after amputations. At all events, it is a superfluous, useless measure, as a sharp saw, such as ought to be employed, will never be impeded by so slender a membrane as the periosteum. All that the operator ought to do is, to take care to cut completely down to the bone all round its circumference. Thus a circular division of the periosteum will be made; and upon this precise situation the saw should be placed. This is the method which was approved of by J. L. Petit. (*Traité des Mal. Chir.* t. iii. p. 159.) It is what I have always done and recommended; yet it must be confessed, that differences of opinion prevail about the necessity, and modes, of dividing the periosteum. Graefe, in common with several others, entertains considerable apprehension of the effects of the periosteum being torn and irritated by the saw, exfoliations of the bone and abscesses up to the joint being possible consequences of the rude separation and inflammation of this membrane. Hence he is an advocate for making a circular cut through it at the place where the saw is to be applied, and then scraping away all below this point in the direction downwards. (*Normen für die Abl. grösserer Glieder*, p. 165. and 106.) Perhaps no very great objection may lie against this mode, which is not uncommonly followed, though I have some doubts of its real utility, as it scarcely seems practicable in the midst of the oozing of blood to hit with the saw the precise line at which the remains of the periosteum terminate; and, in confirmation of the safety of Petit's practice, Mr. Guthrie's experience may be adduced, who says, "I have often sawn through the bone, without previously touching the periosteum; and the stumps have been as soon healed, and with as little inconvenience as any others." (*On Gunshot Wounds*, p. 88.) A modern author, impressed, like many others, with the fear of tearing the periosteum with the saw, differs from them in thinking it best to scrape the periosteum upwards, by which means, he says, that at least half an inch of this membrane, and a proportionate quantity of muscular fibres, may be preserved for covering the end of the bone, inasmuch as the muscular fibres, adherent to the periosteum, will remain connected with it; an advantage which this author deems very important while the edges of the bone are sharp. In amputation below the knee, he considers the method highly useful, as the sharp edge of the tibia may be not merely covered with skin, but with periosteum and the cellular membrane connected with it. Since his adoption of this practice, he assures us that he has not for a long time seen any exfoliation of the tibia, and never any protrusion of the bone of a stump. (*Brünnenhäuser, Erfahr. &c. über die Amp.* p. 65, 66. 8vo. Hamb. 1818.) Baron Dupuytren passes the knife circularly through the periosteum close to the retracted soft parts, and then detaches it upwards and downwards with the heel of the knife. (*Léçons Orales de Clinique Chir.* t. iv. p. 299.)

But, in no part of amputation, do operators in general display more awkwardness than in sawing the bone, though, if we except directing the saw against the flesh, the faults are here less pernicious

in their consequences than the errors already noticed. At the time of sawing the bone, much depends upon the assistant who holds the limb. If he elevate the lower portion of the thigh bone too much, the saw becomes so pinched that it cannot work. On the other hand, if he allow the weight of the leg to operate too much, the thigh bone breaks before it is nearly sawn through, and its extremity is splintered. It is one of the most common remarks of such persons as are in the habit of frequently seeing amputations, that the part of these operations, which a plain carpenter would do well, foils the skill of a consummate surgeon, and few operators acquit themselves well in the management of the saw. Many of them begin the action of this instrument by moving it in a direction contrary to the inclination of its teeth. Many, seemingly through confusion, endeavour to shorten this part of the operation, by making short, very rapid, and almost convulsive strokes, with the saw. Almost all operators fall into the error of bearing too heavily on the instrument. That operator will saw best, who makes the first stroke of the saw by applying its heel to the bone, and drawing the instrument across the part, towards himself, so as to make a slight groove in the bone, which serves very materially to steady the future movements of the instrument; and who makes long regular sweeps with the saw, at first rather slowly than quickly, rather lightly than heavily. The saw is directed by Dupuytren to be applied perpendicularly, and worked in the beginning slowly, but afterwards more quickly, in proportion as the groove becomes deeper, and the risk of the instrument getting out of it is lessened. When the bone is nearly divided, the sawing should proceed with the greatest gentleness. Then the assistants who hold the opposite parts of the limb, should redouble their care to maintain them in their natural directions. (See *Leçons Orales de Clinique Chir.* t. iv. p. 300.) Mr. Liston places himself so that he may grasp the part to be removed, during the sawing of the bone, without change of position. He makes the incisions with the left hand free; but, as soon as the saw is in the right, he takes firm hold of the limb below the wound. He disapproves of entrusting the limb to an assistant during the sawing, and lays it down as a rule, that the management of the lower part of the limb should always be left to the person using the saw. The saw, he says, may be worked either horizontally or vertically, but the latter direction seems to him best, because, when the section is nearly completed, the uncut part of the bone is deep, and less likely to snap on the weight of the limb, or undue pressure, operating downwards. (See *Liston's Elem.* part iii. p. 364.) But, there is often a fault in the construction of the saw itself, which impedes its action, quite independently of any fault on the part of the surgeon. I allude to the edge of the instrument not being a little broader than its blade. When the saw is well made, the teeth always make plenty of space for the movement of the rest of the instrument. The saw, recommended by Mr. Guthrie, cuts with both edges, backwards and forwards, which expedites the operation, and (what is of more consequence) helps to prevent splintering when the bone is nearly divided, because the division can be finished by the backward motions, which are the most gentle. (*On Gunshot Wounds*, p. 89.) This innovation, Velpeau informs us, is

not adopted in France. (*Nouveaux Elém. de Méd. Opér. t. i. p. 299.*)

If the bone happen to break before the sawing has been finished, the sharp-pointed, projecting spicule, thus occasioned, must be removed by means of a strong, cutting sort of forceps, termed *bone-nippers*. The perpendicular division of the bone leaves a sharp edge at the extremity of its circumference: it is not the common practice to take any measures for the removal of such sharpness; yet Graefe recommends filing it away (*Op. cit. p. 66.*), and Mr. A. C. Hutchison makes it an invariable rule, whether there be any occasion to use the bone-nippers or not, "to take off the asperities, and scrape, or endeavour somewhat to round, the sharp cut edge of the bone with a strong blunt scalpel, in order to prevent the soft parts from being injured, when brought over the end of the bone in forming the stump." (*Pract. Obs. in Surgery, p. 24.*) Though I have not followed this practice, or rather the part of it which relates to cutting off the edge of the bone, nor seen it adopted in London in amputation of the thigh, I know of no objection to it, unless it be on the score of idiosyncrasy, and the delay which it occasions. All projecting points of bone, it is the ordinary custom to remove.

After the removal of the limb, the femoral artery is to be immediately taken hold of with a pair of forceps, or with Assolini's double tenaculum, and tied with a firm, round, smallish ligature. (See *LIGATURE.*) Care is to be taken to leave the *nervus saphæus* major out of the noose. Its diminutive size prevents it from being readily seen; but as it is always situated within the sheath, and on the outer and front part of the artery, in the middle third of the thigh, there ought to be no great difficulty in finding it. (*Velpen, Op. cit. t. i. p. 506.*) None of the surrounding flesh ought to be tied, though the ligature should undoubtedly be placed round the artery, just where it emerges from its lateral connections. The late Mr. Hey was accustomed to tie the femoral artery twice, leaving a small space between the ligatures. Strong reasons against this plan will be found in the article *HÆMORRHAGE*. The smaller arteries are usually taken up with a tenaculum. The tenaculum is not well suited for the larger arteries, because it readily tears their coats; but it answers excellently for the smaller ones, which it draws out with great promptitude. It has also the advantages of not letting the vessel slip away, as the common forceps does; and of admitting of being held by anybody, even a child, while the surgeon applies the ligature; a consideration of importance in places where no professional assistant is at hand. (*Dupuytren, Leçons Orales de Clinique Chir. t. iv. p. 396.*) After tying as many vessels as require it, the best practice is to cut off one half of each ligature, near the knot on the surface of the stump. One portion is quite sufficient for withdrawing the ligature, when this becomes loose; and the other, being only an extraneous body, and productive of irritation and suppuration, should never be allowed to remain.

The plan, here recommended, is founded upon that valuable principle, which teaches us to lessen, as much as possible, the quantity of extraneous matter in a wound; and as one half of the ligature answers for withdrawing the noose, as soon as loosened, I never follow a method occasionally advised, viz. that of leaving both ends, and twist-

ing them together into one cord; by means of which, when further twisted at the proper period, it is alleged, that the detachment may be more quickly brought about.

My friend, the late Dr. Hennen, in his excellent publication, ascribes the improvement of removing one half of the ligature, to Dr. James Veitch, who, in April, 1806, published some valuable precepts relative to the mode of tying the arteries in amputation. (See *Edinb. Med. and Surg. Journal, vol. ii. p. 176.*) But, highly as I approve of the tenor of the anonymous paper here referred to, it is impossible for me to suppose that Dr. Veitch could be the first who suggested such improvement. When I went to St. Bartholomew's Hospital, in 1797, no surgeon of that hospital ever followed any other mode; and the practice was then so far from being new there, that gentlemen who had been at the hospital seven years before that date, saw one half of each ligature regularly cut off, the very first time of their attending an operation there. The use of broad ligatures, and the inclusion of a considerable quantity of flesh in the noose together with the vessels, were also practices quite exploded at St. Bartholomew's at the very beginning of my apprenticeship. Dr. Veitch, however, seems to merit the honour of having been the first to set the example of tying every vessel, the femoral, as well as the smaller arteries, with a single silk thread, taking care to include, as far as was possible, nothing but the artery; and when this had been done, he took off one half of each ligature, as near as possible to the knot, "so that the foreign matter introduced was a mere trifle, compared with what I had been accustomed to see." (*Edinb. Med. and Surg. Journ. vol. ii. p. 178.*) The use of a single silk thread, therefore, was the part of these improvements originating with Dr. Veitch.

Mr. Alanson directs the ends of the ligatures to be left hanging out at the two extremities of the wound. But when a ligature is situated in the centre of the wound, it is best to bring it out between the strips of adhesive plaster, at the nearest part of the surface; otherwise its running across one half the wound to get at either angle, would create a great deal of unnecessary irritation and suppuration. The advantages of this method of placing the ends of the ligatures were well explained by Dr. Veitch; but his practice, like the innovation of cutting off the half of each ligature, has been common in the London hospitals, and at Bartholomew's in particular, many years earlier, I presume, than the case referred to by this gentleman; since it has been familiarly adopted in these institutions ever since 1797, as I can testify from my own personal observation, and, indeed, at a much earlier period, according to the report of those gentlemen now living, who were my seniors. These remarks are offered, without the slightest intention of detracting from the merits of the above-mentioned paper, which is replete with valuable advice; nor am I influenced by any design of throwing honour on the memory or character of any other individual at the expense of Dr. Veitch, being at this time acquainted with the exact periods when either this improvement, or that of removing the half of each ligature, commenced. Bayon Dupuytren, and M. Roux, declare their preference to the method of bringing out all the ligatures at the lower angle of the wound; the benefit of having

them brought out thus low, so as to keep up a drain for any pus that may form, being in their opinion greater than that of arranging them at the points of the wound nearest to them. (*Mém. sur la Réunion de la Plaie après l'Amp.* p. 12.) Dupuytén, who only approved of endeavouring to procure union by the first intention at every point, when amputation had been performed without delay, for a gunshot wound, or other bad accident, on a person otherwise healthy, used, in all cases, to leave the lower part of the wound unclosed. Here he brought out the ends of the ligatures well twisted together into a single cord; and, for the purpose of still farther insuring an outlet for the pus, if the cord was small, he occasionally introduced a small cylinder of charpie into the posterior angle of the incision; for as it was his custom, after circular amputation of the thigh, to bring the sides of the wound partly together, (see *Leçons Orales*, &c. p. 416.) so as to render the line of it transverse, I infer that he selected the inner angle of the incision as the outlet for the discharge and the place for the cord of ligatures.

As Dr. Hennen observes, the reducing the immoderate size of ligatures, the separating the threads of which they were composed, and placing them at convenient points along the face of the stump, or wound, and the actual removal of one half of each ligature, were amendments very slowly made; "but," says he, "an improvement which appears to me of great consequence, was the last of introduction, and is now the slowest of adoption, although, the artery once secured, and the value of adhesion duly acknowledged, it is the most obvious of all. I allude to the plan of removing the ends of the ligature altogether, and thus leaving to an extensive wound the greatest possible chance of immediate union." The first printed mention of this practice, as far as Dr. Hennen's investigations have discovered, was in a letter written by Mr. Haire, dated Southminster, Essex, Nov. 1786. "The ligatures," says this gentleman, "sometimes became troublesome and retarded the cure. An intimate friend of mine, a surgeon of great abilities, proposed to cut the ends of them off close to the knot, and thus leave them to themselves. By following this plan, we have seen stumps healed in the course of ten days. The short ligature, thus left in, commonly made its way out by a small opening in a short time, without any trouble, or the patient being sensible of pain." (See *London Med. Journ.* vol. vii.) Certainly, considering the thickness of the ligatures in use at the above period, this testimony of the success of the method, as Dr. Hennen remarks, is very satisfactory. (*Principles of Military Surgery*, p. 181. ed. 2.) In a letter received by me from Mr. Dunn, surgeon at Scarborough, and dated June 3. 1819, he tells me, "My predecessor, Mr. J. Wilson, the late partner of Mr. Travis, amputated a limb in 1792, or 1793, and cut off the ligatures close to the arteries, and no trouble ensued. He did this at the recommendation of Dr. Balcombe, of York, who had seen the method practised on the Continent." In September, 1813, Dr. Hennen, who was serving with the army in Spain, began the adoption of this plan, which, he expected, would not only prove useful in promoting immediate union, but in obviating any accidental violence to the ligatures, and the wrong interference of the younger dressers in trying to pull them away. Between September

and January, thirty-four cases were treated in this way, without any inconvenience following, or the small particles of silk left behind giving rise to any apparent irritation. Dr. Hennen also presented to Sir J. M'Grigor some of the small circles of silk, a part of which had come away with the dressings, while others had floated out on opening the little pustules, which formed over the face of the stump at the points where the arteries had been tied. Some few of the ligatures never made their appearance, and the patients complained of no uneasiness whatever. Convinced of the utility of the method, Dr. Hennen afterwards published an account of it. (See *London Med. Repository*, vol. iii. p. 177. and vol. v. p. 221.) This gentleman subsequently found, that Dr. Maxwell of Dunfries had adopted the plan as far back as 1798; and Dr. Ferguson, who was at Stockholm during the peace of Amiens, saw it also then followed by some of the surgeons of that city, without any ill effects. (*Hennen's Military Surgery*, p. 175—178. ed. 2.) In July, 1814, Mr. Lawrence communicated to the Medical and Chirurgical Society of London, some cases and observations highly in favour of the practice; and the particularity, which he lays much stress upon, is using for the purpose minute firm ligatures, composed of what is called dentist's silk; a material, which had been previously recommended by Dr. M'Sweeney in one of the volumes of the *Edin. Med. and Surgical Journ.* (See *Med. Chir. Trans.* vol. vi. p. 156.) In a paper of later date, he says, his further experience had confirmed the usefulness of the method; "that this plan, by diminishing irritation and inflammation, and simplifying the process of dressing, materially promotes the comfort of the patient, and the convenience of the surgeon, while it has not produced ill consequences, or any unpleasant effect, in the cases which have come under his own observation." According to Mr. Lawrence, the small knots of silk generally separate early, and come away with the discharge; that where the integuments have united by the first intention, the ligatures often come out rather later, with very trifling suppuration; and that, in some instances, they remain quietly in the part. (*Op. cit.* vol. viii. p. 490.)

When this plan is tried, single strong threads and silks, or rather the kind of ligature which will be described in another place (see *LIGATURE*), should be employed; for, otherwise, the knots would be large, and likely to create suppuration and future trouble. The practice was tried by Delpech at Montpellier; but it is not explained whether he used single threads, or silk, or whether any inconveniences resulted from the method. (See *Rélation d'un Voyage fait à Londres en 1814, ou Parallèle de la Chirurgie Anglaise avec la Chirurgie Française*, par P. J. Roux, 8vo. 1815.) Yet candour requires me to state, that the method has gained but few advocates in this country. One well-informed writer (see *HÆMORRHAGE*) has recited a case, and some experiments, which are unfavourable to the practice. (*Crosse, in London Med. Repository*, vol. vii. p. 355.) By Sir Astley Cooper, the practice was found to occasion suppuration, and he has therefore given it up. (*Lancet*, vol. i. p. 149.) Mr. Guthrie, in two or three instances, has also seen some ill-looking abscesses arise from the presence of the bits of ligature, though he approves of the plan where the wound

will not unite by the first intention, which, however, can rarely be known beforehand. (*On Gunshot Wounds*, p. 941.) When amputation is performed in crowded hospitals, where hospital gangrene is prevailing, Delpech was an advocate for the plan, because it enabled the surgeon to bring the lips of the wound more perfectly together. By this means, as his experience had taught him, the risk of the wound being infected was materially lessened. (*Chirurgie Clinique*, t. i. p. 83.) The small particles of the ligatures, enclosed in the stump, he says, are discharged at a period when the patient has regained strength enough to be removed into a healthy atmosphere; little openings being produced for their escape, which heal up in twenty-four hours.

Sometimes, the sawn surface of the bone itself bleeds rather profusely. When this happens, it is an excellent plan to hold a compress of lint over the end of the bone, during the time requisite for securing the rest of the vessels. The bleeding from this source will then give no further trouble. At the end of this period, the compress may generally be taken away, the bleeding from the bone having entirely ceased. The surgeon ought not to be content with tying only such vessels as he observes throwing out blood, while the patient is faint with pain; he should endeavour to rouse him from that faintish state by a cordial, and then, wiping off the coagulated blood with a sponge wet in warm water, he should examine narrowly all the surface of the stump; for otherwise he may expect to be obliged by a fresh hemorrhage to undo all the dressings. (*On Amputation of the Larger Extremities*, p. 475. *Mouvo's Works*.)

When there is merely an oozing from small vessels, Bromfield's advice to loosen the tourniquet completely is highly proper, as this measure, and washing the stump with a little cold water, will put an entire stop to such bleeding, without any occasion for more ligatures. A good deal of blood is sometimes lost from the mouths of the larger veins; and where they bleed much in debilitated subjects, I think Dr. Hennen is right in recommending them to be tied. (*On Military Surgery*, p. 264.) There is no necessity for doing so, however, in ordinary cases; nor should I be disposed to imitate Mr. Hey, who, in consequence of having seen a few instances of bleeding from the femoral vein, generally enclosed that vessel in the ligature along with the artery. (*Practical Obs. in Surgery*, p. 530. ed. 2.) This method was sanctioned by the eminent Desault, who says, that if the vein be left open, and the bandage at the upper part of the limb be too tight, the blood regurgitates downwards, and hemorrhage takes place, as this surgeon assures us he has often seen. When the vein and artery lie close together, as often happens, one branch of the forceps is to be introduced into the artery, and the other into the vein; which being done, the two vessels are to be drawn out together, and included in one ligature; but, if they are not so near together, they must be tied separately. (*Œuvres Chir. de Desault, par Bichat*, t. ii. p. 550. 8vo. Paris, 1801.) In the hospitals of London, it is not the usual practice to tie the femoral vein, and, except in particular cases, I consider the custom wrong, because a ligature on a large vein sometimes excites a dangerous and fatal inflammation within the vessel, while the intervention of the vein between the one side of the circle of the ligature and the artery, must rather tend to hinder the

thread from operating in the most desirable manner upon the latter vessel. For some remarks on venous bleeding during operations, and an account of Dupuytren's views and practices under such circumstances, see HEMORRHAGE. If the end of the great sciatic nerve should project too much, the best plan is immediately to cut it off, as advised by M. Descot. (See *Velpeau, Nouv. Élém. de Méd. Opér.* t. i. p. 506.)

OF DRESSING THE STUMP.

The wound is now to be evenly closed with strips of sticking-plaster, so that the edges of the skin may form a straight line across the face of the stump. This was the mode commended by Alanson, and is what is preferred by the generality of surgeons in this country. It is also advised by Graefe, Delpech, and others. (*Normen für die Abl. grösserer Gliedm.* p. 106.; *Chirurgie Clinique de Montpellier*, t. ii. p. 395.; *Guthrie on Gunshot Wounds*, p. 208.) Over these plasters and the ends of the ligatures, it is best to place some pieces of lint, spread with the unguentum cetaceum, in order to keep such lint from sticking, which becomes an exceedingly troublesome circumstance, when the dressings are to be removed. I am decidedly averse to the plan of loading the stump with a large mass of plasters, pledgets, compresses, flannels, &c.; and I see no reason why the strips of adhesive plaster, and a pledget of simple ointment, should not suffice, when supported by two cross bandages, and a common linen roller, applied spirally round the limb, from above downward. The first turn of the roller, indeed, should be fixed round the pelvis, while the lower circles secure the cross bandages, often called the Malta cross, over the end of the stump. It is also an excellent method to leave some little interspaces between the plasters, and in summer to keep the linen bandages constantly wet with cold water. In this way, any discharge will readily escape, and the parts, being kept cool, will be less disposed to hemorrhage and inflammation.

Sir Astley Cooper states, that he has seldom succeeded with his stumps above the elbow or knee, when a roller was not employed, which, he says, prevents retraction of the muscles and extensive suppuration. After applying the roller, and bringing the integuments together, he merely puts three strips of adhesive plaster over the wound, and one round the stump, to keep the ends of the plaster in their place: in hot weather, he applies a lotion of spirit of wine and water. (*Lancet*, vol. i. p. 150.)

I am completely of opinion with Mr. Alanson, that the elastic woollen cap, sometimes placed over all the bandages and dressings, if not put on with a great deal of care, has a tendency to push the skin backward from the extremity of the stump; and as it must also heat the part, its employment should be discontinued. In the North London Hospital, stumps are very lightly dressed, and for the first few hours, Mr. Liston, who always practises flap-amputation, merely keeps the flaps together with two or three sutures, and lays over the stump, linen or lint wet with cold water. The best position for the stump is that in which it is supported on a small pillow, with the thigh moderately bent.

If possible, the dressings should never be removed before the fourth day, not reckoning the

one on which the amputation is performed; and Sir Astley Cooper even prefers the sixth or eighth day; merely removing on the fourth one strip of plaster, in order to let out any confined matter. (See *Lancet*, vol. i. p. 150.) Monro also set down the fifth, sixth, or seventh day, as generally soon enough for the change of the dressings. He allows, however, that, if the smell of the wound should become offensive, the outer dressings may be removed sooner. Even when the dressings are to be taken away, it will frequently be found useful not to remove one strip of plaster; but the stump must be made clean, and any discharge washed away. These, and other valuable precepts, derived from the eminent Dr. A. Monro senior, are worthy their great source, and the correctness of them promises to be acknowledged for ever.

The manner of renewing the dressings of stumps is, indeed, a very important business, which should never be intrusted to mere novices; for in removing off the straps of sticking plaster, if great care be not taken, the slight and newly formed adhesions may be torn asunder. Thus, as Mr. A. Hutchison has remarked, if the strap be pulled off by holding one end of it at nearly a right angle with the adhering part, the flap will be raised up with it, and thus a separation of the newly united parts will be produced. "My plan," says he, "is to reflect the raised end of the strap close down upon the adhering parts, and to bring it gently forward with one hand, while the removing part of the strap is followed by two fingers of the other placed upon the skin, &c.; and when one end is detached from its adhesion, as far as the line of incision, on the face of the stump, in like manner the other end is brought down and wholly removed." (*Practical Obs.* p. 46.)

In order to facilitate the removal of the plasters, and save the patient a great deal of pain, I follow the plan of letting warm water drop over them from a sponge for a few minutes previously to the attempt to remove them. In the early part of the treatment, it is also a valuable rule never to let every strap of plaster be off at once, so as to leave the flesh quite unsupported. Some skill and care are also invariably necessary to avoid pulling away the ligatures with the dressings.

At the end of five or six days, the surgeon may begin to try, in a very gentle manner, whether any of the ligatures are loose; observing rather to twist, than suddenly pull them directly outward. However, he should not use the smallest force, nor persist if the trial create pain. One would hardly try whether the ligature on the main artery were loose, before the tenth or twelfth day, for it rarely comes away before the expiration of a fortnight. If minute ligatures made of dentist's silk be employed, and both their ends cut off close to the knot, of course, this delicate business of trying to get rid of the irritation of these foreign bodies is entirely superseded.

Though, in the above account, I have directed the wound, after the amputation of the thigh, to be brought together in such a way that the wound shall appear as a line across the face of the stump, yet there are instances in which the bone seems most easily and conveniently covered, by making the line of the wound in a perpendicular direction. Mr. B. Bell, indeed, generally approved of it, as affording a ready outlet for

matter; it is likewise directed by Sir C. Bell (*Op. Surgery*, vol. i.), by Roux (*Mém. sur la Réunion immédiate de la Plaie après l'Amp.* p. 11.), and by Dr. Hennen (*On Military Surgery*, p. 265. ed. 2.).

On the other hand, Mr. C. Hutchison objects to it, because it seems to him, that when a stump, thus put up, is laid on a pillow, the pressure tends to separate and open the lower part of the wound. (*Pract. Obs. on Surgery*, p. 37.) Delpech was also led, by the view he took of the consequences of suppuration, and the contraction of cicatrices, to prefer bringing the sides of the wound together after the circular amputation of the thigh, so that the line of the cicatrix might be transverse, and not perpendicular. His reason was, that most of the ligatures, which unavoidably produce suppuration, are placed on branches of the profunda in the posterior part of the limb; consequently, here the greatest contraction follows cicatrization, and the anterior flap is thereby drawn over the extremity of the bone in the most advantageous manner. (*Chirurgie Clinique de Montpellier*, t. ii. p. 395.) the muscles in front of the femur also contract to a less extent than those behind; another reason assigned by Velpeau, in explanation of the fact, that, after the circular amputation of the thigh, the cicatrix is drawn backwards or inwards, and the end of the bone is never at the central point of the stump. (Velpeau, *Nouveaux Elém. de Méd. Opér.* t. i. p. 505.)

It is curious to remark, however, that the thing which leads Mr. C. Hutchison to disapprove of the plan, is one which would be urged in its favour by Dupuytren, Roux, and some other surgeons, who actually take the precaution of never closing the lower angle of the wound, in order that whatever discharge occurs may find a ready outlet. (*Mém. cit.* p. 14.) Thus, Velpeau states, that the French surgeons prefer having one angle of the wound forward, the other backward, in order that fluids may have a ready outlet. (*Nouv. Elém. de Méd. Chir.* t. i. p. 509; also, Dupuytren, t. iv. p. 416.) As a general maxim, observes this very distinguished surgeon, the soft parts should be brought together in the direction of the lesser diameter of the stumps, if circular amputations have been performed; and so as to bring the bleeding surfaces of the flaps together, if flap-amputations have been done: the wound is to be brought together, with its line in the direction of the great diameter of the oval, if the oval, or oblique mode of amputation has been selected.

Mr. Atanson objected to the line of the wound being vertical, asserting that the cicatrix afterwards became situated immediately over the end of the bone, the pressure of which was very likely to make the part ulcerate. However, in St. Bartholomew's Hospital I have seen the edges of the wound occasionally brought together in the perpendicular direction, and capital stumps made in this manner. In a case in which I assisted Mr. Ramsden at Christ's Hospital, when an attempt was made to put up the wound in the common manner, the bone seemed to make considerable pressure against the skin, which did not happen, when the line of the wound was made in the other direction, which of course was immediately adopted. Mr. Hey has noticed this subject as follows: the integuments and muscles may be brought into contact by pressing either the anterior and posterior parts, or the sides of the thigh, toge-

ther. The former method, by the gradual retraction of the posterior muscles, causes the integuments of the anterior part of the stump to cover more completely the extremity of the bone. The latter method causes the integuments and muscles to meet each other the more readily, and therefore is to be preferred, when the quantity of soft parts preserved is somewhat deficient. (*Pract. Obs. on Surgery*, p. 533. ed. 2.)

M. Malgaigne observes, that, whether the line of the wound be transverse, or perpendicular, the inconveniences are equal. The former plan leaves a *cul de sac* below, in which pus lodges; in the latter method, one angle of the wound is pressed against the cushion, which supports the stump. Perhaps, says M. Malgaigne, the oblique direction should be preferred. (See *Malgaigne, Manuel de Méd. Op.* p. 298.)

The plan of bringing the edges of the wound together after amputation, so that they may unite by the first intention, has received, for many years past, the universal approbation of British surgeons. It is their general practice, in the treatment of all incised wounds. It may be said to be the pride of English surgery; for in nothing does she display more convincingly her superiority. Baron Larrey, however, in cases of amputation, disapproves of the attempt to unite the wound by the first intention, and merely brings forward its edges somewhat towards each other with a piece of linen, that covers the whole of the wound, and has small holes cut in it for the passage of the discharge. (*Mém. de Chir. Mil. t. iii.* p. 379.) This piece of linen is supported with a moderately tight roller.

M. Roux, on his arrival in this country, wondered to see British surgeons so prejudiced in favour of union by the first intention, as to adopt it after all amputations. "*C'est pareillement abuser de la réunion immédiate que de l'appliquer en toute circonstance à la plaie qui résulte de l'amputation des membres. J'entends parler de l'amputation dans la continuité des membres, et plus particulièrement encore de l'amputation circulaire.*" (P. 128. *Parallèle de la Chirurgie Anglaise avec la Chirurgie Française*, 8vo. Paris, 1815.) But M. Roux has curiously omitted to explain, in his book, what are the advantages of not bringing the edges of the wound together, and why he calls prejudice the partiality to a method, the superior efficacy of which is continually demonstrated in every hospital of London. He does not, indeed, presume to condemn the practice altogether; on the contrary, he allows it to be proper in certain cases; yet he contends, that it ought to be confined within particular limits. (P. 130. See, also, *Mém. et Obs. sur la Réunion immédiate de la Plaie après l'Amputation*, 8c. 8vo. Paris, 1814.)

In this tract, M. Roux proves most convincingly the benefits of union by the first intention, after amputation of the thigh by the circular incision; but, strangely enough, his prejudices hinder him from advising the practice to be extended to other amputations. He does not positively condemn it in the arm, though he thinks the method less necessary, because amputation there is less dangerous than in the thigh, &c. (P. 45.) To such futile reasoning is this author reduced by the unsoundness of his doctrine. He also deems the attempt at union by the first intention counterindicated, where limbs are amputated for injuries which violently contuse and crush the parts (P. 48.), and

where the limb is much wasted. (P. 50.) In the latter condition, however, he thinks Desault's flap-amputation may be done, and an effort made to heal the wound by adhesion. In one case, he did this with success. (P. 61.) The opinions of Dupuytren on this subject lead him also to be an advocate for reform in the practice of aiming constantly at complete union by the first intention, after all amputations. He was for *un sage milieu*. The facts and arguments, which form the basis of his precepts, will be noticed with the subject of union by the first intention in the article *Wounds*.

Dubois has tried the plan with a success equal to that of the London surgeons. "The method is preferable," says Richerand, "to the old one, in whatever point of view it is considered. This union is more expeditious, a few days being sufficient for its completion. A woman, whose thigh I took off in 1810, was very well in a week, &c.— Besides the advantage of a quick cure, and such quickness is especially of great importance, where the patient has been much reduced, so that he would hardly be able to bear a long suppuration, union by the first intention has the recommendation of saving the patient from a great deal of pain, the flap of integuments, with which the bleeding surface of the stump is covered, being much less irritating to the flesh, than the softest charpie would be, &c.—Three years have elapsed since the publication of the third edition of this book. During this interval, I have performed more than a hundred and fifty amputations, and the utility of immediate union has been more and more proved to me." (*Nosographie Chirurg.* p. 475. 477. ed. 4.)

But, notwithstanding these and other encomiums on the practice, Richerand, like other French surgeons, is not an advocate for it in certain cases; as, for instance, limbs shattered by gunshot wounds, or affected with hospital gangrene. Here he maintains that it hardly ever succeeds. (P. 478.) But, though it be true, that amputations after gunshot wounds do not generally heal so well as many other cases, it cannot be denied that they do sometimes unite more or less by the first intention; and why should not the chance be taken? It is productive of no danger; there is nothing better to be tried; and if it fail, what is the harm? Why, the wound will then heal by suppuration and the granulating process, just as soon as if the hollow of the stump had been filled with charpie, or left open; it will, in fact, heal in a way, which is less advantageous than union by the first intention, but which is the best which can now happen. The very cases, which Richerand condemns as unfit for union by the first intention, are those particularly specified as most favourable for it by Dupuytren (see *Leçons Orales*, t. iv. p. 419.); while Delpach is so convinced of the necessity of the perfect closure of the wounds, where hospital gangrene is prevailing, that in order to let this object be most completely fulfilled, he advises both ends of each ligature to be cut off close to the knot.

From what has been said, it appears that the practice of healing the wound by the first intention after amputation is less general in France than it is in England; a circumstance, which may perhaps be explained by the fact of its being much newer to the French than to us. Every improvement must encounter for a time the opposition of prejudice; but one, so important as that which we are

considering, must at length prevail and meet with universal adoption. Our extraordinary partiality to union by the first intention arises from a conviction of its superior efficacy, and is a decisive proof of the goodness of English surgery in respect to wounds. The observations of MM. Roux and Richerand tend to prove, that they are not altogether unaware of its advantages, and they therefore recommend it for certain cases; but, their backwardness to extend it to all amputations is little in favour of the comparison, which they are so fond of making of French with English surgery. Even the eminent Dupuytren had great apprehensions about lodgments of matter, if union by the first intention were completely attempted: and, for the prevention of them, left the lower angle of the wound open, sometimes placing a tent in it, and always the ends of all the ligatures twisted into one cord, as already explained. This cord of ligatures serves to conduct the discharge out of the unclosed angle of the wound, and abscesses in the deep part of the stump are prevented. A great portion of the wound unites by the first intention; suppuration only takes place in the track of the ligatures, and, in general, as soon as these have been detached, it soon ceases. (See *Leçons Orales*, t. iv. p. 416.)

However, that stumps may fall into a state, in which the pressure of all plasters and bandages whatever should be most carefully avoided, and emollient poultices used, is a truth of which every surgeon of experience must be fully convinced. This happens, whenever the parts are affected with considerable tension, inflammation, and swelling, or painful acute abscesses. There is also no utility in keeping the edges of the wound very closely compressed together when all chance of adhesion is past, and the parts must heal by the granulating process. My friend, Mr. Guthrie, after amputations, performed from necessity in parts not in a healthy state, as in most secondary amputations after compound fractures of the thigh, does not insist upon the edges of the wound being brought into close contact by sucking plaster, compress, and bandage. In these cases, he also recommends the bone to be sawn an inch shorter than usual, or than would be necessary under other circumstances, in order to prevent its protrusion, and the ligatures to be cut off close to the knots, so as to lessen irritation. The integuments and muscles are to be brought forward, and retained so by a moderately tight roller, but not laid down against the bone. Some fine lint, smeared with cerate, or oil, is to be put between the edges of the wound; and a piece of linen and a Malta cross over it, supported by a few light turns of the roller. "In some cases," says Mr. Guthrie, "I have put one, and even two straps of plaster over the stump to keep the edges approximated, without being in contact; and where the parts are but little diseased, this may be attempted; but if the stump becomes uneasy, they should be cut, and a poultice applied. When only a part of the stump has appeared to slough, I have found the spiritus camphoræ alone, or diluted with a watery solution of opium, applied with the lint, very useful." (*On Gunshot Wounds* p. 101.)

The reasons which led Mr. Guthrie to incline to the plan of not bringing together the edges of the wound, in cases of this description, must be learned by reference to his own valuable work. His cases and arguments are entitled to serious consideration;

and though they, as well as the observations of M. Roux (*Mém. sur la Réunion immédiate de la Plaie après l'Amputation*, 8vo. Paris, 1814), leave me unconvinced of the usefulness of not bringing the edges of the wound together, immediately after the amputation of bad compound fractures, there are some of his observations, respecting the injurious effects of pressure in certain conditions of the stump, perfectly agreeing with my own sentiments. At present, I have never seen any case of amputation, in which I should not have thought the surgeon wrong, had he not brought the sides of the wound together directly, or within a few hours after the operation, so as to afford the chance of union by the first intention.

VARIOUS BAD CONSEQUENCES MAY FOLLOW AMPUTATION;

As, for instance, spasms of the stump, tetanus, hæmorrhage, severe inflammation of the stump, abscesses and extensive sinuses, inflammation of the medullary membrane, necrosis (see *B. Phillips in Lond. Med. Gaz. for 1833—34*, p. 139.), protrusion of the bone, phlebitis, and suppuration in internal organs and in various other parts of the body, hospital gangrene, neuromata, &c. Of these several complications, which may either interrupt cicatrization, or subject the patient to great and protracted suffering, or even lead to a fatal termination, some are common to many operations; others restricted to that which is now under consideration; some arise from external causes; others from internal. (See *Dupuytren, Leçons Orales*, t. iv. p. 425.) It is only necessary to enter into a part of these topics in the present place, because the others more properly belong to the articles HOSPITAL GANGRENE, NECROSIS, PHLEBITIS, STUMPS, SUPPURATION, and TETANUS.

SECONDARY HÆMORRHAGE.

Bleeding, after the operation, is of two kinds in regard to the time when it occurs. The first takes place within twenty-four hours after the operation, and when the circulation has risen with the inflammatory fever. Hence, an assistant should always be left with the patient, with directions carefully and repeatedly to look at the stump, and if any bleeding should arise, to apply the tourniquet, until further aid be obtained. In case no assistance can be spared for this purpose, as must frequently happen in country practice, the tourniquet should be left loosely round the limb, and the nurse, or patient himself, directed to turn the screw of the instrument, in order to tighten it in case of need. A slack tourniquet, left round the limb after amputation, cannot do harm, and its not having been ready in this way has cost many patients their lives.

This kind of hæmorrhage has often been known to arise from the pressure of a tight bandage round the stump. As Monro observes, the circular turns of the bandage, when tight, must stop the return of blood in the cutaneous veins, and thus by making a greater resistance to the blood in the arteries, which anastomose with them, occasion the contracting power of the heart and arteries to dilate, and force more blood into their other branches; but, these being cut in the amputation, will pour out their blood, and so hæmorrhage is brought on. Making much pressure round the stump is highly deserving of reprobation; and whenever there is

a universal oozing of blood, I would recommend the operator to be sure, that the circulation in the superficial veins is not impeded by the tightness of any bandage or tourniquet.

If the bleeding should not be from an artery of consequence, the application of linen dipped in cold water will sometimes check it, and the disagreeable necessity for removing the dressings and opening the wound may thus be avoided. But, it often happens, that the wound must be opened, and the bleeding vessel tied. This is a very painful proceeding; and when the dressings have been applied some hours, so that the stump has had time to inflame, nothing can exceed the suffering, to which the patient is now subjected. Here we see the prudence of being particularly careful at first to tie every suspicious vessel.

A few years ago, directly after the ligation of the vessels, the stump was always closed and dressed. Such, indeed, is still the general practice. Dupuytren deviated from this custom by letting one or several hours elapse before he dressed the stump. The vessels having been secured, the patient was conveyed into bed again, with merely a single compress and slack bandage placed on the stump. Dupuytren's reasons for this practice are, that, notwithstanding every possible attention, hemorrhage will frequently take place shortly after operation, and compel the surgeon to remove the dressings; and that these often conceal the bleeding, till it has gone on to a fatal extent. Arteries are frequently prevented for a time from throwing out blood by the patient's syncope, or mental depression; but, in two or three hours, they begin to bleed profusely, on the circulation recovering its force. From the period when Dupuytren commenced the custom of deferring the dressing for a time, no consecutive hemorrhage of this kind occurred in any of his patients. (See *Lçons Orales*, &c. t. iv. p. 412.) The regular dressing of stumps is also deferred by Mr. Liston for six or eight hours, or till all oozing has ceased; merely lint, wetted with cold water, being at first placed over the wound. (See *Liston's Elem.* part iii. p. 368.)

The second sort of hemorrhage, after amputation, arises from ulceration of arteries, and may occur a few hours, or even some weeks or months, after the operation, when all the ligatures have come away, and the patient seems nearly well. Two such cases are related by Mr. Broomfield. (Vol. i. p. 307.) J. L. Petit saw an instance, in which the hemorrhage came on twenty days after amputation of the thigh very high up; and Baron Dupuytren refers to an example in La Charité, where the bleeding took place two months after an amputation of the leg, from a fistulous opening in the stump, in consequence of ulceration of one side of the popliteal artery. (See *Lçons Orales*, &c. t. iv. p. 426.) Now that the plan of covering the stump with sound skin is adopted, this kind of bleeding is less common than formerly. When the bleeding vessel is large, there is no chance of putting the patient out of danger, except by cutting down to the vessel, and tying it. The trunk of the vessel, however, may sometimes be more conveniently tied than the bleeding branch itself.

Mr. Hey mentions a particular sort of hemorrhage, after the operation: "I have seen," says he, "a few instances of the integuments becoming so contracted after the operation, as to compress the veins just above the extremity of the stump,

and bring on after some hours a copious hemorrhage. When it has appeared clear to me, that the hemorrhage was venous, I have made a division of integuments on one side of the thigh, sufficient to remove the stricture, and this method has immediately suppressed the hemorrhage." (P. 530. edit. 2.)

I have never met with a case, where hemorrhage was unequivocally produced by a contraction of the integuments. Dr. Hennen states, that he had seen only one example, and it was successfully treated by loosening the bandage, and moistening the dressings with cold water. (*On Military Surgery*, p. 264. ed. 2.) Here I infer from the mode of relief, that the cause was not the pressure of the integuments, but that of the roller on the veins.

In Mr. Guthrie's practical work, there are some excellent remarks on those hemorrhages, which in an irritable and sloughing state of a stump, frequently take place from the small branches, or from the main trunks of the arteries, in consequence of ulceration. It is (says he) not always easy to discover the bleeding vessel, or, when discovered, to secure it on the face of the stump; for, as the ulcerative process has not ceased, and the end of the artery, which is to be secured, is not sound, no healthy action takes place. The ligature very soon cuts its way through, or is thrown off, and the hemorrhage returns; or some other branch is opened, and another ligature is required, which is equally uncertain; and, under this succession of ligatures and hemorrhages, the patient dies. Here, cutting down to the principal artery, in preference to another amputation, has often succeeded, but, under certain circumstances, it fails, and amputation becomes ultimately necessary. At the same time it is allowed that this operation may also fail. On the whole, Mr. Guthrie professes himself to be an advocate in most cases for tying the artery in the first instance; and if this proceeding should not answer, he would then amputate. However, the practice of taking up the artery, he thinks, should not be adopted indiscriminately, the doctrines of aneurism not being here applicable, because there is a wounded vessel, with an external opening. "In the thigh, the operation is less certain than in the arm, and especially if it is not the main artery that bleeds; for, the branch from which the hemorrhage proceeds may come from the profunda, and tying the artery in the groin on such opinion would be doing a serious operation, and one which probably would not succeed; for, the anastomosing branches would restore the circulation in the stump in a short time, and again establish the bleeding. If it is the femoral artery that bleeds, and the ligature is applied high, it is very liable to a return of hemorrhage. To obviate these difficulties, the part from which the bleeding comes should be well studied, and the shortest distance from the stump carefully noted at which compression on the artery commands the bleeding; and, at the spot, the ligature should be applied, provided it is not within the sphere of the inflammation of the stump." (*On Gunshot Wounds*, p. 105, 106.) Thus far the advice seems to me correct and valuable; but, where the hemorrhage could be restrained by taking up the artery in the groin, though not lower down, I doubt the propriety of preferring amputation to this other less severe operation, provided the efficiency of a ligature above the profunda be proved, in the manner

judiciously recommended by Mr. Guthrie, viz. by means of pressure.

The following is the counsel offered by Mr. Hey: "When we are under the necessity of amputating a limb that has suffered great contusion, though the operation is performed upon a part apparently sound, the wound sometimes becomes sloughy and ill-conditioned. No good granulations arise to cover the extremities of the arteries; but the ligatures cut through these vessels, or, becoming loose, cease to make a sufficient pressure upon them, and hence repeated hemorrhage ensue. This is a dangerous state for a patient; for, if the vessels are taken up afresh with the needle, the hemorrhage will now and then return in the course of two or three days. In such cases the application of dry sponge, cut transversely, as directed by Mr. White (*Cases in Surgery*), has been found singularly useful, and has saved the life of the patient. But a constant pressure must be kept upon the pieces of sponge, by the fingers of a succession of assistants, till granulations begin to arise upon the stump, and the prospect of future hemorrhage disappears. This method is of the greatest importance after amputation on the thigh, or leg, where the great vessels are deeply seated. In the arm, above the elbow, where the vessels are more superficial, the great artery may be taken up, with a portion of muscular flesh, above the surface of the stump, by making first an incision through the integuments. My colleague, Mr. Logan, has done this twice within the last year, with complete success, when repeated ligatures, applied in the usual way, had failed.

"In the morbid sloughy state of the stump, above mentioned, the application of lint, soaked in a liquid, composed of equal quantities of lemon-juice and rectified spirit of wine, has been found very advantageous, and has caused it to put on soon a healthy aspect." (P. 536, 537. edit. 2.)

Inflammation and suppuration in the arteries of a stump have a particular tendency to loosen the clot in them, and thus produce secondary hemorrhage. Ulceration of an artery may also be excited by an inflammation, which keeps up suppuration directly around the vessel. At the period, when the ligatures are expected to be detached, the utmost vigilance should always be exerted to guard the patient from the risk of secondary hemorrhage. (See Dupuytren, *Leçons Orales* t. iv. p. 428.)

These kinds of secondary hemorrhage, as Baron Dupuytren justly observes, are much more difficult to stop, than such as come on immediately or soon after amputation. The cellular tissue is deprived of its natural suppleness and flexibility; and is so thickened and changed that every fresh ligature cuts through it. Generally, also, the direct application of a ligature to the bleeding part of the arteries is impracticable; because, as the coats of the vessel adhere to the neighbouring textures, it either cannot be taken hold of, or is torn with the least effort being made with the forceps to draw it out. As for permanent compression, this is frequently ineffectual, and attended with too much pain. Under these circumstances, it is better to expose and tie the principal artery at some distance above the stump. (*Op.* vol. i. cit. p. 429.) Thus, in a case of secondary hemorrhage after amputation of the leg, where the bleeding returned notwithstanding the repeated application of the ligature, and even the actual cautery, Baron Dupuy-

tren took up the femoral artery in the upper third of the thigh, and the result was perfectly successful. The same practice has succeeded with others. Mr. Liston informs us, that he has had recourse to it in many cases, and uniformly with success. (See *Elements*, part iii. p. 371.) This gentleman notices a kind of secondary hemorrhage, which does not consist in an arterial and rapid flow, but in a slow and continual oozing from the dark ulcerated cavities round the end of the bone. This case is ascribed by Mr. Liston to diseased action in the cancellated texture of the bone; and the treatment which he recommends is that of removing the coagula, filling the cavity with lint, and applying firm pressure. (See *Liston's Elem.* part iii. p. 372.)

ON PROTRUSION OF THE BONE

It appeared to M. Louis, that this disagreeable consequence may generally be prevented by taking care to divide the loose muscles first, and after their complete retraction, unresisted by any band or tourniquet, by observing to divide with a bistoury the muscles which adhere to the bone; namely, the cruralis, the vasti, and the adductors. By this method, the bone may be sawn three finger-breadths higher than it could be, if no attention were paid to beginning with the division of the loose muscles, and concluding with that of others attached to the bone. M. Louis argues, that the protrusion of the bones will never take place, so long as they are immediately encompassed with the fleshy substance of the muscles: this proposition is incontestable. But, with regard to another assertion that, whether the skin, saved by the operation, be long or short, is a circumstance that has no influence in preventing or promoting the protrusion, I believe that this part of his statement is less correct. (See *Mém. sur la Saille de l'Os après l'Amputation*, in *Mém. de l'Acad. de Chirurgie*, tom. v. p. 273. edit. in 12mo.) According to my own observation, one of the best-founded arguments in favour of flap amputation of the thigh is, that this method is attended with scarcely any risk of a subsequent protrusion of the bone.

As Mr. Guthrie has observed, a protrusion of the bone, after sloughing of the stump, or other accidental circumstances, will sometimes happen, without any fault on the part of the operator; but, he thinks, it may almost always be prevented by attention to the following rules:—1. To leave the integuments attached to the muscles, instead of turning them back. 2. When the muscles are cut through in a slanting direction, upwards and inwards, or even directly downwards, to separate them from the bone, so that it may appear at the bottom of the cone as a depressed point. 3. To cut the bone short, and to keep the thigh constantly bandaged from the trunk during the cure, so as to prevent the retraction of the muscles. If a surgeon and, directly after the operation, that the bone cannot be well covered, he should immediately saw off as much more of it as will reduce it to its proper length. The error may be remedied at this moment with very little inconvenience, in comparison with what must afterwards be encountered, if the opportunity be neglected. (*On Gunshot Wounds*, p. 109.) This last piece of advice perfectly agrees with the view which I entertain of the subject. For some useful directions how to bandage and support the soft parts with adhesive plasters, with the view of counteracting the tendency of the

bone to protrude, I refer to some observations by Mr. Wright. (See *Bromfield's Chir. Cases*, &c. vol. i. p. 177.)

Having explained, that the surest way of preventing the evil is either to perform the flap-amputation, or, if the circular, to save a sufficiency of muscle, especially of that muscular substance which is naturally most near and adherent to the bone, I shall next speak of the mode of relief.

When the end of the thigh-bone protrudes, it of course hinders cicatrization, and becomes itself affected with necrosis. By the process of exfoliation, the dead portion of bone is sometimes thrown off, and cure follows. But, in general, this desirable change is extremely tedious, and the result uncertain; because it frequently happens, that, after the piece of bone has separated, the rest yet projects too much, and the stump still continues too conical to heal firmly enough to be capable of bearing the pressure of a wooden leg. When, however, the end of the bone forms only a slight projection, and the stump is not too conical, it is always best to leave nature to throw off the redundant exfoliating portion. In the opposite circumstances, the removal of all such parts of it as cannot be covered by the integuments, is the best practice, and, if well executed, will effect a cure.

This second operation is exceedingly unpleasant to the surgeon, because patients are apt to suspect, and not without reason, that the first was not properly managed. Let me therefore repeat, that the surest way of avoiding the evil is to cut the deep muscles, rather higher than the superficial ones, as inculcated by M. Louis, by which means the bone will certainly lie within the level of the surface of the divided flesh. If the soft parts are found to be deficient, let another piece of the bone be exposed and sawn off at once, before the patient is removed from the operation table.

The second performance of amputation is a still more severe and unpleasant operation; yet, as Dr. Hennen has explained, it sometimes becomes necessary for osteosarcoma, extensive necrosis, abscesses of the medulla, unsuspected fissure, phagedæna, or great protrusion of bone, with an extensively diseased periosteum, where the powers of nature are inadequate to the cure. "If the general health is not impaired, and the flesh does not peel off from the bone, as if it were boiled, the efforts of nature may be trusted to, aided by proper bandaging, and, in some cases, by the employment of the saw, but, when restless nights, intense pain, flushings, and irregular bowels, with great tumefaction and hardness of the stump, take place, indicating approaching hectic, and there is evidence of an irregular action of the parts, osseous matter becoming deposited, and forming a distinct tumour around the stump, our best plan will be to operate again near the trunk." (*Principles of Military Surgery*, p. 266. ed. 2.)

OF NEUROMATA AFTER AMPUTATION.

Sometimes amputation has been found necessary a second time, in consequence of a morbid protuberance of the nerves of the stump, a change noticed by Molinelli, Morgagni, Lower, Arne-mann, and Prochaska, and always attended with excruciating pain and great irritability of the part, and sometimes with retraction of the skin, and protrusion of the bone. According to Mr. Liston, neuromata are more frequent after ampu-

tion of the arm and forearm, than other amputations. The disease seems to him, however, to be less common than formerly, which he refers partly to flap-amputations having been more extensively adopted, and partly to the method of tying arteries, so as to include nothing else in the ligation. In the forearm I have never seen a neuroma follow amputation, and yet almost all the operations were circular. Sir Astley Cooper, in his lectures, relates one instance of such a stump high up the arm, where, upon examination of the part near the axilla, a tumour was felt, which, when touched, made the patient jump, as if he had been electrified. In this case, as the bone protruded, amputation at the shoulder was performed. In another example, where a leg-stump was in a painful irritable state from a similar cause, Sir Astley Cooper effectually relieved the patient by removing the diseased end of the posterior tibial nerve. This plan should always be preferred to amputation when it presents any chance of being efficient. In a third instance, amputation was repeated at the patient's desire, and the nerves were found enlarged, forming a ganglion which partly rested upon the extremity of the bone. Such a degree of irritation had been produced by it, that no part of the stump could be touched without exciting a kind of electric shock. In a case that occurred in the Middlesex Hospital, amputation of the thigh was performed a second time, in consequence of the first stump being thus diseased. A complete ganglion, or plexus of nerves, was found closely adhering to the removed portion of bone, having almost the appearance of cartilage. The os tumori was of an unusually small size, but the linea aspera larger than natural. (See *Lancet*, vol. i. p. 115; vol. iii. p. 192.) In the same hospital, Mr. Mayo also amputated at the hip, on account of the extreme sufferings caused by a diseased state of the nerves of a thigh stump. — See *NEUROMA*. For some observations on the changes which occur in stumps after cicatrization, see *STUMPS*.

The following works may be consulted for information on diseases of the bones of stumps: *Bonn*, Thesaurus Ossium Morborum, Anst. 1758; *Wiedmann*, De Necrosi Ossium, Francoi. 1758; *Macdonald*, De Necrosi ac Allo, Edinb. 1759; the above mentioned Essays of M. Louis; *Léveillé*, Sur les Mal des Os après l'Amputation, Mém. de la Société d'Emulation, t. i. p. 148; *Van Hoon*, De us, qua in partibus membris, præsertim ossibus, amputatione vulnificatur, notanda sunt, Lugd. 1803; *Roux*, De la Résection des Os Malades, Paris, 1812; Mém. de Physiologie, Sc. par *Scarpia*, et *Léveillé*, Paris, 1804; *B Phillips* on Inflammation of the Medullary Membrane after Amputation, Lond. Med. Gaz. 1835:54; *Langstaff* on the Healthy and Morbid Conditions of Stumps, in Med. Chir. Trans. vol. xvi. *Cruikshank* on a Neuralgic Affection of Stumps, Lond. Med. Gaz. 325.

SPASMS OF THE STUMP.

Constitute another afflicting occurrence, as they put the patient to the greatest agony, tend to cause a protrusion of the bone, or sugar-loaf stump, and, in some cases, extend to the whole body, and ultimately prove fatal. But, this unfortunate affection, which was rather frequent after amputations performed in the ancient manner, is infinitely less so, after the modern improved plans of operating, tying the vessels, and dressing the wound. When, however, it does occur, the stump must be kept from starting, by binding it down with a broad band, placed across it a little way above the wound. The flesh is to be properly supported with a bandage applied from the pelvis downwards, and opium and the camphor mixture should be liberally exhibited. (*Encyclopédie Méthodique, Partie*

Chir. t. i. p. 93. *Latta's Surgery*, vol. iii. &c. Also *Liston's Elements*, part iii. p. 395.)

FLAP-AMPUTATION OF THE THIGH.

Although the majority of surgeons in England and France (see *Velpeau, Nouv. Élém. t. i. p. 510.*) regard the operation by a circular incision as the most eligible under ordinary circumstances, no doubt can exist about the preference which should be given to amputating with a flap, in particular examples. The choice, Dr. Bushe conceives, ought to depend on the state of the limb and nature of the malady. "One surgeon is so devoted to the double circular incision, that he performs no other (method), though his coadjutor in the same hospital is bigoted to the double-flap operation, and never amputates but after this manner. But the unprejudiced practitioner will look to the nature of the case, and adjust means accordingly." (*Lancet*, No. 246. p. 204.) Notwithstanding the profession of this doctrine, however, Dr. Bushe is in reality very partial to flap-amputations, affirming that there is only one part, viz. the upper third of the leg, where he would recommend the double circular incision to be preferred. (*Op. cit. p. 207.*) At the same time, he confesses that when the arm is much emaciated, and flaccid, Dupuytren's mode, with a single circular incision, is that to which he has himself given the preference. He admits, also, the frequency of tedious suppuration and sinuses after flap-amputations, which evils, however, he ascribes to the fault of making the flaps too long. (*Id. p. 206.*) Flap-amputation of the thigh occupies less time than the circular method, and, I believe, has the important advantage of being less exposed to the danger of a protrusion of the bone. Hence, whenever any reasons exist in the state of the parts, or the constitution, for apprehending that disagreeable occurrence, it should be preferred. An experienced military surgeon informs us, that, in the first years of his practice, he performed several amputations by the double incision, strictly according to the precepts of Sabatier, Desault, Pelletan, and Pott, but had the mortification to have three cases in which the bone protruded, though the greatest circumspection was used in the operation and after-treatment. Hence he was induced to make trial of the flap-amputation; and although he imitates O'Halloran in not attempting to bring the flaps close together for the first six or eight days, he reports that the stump is generally healed in twenty or thirty days, and exfoliations rarely happen, on account of the bone being so well covered. In short, he says, that this method is to be preferred to all others. (*J. B. Paroisse, Opu c. de Chir. p. 185—203. Paris, 1806.*) Mr. Syme also states, that though the flap-amputations seen by him have been numerous, he has never met with an instance of the bone protruding, or exfoliating after them. (*Ed. Journ.* vol. xiv. p. 38.)

Although surgeons differ on the question, whether flap-amputation of the thigh ought to be preferred, as the general practice, Desault's, or rather Vermeil's mode of operating, has certainly obtained the sanction of many respectable names. In Guy's Hospital, flap-amputation of the thigh seems now to be mostly preferred. The operation has been for many years past adopted by my friend Mr. Vincent in St. Bartholomew's Hospital; and it is the plan which is always followed by Mr. Liston in the North London Hospital. According to

the point of removal (says he), the direction of the flap varies. If, in operating high in the limb, the flaps be made laterally, there will be imminent risk of the bone protruding through the upper part of the wound; for the patient uniformly raises the stump towards his abdomen. No antagonist muscular power is left to oppose the action of the muscles inserted into the trochanter minor, and the elevation of the stump is involuntary: it always occurs to a remarkable extent in young persons. On this account, anterior and posterior flaps are here preferable to the lateral; for then the more the stump is raised the better is the end of the bone covered—the anterior flap folding over it. Transfixion is, therefore, made horizontally, and the posterior flap should be a little longer than the anterior. But, in the lower part of the limb, lateral flaps are not only not liable to the same objection, but preferable to the anterior and posterior. In the neighbourhood of the knee-joint, the soft parts consist almost entirely of ligamentous tissue on the fore and back part, and proper cushions can be obtained only from the sides. Transfixion is therefore made perpendicularly. Thus the bone will be well covered by parts likely soon to adhere," &c. (See *Liston's Elements*, part iii. p. 394.)

By Mr. Guthrie, the flap-operation is considered preferable to the circular incision at the upper part of the thigh, "as it permits the head of the bone to be removed, if found necessary, allows it to be examined and cut shorter with greater ease, and makes a much better covering afterwards." (*On Gunshot Wounds*, p. 200.)

In military surgery, flap-amputation of the thigh is often advantageous, because all the flesh on one side of the limb is frequently torn away, or left in so terribly a mangled state, as to be unfit for making a covering for the end of the bone. Here a flap, sufficient to cover the whole face of the stump should be saved from the sound flesh on the other side of the limb. When the surgeon chooses the flap-amputation, not from necessity, as under these last circumstances, and the flesh is sound all round the member, the best way is to save a flap on each side of the limb, by making two semicircular cuts, the convexities of which extend in a parallel manner forwards, and the terminations of which meet at the upper and lower surfaces of the limb. The skin is not to be at all dissected from the muscles, which are to be obliquely divided as high as the base of the flap on each side. However, though this is the best plan, particular cases may require a flap to be made from the anterior, or even the posterior side of the thigh. The latter method should never be followed, but from necessity. (See *Hey's Pract. Obs. in Surgery*, p. 531. ed. 2.)

According to Mr. Guthrie, the difference between the flap-operation, at the upper part of the thigh, and that at the hip, consists in its being done lower down, and in the flaps being saved more immediately from the external and internal sides of the thigh, the inner flap being the largest, in order to prevent the inconvenience which might arise from the external one being tightly stretched over the end of the bone. For the same reason, Mr. Guthrie also recommends the bone to be sawn off close to the lesser trochanter, even when the nature of the injury would allow of its being left an inch longer. (*On Gunshot Wounds*, p. 200.)

In the flap-amputation of the thigh, as originally

AMPUTATION.

practised by Vermales, the operator takes hold of the soft parts with his left hand, and draws them more or less away from the bone. He then introduces a long sharp-pointed knife down to the anterior surface of the femur, a few lines below the place where it is intended to apply the saw. The point is then conveyed close round the outer side of the bone, and pushed through the skin at the point of the back of the thigh exactly opposite that of its entrance. By cutting from above downwards, and from within outwards, the surgeon now forms the external flap, which should be three or four inches in length. It is to be held upwards by an assistant. The point of the knife is next brought to the front angle of the wound, and, while the soft parts are drawn inwards, it is to be carried close round the inner side of the femur, and pushed out at the posterior angle of the wound, without injuring the skin there, a second time. In this way a second flap is formed, of the same shape and length as the first. No retractor is necessary in this mode of amputating. Velpeau prefers making the external flap first, for two reasons: first, because the soft parts being less bulky on this side; it is proper to begin with saving a sufficiency of them, so that the flap may be equal in size to the other; and, secondly, because the femoral artery is not cut till the moment when the flap is completed, and the vessel may then be instantly secured without any previous pressure being made upon it in the groin. (*Velpeau, Nouv. Elém. de Méd. Opér. t. ii. p. 511.*) Flap-amputation of the thigh is varied by different operators, some making anterior and posterior flaps; and others, like Langenbeck, not transfixing the limb, but cutting down to the bone from without inwards. Transfixion seems to me to be recommended by the power, which it gives the surgeon of making with rapidity a capital flap.

Flap-amputation of the thigh, after the manner of Vermales, is preferred by Klein, Lisfranc, Liston, Syme, and many other modern surgeons. (See *Edinb. Med. and Surg. Journ.* vol. xiv. 36—46, &c.) Of seven cases, in which Klein adopted this method, the greater number were healed in ten days, and the rest in three weeks; and this success determined him in future always to practise it. After this mode, he finds there is no danger of the muscles retracting themselves, and the end of the bone protruding, even though the patient be transported from one place to another. With respect to the occasional difficulty of taking up the obliquely cut vessels, Klein admits this objection, but thinks that it equally applies to Alanson's method. He lays great stress on the utility of giving due support to the flaps with compresses and a roller. (See *Practische Ansichten der bedeutendsten chirurgischen Operationen*, p. 35—38. 4to. Stuttgart, 1816.)

If the state of the integuments did not admit of two flaps being made, a single one might be formed on the inner or outer side, the front, or the back part of the limb, according to circumstances. MM. Hello and Foully commonly prefer making only one flap from the anterior soft parts, a method which seems to M. Velpeau to have the advantage of more certainty, than any other plan, of preventing the protrusion of the bone, because the flap is kept over the whole extent of the wound by its own weight. Yet, he is disposed to believe the circular method, when well performed, preferable to all these modifications, which he would employ

only as exceptions to it. (*Nouv. Elém. de Méd. Opér. t. i. p. 512.*)

In one instance, where a bull had broken the upper third of the femur, and mortification had spread so far towards the great trochanter and buttock, that it was impossible to operate, except by the flap-operation, or by taking the head of the bone out of the joint, Klein made a broad flap six inches long at the inner and upper part of the thigh, and then he cut the soft parts straight across just below the great trochanter, so as to make this wound meet the termination of the incision, by which the inner flap was formed. This patient got perfectly well in three weeks (*Op. cit. p. 39.*); and so did another very similar case, operated upon by the same gentleman. (*P. 43.*) Where the bleeding is considerable, the femoral artery and profunda should be tied previously to sawing the bone; but, if the vessels are well commanded by the pressure, the sawing ought to be first completed.

In the middle of the thigh, Lisfranc prefers amputating with two lateral flaps; pressure is made on the femoral artery as it passes over the brim of the pelvis; and the vessel is tied immediately the inner flap is formed. Lisfranc makes the flaps with a long narrow two-edged knife, which is introduced through the limb on each side, and then cuts obliquely outward and downward with it; but, I think Mr. Syme is right in recommending the knife used by Mr. Liston, and the back of which is thin and blunt, except for an inch from the point. (*Ed. Med. Surg. Journ.* vol. xiv. p. 37.) Mr. Hey likewise preferred a knife with a blunt back, lest the vessels should be cut with it in a way that would render the securing of them troublesome.

AMPUTATION BELOW THE KNEE.

In treating of amputation of the thigh, I have remarked, that as much of the limb as possible should be preserved. The longer it is after the operation, the stronger and more useful will it be found. But, when the leg is to be amputated, the operation is usually done a little way below the knee, even though the disease, for which the limb is removed, may be situated in the foot, or ankle, and would allow the operation to be done much further down. The common practice is to make the incision through the integuments, just low enough to enable the operator to saw the bones, about four inches below the lowest part of the patella. This is termed the place of election. About six inches below this point is generally an eligible place for the first circular cut through the skin. This plan is followed, in order not to deprive the stump of that power of motion, which arises from the flexor tendons of the leg continuing undivided. It is alleged also as a reason for this mode of proceeding, that it is quite sufficient to preserve a few inches of the leg, in order to afford the body a proper surface of support, in walking with a wooden leg; whereas, if a larger portion were saved, the superfluous part would be a great inconvenience both in walking and sitting down, without being of the smallest utility in any respect whatever. However, as I shall presently notice, experience proves that where, according to these maxims, an injury, or disease, would dictate the performance of amputation above the knee, the practice of amputating below this joint, but much

higher than is generally sanctioned, may be followed with advantage.

The tourniquet should be applied to the femoral artery, about two-thirds of the way down the thigh, just before the vessel perforates the tendon of the adductor magnus. This place is more convenient than the ham, where it is difficult to compress the vessel against the bone. The patient is to be placed upon a firm table, as in amputation of the thigh; the sound limb fastened with a band to the nearest leg of the table; and the leg which is about to be removed, being properly held by one assistant, while the integuments are drawn upward by another, the surgeon, with one quick stroke of the knife, is to make a circular incision through the integuments all round the limb. Some recommend the operator to stand on the inside of the leg, in order that he may be able to saw both bones at once. This is the old manner, which is still very generally followed. Many suppose that it diminishes the chance of the fibula being splintered, which is completely divided rather sooner, than the tibia. But splintering the bones generally arises from the assistant depressing the limb too much, or the surgeon pressing too heavily on the saw. If this mismanagement were to occur, it would be difficult to explain why the tibia should not be splintered instead of the fibula, when a certain thickness of it had been sawn through. Le Dran long ago remarked, that the surgeon might deviate from this custom without danger, and even sometimes with advantage. At the same time, it must be admitted that, if the surgeon prefer standing on the inside of the limb, there is no objection to it at the time of using the saw; but, before this period, in amputating the right leg, there is great convenience in having the left hand next to the wound, as is the case when the surgeon stands on the outside of the right limb. Hence some surgeons cut the soft parts of the right limb while they stand on the outside of the limb; and having done this part of the operation, they proceed to the other side of the member for the purpose of applying the saw. I believe that no particular reason exists against sawing the two bones together, yet in such manner as to let the fibula be first divided entirely through. The advantage of fixing this bone against the tibia by the pressure of the hands of the assistants, while the surgeon is sawing it, is a circumstance which influences many writers to commend the latter plan. Graefe, who prefers the true flap-operation, does not think it advisable for the surgeon to stand on the inside of the limb in his method of operating, because, when the knife is introduced through the muscles of the calf, its point would be apt to go between the two bones. (*Normen für die Abl. grösserer Gliedm.* p. 130.) And, instead of the old maxim, that the operator should always stand on the outer side of the limb, Velpeau considers that it would be a better rule to let the surgeon's position be such as will constantly enable him to take hold of the limb below the knee with his left hand. This is the plan, to which he has for a long while conformed. (*Nouv. Elém. &c.* t. i. p. 464.)

A circular cut having been made through the integuments, about two inches below the place where it is intended to saw the bones, the next object is to preserve skin enough to cover the front of the tibia, and the part of the stump, corresponding to the situation of the tibia anticus,

extensor longus pollicis pedis, and other muscles, between the tibia and fibula and those covering the latter bone. Throughout this extent, there are no bulky muscles which can be made very serviceable in covering the end of the stump, and consequently the operator must take care to preserve sufficient skin in this situation, by dissecting it from the parts beneath, and turning it up.

On the back part of the leg, on the contrary, the skin should never be uselessly detached to a great extent from the large gastrocnemius muscle, which, with the soleus, will here form a sufficient mass for covering the stump. However, the experience which I had in the army taught me the truth of a remark made by Graefe, that, in forming the posterior flap of muscle, it is a matter of the highest importance to let the integuments be somewhat longer than it; for, otherwise, when it is turned forward, as it must be for the purpose of covering the ends of the bones, its front edge will be left uncovered by integuments, which, being the outermost, describe a greater circumference than the deeper muscular flap. (*Normen für die Abl. grösserer Gliedm.* p. 131.) My friend, Mr. Langstaff, also bears witness to the same fact, where he observes; "When the circular incision has been employed, I have seen the woful effects that have ensued from the union having been prevented by leaving too much muscle; and it is injurious by impeding the adhesive process, the absorbents having to remove the unnecessary parts off the muscles, before this process can be established." (*Langstaff on the Healthy and Morbid Conditions of Stumps, Med. Chir. Trans.* vol. xvi. p. 152.) I was fully convinced of the truth of these observations, by two amputations which were done by myself, one in the neighbourhood of Antwerp, in 1814, and the other at Brussels, the day after the battle of Waterloo. Yet Graefe, who performs the flap-amputation, strictly so called, (that is to say, the operation in which a flap of skin, corresponding in shape to the flap of muscle, is preserved,) does not himself detach the skin from the muscles of the calf at all, but, at the time of making the incision in that situation directs one assistant to pull up the integuments, while another bends the foot as much as possible, which manœuvres have the effect of letting the muscles be cut rather shorter than the skin. Unfortunately, however, in many cases, the very nature of the disease, or injury, for which the operation is performed, would not admit of these proceedings. Nor, in a very muscular limb, would they be likely to suffice, as Graefe himself confesses, since, in such cases, he recommends the use of a knife bent laterally, for the purpose of excavating, as it were, the thick muscular flap, as the incision is made. (*Op. cit.* p. 134.) In the common method, with the circular incision, I am disposed to think it best, therefore, when the calf is bulky, to let a small quantity of skin be detached and saved at the back part of the leg, so that there may be a certainty of having enough to cover well the extremity of the divided gastrocnemius. As soon as the skin has been separated in front, and on the outside of the leg, the surgeon is to detach the skin from the calf for about an inch; and having reflected or drawn this preserved portion out of the way, he is to place the edge of the knife close to the edge of the retracted or reflected skin at the back of the limb, and cut

obliquely upwards through the muscles of the calf, from the inner edge of the tibia quite across the fibula, supposing the operator to be on the outside of the right leg, and that it is this member which is undergoing removal. In performing this last incision, as M. Louis well observes, it is essential to incline the edge of the knife obliquely upwards. Thus, the skin will be longer than the muscles, and the cure accelerated. (*Mém. de l'Acad. de Chir.* t. v. edit. in 12mo.)

In the leg, the necessity of dissecting the skin from the subjacent parts is acknowledged to be greater than in the thigh: thus, Mr. Guthrie says, "As the attachment of the skin to the bone will not readily allow of its retraction, it must be dissected back all round, and separated from the fascia, the division of which in the first incision would avail nothing, from its strong attachment to the parts beneath." (*On Gunshot Wounds*, p. 220.) In dissecting the skin, however, a much greater detachment of it should be made at the front and outer part of the limb than at the opposite points, as already explained.

The flap, formed of the integuments and muscles of the calf, is then to be held back by one of the assistants, while the surgeon completes the division of the rest of the muscles, together with that of the interosseous ligament, by means of the catling, a kind of long, narrow, double-edged knife.

In amputating below the knee, very particular care must be taken to cut every fasciculus of muscular fibres, before the saw is used. Every part, except the bones, being divided, the soft parts are next to be protected from the teeth of the saw by a linen retractor, made with two slits to receive the two bones, care being taken to let the unslit part be applied to the muscles of the calf, as particularly advised by Gracfe. (*Op. cit.* p. 136.)

Reckoning from before backward, the arteries requiring ligatures are — 1st, The anterior tibial, which lies close to the nerve, and in front of the interosseous ligament. 2dly, The posterior tibial, with the nerve on its fibular side. 3dly, The peroneal: both these arteries being situated behind, between the soleus and the deep stratum of muscles,—the posterior tibial behind the external edge of the tibia, on the posterior surface of the flexor communis digitorum pedis, and the tibialis posterior; the peroneal behind the fibula, amongst the fibres of the long flexor of the great toe. 4thly, Sometimes two or more branches in the calf, termed sural. 5thly. Now and then the nutrient artery of the fibula. Frequently the anterior tibial artery retracts so far that it cannot be taken up, without first dividing the soft parts concealing it. The occurrence is ascribed by M. Ribes to the double curve which the artery describes to get in front of the interosseous ligament; by M. Gensoul, to the retraction of the artery exceeding that of the muscles which adhere to the bone; and by M. Sedillot, to the irregular division of the soft parts between the bone. (See J. F. Malgaigne, *Manuel de Méd. Opér.* p. 287.) Hence, he recommends the incision through the soft parts in the interosseous space never to be commenced, until the exact point where the bones are to be divided has been determined. A transverse cut is now made through the periosteum, on the inner surface of the tibia; and, supposing the operator to be standing on the

outside of the limb, he next applies the edge of the knife, with the point downwards, to the outer side of the fibula, at the same height; and drawing it towards himself, cuts the peroneus longus, the extensor digitorum communis, the tibialis anticus, and at the same time the anterior tibial artery and interosseous ligament. The divided soft parts are gently drawn downwards, the point of the knife passed into the interspace from behind, and the division of the fleshy fibres in this direction completed by directing the knife towards the tibia and fibula. I am of opinion that the objection made by M. Malgaigne to the part of M. Sedillot's plan which consists in cutting the bones and muscles on the same level, is well founded; viz. the muscles will always retract in some degree, and leave the bone projecting.

When the soft parts have been cut, the bones sawn, and the arteries tied, the wound is to be closed by bringing the flap of skin over the front and external part of the stump, so as to meet the flap composed of the gastrocnemius, soleus, and integuments on the opposite side. This should be done, without letting any tight strap of plaster press the skin against the sharp edge of the tibia; a serious and hurtful practice, which has often occasioned ulceration and sloughing of the integuments, and protrusion and necrosis of the bone. It is this danger which leads Mr. Guthrie to prefer closing the wound vertically, or nearly so, and applying the adhesive straps from side to side. (*On Gunshot Wounds*, p. 221.) I think, however, the above mode of operating almost necessarily requires the wound to be closed, so as to form a line, extending in a direction from the tibia to the fibula, or in the direction of the greatest osseous diameter of the limb, as generally preferred in France. (See Richerand, *Nosogr.*; and J. F. Malgaigne, *Manuel de Méd. Opér.* p. 292.) But where a great deal of skin is saved all round the limb, and the muscles of the calf are not closely calculated upon for covering the bones, the perpendicular line of the wound will answer very well.

Many surgeons, however, operate differently. They first make the circular incision through the skin, two inches below where they mean to saw the bones. They next detach the skin from the muscles and bones equally all round the limb, to the extent of about a couple of inches. The integuments are then turned up, and a division of the muscles made all round down to the bones, on a level with the line where the detachment of the skin has terminated. The parts between the bones are afterwards cut through, &c. The hemorrhage having been stopped, the integuments are drawn down over the stump, and the line of the wound made either transverse or perpendicular.

The practice is sometimes adopted of sawing off the sharp upper ridge of the tibia. It is advocated by A. C. Hutchinson, Marjolin, and Ballard. It has the sanction of Mr. Guthrie, who says, that, in thin persons, where the spine of the tibia is very sharp, this part should be removed with the saw. (P. 222.) In France, the removal of the front angle of the tibia is generally approved. (J. F. Malgaigne, *Op. cit.* p. 291.)

Occasionally, surgeons have also removed the small remnant of the fibula, and such was sometimes the practice of Larrey, when he amputated nearer the knee than common. (*Mém. de Chir.*

Mil. t. iii. p. 389.) This plan, however, is objectionable, as will be hereafter explained.

By some surgeons of repute, the above plan of amputating the leg so high up, when the foot or ankle is the part diseased or injured, has been condemned. It was strongly disapproved of by Solingen, towards the close of the sixteenth century. His precept was, that the leg, like the forearm, ought to be amputated as low as possible, and the patient furnished with a suitable mechanical contrivance, on which he would be able to walk exceedingly well. Dionis was nearly in the same way of thinking upon this subject as Solingen. The opinions of these surgeons, however, had fallen into such oblivion by the middle of the seventeenth century, that Ravaton, White, and Bromfield severally imagined, that they were the first inventors of amputations low down the leg.

Mr. White, of Manchester, in a paper dated 1769 (*Med. Obs. and Inq.* vol. iv.), informs us, that he took the hint to amputate a little above the ankle, from seeing a case in which this had been done by a simple incision, with such success that the patient could walk extremely well, though with a machine that was very badly constructed. After this, Mr. White began to operate above the ankle with the double incision; and he invented a machine, much better calculated for the patient to walk upon.

In 1773, Mr. Bromfield published his *Chirurgical Cases and Obs.*, wherein he mentions his having begun, about the year 1740, to amputate above the ankle, in a case of a gangrene of the foot. The patient walked so well, with the aid of a simple machine, both along a level surface, and in going up and down stairs, that it was difficult to perceive he had lost his foot. Mr. Bromfield was persuaded, however, to give up this practice, until he learned that, in 1754, a Mr. Wright had thrice amputated in this way with success, when he again had recourse to it, without the least unpleasant consequences. (See vol. i. p. 189, &c.) Of late, the method has been revived by Vacca, Brünnighausen, and Soulera, and is even sanctioned by Velpeau, under particular circumstances, as where the patient is not obliged to walk a great deal, or is very desirous of not letting it be seen that he has lost any part of the limb. (See *Velpeau, Nouv. Elém.* t. i. p. 480.) Velpeau recommends cutting the skin in such a manner that the cicatrix may be situated behind and not in the centre of the stump. But, as Malgaigne observes, the delicate skin in this place would hardly be capable of bearing the pressure of the kind of short boot on which the patient would have to walk. (See *Malgaigne, Manuel de Méd. Opér.* p. 294.) He prefers, therefore, amputating at the place of election, except when the operation is practicable at the ankle-joint.

The advantage of amputating a little below the knee, is, that the pressure in walking with a wooden leg is entirely confined to the front of the limb, the cicatrix itself not being subjected to irritation. After amputating at the ankle, the pressure in walking operates directly on the cicatrix. According to Sabatier, this last plan has been extensively tried in France, but not found to answer, the stump being incapable of bearing pressure, and not continuing healed. (*Médecin. Opératoire*, t. iii. p. 377, edit. 2.) The same author refers to

some instances, in which the patients were obliged, under these circumstances, to undergo amputation a second time; an observation made as long ago as the time of Paré. Baron Larrey speaks of the method as an objectionable operation, not merely because some patients, as, for instance, soldiers, have not the means of providing themselves with artificial legs of the above description, but because it is almost always followed by bad symptoms, owing to the small quantity of cellular substance and flesh, and the thickness of the bone at this part of the leg, whereby cicatrization is impeded. A nervous irritation is more apt to be produced by this than the common mode of operating, and the suppuration, which is always sanious, takes place with difficulty. "I have (says Larrey) seen many amputations done at this part; but nearly all the patients died of nervous fever, or tetanus." (*Mém. de Chir. Mil. t. iii. p. 394.*) Mr. Liston also pronounces the operation near the ankle to be inadmissible, because a sufficiency of soft parts for the protection of the stump cannot be obtained below the calf. The place for incision, he observes, is consequently limited to two points,—either immediately below the tuberosity of the tibia, or in the bellies of the gastrocnemii. The former situation he prefers in hospital practice, and among the lower orders generally; the latter in the better classes of society, who can afford to purchase an expensive artificial support. (*Elements, &c.* part iii. p. 391.)

In flap-amputations below the knee, Alanson and Lucas conjectured, that the cure might be rendered more safe, easy, and expeditious, by applying the flap, with the view of uniting it by the first intention.

The following case explains Mr. Alanson's flap-operation:—The disease was in the left leg; the patient, therefore, lay upon his right side, upon a table of convenient height, so as to turn the part to be first cut fully into view. The intended line, where the knife was to pass in forming the flap, had been previously marked out with ink. A longitudinal incision was made with a common scalpel, about the middle of the side of the leg; first on the outside, then on the inside, and across the tendo Achillis: hence, the intended flap was formed, first by incisions through the skin and adipose membrane, and then completed by pushing a catling through the muscular parts in the upper incised point, and afterwards carrying it out below, in the direction of the line already mentioned. The flap was thick, containing the whole substance of the tendo Achillis. The usual double incision was made; the retractor applied to defend the soft parts; and the bone divided, as high as possible, with the saw.

The flap was placed in contact with the naked stump, and retained there, at first, by three superficial stitches, between which adhesive plasters were used. Notwithstanding the patient caught an infectious fever a few days afterwards, the stump healed in three weeks, except half an inch at the inner angle, where the principal vent had been. In another week, the wound was reduced to a spongy substance, about the size of a split pea. This, being touched with caustic, healed in a few days. The man was soon able to use an artificial leg, with which he walked remarkably well. He went several voyages to sea, and did his business with great activity. He bore the pressure of the

machine-totally upon the end of the stump, and was not troubled with the least excoriation or soreness.

In the next instance, in which Mr. Alanson operated, he formed the flap by pushing a double-edged knife through the leg, and passing it downwards and then outwards, in a line, first marked out for the direction of the knife. In this way, the flap was more quickly made.

The leg should be completely extended during the operation; and kept in that posture till the wound is perfectly healed.

Notwithstanding Mr. Alanson's favourable report of the first of these amputations low down the leg, I fully coincide with my colleague, Mr. Liston, that the method should be abandoned; for I have known several persons, whose stumps, formed in this manner, were never capable of bearing pressure. For authorities in support of this statement, I may also refer to Paré, Sabatier, and Velpeau. (*Nouv. Élém. de Méd. Opér.* t. i. p. 479.)

I will next notice Mr. Hey's method. He was satisfied, that very near the ankle was not the proper place for this kind of amputation.

Some cases occurring, in which, from a scrofulous habit, the stump would not heal completely, nor remain healed, Mr. Hey determined to try whether amputation, in a more muscular part, would not secure a complete healing, and give the patient an opportunity of resting his knee on the common wooden leg, or using a socket, as he might find it most convenient. Mr. Hey latterly preferred this method, which he reduced to certain measures.

It had been customary, at the Leeds Infirmary, to make the length of the flap equal to one third of the circumference of the leg. This was determined by the eye of the operator, who usually pushed the cutting through the leg, near the posterior part of the fibula. Mr. Hey, finding the flap was not always of the proper breadth, began to determine this by measure, and then operated as follows:—To ascertain the place where the bones are to be sawn, together with the length and breadth of the flap, he draws upon the limb five lines, three circular, and two longitudinal ones. He first measures the length of the leg from the highest part of the tibia to the middle of the inferior protuberance of the fibula. At the mid-point, between the knee and ankle, he makes the first or highest circular mark upon the leg. Here the bones are to be sawn. Here also Mr. Hey measures the circumference of the leg, and thence determines the length and breadth of the flap, each of which is to be equal to one-third of the circumference. Mr. Hey takes a piece of marked tape, or riband, and places one end of it on the front edge of the tibia. Supposing the circumference to be twelve inches, he makes a dot in the circular mark on each side of the leg, four inches from the anterior edge of the tibia. These dots must, of course, be four inches apart behind. From each of these dots Mr. Hey draws a straight line downwards, four inches in length, and parallel to the front edge of the tibia. These lines show the direction which the cutting is to take in making the flap. At the termination of these lines, Mr. Hey makes a second mark round the limb, to show the place where the flap is to end. Lastly, a third circular mark is to be made, an inch below the

upper one, first made for the purpose of directing the circular cut through the integuments, in front of the limb. The cutting, for making the flap, should be longer than those commonly employed in amputations. Mr. Hey uses one which is seven inches long in the blade, and blunt at the back, to avoid making any longitudinal wound of the arteries, which is very difficult to close with a ligature; and, for the same reason, he pushes the cutting through the leg a little below the place where such muscles are to be divided as are not included in the flap; the limb being nearly horizontal, and the fibula upward, he pushes the cutting through the leg, where the dot was made, and carries it downward along the longitudinal mark, till it approaches the lowest circular mark, a little below which the instrument is brought out. The flap being held back, Mr. Hey divides the integuments on the front of the limb along the course of the second circular mark. The muscles not included in the flap are then divided a little below the place where the bones are to be sawn. No great quantity of these muscles can be saved, nor is it necessary, as the flap contains a sufficient portion of the gastrocnemius and soleus muscles to make a cushion for the ends of the bones. After sawing the bones, Mr. Hey advises a little of the end of the tendon of the gastrocnemius to be cut off, as it is apt to project beyond the skin, when the flap is put down; and he recommends the posterior tibial nerve, when found on the inner surface of the flap, to be dissected out, lest it should suffer compression.

As strips of adhesive plaster cause great pressure on the end of the stump, Mr. Hey prefers sutures for keeping the flap applied; small strips of court plaster being put between the ligatures.

Sir Charles Bell proposed another sort of flap-amputation. The operation is not to be done so low, as there will not be a sufficiency of muscle to cover the end of the bones. An oblique cut is to be made, with the large amputating knife, upward, through the skin of the back part of the leg. The assistant is to draw up the skin, and the knife is to be again applied to the upper margin of the wound, and carried obliquely upward till it reaches the bones. The knife, without being withdrawn, is next to be carried, in a circular direction, over the tibia and fascia, covering the tibialis anticus, until it meets the angle of the first incision on the outside of the limb. The surgeon is then to pierce the interosseous membrane, &c. The sawing being completed, and the arteries secured, the flap is laid down, and the integuments of the two sides of the wound will be found to meet. (*Operative Surgery*, vol. i.) Langenbeck disapproves of the plan of pushing the knife through the calf of the leg, as practised by Alanson, Hey, Græfe, Liston, Lisfranc, Syme, &c., because an inexperienced surgeon may run the point between the two bones, and in this way the wound is never made evenly. His manner of forming the flap is very similar to Sir C. Bell's, except that he first makes three cuts in the integuments, two longitudinal and one transverse, by which the shape of the flap of skin is determined. (*Bibl. für die Chir.* b. i. p. 571.)

Mr. Liston's mode of amputating with an anterior and a posterior flap below the knee, is the most simple and expeditious of all the plans with which I am acquainted, and, what is still of greater importance, forms an excellent stump. I will introduce the description of it, after noticing Lar-

rey's proposal, that amputation may often be done with advantage much nearer to the knee than the usual place; a doctrine which is now generally acknowledged to be correct, and the truth of which is confirmed by the results of Mr. Liston's practice.

Flap-amputation of the leg, I mean that operation in which a flap both of skin and muscle is preserved, is often considered more painful than the common method. Yet, when we come to see what respectable names are recorded in its favour, how soon the stump frequently heals, how well the ends of the bones are covered, and how all dissection of the integuments from the fascia is avoided in this mode of operating, at least as far as the flap extends, the method must be allowed to possess weighty recommendations. Indeed, in its present improved state, and with the peculiar fitness of such a stump for adhesion, this operation, I think, is again rather rising in the estimation of the profession. In 1816, Klein had performed flap-amputation of the leg about twenty times. If the flap should happen to be made too large, he particularly dwells on the propriety of removing part of it at once; and, when it is too short, he enjoins carrying the incision a little further upwards without delay. He confesses that the plan is attended with some little trouble in securing the interosseous arteries, which are apt to retract considerably; but, such has been the success of his practice, that out of twenty cases seventeen got well, and most of them very soon, without the least exfoliation, and the other three died of typhus. (*Practische Ansichten der bedeutendsten Chir. Op.* 1ste Heft, p. 47.) In the same work, this experienced surgeon, convinced how much more quickly and certainly the wound heals after amputations with two flaps, than those with one, has suggested a plan of amputating below the knee, so as to form two lateral flaps. On the other hand, as already mentioned, it is only in amputating below the knee, that Dr. Bushe conceives the circular incision decidedly preferable to the flap-operation. He "never saw a case, where a flap was formed from the calf of the leg, in which considerable retraction of the remaining muscles did not ensue, attended with great induration of the flap, separation of its edge from the skin on the front of the tibia, sometimes exfoliation of the bone, and generally tedious suppuration." (*Lancet*, No. 246. p. 208.)

The principal reasons have already been specified for the general custom of amputating the leg about four inches below the patella; and if the disease or injury will not admit of the operation being done thus low, of removing the limb above the knee-joint. In the Egyptian campaign, however, Baron Larrey performed two amputations very near the knee-joint, almost on a level with the head of the fibula, which he judged proper to extirpate. The successful result of these operations dispelled the fear, which this experienced surgeon previously entertained, about amputating in the thick part of the upper head of the tibia; for no caries of this spongy portion of the bone, no bad effects on the knee-joint, and no anchylosis of the stump ensued; and with the difference of a few days, the wound healed as readily as that made in the common place of election, *viz.* three or four finger-breadths below the tuberosity of the tibia. Since the above mentioned campaign,

Larrey has adopted this practice in many cases, where it was impossible to have operated at the usual place; and he assures us, the success fully equalled what attends operations done at the ordinary distance from the knee. In 1806, another French military surgeon, who had tried this method himself, published a dissertation, in which he commended operating, where circumstances required it, much higher than the point allowed by generally received rules. Larrey differs, however, from Garrigues, in forbidding amputation higher than the level of the tuberosity of the tibia, the thick portion of which may be sawn, but not above the insertion of the tendon of the patella. A transverse line, drawn from this point, usually passes below the articulation of the fibula, and over the lower portion of the uppermost part of the condyles of the tibia; but, as the relative positions of the heads of the two bones to each other differ somewhat in different individuals, Larrey makes the tuberosity of the tibia the point above which the bone should never be sawn. By cutting higher, the ligament of the patella is separated from its insertion; the bursa mucosa, situated underneath it, is wounded, and the ligaments at the sides of the joint are injured; whence arise retraction of the patella, effusion of the synovia, and such disease of the knee-joint as may render another amputation indispensable. By making the division on a level with the tuberosity of the tibia, the attachment of the ligament of the patella is preserved, as well as that of the flexor tendons of the leg, which are requisite for the motion of the stump. The bursa mucosa is left untouched; and the head of the bone is sawn low enough to avoid creating a risk of caries. But, says Larrey, if this mode of amputating below the knee be compared with amputation of the thigh, as recommended by authors for the cases in which the new method is proposed, the advantages of the latter are considerable. In the first place, life is less endangered, because a smaller portion of the body is removed. The operation is as easy in one situation as the other. The stumps heal with equal facility. Larrey has never seen the spongy part of the tibia become carious, nor perceptibly exfoliate. When the remaining portion of the fibula is very short, as usually happens, he recommends it to be taken away, as it is an useless body, inconvenient for the employment of a wooden leg. He directs as much skin as possible to be preserved, and a perpendicular incision, through that part of it which covers the tibia, in order to hinder the bone from making its way through it by ulceration.

With a stump thus formed, comprising the knee and one or two finger-breadths of the leg, the patient has a firm point of support, on which he can securely walk without a stick. The stump admits also of an artificial leg of the natural shape being worn, the knee being always bent, provided the length of the stump do not exceed the diameter of the calf of the artificial limb. (*Mém. de Chir. Mil.* t. iii. p. 386—384.) Again a passage, quoted by Mr. Guthrie, it would seem that Mr. Bromfield (*Chir. Obs. and Cases*, vol. i. p. 185.) advised amputating as near to the knee as could be done, without risk of cutting the ligament of the patella, so that the stump might not extend beyond the wooden leg. On the whole, Mr. Guthrie's own observations are favourable to this

practice; but he candidly acknowledges his belief, that "it would not succeed when indiscriminately done in the hospitals of large cities," though it may frequently be practised in the army with advantage, provided the surgeon saw through the tibia below its tuberosity. (*On Gunshot Wounds*, p. 223. and 227.) Upon looking over the details of the cases recorded by Larrey in confirmation of the above statement, I was struck with one important fact, which does not justify a part of his commendations; viz. most of the stumps were above four months in healing; and that which healed most quickly was not well before the sixty-eighth day. (See *Mém. de Chir. Mil.* t. iii. p. 57. 397, 398, &c.) Hence, unless it be supposed, that the wounds, produced by amputation below the knee in the ordinary manner, are generally thus long in healing, as treated by the French surgeons, the inference is rather unfavourable to the method so highly commended by Larrey.

One advantage of this operation is, that frequently only the popliteal artery requires a ligature, this vessel not dividing till lower down. Before adjusting the flaps, Mr. Liston sometimes cuts off the sharp anterior edge of the tibia with the pliers, for the purpose of preventing it from injuring the integuments. Mr. Liston objects to Larrey's method of cutting away the head of the fibula, because, in several cases where he tried it, a discharge of synovial fluid occurred on the second day, followed by profuse long-continued suppuration. In more than one case, the joint became ankylosed, and one patient died from the copiousness of the discharge. Mr. Liston found, from repeated examination of the parts in the dead subject, that, in cutting out the head of the fibula, the capsular ligament was wounded, or the bursal cavity beneath the popliteus muscle, communicating with that of the knee-joint. (*Elements*, part iii. p. 391—393.) If the tibia were affected very high up, the operation may sometimes yet be done.

When the patient cannot afford to purchase expensive artificial contrivances to walk upon, Mr. Liston always amputates immediately below the tuberosity of the tibia. If the right leg is to be removed, he places himself on its inner side, and grasps the lower part of the limb with his left hand, an assistant supporting the foot at a proper height. The knife is introduced over the outer side of the fibula, and carried upwards along that bone, for an inch and a half or two inches. It is then brought across the limb in a semi-circular direction; and as soon as it reaches the inner and lower part at the tibia, transfixion is performed by pushing the knife across the posterior surface of the bone, and out at the upper part of the fibular incision. By then carrying the knife downwards, a posterior flap is formed sufficient to cover the bones. The integuments on the fore-part are then dissected upwards a little, with the same knife, so as to form a small semilunar flap. The muscles in the interosseous space are next cut through, and the knife carried round the bones in order to divide the soft parts. Yet for patients who can afford more expensive artificial substitute for the lower part of the limb, and in whom a less efficient, though more handsome, contrivance is preferred, Mr. Liston amputates in the middle of the leg. The same directions apply to this operation as to that immediately below the knee, and the attachment of the ligament of the pa-

tella is left uninjured, by sawing the tibia obliquely upwards and backwards. (See *J. F. Malgaigne*, *Op.* cit. p. 295.) Indeed, as this author particularly remarks, the exact situation of the tuberosity of the tibia should always be precisely ascertained before the operation is begun, so as to avoid cutting through the insertion of the ligament of the patella, and opening the synovial membrane behind it. The tibial tuberosity presents a triangular surface, the inferior angle of which is continuous with the crista of the tibia. As the ligament of the patella is inserted into the whole of the triangular surface, J. F. Malgaigne sanctions, where circumstances call for it, a bold division of it nearly as high as its base, the remaining connection of the patella with the tibia by the latter part being sufficient. I fear this plan would too often be followed by injuries and disease of the knee-joint, to merit adoption.

OF THE OBLIQUE OR OVAL AMPUTATION OF THE LEG.

The method adopted by M. Sedillot consists in dividing the integuments on the outer side of the leg obliquely, from before backwards, and from below upwards. The knife is then carried round the posterior part of the limb to its inner side from behind forwards, and from above downwards. The division of the integuments is next completed in front by a transverse incision, leaving an oval wound, with its anterior angle truncated.

The only difference in the process of M. Baudens from that of M. Sedillot, consists in making the incision through the skin entirely oval, and letting the knife descend about an inch lower down in front than behind.

"One reason," says M. Malgaigne, "not mentioned by any writer, makes me prefer the oval even to the circular method. In the latter, the principle is to leave the integuments sufficiently long on every side to cover one half of the stump. Now the posterior integuments, on the retraction of the muscles, reach the centre of the wound more readily than the integuments in front, which have to pass and bend over the end of the tibia. The object then can only be fulfilled by allowing a greater length to the skin in front." (*Manuel de Méd. Opér.* p. 293.)

Oval amputation of the leg seems to me the most tedious and painful of all the modes hitherto proposed of removing this part of the limb. Nor can it be necessary, if care be taken in the other methods to save a sufficiency of the integuments in front of the limb, as advised in the descriptions already given of those operations.

AMPUTATION OF THE ARM.

The structure of the arm is very analogous to that of the thigh: like the latter, it contains only one bone, round which the muscles are arranged. The deep muscles are attached to the os brachii, while the superficial extend along the limb, without being adherent to the bone. The first consist of the brachialis internus, and the two short heads of the triceps: the second of the biceps, and long head of the triceps. Hence, amputation may here be done in the same way as in the thigh, except when performed above the insertion of the deltoid muscle. In the arm, says Graefe, the incisions through the muscles should even be made more obliquely upwards than in the thigh, where the muscles are more bulky, by which means two inches of muscle

may be saved, besides the retracted integuments; an abundance for covering the stump, were the arm full ten inches in circumference. (*Normen für die Abl. grösserer Gliedm.* p. 109.)

The patient being seated, the arm is to be raised from the side, and, if the disease will allow it, nearly into the horizontal position. As I have seen inconveniences produced by the patient's fainting in the midst of the operation, I join Graefe and some other practitioners in thinking that the patient, if already weak, should be placed upon a table in the recumbent position. (*Op. cit.* p. 108.) The surgeon is to stand on the outside of the limb, and apply the tourniquet as high as possible; or, if it be preferred, an assistant, standing behind the shoulder, makes pressure on the axillary artery with his four fingers. The skin and muscles, which are about to be divided, are to be drawn up and made tense. The soft parts are next to be divided, as much of the limb being preserved as possible. The retractor is to be applied, the bone sawn with the usual precautions, and the bleeding stopped in the ordinary way, care being taken to leave the median nerve out of the ligature, which is put round the brachial artery. The wound is then to be closed so as to form a transverse line, the dressings are to be applied, and the patient put to bed, with the wound a little elevated from the surface of the bedding.

In amputation of the arm, I entirely coincide with Mr. Guthrie, with regard to the uselessness of dissecting back the integuments, a plan long ago renounced by Dupuytren, their effectual retraction by an assistant, after their complete division, being quite enough. (*On Gunshot Wounds*, p. 354.) In fact, the integuments are so loose and moveable over the fascia, that Alanson's painful plan of dissecting them from it is perfectly unnecessary. Instead also of attempting to perform the circular oblique incision through the muscles with one stroke of the knife down to the bone, it is a good plan first to divide the biceps only, and loose portion of the triceps immediately the integuments have been cut and retracted, and to let those muscles fully recede, before the division of the rest of the soft parts is begun. The incisions having next been carried down to the bone, the muscular fibres may be separated from it, if necessary, an inch or so further upwards, and the saw then applied as high as practicable.

Baron Dupuytren's method, which is a modification of that of M. Louis, is one of the most expeditious, and, I believe, in every respect commendable. The integuments are drawn up, and a circular incision made at once through them and the biceps, and loose part of the triceps. The edge of the knife is then applied close to the margin of the retracted muscular fibres, and the brachialis, the rest of the triceps, &c. divided by a circular incision down to the bone, directed sometimes perpendicularly, sometimes obliquely. Lastly, the muscular fibres, closely adherent to the part of the bone above the incision, are detached from it some way upwards with a scalpel, so that the saw can be applied higher up than would otherwise be practicable. This plan combines all the quickness of a flap-amputation, with another advantage ascribed to the latter, namely, that of no risk of a subsequent protrusion of the bone.

If the disease should require the arm to be taken off at its upper part, there would be no room for

the application of the tourniquet. Here, instead of putting a compress in the axilla, and having it held firmly upon the artery by a bystander, as advised by Sabatier, it is more eligible to make pressure on the artery as it passes over the first rib, of which method I shall speak in treating of amputation at the shoulder-joint. With a straight bistoury, the surgeon is now to make a transverse incision down to the bone, a little above the lower extremity of the deltoid muscle. Two other longitudinal incisions, made along the front and back edge of this muscle, now form a flap, which must be detached, and reflected. Lastly, the rest of the soft parts of the limb are to be divided by a circular cut, made on a level with the base of the flap, and the operation finished like a common amputation. (*Sabatier, Méd. Opér.* t. iii. p. 375, &c. ed. 2.)

As a matter of choice, and not of necessity, the arm may be amputated with two semilunar flaps: one, anterior; the other, posterior. The first should be formed of the skin, biceps, and brachialis, and be about three inches in length; the other is to be of the same size, and composed of the triceps and integuments. The muscular fibres, close to the bone, are now to be divided all round, and the saw used. Klein preferred this to the common method, and adopted it in nine cases. So well is the end of the bone covered, that a protrusion of it seems to him impossible. (*Practische Ansichten der Chir. Opér.* p. 44.) Langenbeck, instead of making the flaps in the preceding way, forms two lateral ones by cutting from below obliquely upwards, and turns the skin down to the bone. In one case in the North London Hospital, I lately tried this method; with one difference, namely, that of transfixing the soft parts, and cutting downwards and outwards, instead of cutting from without inwards, as practised by Langenbeck. This, as well as the preceding mode, is very quickly accomplished, and makes a good stump. Both also have the recommendation of being done without any painful dissection of the skin from the fascia, and of the bone being well covered not only by integument but muscle. Three strokes of the knife, as M. Velpeau observes, one for each flap, and another on the division of the muscular fibres adherent to the bone, and then the use of the saw, bring the operation to a conclusion. Yet it is contended, that flap-amputations of the arm are followed by more inflammation of the stump than circular ones, for which the round shape of the limb, and the moderate size of its single bone, seem admirably to adapt it. (See *Velpeau, Nouv. Elem. de Méd. Opér.* t. i. p. 425.)

When the arm is injured very high up, Baron Larrey prefers amputation at the shoulder-joint to preserving a short stump, containing the upper end of the humerus; for, says he, if this bone cannot be divided at least on a level with the tendinous insertion of the deltoid, the stump is retracted towards the armpit by the pectoralis major and latissimus dorsi; the ligatures on the vessels irritate the brachial plexus of nerves; great pain, and nervous twitchings, often ending in tetanus, are produced; the stump continues swollen; and, in the end, the humerus is fixed by ankylosis to the shoulder, so that this portion of the arm remains altogether useless, and renders the patient liable to accidents. "I have seen (says Larrey) many officers and soldiers, who, on these accounts, were sorry that they had not undergone amputation at

the shoulder." (*Mém de Chir. Mil.* t. iii. p. 53. 400.)

Mr. Guthrie also states, that when amputation by the circular incision is attempted at the insertion of the pectoralis major, the bone will generally protrude after a few dressings. However, he entirely dissents from Larrey, respecting the necessity of taking off the limb at the shoulder, and prefers doing it from half an inch to an inch and a half below the tuberosities of the humerus, as the state of the injury may require. Two incisions are to commence, one or two finger-breadths below the acromion; and the inner one is to be extended directly across the under side of the limb, till it meets the lower point of the outer wound. Thus the under part of the arm is cut by a circular incision; the upper in the same manner as it sometimes is in removing the limb at the shoulder-joint. Without detaching the skin from the muscles, these are cut through; the soft parts are held out of the way of the saw; the bone is sawn; the vessels secured; and the flaps brought together, so as to form a line from the acromion downwards. (*Gun-shot Wounds*, p. 337, &c.) I am decidedly of opinion, that, in the description of cases referred to, either this method, or Sabatier's operation, should be preferred to the removal of the whole limb at the shoulder-joint.

AMPUTATION AT THE ELBOW-JOINT.

Dupuytren, convinced of the correctness of the principle that as much as possible of the upper extremity should always be saved, revived the practice of amputating at the elbow, whenever the state of this joint and of the soft parts admitted of such operation. The forearm being slightly bent, a double-edged knife is introduced transversely in front of the joint from one condyle to the other, and a flap made of the soft parts of the upper and anterior part of the forearm. The flap is now reflected, the capsular and lateral ligaments cut, and the operation finished by the surgeon sawing through the olecranon from before backwards. The brachial artery is not divided, but the radial and ulnar. The bleeding vessels having been secured, the flap is brought over the end of the humerus, and secured in this position with long straps of adhesive plaster.

When there is not a sufficiency of soft parts left for an interior flap, Dupuytren used to amputate at the elbow with the circular method, the first incision through the skin and fascia being begun three finger-breadths below the condyles. The integuments and fascia were then drawn upwards, the knife applied just below their edge, and muscles divided down to the bone. By next carrying the knife a little upwards, and separating the soft parts from the bones, the joint was reached, and opened by cutting the lateral ligaments and forepart of the capsule. The operation was completed by dividing the olecranon with the saw. (See *Dupuytren, Leçons Orales de Clinique Chir.* t. iv. p. 316.) Amputation at the elbow was practised by Dupuytren in ten or twelve examples with great success, and the method is highly commended by Mr. Liston. (See *Elem. of Surgery*, part iii. p. 381.)

AMPUTATION OF THE FOREARM.

The wisest maxim, with respect to the place for making the incision, is to cut off as little of the

limb as possible. This fact is perfectly established, notwithstanding the truth that Larrey, in consequence of his mode of dressing the stump, has not experienced success in his amputations done in the tendinous part of the forearm. The forearm is to be held by two assistants, one of whom is to take hold of the elbow, the other of the wrist. The tourniquet is to be applied to the lower part of the arm, and pressure made by an assistant on the brachial. The integuments should be drawn up so as to make them tense. The circular incision is then to be made down to the fascia; from this as much skin is to be detached, reflected, and saved, as is necessary for covering the ends of the bones, and the muscles are to be cut on a level with the reflected skin, the knife being at the same time directed obliquely upward. As many of the muscles are deeply situated between the two bones of the forearm, too much attention cannot be paid to dividing all of them, with a double-edged knife, introduced between the radius and ulna.

The soft parts are to be protected from the saw by a linen retractor. It is generally recommended to saw the two bones together, for which purpose the forearm should be placed in the utmost state of pronation. As the radius at the lower part of the forearm is larger than the ulna, it should perhaps be sawn through first, the latter bone, in consequence of its connection with the humerus, being better adapted to bear the weight of the saw. (*Arerill's Op. Surgery*, p. 124.)

The ulnar, radial, and two interosseous arteries, are those which usually require ligatures.

Graefe removes the forearm by making a flap from the flesh in front of the limb, and then extending the wound quite round the member. (*Normen für die Ablösung grosserer Gliedm.* p. 138, &c. 4to. Berlin, 1812.) Mr. Guthrie makes two flaps, one in front, the other on the back of the forearm; but, above the middle of this part of the limb, he prefers the circular incision. (*On Gunshot Wounds*, p. 373, 374.) Dr. Hennen also expresses his approbation of amputating the forearm, so as to make two semilunar flaps. (*Principles of Military Surgery*, p. 265. edit. 2.), which is the method recommended and practised by Klein (*Practische Ansichten bedeutendsten Operationen*, heft i. p. 45.) and Lisfranc also operates in this way at the lower third of the forearm. These flap-operations of the forearm are rather proceedings of choice, than of necessity; for, I have seen this part of the limb removed in numberless instances by the circular incision, and can hardly remember a case in which the stump turned out badly. In making the inner flap, the radial and ulnar arteries must obviously be in danger of being wounded higher up than the point where they are quite cut through, as Mr. Guthrie candidly acknowledges; an accident, which might give rise to a great deal of trouble.

With respect to Larrey's preference to amputating in the fleshy part of the forearm, though the case would admit of the operation being done much lower, I need only say he would find no reason for this choice, were he to aim at union by the first intention, at every opportunity, as is the custom in England.

AMPUTATION AT THE WRIST OR RADIO-CARPAL ARTICULATION.

The hand may be amputated at the joint of the

wrist, whenever the disease does not extend too high, and a flap can be made either from the integuments of the back of the hand, or from those of the palm. Lisfranc makes both an anterior and a posterior flap. The circumstances of the case should determine the choice. Here amputation may also be done by the circular incision. The scaphoid, semilunar, and cuneiform bones form a convexity, which is almost entirely received in the concavity of the radius, the ulna having no connection with this joint, except through the intervention of the triangular ligament, and to the extent of about four lines. The styloid processes of the radius and ulna can be readily felt, and below them the articulation commences; but, as Malgaigne observes, the direction of the joint is less easily determined; and if, while the hand is extended, the wrist itself be alternately bent and extended, those motions will take place in the medio-carpal articulation, into which the surgeon might erroneously carry the knife. The following are the instructions given by M. Malgaigne, for the avoidance of this mistake:—

1. If the hand be extended very much backward, the apex of the angle formed with the forearm will denote the radio-carpal articulation.

2. The transverse projection of the radius forwards may also be felt, the joint being one line below it, and about five lines above the cutaneous wrinkle between the palm and the forearm.

3. The situations of the ends of the styloid processes being determined, and a line drawn across from one to the other, the middle of the joint will be two lines and a half above such transverse line.

4. If only the styloid process of the radius is perceptible, that of the ulna is known not to descend so far as it by two lines; and the middle of the joint is three or four lines higher. (*J. F. Malgaigne, Manuel de Méd. Opér.* p. 324.)

The projection of the pisiform and cuneiform bones beyond the level of the palmar surfaces of the radius and ulna, must be remembered in the operation.

Amputation by the circular method is performed as follows:—An assistant draws up the integuments, and the surgeon makes an incision through them all round the wrist, about an inch below the styloid processes. The skin may now be easily retracted nearly as high as the joint; a second incision, made so as to leave the pisiform and cuneiform bones just beyond it, divides all the tendons on a level with the retracted skin. The joint is then to be cut into on one side or the other, under the guidance of the corresponding styloid process, and the knife directed through the articulation in a line, answering to the posterior convexity of the scaphoid, lunar, and cuneiform bones. The radial and ulnar arteries are now to be tied, but the interosseus here seldom requires a ligature. The wound is to be closed with the line of it in the transverse direction, and the stump placed in a depending position, so that, if suppurative take place in the tendinous sheath, or under the fascia, the matter may not pass far up the limb.

In the *double-flap amputation*, as executed by Lisfranc, the hand and forearm are placed in the supine position, and supported by an assistant, who, at the same time, makes pressure on the radial and ulnar arteries. The surgeon, with a narrow knife, transects the soft parts on a level with the styloid processes, and from the radius towards the ulna,

or from the ulna towards the radius, according as he is operating on the right or on the left limb. The knife is then carried along the anterior surface of the carpus, and its edge inclined forward, so as to make a semilunar flap about two inches in length. This flap being held back, another very similar one is made on the back of the wrist; the extensor tendons are then to be cut through nearly on a level with the articulation, the joint opened just below one of the styloid processes, and the disarticulation finished, as in the circular method.

When the soft parts are so diseased that two flaps cannot be saved, the operation may be done with a single one, which should then be made somewhat longer.

AMPUTATION AT THE HIP-JOINT.

The very idea of this formidable operation, for a long while, checked the hand even of the most ready advocate for the use of the amputating knife, and every mind shuddered at so extensive a mutilation. Still, it could not be denied, that the chance of saving life occasionally depended upon a submission to the greatest temporary suffering, and that, without the most cruel sacrifices, the preservation of the patient was totally impossible. Dreadful as amputation at the hip appears, both in respect to the magnitude of the part of the body to be removed, and the extent of the wound caused by such removal, the desperate nature of some cases at length began to incline surgeons to view more dispassionately a scheme, at which the mind at first naturally revolted. Morand is the earliest practitioner who made this severe operation the subject of attention. (*Opuscules de Chir.* t. i. p. 176. 8vo. 1768.) In 1739, two essays on the same topic were communicated to the Royal Academy of Surgery at Paris, by two of his pupils, Volner and Puthod. In 1743, Ravaton wished to have performed amputation at the hip-joint for a gunshot fracture of the trochanter major and neck of the thigh-bone, but was prevented by the opposition of other surgeons. (*Chir. d'Arm.* p. 323, &c.) In 1748, the propriety of attempting the operation was urged by l'Alouette. (*Disp. Chir. Halleri.* t. v. p. 265.) At length, the Royal Academy of Surgery at Paris thought the subject highly deserving of further investigation. In 1756, they therefore proposed the following question, as the grand prize subject: *In the case, in which amputation of the hip-joint should appear to be the only resource for saving the patient's life, to determine whether this operation ought to be practised, and what would be the best way of performing it?* No satisfactory memoirs having been presented, the same subject was proposed again in 1759. The approbation of the Academy was now conferred on a paper written by Barbet, in which the propriety of amputating at the hip-joint was defended, and some of the cases demanding the operation specified. If, for instance, a cannon-ball, or any other violently contusing cause, had carried off or crushed the thigh, so as to leave only a few parts to be cut to make the separation complete, he thought a surgeon ought not to hesitate about doing it. The same author conceived that a sphacelus, extending to the circumference of the joint, and destroying the greatest part of the surrounding flesh, might also render the operation equally necessary and easy. (See *Sabatier, Méd. Opér.* t. iii. p. 271, &c.) Cases were also adduced, where the surgeon

completed the separation of the dead parts with a knife. However, this cannot be considered as amputation at the hip-joint. Dividing a few dead fibres was a thing of no importance, in regard to the likelihood of its creating any bad symptoms. The proceeding, in fact, seems to me to have no analogy at all to the bloody operation of taking the thigh-bone out of the socket. It is quite a different thing, when the operator has to cut through parts which bleed profusely, and are endowed with life and sensibility.

In addition to the memoir by Barbet, thirty-three other essays were offered to the Academy, the majority of which were filled with arguments in favour of the operation; and, besides these productions, two other memoirs were published at Paris, one by Goussaud in 1758, explaining a new method of operating, and another by Moullet (see *Journ. de Médecine* n 1759), in which, says Professor Thomson, the operation is considerably considered in all its extent & details. (See *Trans. made in the Mil. Hospital in Beloit*, p. 260—63.)

The six surgeons of the list and many condemn the proceeding. The sentiments of Mr. Pott's are—“M. Billaud and M. Tissot are the only people whom I have met with, or heard of, in the profession, who speak of an amputation in the joint of the hip as an advisable thing, or as being preferable to the same operation in the thigh.” After a quotation or two, he continues—“That amputation in the joint of the hip is not an impracticable operation (although it be a dreadful one), I very well know. I cannot say that I have ever done it, but I have seen it done, and am now very sure I shall never do it, unless it be on a dead body. The parallel, which is drawn between this operation and that in the shoulder, will not hold. In the latter, it sometimes happens, that the caries is confined to the head of the os humeri, and that the scapula is perfectly sound and unaffected. In the case of a carious hip-joint, this never is the fact; the acetabulum ischi, and parts about, are always, more or less, in the same state, or at least in a distempered one, and so indeed most frequently are the parts within the pelvis,” &c. (*Pott on Amputation*.) Here it may be remarked, that Pott was right, inasmuch as the operation is totally unjustifiable in disease of the hip-joint; but wrong in not perceiving that, though unfit for such a case, it might be proper for others. Callisen had difficulty in supposing any circumstances, in which the operation could be undertaken with hopes of success. (*Syst. Chir. Hod.* p. 418. t. ii. edit. 1800.) And Richerand thinks, that, unless the limb be nearly separated by the disease, or accident, a prudent surgeon should decline making the attempt. (*Nosogr. Chir.* t. iv. p. 519. edit. 4.)

It is a remarkable fact in the history of surgery, that an operation, which had been invented in France, and concerning which so much had been written in that country, should have been first put in practice in England. “I have been informed,” (says Professor Thomson,) that the operation was performed in London by the late Mr. H. Thomson, surgeon to the London Hospital, and imagine that it must have been his operation to which Mr. Pott alludes.” (*Obs. in the Mil. Hospitals in Belgium*, p. 264.) At all events, whether this was the identical case which Mr. Pott saw, or not, the example referred to by this distinguished surgeon

is the earliest instance of the operation being actually performed. It was even repeated in this country before it was ever practised on the Continent, as far as can be made out from the records of the profession; for, it was performed by Mr. Kerr, of Northampton, on a girl, between eleven and twelve years of age, in a case of diseased hip; a case, however, in which I am completely satisfied that it ought never to be attempted, for the reason laid down by Mr. Pott. In fact, Mr. Kerr, after removing the limb, found the acetabulum, and all the adjacent parts of the ossa innominata, carious. But the experiment was here rendered still more hopeless, by the patient being consumptive. Yet, with all these disadvantages, the girl lived till the eighteenth day from the operation, and, after death, her lungs were found to be a complete mass of disease, one of them being totally reduced to matter. (See *Duncan's Med. Commentaries*, vol. vi. p. 337. 8vo. Lond. 1779.) In the first successful amputation of the hip, M. Perrault, of Sainte Maure, was the operator. It was done in the year 1774, in a case of traumatic gangrene. The particulars are recorded by Sabatier. The patient, named Goix, recovered, and afterwards lived a good while as cook at an inn at St. Maure, where M. Velpeau saw his son in 1815. About the same time that Perrault's operation took place, another successful amputation at the hip seems to have been done by M. Perret, a French military surgeon. (See *Velpeau, Nouv. Elém. &c.* t. i. p. 514.) Although amputation at the hip used commonly to be demonstrated on the dead subject, by lecturers on surgery in London, the observation of M. Velpeau is very correct, that in England and Germany little serious idea was entertained of reviving the practice of it on the living till the commencement of the present century, and that about this epoch several trials of it were made by surgeons of the French army. M. A. Blandin relates three cases. His first patient was operated upon (*fructidor an. 3*.) and recovered. The second also got well, and the third lived till the fifty-eighth day after the operation. About the same period, M. Perret, another military surgeon, had one successful case. In 1798, Mulder amputated at the hip with success, on a young woman aged 18. (See *Velpeau, Elém. de Méd. Opér.* t. i. p. 514.) Larrey performed this operation twice in Egypt; and once, while he was serving with the French army on the Rhine. He was encouraged to make these attempts to save his patients by the consideration, that he had already preserved some lives by amputating either both thighs, both legs, or both arms, or removing the humerus at the shoulder-joint. Larrey has also the merit of having first done the operation in the description of cases, in which (with the exception of bad examples of necrosis, or of incurable disease, of the higher part of the femur) it is more decidedly proper than any other; viz. gunshot injuries of the head, neck, and upper part of the femur, with or without injury of the femoral artery, or where the limb has been carried away by a shell, or cannon-ball, too high up to admit of amputation in the ordinary manner. However, he also regards as fit occasions for amputation at the hip-joint, circumstances in which, from gunshot violence, the limb is seized, or threatened with gangrene, nearly up to the hip. (*Mém. de Chir. Mil.* t. ii. p. 185.)

Severe as the operation is, Larrey contends that, if it ever prove the means of saving lives which

one in danger, it is an act of humanity, and he argues that it is justifiable by the old maxim of Hippocrates, "Ad extremos morbos extrema remedia." To the chief objections which have been made to it, he replies, 1st, That the wound is more alarming than dangerous. The Cæsarean operation (says he) has been successfully performed on the living female, and is still recommended by many practitioners. L'Aumonier, principal surgeon of the Rouen Hospital, successfully removed a scirrhus ovary of considerable size. Examples are recorded of the arm and scapula being torn away, and the patients soon recovering. Besides, the surgeon has it in his power to lessen the wound produced by the operation. 2dly, The dangers of hemorrhage may be obviated by the assistants temporarily placing their fingers on the mouths of the cut vessels, until ligatures can be applied.

In confirmation of his sentiments, concerning the propriety of the operation, Larrey adverts to a fact reported by Morand, where a soldier had both his legs amputated very high up, and also both his arms so near the shoulders, that he could hold nothing in his amputa. Yet, mutilated as he was, he enjoyed good health. (*Opusculs de Chir.* p. 183.) And Larrey, in his own work, has recorded several instances, in which the whole of a limb was removed, or more than the halves of both the upper or lower extremities of the same subject, without any fatal constitutional disturbance. (*Mém. de Chir. Mil. t. ii. p. 182—184.*) One of his patients above alluded to survived the operation a week, at the end of which he was carried off by the plague; and the others died, after being conveyed, in a very uneasy manner, during a precipitate march of the army. (See *Relation de l'Expédition de l'Armée d'Orient en Egypte*, &c. p. 319. 8vo. Paris, 1803.) At the battle of Wagram, Larrey operated at the hip-joint on two soldiers of the imperial guard, under very unfavourable circumstances; these patients died in a few hours. (*Mém. de Chir. Mil. t. iii. p. 349.*)

Whatever method of amputating at the hip he adopted, the surgeon should remember, that the acetabulum is not deep enough to receive the entire head of the femur, which constitutes more than the half of a sphere, and is so embraced by the fibrous capsule, that it remains as it were strangulated, if this latter part be not divided close to the margin of the acetabulum. As for the ligamentum teres, it is rendered tense by abduction of the limb, and presents itself to the edge of the knife. On the contrary, if the operator begin with dividing the external portion of the capsule, the limb should be placed in the position of adduction; the ligamentum teres is then relaxed, but it makes no resistance to the disarticulation, and may afterwards be easily divided. The hip-joint is more superficial in front than in any other direction. A line drawn perpendicularly downwards, from the union of the middle with the external third of Poupert's ligament, will be sure to pass over the forepart of it.

Larrey operated as follows:—He began with making an incision in the track of the inguinal artery in the bend of the groin, and tied this vessel as closely as possible to Poupert's ligament, in order that the ligature, which was placed above the origin of the circumflex arteries and the profunda, might prevent all inconvenience from the bleeding, which

might otherwise have happened from their numerous branches. This being done, a straight knife was perpendicularly plunged between the tendons of the muscles attached to the trochanter minor and the base of the neck of the femur, so as to bring out its point at the back part of the limb, or in a diametrically opposite situation to its first entrance; and now, by directing the knife obliquely inwards and downwards, a flap, which was not to be too large, was made of the soft parts at the inner and upper portion of the limb. This flap was now drawn towards the scrotum by an assistant, and the articulation was brought into view. The obturator artery, and some branches of the pudendal, wounded in making the flap, were immediately tied. The thigh was now put into the state of abduction; the inner part of the orbicular ligament, made tense by this position, was divided, and the joint opened. The ligamentum teres was then cut, and the bone dislocated. The knife was next brought to the outside of the great trochanter, and an external flap formed of the soft parts, calculated to meet that which had been made at the inner side of the limb. In proceeding through the operation, Larrey secured, as soon as they were divided, the obturator arteries, and several branches of the pudendal, gluteal, and ischiatic arteries. The two flaps were brought together, and kept in this position, with strips of adhesive plaster, and a woollen spica bandage. (See *Mém. de Chir. Mil. t. ii. p. 186—188.*)

In the Russian campaign, Larrey had two more opportunities of amputating at the hip-joint. In the first instance, he operated upon a Russian at Witpepsk, whose thigh-bone was broken to pieces up to the trochanter, and the soft parts of two-thirds of the thickness of the limb destroyed. This man went on as favourably as possible until the 25th day from the operation, the parts being healed except at two points, where the ligatures had been brought out; but, unfortunately a scarcity of provisions now occurred, and the patient died on the 29th or 30th day. The second operation was done on a French dragoon, after the battle of Mozaïsk, who was afterwards seen perfectly cured by the surgeon-major, at Orcha, who received him there, and made a report of the fact to Larrey. (See *Mém. de Chir. Mil. t. iv. p. 26. 50, 51. 8vo. Paris, 1817.*)

In 1812, M. Baffos amputated at the hip nearly in the manner of Larrey, except that he only compressed the artery in the groin, and did not begin with tying it, a method to which Larrey himself now gives the preference. (See *Mém. de Chir. Mil. t. iv. p. 434.*) The patient was only seven years old, and the case a diseased hip. The wound healed, but the child died of scrofula three months afterwards. The cotyloid cavity was found full of fungous flesh, and the os innominatum carious. As the latter state always exists in the diseased hip-joint, the whole of the disease does not admit of removal by amputation, and consequently the attempt ought never to be made. (See *JOINTS, DISEASES OF.*)

The plan of operation, adopted by Baffos, is considered, I believe, by all surgeons of the present day, better than that formerly practised by Larrey, inasmuch as the unnecessary preliminary measure of taking up the artery in the groin, instead of simply compressing it against the os pubis, was rejected. Cutting down to the artery as a

precaution against hemorrhage, is doing a double operation, and putting the patient to needless suffering: it was the earliest method, having been proposed by Volther and Puthod. Who was the first proposer to compress the artery against the os pubis, instead of cutting down to the vessel, I am not at present aware; but the plan was publicly recommended by Mr. Abernethy, in his anatomical lectures, for the last thirty years of his life.

Lisfranc is said to complete amputation at the hip-joint upon the dead subject in ten seconds; the following is his method, as described by a modern writer:—The nates of the patient resting on the edge of the table, and the limb being supported by an assistant, the operator draws a line, an inch in length, from the anterior and superior spinous process of the ilium, straight down the thigh. From this point, he marks another inwards towards the pubes, of half an inch, so as to form a right angle. On the inner extremity of the last, he places the point of a long-bladed catling, and pushes it perpendicularly downwards, till it strikes against the head of the femur. Then passing it on the outer side of the bone, he thrusts it onwards till it protrudes at about an inch from the margin of the anus. He now cuts outwards, for near an inch, in order to clear the great trochanter, and forms the external flap, four or five inches in length, by cutting down the limb between the muscles and bone. The femoral artery, which may now be seen, is compressed between the fingers and thumb of an assistant, while the operator thrusts the knife in and out at the same points, as before; but, carrying it on the inner side of the head of the bone, he forms a smaller flap on that side of the extremity. Then, with the point of the knife, he cuts through the capsular ligament, dislocates the bone, and removes the limb by dividing the round ligament, &c. (See *Arrell's Operative Surgery*, Lond. 1823, p. 158. &c.; *Maineault, Méd. Opérateur*, fol. Paris, 1822.) It is obvious (says Mr. Syme) that, so long as the surgeon merely cuts downwards, and keeps close by the bone, he will not injure the femoral artery, which cannot be divided till the knife is carried outwards. This is one great excellence referred by Lisfranc to his operation; for, before the surgeon cuts the artery, the assistant can introduce his fingers into the wound, and compress the vessel.

The disarticulation is accomplished as follows:—The surgeon, seizing the limb with his left hand, while the assistant holds aside the flaps, makes a cut half round the margin of the acetabulum at its fore part. The limb is then put into the posture of abduction, the bone starts from its socket, the knife is carried round its head, and the triangular ligament, and remains of the capsular ligament, are divided. (See *Ed. Med. Surg. Journ.* No. 78. p. 41.) A similar method of operating was followed by Walther. (See *Graefe and Walther's Journ.* Also *Anderson's Quarterly Journ.* vol. i. p. 630.) It was likewise preferred by Mr. Syme, in an interesting case, where he amputated at the hip-joint for an extensive necrosis of the femur, involving the neck of the bone. Unfortunately, when the wound was nearly healed, the patient became dropsical, and died at the beginning of the eighth week from the period when his limb was taken off. (*Op. cit.* p. 25.) Dupuytren made a semilunar incision, with its convexity downwards; it began near the

anterior superior spine of the ilium, and terminated near the tuberosity of the ischium. Only the skin was first divided, which was then retracted by an assistant, and the muscles cut in the same direction, so as to form the internal flap four or five inches long. This was reflected, the capsule opened in Larrey's manner, the knife passed through the joint, and the outer flap made. Dupuytren and Bécclard preferred compressing the artery on the horizontal branch of the os pubis to applying a ligature to it. Here we find two very high authorities in support of what has always seemed to me the best practice.

Langenbeck begins the first incision on the outside of the femoral artery, and forms the external flap, by extending the wound towards the tuberosity of the ischium. The knee is then inclined inwards, and the head of the femur dislocated; after which the knife is carried to the inside of the thigh, and the inner flap made. (*Bibl. für die Chir.* b. iv. s. 512.) Bécclard's method seems to differ from this, chiefly by transfixion being adopted in making the flaps. The same observation applies to Lisfranc's plan. It would be useless to describe every variety of operating where the only peculiarity consists either in making the outer or the inner flap first; or in transfixion, and then cutting from within towards the skin; or in not transfixing the limb, but cutting from the integuments inwards. Some operators also make one flap longer than the other; while others, with Delpsch, consider the wound more likely to heal favourably when only an internal flap is made. (See *Velpau, Nour. Élém.* t. i. p. 522.)

When serving with the army in Holland in 1814, I assisted the late Dr. Cole in the performance of this operation. The plan adopted by him was that taught by Mr. Abernethy, in his lectures, for more than thirty years. The flow of blood through the femoral artery was stopped by compressing the vessel in the groin with the handle of a key covered with lint. The thigh was then amputated as high as possible, close below the trochanters. The femoral artery was immediately secured, and afterwards every other vessel requiring ligature. An incision was now made near the border of the acetabulum, the cotyloid ligament divided, and the head of the bone removed with the utmost facility and expedition. The patient lost even less blood than in an ordinary amputation, and the wound admitted of being brought together with adhesive plaster in the best manner possible, so as to represent a transverse line. I am sorry to add, that the patient lived only till the following day. In one dreadful case of fracture of the upper part of the femur by a grape-shot, where the operation had been delayed too long, the whole limb being inundated with matter, and the upper end of the lower portion of the bone projecting through the flesh backward, I ventured to perform the same operation at Oudenbosch in Holland, a few days after the assault on Bergen-op-Zoom; and here happened what must often occur: immediately the soft parts had been divided, as the bone was broken to pieces, the limb came off, leaving the head of the bone, the trochanters, and a small piece below them projecting. Had not the man appeared in a very bad way by the time the vessels had been secured, I should now have removed the head of the bone; but the shock of the operation was such that he survived

it but a few minutes, though scarcely any blood was lost. The mode of operating by the circular incision is preferred by Graefe, who unknowingly considers it as a new method. (*Normen für die Abl. grösserer Gliedm.* p. 118.) It has also been proposed by Dr. Veitch, with the modification of leaving an inch or two of the bone projecting, which is done without giving any additional pain, by dissecting off the soft parts below the first incisions down to the bone. This projecting piece is intended to serve as a lever, with which the head of the bone is to be got out of the acetabulum. (*Edin. Med. and Surg. Journ.* vol. iii. p. 129.) Ingenious as this suggestion may be, I do not regard it as an important practical improvement; 1st, because in almost all cases where the operation is necessary, the bone is so fractured that its division is already made by the injury; 2dly, because the scheme is unnecessary; for, in Dr. Cole's case, where I assisted, the head of the femur was removed from the acetabulum with the utmost facility by merely making an incision over that cavity, cutting the ligaments, and availing ourselves of the small piece of bone accidentally projecting. In fact, in all gunshot injuries requiring this operation, excepting a few instances of spreading gangrene from wounds, the bone is usually broken too high for Dr. Veitch's method to be practicable. With the same view of facilitating the exit of the head of the bone from the acetabulum, Graefe (p. 123.) recommends dividing the transverse ligament which completes the brim of the anterior and inferior sides of the socket. Disarticulation will always be free from difficulty, however, if the capsule be divided close to the borders of the acetabulum.

Sir Astley Cooper commenced his operation by making an incision just below Poupart's ligament, a little on the outside of the femoral artery. The wound was then carried obliquely downwards and outwards to the back of the thigh, about one third of the way down it, from which point the knife was carried in the opposite direction, obliquely upwards and inwards to meet the first incision, so as to form an elliptical curve. The femoral artery, being now divided, was immediately tied. The muscles were next cut through, another artery secured, and the bone taken out of its socket. Only about twelve ounces of blood were lost.

The following method, recommended by M. Scutten, is stated not yet to have been practised on the living subject (*Velpéu, Nouv. Elém. t. i. p. 525.*), though Sir Astley Cooper's plan seems to have been very similar to it in regard to the track of the incisions. The patient is to lie on the opposite side of the body to that on which the operation is to be done. The inguinal artery is to be compressed. The surgeon, standing behind the limb, is to put the thumb or forefinger of his left hand on the great trochanter. With the right he introduces the point of the knife perpendicularly over this process, and then gradually depressing the handle, extends the incision forwards and inwards four finger-breadths below the groin. He then carries the knife round the limb, cutting as deeply as possible, and bringing the knife at length up to the point from which the wound commenced. All the muscular fibres are nearly divided by this first incision, and hence the knife must generally be applied again, ere this first stage of the operation can be completed. For the

purpose of getting at the capsule, the sides of the wound must be kept apart, and any muscular fibres, not yet cut, be divided. As soon as the capsule is perceived, it is to be cut through perpendicularly on the head of the femur. The limb is now to be somewhat depressed, and the foot turned outwards, whereby the head of the bone is forced nearly out of its socket, and quits it completely as soon as the round ligament is cut, which is the only part by which it is confined. The operator then raises the thigh-bone, so as to make its head project; after which he cuts the rest of the capsule and muscular fibres, and completes the separation of the limb. When the operation is on the left side, the surgeon stands in front of the limb. (See *Scutten, Méthode Oculaire, ou Nouvelle Méthode pour amputer dans les Articulations*, Paris, 1827, 4to.)

Mr. Liston prefers anterior and posterior flaps. The patient is placed on a firm table, with the nates projecting a little beyond its edge. The sound limb may be secured to the foot of the table with a towel; all occasion for an assistant to hold it being thus done away with, and more freedom afforded to the operator in his movements. The other limb is supported by one assistant, while another presses with one or both thumbs on the femoral artery, where it passes over the pubes. Transfixion is then performed horizontally, the knife passing in a somewhat semicircular direction, so as to include as much of the soft parts as possible, and an anterior flap is made by cutting downwards. During the passage of the knife across the joint, the assistant, holding the limb, rotates the limb, if it be the right one, a little outwards, or, if it be the left, in the contrary direction, so as to facilitate the bringing of the point of the knife through the skin well inwards. After the formation of the flap, the assistant abducts the limb forcibly, and depresses it; the joint is opened; the round ligament cut; the rest of the capsule divided; the blade of the knife placed behind the great trochanter; and the posterior flap quickly formed. After transfixion for the anterior flap, and when the sawing motion of the knife has made a little advance, the compressing assistant shifts his hands into the incision immediately behind the back of the knife, and thus obtains a firm grasp of the femoral artery, previously to its division. He retains this hold during the rest of the operation, at the same time retracting the flap. As soon as the limb is off, the bleeding vessels in the posterior flap are compressed, and tied as quickly as possible. Lastly, the femoral artery is secured, which, while the assistant retains his hold of it, will not bleed. (See *Liston's Elements*, part iii. p. 395.) The methods of M. Plantade, M. Manec, and Mr. Ashmead (see *Velpéu, Nouv. Elém. &c.*, t. i. p. 520.) are all only modifications of the foregoing plan. M. Plantade makes the principal flap in front, and seems to have been one of the greatest advocates of this method, which he began to recommend in 1806. • • •

Amputation at the hip-joint has now been performed in many instances, and the patients saved. The earliest example of success is that done, as I have stated, by M. Perrault in 1774. Other successful operations, done by Blandin and Mulder, I have already noticed. Another successful amputation of the hip, (the first by any British surgeon,) was performed by Mr. Brownrigg, staff surgeon, on the 12th of December, 1812. The

upper part of the thigh-bone had been broken by a gunshot near Merida, in Spain, on the 29th of December, 1811. Some time ago, the man was living at Spalding in Lincolnshire in perfect health. Other successful amputations at the hip are those performed by Larrey at Witepsk; by Mr. Guthrie in the Netherlands on a French prisoner of war; and by Sir Astley Cooper, who performed the operation on account of a disease of the higher part of the femur. As the patient had formerly suffered amputation of the thigh, it was certainly not the sudden removal of nearly a quarter of him; but, I cannot presume to say, what difference in the chances of success, and whether any, would be connected with the circumstance. The same remark applies to a case lately under Mr. Mayo, where the patient, a young woman, recovered. The proceeding was adopted on account of the agony experienced by the patient from a neuralgic affection of her stump.

In June, 1824, amputation at the hip was done by Delpech, on account of a necrosis of the femur, and the patient was completely well in the following September. (See *Revue Médicale*.) The operation was also performed by Dr. Mott, of New York, on the 7th of October, 1824, and the whole of the wound had healed by the 20th of November. This case was a bad fracture of the upper part of the femur, followed by abscesses and disease of the bone. (See *Philadelphia Journal*, No. 9. vol. v. New Series.) The patient's age was favourable, as he was a boy of only ten years of age. At this period of life, the chances of success will always be greater than in adults, not only in consequence of the remedial power of nature being then particularly great, but on account of the smaller dimensions of the wound necessary for the purposes of the operation. Another successful amputation at the hip was performed by Mr. Orton, in 1826: the disease commenced in the knee; but terminated in extensive disease of the thigh-bone, large abscesses, and dislocation of the knee, the leg being fixed in the bent position, and drawn under the thigh. (See *Med. Chir. Trans.* vol. xiii. p. 605.) The operation has also been performed with a successful result by Wedemeyer and Bryce.

On the other hand, the failures of this operation are numerous, though undertaken by surgeons of reputation and ability. Mr. Guthrie, Dr. Emery, Mr. Brownrigg, Baron Larrey, Baron Graclet, Sir B. Brodie, Mr. Carmichael (*Trans. of the Assoc. Physicians*, vol. iii.); Drs. Blick, Emery, and Cole; Baron Dupuytren; MM. Gensoul, Clot, Roux, Delpech, Pelletan, Diefenbach, Syme, Velpeau, and Walther, have each had the mortification of losing at least one of their patients, after this very severe operation.

A calculation has been made, that the proportion of recoveries has been six in twenty operations. At all events, it appears, that, in the course of ten years, nearly twenty well authenticated instances of recovery, after this severe operation, have occurred. (See Velpeau, *Nouv. Elém. de Méd. Opér.* t. i. p. 515. *Chelius, Handb. der Chir.* b. ii. p. 763.)

No one can expect, however, this operation not to fail in a large proportion of the cases in which it is attempted: this must always happen, let it be done in the most skilful manner possible. Yet, as there are unquestionably some descriptions of

injury, where life must inevitably be lost, if this proceeding be rejected, and experience proves that it sometimes answers, an important consideration is, what cases are most proper for it? Here I am decidedly of opinion, with Professor Thomson, that the examples in which it is particularly called for, and where no delay should be suffered, are those in which the head or neck of the thigh-bone has been fractured by a musket-ball, grape-shot, or small piece of shell. Eight or ten such cases, where amputation ought to have been done in the first instance, were brought in waggons several days after the assault on Bergen-op-Zoom into the hospital superintended by myself at Oudenbosch, and not one of these patients lived ten days after their removal. In the whole course of my professional life, I have never elsewhere witnessed so much suffering, or suppuration in such profusion. From each limb, at least three or four pints of matter were discharged daily. Had amputation at the hip been performed at first, some of these patients might possibly have been saved; at all events, I am certain that it was their only chance.

Larrey deems the operation proper, where the thigh has been shot off high up, or where the femur and soft parts near the hip have been broken, and extensively lacerated by a cannon-ball or pieces of shell. Here the operation (though, perhaps the only chance) must almost always fail, because, as Professor Thomson observes, these injuries occasion a shock to the constitution, of which the patient mostly sinks either immediately, or in a few hours. (*Obs. made in the Mil. Hosp. in Belgium*, p. 274.) The truth of this observation I saw exemplified at Mersham, near Antwerp, at the bombardment of the French fleet in that port: a shell burst between the thighs of one of the guards; tore and lacerated two thirds of the thickness of the upper part of the right thigh; broke the ascending ramus of the ischium; lacerated the perineum and scrotum; and fractured the higher part of the femur. There was no hemorrhage of consequence; but the exposed lacerated surface of the soft parts was immense, and the unfortunate soldier, who lay with his hairs standing erect, and bereft of his intellectual faculties, sunk in the course of a quarter of an hour into a state of insensibility, and was quite dead in twenty minutes. However, there are numerous cases, in which the patients, after dreadful injuries of the upper part of the thigh, are less depressed and overcome, and live several weeks; facts clearly proving, that the operation ought to be attempted. Many instances of this kind are related by Mr. Guthrie. (*On Gunshot Wounds*, p. 134, &c.) Bad and incurable disease of the upper part of the femur (not the scrofulous hip, nor any other example in which the pelvis is affected) may also require the performance of amputation at the hip-joint, as was recently illustrated in the practice of Mr. Syme, and in that of Sir Astley Cooper. The case in which Mr. Carmichael amputated at the hip was what is termed an osteosarcoma: the patient, a girl, nineteen years of age, died on the fifth day. (See *Trans. of the King's and Queen's College of Physicians, Ireland*, vol. ii. p. 357, &c.; and vol. iii. p. 158.) Dr. Mott's case was one of fracture of the upper part of the femur, ending in disease of the bone and extensive abscesses. The disease for which Delpech operated was necrosis of the

thigh-bone. The propriety of the operation in desperate cases is now perfectly established.

Thus, as M. Velpeau observes, a comminuted fracture, an osteo-sarcoma, a spina-ventosa, any incurable disease of the femur extending above its shaft; gangrene; in short, any disease reaching to the vicinity of the hip, and so serious as to require the removal of the limb, are cases for amputation at this joint, provided the acetabulum and the bones of the pelvis be unaffected. It is indispensable for gunshot wounds of the upper third of the thigh, combined with fracture. (See *Nouv. Elém. de Méd. Opér.* t. i. p. 516.) It was performed by Mr. Mayo for a neuralgic affection of a thigh stump.

AMPUTATION AT THE SHOULDER-JOINT.

The head of the humerus represents nearly the half of a sphere, scarcely one third of which is received by the glenoid cavity of the scapula, the rest being contained in the exceedingly loose capsule of this articulation. The articular surfaces are held together principally by the deltoid, supra-spinatus and infra-spinatus, teres minor, and subscapularis muscles. The joint is also very much strengthened by the tendon of the long head of the biceps, and by the accessory ligament extending from the acromion to the upper part of the humerus. Above the articulation is a kind of osseofibrous arch, formed by the acromion, the coracoid process, and the ligament stretched between them. This arch projects more than an inch in front of the glenoid cavity, and descends further in the direction backwards than in that forwards. (See *J. F. Malgaigne, Manuel de Méd. Opér.*, p. 328.) If we examine the anatomy of the shoulder, from above downwards, we first meet with the deltoid muscle, covered by the integuments, some fibres of the platysma, and a very thin fascia. Then we come to a loose cellular tissue, the tendons of the supra-spinatus, infra-spinatus, subscapularis, and teres minor, the accessory ligament and fibrous capsule, and the tendon of the long head of the biceps. Lower down we arrive at the scapular portion of the triceps; and then the brachial plexus of nerves, the axillary vessels; and, under the skin, the pectoralis major, the latissimus dorsi, and the teres major. The apex of the acromion is very perceptible just above the cushion of the shoulder, as well as the coracoid process more towards the chest. Between these bony points is situated a triangular interval, useful to be recollected by the practical surgeon, bounded outwards and downwards by the head of the humerus; above by the clavicle and acromion, or rather by the coraco-acromial ligament; and inwardly by the coracoid-process itself. This is the place where the joint may be at once cut into, without any impediment from the bones; and it is on the knowledge of this fact, that Lisfranc proposed one of his methods of amputating at the shoulder. When the posterior border of the axilla is reflected towards the scapula, as Velpeau observes, the knife may be made to pass below the acromion, into the superior and external part of the joint. In some persons the acromion is much more prominent than in others; and occasionally it is considerably depressed, so that its humeral aspect forms a deep concavity. In childhood, it is cartilaginous; and Velpeau found it in two adult bodies separable by a very slight effort, as an epiphysis from the

spine of the scapula. (*Velpeau, Nouv. Elém. t. i. p. 428.*) The course of the circumflex arteries, that of the circumflex nerve; the situation of the accessory ligament extended from the acromion to the humerus; and, in particular, the origin and track of the tendon of the long head of the biceps, between the fibrous capsule and the synovial membrane into the bicipital groove of the humerus; the mode in which the capsule is attached to the humerus just below its anatomical neck; the very open angle formed by the junction of the head with the shaft of the bone; and the circular shape of its head, requiring an incision of corresponding figure for the prompt division of the fibrous capsule,—are all interesting points of surgical anatomy, without a due knowledge of which a surgeon cannot amputate at the shoulder with skill and judgment.

The principal methods of amputating at the shoulder are comprised under four varieties: 1st, the operation with one flap; 2d, with two flaps; 3d, by the oval method (*Scoutteten*); 4th, by a circular incision (*Alanson, Sanson, &c.*) Here one fact merits particular attention, namely, that no mode of amputating at the shoulder can be exclusively employed in all the cases requiring the operation, because the soft parts around the joint are frequently destroyed, or very much injured, to a greater or lesser extent, so that the surgeon is obliged to save skin and muscles wherever he can find them. On this point, Dupuytren fully agrees with the surgeons of the British army.

Whether the operation done by Laroque, in 1686, was truly an amputation at the shoulder joint, or merely the separation of a gangrenous limb by a natural process, and a little assistance of the surgeon, may admit of dispute. I believe that H. F. Le Dran performed the first operation of this kind, of which the particulars are clearly recorded. It was in a case of caries and exostosis, reaching from the middle to the neck of the humerus. Le Dran began with rendering himself master of the bleeding, for which purpose he introduced a straight needle, and a strong ligature under the artery. This was passed from the front to the back part of the arm, as closely to the axilla and bone as possible. The ligature, then including the vessels, the flesh surrounding them, and the skin covering them, was tightened over a compress. Le Dran, with a straight narrow knife, then made a transverse incision through the skin and deltoid muscle down to the joint, and through the ligament surrounding the head of the humerus. An assistant now raised the arm, and dislocated the head of the bone from the cavity of the scapula. This allowed the knife to be passed with ease between the bone and the flesh. Le Dran then carried the knife downward, keeping its edge always somewhat inclined towards the bone. In this manner he gradually cut through all the parts, as far as a little below the ligature. As there was a large flap, Le Dran made a second ligature with a curved needle, which ligature included a great deal of flesh, the redundant portion of which was cut off together with the first ligature, which had become useless. The cure was completed in about ten weeks. (*Obs. de Chir. t. i. p. 315. Paris, 1731; and Traité de Opér. p. 365.*) Le Dran (the son), who published this memorable case, does not state that the operation was a new one; and it appears from the *Recherches Critiques sur l'Origine, &c.*

de la Chirurgie en France, and from La Faye's notes on Dionis, that it had been previously practised by Morand, the father.

Garengot thought that the ligature might be applied by means of a curved needle, with sharp edges; and, in order to lessen the wound, he directs the incision to begin two or three finger-breadths below the acromion, across the deltoid muscle, so as to form one flap; then a lower one was made in the axilla; and after the second ligature had been applied, the two flaps were brought into contact. (*Traité des Opér. de Chir.* t. ii. p. 350.; *Mém. de Acad. de Chir.* t. ii. p. 261.)

La Faye extended the improvements further. After placing the patient in a chair, and bringing the arm into a horizontal position, he made a transverse incision in the deltoid muscle down to the bone, four finger-breadths below the acromion. Two other incisions, one in front and the other behind, descended perpendicularly to this first, and made a large flap of the figure of a trapezium, which was detached and turned up towards the top of the shoulder. The two heads of the biceps, the tendons of the supra-spinatus, infra-spinatus, teres minor and subscapularis, and the capsular ligament, were next divided. Now, when the assistant, who held the lower part of the limb, made the bone describe the motion of a lever upward, the head of the bone was easily dislocated. La Faye next carried his incision downward, along the inner part of the arm, until he was able to feel the vessels, which he tied as near the axilla as possible. The separation of the limb was then completed a finger's breadth below the ligature. The flap was then brought down over the glenoid cavity, and the wound dressed. (See *Nouvelle Méthode pour faire l'Opération de l'Amputation dans l'Articulation du Bras avec l'Omoplate*, par M. La Faye, in *Mém. de l'Acad. de Chirurgie*, t. v. p. 195. ed. in 12mo.) With respect to La Faye, it is curious to remark a coincidence between him and Larrey: the latter, though generally averse to the attempt of uniting stumps by the first intention, is an advocate for this practice after hip-joint amputations; so La Faye, who was fearful of laying down the flap, after amputation of the leg, had no such apprehension at the shoulder.

La Faye's method is yet regarded as one of the most approved, where the state of the soft parts will admit of it. But it is absurd to think of applying any one plan to all the various states in which the injured or diseased limb may present itself. It is advised by Larrey himself, when a wound extends through the upper part of the arm, breaking the bone, and injuring the soft parts. Here, says he, it would be impossible to form an anterior and a posterior flap, because the soft parts in these situations have been destroyed. On the contrary, when the deltoid is shot away, La Faye's plan is inadmissible. (*Mém. de Chir. Mil.* t. ii. p. 167.)

The advantages of La Faye's plan are obvious. As only one ligature was applied, the patient was saved a great deal of pain; the flap connected with the acromion was capable of covering the whole surface of the wound, and was more easily applied and kept on the stump than the lowermost of the two flaps which Garengot recommended; and the discharge found a ready outlet downwards.

In 1774, Alanson amputated at the shoulder-joint, as follows: The subclavian artery was compressed by the fingers of an assistant. An incision

was made about a hand's breadth below the acromion, and carried through the integuments all round the limb. The deltoid and posterior muscles were then obliquely divided up to the capsular ligament. The tendon of the biceps, and the capsular ligament upon the anterior and posterior part of the joint, were now cut through. One of the circumflex arteries, which bled a good deal, was next tied. The great pectoral muscle, the rest of the capsule, and all the other parts, except the vessels and nerves, were then divided; but previously to cutting the vessels, a temporary ligature was put round them. Thus the separation of the limb was completed. The mouths of the vessels were drawn out and tied, and the temporary ligature taken away. Lastly, the sides of the wound were brought together, so as to make a transverse line. Gracile, seeming not to recollect that amputation by the circular incision, directed obliquely upwards, had been practised by Alanson, and even by some surgeons spoken of by Garengot, mentions it as a new proposition. In one case, after operating in this manner, his patient was quite well in three weeks; and, with the particular sort of knife which he uses, and which is broadest towards its point, he pretends to be able to make the oblique incision through the muscles all round the limb with one sweep. He is careful to make pressure on the artery, both with Mohrenheim's compressor applied under the clavicle, and the fingers of an assistant above it. (See *Normen für die Abl. grösserer Gliedm.* p. 110. &c.) In proof of the possibility of making the oblique incision quite evenly with one stroke of his particular knife, he injected a female subject, did the operation, and caused the stump to be drawn from nature. (See Plate 2. of his Work.) M. Cornuau and M. Velpeau have also suggested modifications of circular amputation at the shoulder. In the method of the former, the integuments being drawn up by an assistant, are divided four inches below the acromion, and the muscles next cut through transversely by one stroke of the knife, from the coraco-brachialis to the tendon of the teres major. The muscles are then raised, the joint opened, the knife passed through it from above downwards, close to the neck of the humerus, and a second transverse incision made, which joins the extremities of the first, divides the artery, and leaves a circular wound. This would not be a disadvantageous method, were the soft parts all tolerably sound.

M. Velpeau informs us, that he has tried on the dead subject every variety of the circular method, and he believes that no other plan is more expeditious, or leaves a more regular wound, or one more disposed to union by the first intention. He prefers dissecting up, and reflecting the integuments for two inches, without meddling with the artery; and then cutting the muscles in M. Cornuau's way, as close as possible to the joint, through which the knife is to be carried; and finally, the triceps divided, together with the artery, which is first to be taken hold of by an assistant. (See *Velpeau, Nouv. Elem.* t. i. p. 430.)

In 1760, P. H. Dahl published at Göttingen a dissertation on amputation at the shoulder. In this tract a tourniquet was proposed, the pad of which was calculated to press upon the subclavian artery under the clavicle, and enabled the operator to dispense with tying the vessels in the first instance. Camper had observed, that if the scapula

were pushed backward, and the axillary artery pressed with the finger between the clavicle, coracoid process, and great pectoral muscle, the pulse at the wrist might be instantly stopped.

Dahl's tourniquet was obviously constructed, in consequence of what Campar had observed. It is made of a curved elastic plate of steel, to the shortest end of which a pad is attached, capable of projecting further by means of a screw. The instrument embraces the shoulder from behind forward, while the pad presses on the hollow under the clavicle, between the margins of the deltoid and pectoral muscles. The long extremity of the steel plate, which descends behind the shoulder, is fixed to the body by a sort of belt. The pad is depressed until the pulsation of the axillary artery is stopped.

Further experience has proved, however, that this tourniquet may be dispensed with, and the flow of blood in the axillary artery commanded, by properly compressing this vessel with the end of a key covered with soft materials, or even with the fingers alone, as some operators prefer, at the place where the vessel emerges from between the scaleni muscles, above the middle part of the clavicle. Thus the artery is pressed between the pad or fingers and the first rib, across which it runs. In certain plans of operation hereafter to be described, all compression of the artery, either above or below the clavicle, is dispensed with.

Some practitioners, forgetful of the horizontal posture in which the patient is usually placed after the operation, have feared that, in La Fay's method, the lower flap may sometimes confine the discharge. In order to avoid this inconvenience, Desault recommended the formation of two flaps, one of which was anterior, the other posterior. The axillary artery was compressed from above the clavicle, at its coming out from between the scaleni muscles, while the integuments and flesh of the upper and internal part of the arm were pushed away from the humerus. A knife was plunged between these and the other soft parts behind, to make the anterior flap. The arm being inclined backward and outward, the humeral artery was tied, the articulation opened, and the head of the bone dislocated. The knife was then carried downward and backward, so as to form the posterior flap, the incisions meeting in the axilla. (See *Sabstion, Méd. Opér.* t. iii. p. 393—399. ed. 2.)

Larrey, who had frequent opportunities of amputating at the shoulder-joint, aimed at the same object which Desault did; but, in his earlier operations, he was in the habit of beginning with the formation of the external or posterior flap, for the following reason: by proceeding in this way, the surgeon can tie the humeral artery more safely, because the ligature is applied after the operation is entirely finished, and consequently at a time when there is nothing to be attended to but the hemorrhage. Thus, the patient being placed on a stool, and well supported, the arm is to be raised from the side, and the axillary artery compressed from above the clavicle. The integument and other soft parts of the upper and outer portion of the arm are then to be pushed away from the humerus, and the external flap formed. It is now very easy to cut the tendons of the infra-spinatus, and very minor, and open the outside of the joint. The limb is to be carried inward, and luxated backward. The tendons of the supra-spinatus

and biceps are to be divided; and as soon as the head of the bone is out of the glenoid cavity, the knife is to be carried along the internal part of the head and neck of the humerus, with its edge close to the bone. An internal flap, equal to the external one, is to be formed, consisting of a portion of the deltoid, great pectoral, biceps, and coracobrachialis muscles, and including the brachial vessels and nerves. The artery is to be taken hold of with a pair of forceps, and tied. Any other vessels, which require a ligature, are also now to be secured. Larrey puts charpie betwixt the flaps, and brings them towards each other by the usual means. (See *Mém. de Chir. Militaire*, t. ii. p. 170.) Of this method of putting charpie to prevent union by the first intention, I entertain the most unfavourable opinion.

When Larrey published his campaign in Egypt, he had operated in this way on nineteen patients, thirteen of whom recovered. But, at a subsequent period, he and his colleagues had amputated at the shoulder, in the above manner, in upwards of a hundred cases, more than ninety of which recovered. (*Mém. de Chir. Mil.* t. iv. p. 432. 8vo. Paris, 1817.)

In his latter operations, he adopted the innovation of first making a longitudinal incision from the acromion to about an inch below the neck of the humerus, down to the bone, so as to divide the fleshy part of the deltoid into two even parts. This cut, he says, facilitates and renders more exact the rest of the operation. From this wound, the incisions for the flaps are continued. Having made the foregoing incision, "I direct an assistant to draw up the skin of the arm towards the shoulder, and I form the anterior and posterior flaps by two oblique strokes of the knife made from within outwards and downwards, so as to cut through the tendons of the pectoralis major and latissimus dorsi. There is no risk of injuring the axillary vessels, as they are out of the reach of the point of the knife. The cellular connections of these two flaps are to be divided, and the flaps themselves raised by an assistant, who, at the same time, is to compress the two divided circumflex arteries. The whole joint is now exposed. By a third sweep of the knife, carried circularly over the head of the humerus, the capsule and tendons running near the articulation are cut; and the head of the bone being inclined a little outwards, the knife is to be carried along its posterior part, in order to finish the section of the tendinous and ligamentous attachments in that direction. The assistant now applies his forefingers over the brachial plexus, for the purpose of compressing the artery, and commanding the current of blood through it. Lastly, the edge of the knife is turned backwards, and the whole fasciculus of axillary vessels is cut through, on a level with the lower angles of the two flaps, and in front of the assistant's fingers. The patient does not lose a drop of blood; and ere the compression is remitted, the extremity of the axillary artery is readily seen, taken up with a pair of forceps, and tied. The circumflex arteries are next secured, which completes the operation." (*Mém. de Chir. Mil.* t. iv. p. 428. Paris, 1817.) In addition to these important deviations from his earlier method, he subsequently preferred bringing the flaps together with two or three straps of adhesive plaster, and interposed no charpie. (P. 429.)

It should be observed, also, that he lays no stress on first making the outer flap, though, from the description, it does not exactly appear which flap he now begins with. He has changed, likewise, on another point of importance; viz. instead of preferring La Faye's plan, in certain examples already specified, he affirms, that the above described way of operating is applicable to almost every case met with in military practice. First, because all gunshot wounds, generally, which mutilate the arm, so as to create the necessity for the operation, partly or entirely destroy the centre of the deltoid, while there is always enough flesh left at the sides for making the two flaps. Secondly, because, in the very rare instances where the lateral parts of the shoulder are destroyed, and the middle untouched, no advantage would be gained by operating in La Faye's manner, as Larrey conceives that the detached flap would slough, or become, as he terms it, disorganized. He now prefers dividing the middle piece of flesh, and giving the flaps the same shape as if they were uninjured. He even asserts, that the operation, done without any flaps at all, answers better than any method, in which the surgeon preserves flaps not naturally intended for the part. Thus, when all the flesh of the shoulder has been shot away, he has seen surgeons cover the glenoid cavity with a flap saved from the soft parts of the axilla; but such flaps invariably sloughed, hemorrhages ensued, and the patients died. (P. 430, 431.) Some of these latter observations are, clearly enough, the result of great partiality to a particular method of operating; because who can doubt, when the lateral parts of the shoulder are injured, as they frequently are (and not very rarely, as Larrey asserts), by the passage of a musket-ball through the shoulder, from before backwards, that the right method is that of La Faye; or the same operation, with the slight difference of making the flap of a semicircular shape? It was for cases of this description that Mr. Collier and the author of this Dictionary operated after La Faye's plan, with perfect success, after the battle of Waterloo; and a poor fellow of the rifle brigade, who was brought in too late for operation, and died of sloughing, had his shoulder injured in the same way, the middle of the deltoid being untouched, and shot-holes existing behind, and in front of, the articulation. But, if it required any further arguments to prove that Larrey is wrong in wishing to extend his, or rather Desault's method, to all cases, I might criticise his assertions about the sloughing of the flap, when it is not cut into two portions, and its preservation by the singular expedient of making a division of it, and, of course, injuring it still more, than it may have been injured underneath by the bullet. The cases, however, which have fallen under my own personal observation, and numerous others on record, furnish an adequate proof, that, excellent as Larrey's method is for many cases, La Faye's answers very well in others. Thus, in an example where a Prussian hussar had ~~had his~~ arm amputated, and a projection of the bone took place, to the extent of three inches, with hospital gangrene commencing in the stump, Klein felt obliged to remove the limb at the shoulder. He operated in La Faye's manner; the separation was finished in one minute; and, on the eighteenth day, the stump was perfectly healed. (See *Practische Ansichte Chir. Oper. h. i.*

p. 1—10. 4to. Stuttgart, 1816.) The same practitioner had five other secondary amputations of the same kind; but one patient was afterwards carried off by hemorrhage, and another by hospital gangrene. Klein, however, in common with the majority of army surgeons, considers the idea of applying any one plan of operating to different cases totally absurd. (P. 12.) After the storming of St. Sebastian's, nine shoulder-joint amputations were done with success; seven of them by raising the deltoid as a flap. (See *Guthrie on Gunshot Wounds*, p. 108.)

After the battle of Waterloo, I adopted La Faye's plan; but, with this difference, that I did not cut the brachial artery till I had made the last stroke of the knife, which separated the limb, and consequently I did not tie that vessel till the time when I had nothing but the hemorrhage to occupy my attention. The circumflex arteries I tied as soon as the external flap was made. The modification of thrusting a knife under the deltoid, quite across the shoulder, and making the flap by cutting downwards, until the instrument comes out again through the skin, has the recommendation of quickness and the sanction of many good operators (Klein, Lisfranc, Dupuytren, &c.). An excellent lithographic plate illustrative of this last method, is given by Maingault, pl. 4. fig. 17. (See *Méd. Opérat.* p. 24. fol. Paris, 1812.)

When the state of the integuments will permit the choice, Mr. Guthrie thinks their preservation best effected by Larrey's first method; but he particularly insists upon the advantage of raising the shattered arm, or stump, to nearly a right angle with the body, before the operation begins, and even before the assistant makes pressure on the subclavian artery, as some change in the mode of accomplishing the latter object might be rendered necessary by elevating the limb during the operation itself. Mr. Guthrie commences the first incision immediately below the acromion, and, with a gentle curve, extends it downwards and inwards, through the integuments only, a little below the anterior fold of the armpit. The second incision outwards is made after the same manner; but is carried rather further down, so as to expose the long head of the triceps at the under edge of the deltoid. The third incision, commencing at the same spot as the first; but following the margin of the retracted skin, divides the deltoid on that side down to the bone, and exposes the insertion of the pectoralis major, which must be cut through. This flap is now to be raised, so as to expose the head of the bone. The fourth incision outwards divides the deltoid muscle down to the bone, when the posterior flap is to be well turned back, so as to bring into view the teres minor and infra-spinatus passing from the scapula to the great tuberosity of the humerus. The outer and inner flap being now raised, the head of the bone may be rolled a little outwards, the teres minor and infra-spinatus cut, and an opening made into the joint. The capsular ligament, supra-spinatus, and long head of the biceps are then divided. The inner side of the capsule is now cut through, together with the subscapularis muscle, as it approaches its insertion into the lesser tuberosity of the humerus. The long head of the triceps is next divided; and, lastly, with one sweep of the knife, the rest of the soft parts are cut, together with the axillary artery, veins, and nerve. (On

Gunshot Wounds, p. 274—276.) Larrey, in his latest method, takes no measures in the first stage of the operation for commanding the flow of blood, as the assistant merely presses the axillary artery between his fingers just before it is divided.

Some of the modern French surgeons were earlier than Larrey in dispensing with the compression of the axillary artery, and following a method which renders it unnecessary. Richerand, for instance, describes nearly the same plan as that advised by La Faye; but, after making the deltoid flap, cutting the tendons, and dislocating the bone, he dissects down close to the inside of the humerus, so as to enable an intelligent assistant to put his thumb on the cut surface behind the artery, which, with the aid of the fingers, applied to the skin of the axilla, can then be grasped and compressed, so as to command the flow of blood through the vessel. The operator now, fearless of hemorrhage, completes the internal or inferior flap. (*Richerand, Nosographie Chir.* t. iv. p. 509—511. edit. 4.)

Baron Dupuytren had two methods. In one, the arm being raised and held at a right angle with the trunk, Dupuytren stood at the inside of the limb, with one hand grasped and elevated the mass of the deltoid muscle, and plunged under it a two-edged knife, from before backward, on a level with the end of the acromion. Cutting in this way close to the head of the humerus, he continued the incision downward between this bone and the deltoid, and, at length bringing out the knife, completed the external or superior flap. The rest of the operation did not essentially differ from Richerand's, except that Dupuytren took hold of the lower flap itself, before dividing it, and compressed the artery, until he had cut through it and tied it.

In Dupuytren's second method, which he preferred to the first, whenever the state of the soft parts admitted of it, he formed an anterior and a posterior flap. The arm being raised to a right angle with the trunk, the heel of the interosseous knife, or catling, is placed below and a little in front of the acromion. Thence, the operator cuts with a firm hand, and by one stroke, all the soft parts at the back of the shoulder down to the posterior border of the axilla. The flap being raised, exposes the back of the articulation. The elbow is now carried to the front of the chest, so as to make the head of the humerus prominent, and the tendons and capsule are divided upon it. The bone having been disarticulated, the knife is carried round its head from behind forwards, is conveyed from above downwards along the anterior surface of the humerus, so as to form the second flap, the detachment of which is completed as soon as an assistant has taken hold of its base, and compressed the artery included in it between his finger and thumb. Unless the surgeon were an ambidexter, he should stand in front of the patient in operating on the left shoulder, and commence with the anterior flap. Dupuytren regarded this last method as particularly advantageous. The two flaps extend in the direction of the longest diameter of the wound, and can be brought together with exactness and facility. The ligatures, twisted into a single cord, and brought out downwards, form a kind of conductor for the purulent matter outward. The cicatrix resulting from the operation is linear, and promptly formed, with less risk of axillary abscesses than after the other method.

The operation is also finished in less time than Larrey's. (*See Leçons Orales de Clin. Chir.* t. iv. p. 326.) These observations are subject to the consideration, that, when the patient is put to bed after the removal of the arm at the shoulder, the most depending point of the wound may be in some degree regulated by the position in which he lies. If an anterior and posterior flap were formed, he should lie with his chest raised forwards; if a flap had been formed above, and the line of the wound were transverse, he should be placed with the shoulder less elevated.

Another plan of amputating at the shoulder has been proposed by Lisfranc. Supposing the left extremity is to be removed, the patient is placed on an elevated seat, one assistant pressing the artery against the first rib, whilst another draws the arm forwards; the operator, standing behind the patient with a long-bladed catling, pierces the integuments on the inner edge of the latissimus dorsi muscle, opposite the middle of the axilla, and pushes it obliquely upwards and forwards, till its point strikes against the under surface of the acromion; then, by raising the handle of the knife, its point is lowered, and protruded just in front of the clavicle at its junction with the acromion. By cutting downwards and outwards, he then forms a flap from the superior and posterior part of the arm, including the whole breadth of the deltoid muscle, and a part of the latissimus dorsi. This being held back by the assistant, the joint is cut through from behind forwards, and a corresponding flap is formed by cutting downwards and outwards, between the muscles and bone, on the inner side of the arm. When the operation is on the right side, the patient should be seated on a low chair, and the catling thrust from above downwards, from the part just in front of the point where the clavicle is connected with the acromion, the surgeon raising his hand as the instrument proceeds downwards and backwards, until its point has come out at the inner edge of the latissimus dorsi, when the flap is to be made, and the operation finished as above directed. (*See Averill's Operative Surgery*, p. 135. Also *Lisfranc de St. Martin, et Champesme, Nouveau Procédé Opératoire pour l'amputation du bras dans son articulation scapulo-humérale*. Paris, 1815.)

Speaking of this mode of operating, Richerand remarks, "En l'employant, on parvient à désarticuler l'humérus, et à séparer le bras en aussi peu de temps qu'en met un habile découper à détacher l'aile d'un perdrix." (P. 514.)

A plan, long ago suggested by Pojet, and revived by Dr. Dorgey, consisted in making a perpendicular incision from the acromion down to the insertion of the deltoid muscle; separating the sides of the wound, in order to divide the capsule and tendons; dislocating the head of the bone; passing the knife between it and the soft parts from above downwards, and cutting through the latter with one sweep of the instrument. (*See Velpeau, Nouv. Élém. de Méd. Opér.* t. i. p. 435.)

M. Scoulteten's oval method is done on the left arm, as follows:—The surgeon first takes hold of the middle of the arm with his left hand, and raises it four or five inches from the side. With his right hand he then applies the point of the scalpel immediately below the acromion, and passes it into the flesh until it touches the head of the humerus. He then depresses the handle, and forms the first

incision, which extends downwards four inches from the point of the acromion, and divides the posterior third of the deltoid, and the greater part of the fibres of the long portion of the triceps down to the bone. The second incision is next commenced with the point of the knife directed downwards upon the inner side of the limb, and in front of the biceps, on a level with the place where the first incision ended. The wound is then extended inwards and upwards to the acromion, where it terminates by joining the first. These two wounds form a triangle, which partly consists of relinquished integuments, and has its base downwards.

In order to find the joint with greater ease, the surgeon may now detach a little of the deltoid from the bone. An assistant can also keep the edges of the incision asunder, so that the operator may be enabled to see and divide the capsular ligament, and the tendons of the supra-spinatus, infra-spinatus, and teres minor, which are inserted into the greater tubercle of the humerus, and the tendon of the subscapularis, which is inserted into the lesser tubercle. The operator, who constantly keeps hold of the arm, now communicates to it some rotatory movements, in order to bring the above tendons, one after another, under the knife, and divide them with the capsule. Immediately the capsule and tendons have been cut through, the head of the bone readily quits its socket. The surgeon luxates the bone by pushing it a little upwards, and, at the same moment, inclining the condyles towards the side. The next proceeding is to divide the flesh on the inner side of the limb as closely as possible down to the bone; but, when the knife approaches the artery, this vessel is to be taken hold of and compressed by an assistant, before the incision is completed. In this way, no hemorrhage need be apprehended.

When it is the right limb, the only difference is, that the first incision is made at the inner side of the arm, and extended up to the acromion. Scoutteten considers a single assistant sufficient, and compression of the subclavian artery unnecessary. (*H. Scoutteten, La Méthode Ovale, ou Nouvelle Méthode pour amputer dans les Articulations.* Paris, 1827, 4to.)

When the scapula is shattered, of course the loose fragments should be taken away; and, if the acromion be broken, and the remnant of it pointed and irregular, this sharp rough portion should be sawn off, as was practised long ago by M. Faure. (See *Mém. de l'Acad. de Chir.* t. vi. p. 114.) In one case, indeed, Larrey found it necessary to take away more than two thirds of the scapula, and the humeral end of the clavicle. (*Mém. de Chir. Mil.* t. iv. p. 432.) Sawing off part of the acromion, and coracoid process, as a general rule, seems to me quite unnecessary (see *Fraser on the Shoulder-joint Operation*, 8vo. Lond. 1813), and improper, not only as producing delay, but wounding other parts which should not be at all disturbed. (See *Guthrie on Gunshot Wounds*, p. 285, 286, &c.) The practice of scraping away the cartilage of the glenoid cavity, except when it is diseased, is not of greater value.

Amputation at the shoulder has been partly superseded by a preferable operation, even in cases in which it would formerly have been deemed indispensable; such as considerable gunshot fractures of the head of the humerus, a caries of

the substance of this part, &c. Boucher, in 1753, proved that considerable wounds, extending into the shoulder-joint, might be successfully treated, by extracting the fragments and splinters of bone. (*Mém. de l'Acad. de Chir.* t. ii. p. 287 et 461.) Instances are also recorded, in which, when the head and neck of the humerus in children had been totally disunited from the body of that bone, a cure was accomplished by making such incisions as allowed the portions of bone, now become extraneous bodies, to be taken away. The earliest case of this kind on record is that in which M. Ithomas, a surgeon at Pezenas in Languedoc, removed the separated head of the humerus in 1740, which, in a child four years of age, presented itself loose in an incision, which had been previously made for the extraction of some sequestra. The particulars may be read in Guthrie's valuable work. (*On Gunshot Wounds*, p. 215, &c.) Mr. White, of Manchester, proceeded further; for he made a deep incision at the upper part of the arm; dislocated the head of the humerus, which he knew was carious; and, pushing it through the wound, took it off with a saw. He began an incision at the orifice of a sinus situated just below the processus acromion, and extended the wound down to the middle of the humerus, by which all the subjacent bone was brought into view. He then took hold of the patient's elbow; and easily forcing the upper end of the humerus out of its socket, he brought it so entirely out of the wound that he readily grasped it in his left hand, and held it there till he had sawn it off with a common amputation saw, having first applied a pasteboard card betwixt the bone and the skin. The patient did not lose more than two ounces of blood, only a small artery, which partly surrounded the joint, being wounded, which was easily secured.

In about five or six weeks, the part from which the bone had been taken had acquired a considerable degree of firmness, and the boy was able to lift a pretty heavy weight. At the end of two months, a large piece of the whole substance of the humerus was ready to separate from the sound bone, and with a pair of forceps it was easily removed. After this exfoliation, the wound healed very fast, and, in four months after the operation, the boy was discharged perfectly cured. On comparing this arm with the other, it was not quite an inch shorter; the boy had the perfect use of it, and could not only elevate his arm to any height, but perform the rotatory motion as well as ever. The figure of the arm was not at all altered. Mr. White did not make use of any splints, machine, or bandage, during the cure, in order to confine the limb strictly in one certain situation; nor was the patient's arm ever dressed in bed, but while he was sitting in a chair, and, as soon as he could bear it, standing up. To this method Mr. White attributed the preservation of the motion of the joint.

"As this is the first operation of the kind that has been performed, or at least made public (says Mr. White), I thought the relation of it might possibly conduce to the improvement of the art. That ingenious surgeon, Mr. Gooch, has indeed related three instances of the heads of bones being sawn off in compound luxations. In one of these cases, the lower heads of the tibia and fibula were sawn off; in another, that of the radius; and, in the third, that of the second bone of the thumb; but these were in many respects different from the

present case. I believe it will seldom happen, that this operation will not be greatly preferable to amputation of the arm at the scapula, as this last is generally performed for a caries of the upper head of the os humeri, and as the preservation of a limb is always of the utmost consequence, and what every surgeon of the least humanity would at all times wish for, but particularly where, as in this case, the whole limb, and its actions, are preserved entire, the cure no ways protracted, and the danger of the operation most undoubtedly less. For though amputation is often indispensably necessary, and frequently attended with little danger or inconvenience when only part of a limb is removed, yet, when the whole is lost, the danger is greatly increased, and the loss irreparable." Mr. White concludes with suggesting an analogous operation for removing the head of the femur, in lieu of amputation at the hip. Something of this kind is indeed reported to have been actually done on a girl with success (see *Joannis Mulder, Oratio de Meritis P. Camperi*, &c. p. 81.; *Cases in Surgery*, by C. White, p. 57.; or *Phil. Trans.* vol. lix. for 1769.); and my friend, Mr. Anthony White, of the Westminster Hospital, in the year 1818, removed the head of the femur with a successful result. The patient was a boy, whose femur had been dislocated from the effects of a diseased hip, and the bone lay on the dorsum of the ilium, with the limb fixed across the other. The little patient had several fistulous openings in the hip, and was extremely emaciated, so that the head of the femur seemed very superficial. Mr. White, reflecting that the original structure of the joint had here been already annihilated; that the boy would die if no attempt were made to get rid of the diseased part of the femur; and that, even if he lived, the limb fixed in this manner across the other would only be an incumbrance, determined to operate. Being assisted by Mr. Travers, he cut down upon and exposed the head and neck of the femur; and having sawn through the bone just below the trochanter minor, he raised the detached fragment with an elevator, and extracted it: directly the saw had divided the bone, the limb could be placed in any position. At the end of a year the boy had recovered; and so useful a new joint was formed, that, with the assistance of a high-heeled shoe, he could walk well, and execute all the common movements of the limb. He lived several years afterwards, and then died of phthisis. The new joint is preserved in the Museum of the Royal College of Surgeons in London. A similar operation has also been performed by Sir Benjamin Brodie, but I am not acquainted with the particulars, or the result. Long after the publication of White's case of incision of the head of the humerus, viz. in 1767, an example, in which Vigoroux adopted the same practice, in 1788, was communicated to the profession: the result, however, was unfortunate, the patient, a lad seventeen years of age, having died soon after the experiment. (See *Œuvres de Chir. Prat. par I. M. J. Vigoroux (fils)*, Montp. 1812.)

Mr. Bent, of Newcastle, inserted a similar case to Mr. White's in the 64th vol. of the *Philosophical Transactions*. White made only one incision, from the vicinity of the acromion down to the middle of the arm. Bent, not being able to get at the head of the bone through the wound which he had

pectoral muscle, detached a portion of the deltoid, where it is connected with the clavicle, and another part where it is adherent to the humerus. A third successful case is also reported in the 69th vol. of the same work, p. 6. Afterwards, Bromfield published some directions for the guidance of the surgeon in such operations. (*Chir. Obs. and Cases*.)

I think the cases, recorded by White and Bent, are truly important, inasmuch as they are the earliest models of a practice, which will sometimes supersede all occasion for one of the most formidable and mutilating operations of surgery. To military and naval surgeons, these cases cannot fail to be highly interesting, as they must have frequent opportunities of availing themselves of the instruction which they afford. Larrey, who was surgeon-general to the French army in Egypt, employed the practice with the greatest success, in cases of gunshot wounds. He thereby saved limbs, which, according to ordinary precepts and opinions, would have been a just ground for amputating at the shoulder; and, when it is considered, not only that a most dangerous operation is avoided, but that an upper extremity is saved, for which no substitute can be applied, we must allow that the plan, first suggested and practised by Mr. White, cannot be too highly appreciated. When the arm was fractured near its upper extremity by a musket-ball, most surgeons formerly deemed it necessary to amputate the limb. Here, says Larrey, it would be useless to dilate the entrance and exit of the ball, because a sufficient opening could not be prudently made in this way for the extraction of the head of the bone. Yet this body is now an extraneous substance, having lost its connection with the shaft of the humerus, and its presence exciting irritation and inflammation of the joint, abscesses, necrosis, &c. Here Larrey seems to imply that the detached head of the bone cannot unite again; an assertion which, I have no doubt, is incorrect, as I have attended several cases in which the humerus was broken very high up, yet united without difficulty. The bad symptoms, which he so emphatically attributes to the detachment of the head from the body of the bone, are in reality the effects of the gunshot violence itself. If, therefore, the head of the bone were merely broken off, and it and the neighbouring part of the bone not splintered, nor the flesh not more extensively injured than would arise from the passage of a musket-ball, and the joint itself not involved, I should question the propriety of having recourse, at once, either to the extraction of the head of the bone, or amputation at the shoulder. When the bone is shattered, the case is often different, and Larrey's practice is then commendable. In confirmation of these sentiments, I may mention Mr. Guthrie's opinion, who, in reference to the extraction of the head of the bone, says he does not consider a perfect fracture of the humerus, an inch below its head (although there be evident separation), as demanding even this operation, as he has known such cases to do well when treated as other compound fractures, except that the motion of the joint was nearly lost (*On Gunshot Wounds*, p. 329.) However, it is fair to mention, that Mr. Guthrie inclines to amputation at the shoulder when the body of the bone is splintered, or has long fissures in it, in which sentiment he is undoubtedly right. The other operation seems principally calculated for cases, in

which, the damage is restricted to the head and uppermost portion of the bone.

According to Mr. Guthrie, when the ball passes out with little injury to the bone, and the openings already made are not sufficient to admit of a moderate examination with the point of the finger, the wound should be enlarged. However, others might argue; that such dilatation should be made only when the bone is felt to be seriously broken, and the fragments will probably require immediate removal. But whatever course be adopted, the most rigorous antiphlogistic treatment will be proper; and, if abscesses form, early and depending openings should be made for the discharge.

Larrey says, "I have had the good fortune, on ten different occasions, to supersede the necessity for amputation at the shoulder, by the complete and immediate extraction of the head of the humerus, or its splinters, without delay. I perform the operation in the following manner: I make an incision in the centre of the deltoid muscle, and parallel to its fibres, carrying the incision as low down as possible. I get the edges of the wound drawn asunder, in order to lay bare the articulation, of which the capsule is generally opened by the first incision; and by means of a probe-pointed bistoury, I detach with the greatest ease from their insertions the tendons of the supra and infra-spinati, of the teres minor, of the sub-scapularis, and of the long head of the biceps; then I disengage the head of the humerus, and remove it through the wound in the deltoid by means of my fingers, or of an elevator. I bring the humerus up to the shoulder, and fix it in a proper position with the aid of a sling and a bandage. Such is the operation which I performed on ten patients, in extirpating the head of the humerus, one of these died of the hospital fever, two of the scurvy, at Alexandria; and the fourth, after he was cured, died of the plague on our return to Syria. The rest returned to France in good health. In some, the arm became ankylosed to the shoulder; and in others, an artificial joint, allowing of motion, was formed." (See *Mém. de Chir. Militaire*, t. ii. p. 175.) Another successful case, of the same kind, was published by Mr. Morel. (See *Medico-Chirurg. Trans.* vol. vii. p. 161.)

Mr. Guthrie thinks it not sufficient to make a simple incision through the deltoid muscle into the capsular ligament, and take away the fragments of bone, but urges the removal at the same time of a considerable part of the capsular ligament, lest disease still go on in the joint. Also, as it is impossible to know, beforehand, in what state the bone may be below the fracture (that is, with respect to fissures running more or less down it), he advises the incision, designed for the extraction of the splintered head of the bone, to be made in a situation where, if amputation at the joint be found indispensable, it will be of advantage. Mr. Guthrie likewise describes the manner of turning out the head of the bone in these cases, and sawing it off; the necessity of which, however, I do not clearly comprehend, unless the taking away of any sharp spicula of the upper end of the body of the bone be implied, which may be right. (*On Gunshot Wounds*, p. 333—335.) My ideas, however, chiefly extend to the removal of loose fragments, and splinters; and, with respect to sawing off the head of the bone, this is a proceeding, I suppose, necessarily limited to the kind of cases re-

ported by Mr. White and Mr. Syme. (*Edin. Med. and Surgical Journ.* No. 88. p. 49.)

In Mr. Syme's example, the head of the humerus was diseased. A perpendicular cut was made from the acromion through the middle of the deltoid, extending nearly to its insertion. A similar incision was then made upwards and backwards from the lower end of the first wound, and a large flap formed from the back portion of the deltoid, "which, being held up, exposed the joint so far, that (says Mr. Syme) I was able to insulate the head of the bone by means of my finger, and then to detach the scapular muscles from their connections with the tuberosities, when, the arm being brought forwards, I easily protruded the head of the humerus, embraced it in my left hand, and sawed it off without any injury to the other parts." (*Op. cit.* p. 51.) A portion of the acromion being diseased, was removed with the cutting pliers. From what has been stated, it may be inferred that, when the object is merely to extract splinters, a single perpendicular incision will suffice; but that when the joint is diseased, and the head of the bone requires to be sawn off, the operation will be much facilitated by following the plan adopted by Mr. Syme. In this gentleman's case the patient recovered, and the shoulder had motion in every direction.

Walther first demonstrated on the dead body the practicableness of amputating the scapula; and in one case, where this bone was inseparably connected with a tumour, the greater part of it was successfully removed by Haymann. (See *Walther, in Journ. für Chir. b. v.* p. 274.; and *Haymann*, vol. cit. p. 569.; *Chelius, Handb. der Chir. b. ii.* p. 759.) For a further account of the removal of diseased bones and parts of them, see BONES, EXCISION OF; and JOINTS, EXCISION OF.

AMPUTATION OF THE FINGERS AND OTHER PARTS OF THE HAND.

Amputation of the fingers, or parts of them, is performed with one, or with two flaps, or with a circular or an oval incision, and frequently required, either primarily or secondarily, on account of various accidents and diseases, as comminuted fracture, onychia maligna, necrosis, &c. The best surgeons all agree with Mr. Sharp, that in general the operation is most conveniently performed in their articulations, though exceptions sometimes occur in which it may be done elsewhere, and the phalanx divided with the cutting pliers. Thus it occasionally happens that either the distal or the middle phalanx is torn off, and the end of the proximate phalanx exposed: here, instead of removing the whole of the middle or of the proximate phalanx (as the case may be), it will often suffice to take away the denuded portion of it with the cutting pliers, and save a proper flap for covering the end of the remaining part. As Mr. Liston has explained, it is sometimes desirable to save as much as possible of the proximal phalanx, when amputation is rendered necessary by disease of the middle articulation, or of the distal extremity of the bone. In such cases, two semicircular flaps are made by cutting from without, either on the lateral, or on the palmar and dorsal aspects; and the bone is divided either with a small saw, or the cutting pliers. (*Elements*, &c. part iii. p. 374.) When an injury just includes the joint, and no more, Mr. Guthrie deems it better to saw through

the bone, than to operate at the next articulation. (*On Gunshot Wounds*, p. 384.)

AMPUTATION OF THE DISTAL AND MIDDLE PHALANXES.

The distal bone is but loosely supported by the anterior ligament, and behind by the extensor tendon: at the sides, however, they are much more closely held together by the lateral ligaments. Consequently, it is these which must be divided, in order to lay open the joint freely. The line of the articular interval is nearly transverse. Between the distal and middle phalanx, it is on a level with the palmar cutaneous furrow; but, in the articulation of the middle with the proximate phalanx, it is a line and a half below the palmar furrow. (See *J. F. Malgaigne, Manuel*, &c. p. 305.) In either of these joints the operation is done in a very similar manner; either with a single flap, taken from the palmar surface of the finger, and long enough to cover the whole surface of the wound, or with two flaps, the longer one being formed on the palmar side, and the shorter one on the back of the finger. The surgeon, taking hold of the finger and placing it in the bent position, makes, with a narrow bistoury, an incision (I should say a semilunar one) across the prominence of the articulation; or, as Malgaigne directs, half a line below it. Thus the skin is divided, and the posterior part of the capsule generally opened with the same stroke. If it be not, the surgeon, without stopping to effect this, may proceed to cut the lateral ligaments, one after the other; and the knife being next conveyed through the articulation, the operation is completed by the formation of the palmar flap, which is to be the larger of the two, and long enough to cover the greater part of the wound. (See *Dupuytren, Leçons Orales de Clinique Chir.* t. iv. p. 305.; *Malgaigne, Manuel*, &c. p. 306.) When both phalanges are to be removed, the dorsal incision should end on each side, precisely on a level with the terminations of the cutaneous palmar furrow.

Another method, ascribed to Lisfranc, consists in attacking the joint on its palmar side. All the fingers are bent, except that which is about to be amputated. The point of a narrow straight bistoury, with the edge directed towards the extremity of the finger, is introduced half a line beyond the palmar cutaneous wrinkle, if we are amputating the distal phalanx, and exactly at the base of this wrinkle, if we are removing the middle phalanx. The knife is to pass through the finger from one side to the other, and close to the lateral and anterior surfaces of the bone: along which it should be carried to the extent of six lines, and then brought out, so as to complete a semilunar flap. The knife is then carried again to the base of the flap to divide the anterior ligament. In this operation the lateral ligaments scarcely require to be cut separately; for, the same stroke of the knife by which the anterior ligament is cut usually cuts them also, and makes room for the knife to be conveyed through the articulation. Lastly, the textures on the dorsal aspect are divided, without any posterior flap being made. By this method, a more regular and better nourished flap is produced, and the operation is more sure of being effected with precision; but the extensor tendon is apt to remain too long, in which event its projecting end should be cut off with scissors.

The circular method of amputating a finger is the oldest. The finger is put in the extended posture; a circular incision is made three or four lines beyond the articular interspace, the situation of which is denoted by the position of the palmar cutaneous furrow. The skin is dissected up as far as necessary, and the joint opened either in front or behind, as in the flap-operation already described. Or, if the disease or injury will admit of it, the integuments may be drawn up before the circular cut is made, and thus little or no dissection of them from the subjacent parts will be necessary. In general, after amputation of the distal and middle phalanges, the bleeding ceases as soon as the wound is brought together with adhesive plaster, and no ligature is required.

AMPUTATION AT THE METACARPO-PHALANGIAN ARTICULATIONS.

Each of these joints is of the enarthrosis kind, and furnished only with loose ligaments. What is termed the knuckle, or the articular prominence, seen when the phalanx is bent, is formed by the head of the metacarpal bone. The joint is commonly about ten or twelve lines above the digital commissure.

1st Method.—The hand being placed in the prone position, and the other fingers held apart from the one about to be removed, the phalanx is to be bent, as Lisfranc specifies, to an angle of 45°, and an incision begun over the head of the metacarpal bone, about three lines beyond the articulation, and extended obliquely down to the side of the finger, on a level with the digital commissure, care being taken to divide as completely as possible the extensor tendon. The incision is then carried to the palmar aspect of the joint, and the first flap completed, which is to be reflected. The knife is now pushed into the exposed side of the articulation, the ligaments cut, and the operation finished by the formation of the opposite flap, which ends like the first at the digital commissure.

The following is Mr. Liston's description of this method:—The operator seats himself before the patient; grasps the finger so as to manage its movements with the left hand; and holding the knife perpendicularly, with its point upwards, lays it over the knuckle, and carries it obliquely upwards, so as to open that side of the articulation. He then pushes the finger towards the opposite side, and with the point of the knife completes the loosening of the articulation, which should never be done with the blade, as it would cross-cut and mangle the skin. After the separation of the base of the phalanx with the point, the blade is passed behind; and, being carried downwards and outwards, it forms a flap similar to the first. They are retained in contact by bringing the neighbouring fingers towards one another. In general, this will also stop the bleeding, but sometimes one or both digital arteries will require ligature. (See *Liston's Elements*, part iii. p. 375.)

When this operation is done on the index finger, the outer flap should be the larger; when on the little finger, the inner flap should have the greater size. (See *J. F. Malgaigne, Manuel*, &c. p. 310.) Dupuytren, instead of cutting the integuments obliquely, preferred dividing them perpendicularly, and making a semilunar incision, directed from the dorsal towards the palmar aspect of the finger. Another semilunar flap was next formed on the op-

posite side. As Dupuytren found that, when the ring or middle finger had been removed, without taking away the head of the corresponding metacarpal bone, the adjoining fingers remained widely separated at their base, but obliquely approximated to one another at their extremities, so as to produce a considerable deformity, and an imperfection in their functions, he used not to be content with amputating the phalanges, but made it a rule to apply a retractor, and saw off the head of the metacarpal bone. (See *Leçons Orales*, &c. t. iv. p. 309.) I know that Sir Astley Cooper has long advocated the same practice, which is most readily accomplished with a pair of strong cutting pliers. The extension of disease to one of the metacarpophalangeal articulations may also be another reason for taking away more or less of the metacarpal bone along with the finger. If merely the distal end of the bone is affected, the foregoing plan of operation will suffice; but, as is remarked by Mr. Liston, if a considerable portion of the metacarpal bone is to be taken away, the palm should be left uninjured. "With this view the knife is entered over the dorsal centre of the bone, above the diseased part, and carried straight downwards till near the articulation, when it is made to diverge for the formation of lateral flaps. The integuments in the track of the wound are then dissected backwards, so as to expose the bone completely, and the bistoury is passed round it throughout its whole extent, the edge being kept close to it. Then the bone is clipped at the proper point by the cutting pliers; or the section of the bone may be performed before the separation of the soft parts from its under surface, as by raising the cut end this part of the operation may be facilitated." (See *Liston's Elements*, part iii. p. 377.)

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If merely the anterior extremity of the metacarpal bone were diseased, the bone might be divided with the cutting pliers, so as to remove the part affected, amputation being done either with the circular incision or a flap. (See *Velpeau, Nouv. Elém. de Méd. Opér.* t. i. p. 389.) An operation more frequently practised, however, is disarticulation at the joint between the metacarpal bone of the thumb and the os trapezium. The metacarpal bone is almost subcutaneous at its posterior and external aspect, but covered by a thick mass of muscle on the side towards the palm. The direction of the articulation is oblique, corresponding to a line, which, if carried far enough, would cross the root of the little finger. It has a loose capsule, and may be opened with the greatest facility at its two posterior thirds. The tendons of the long abductor and short extensor lie over the superficial side of it. The radial artery runs over its ulnar side in its way to the palm, to form the deep palmar arch. The tendon of the long extensor lies behind and that of the long flexor in front of it. The place of the joint is readily determined by passing the forefinger over the dorsal aspect, or the sides of it, from before backwards, for it is situated immediately behind the first bony tubercle. (See *Velpeau, Op. cit.* p. 390.)

1st Method.—While the thumb is held in the position of abduction, the knife is applied to the middle of the commissure; an incision is made at once down to the carpus, the edge being carried close to the ulnar side of the metacarpal bone,

which is about to be taken away; the joint is then opened by cutting outwards, the fibrous textures divided rather with the point than the blade, so as not to cross-cut the skin; the thumb abducted and dislocated, and a flap formed from behind forwards, by carrying the knife close to the outer side of the bone, and a few lines beyond the metacarpophalangeal joint. If the radial artery itself has been wounded it must have a ligature; but, in other cases, bringing the flap accurately over the wound will stop the bleeding. Besides applying adhesive plaster, the flap, and especially its base, should be supported with a compress and bandage.

2d Method.—An assistant takes hold of the thumb, while the surgeon takes as much of the soft parts as possible with the fingers of his left hand, and draws them outwards. The latter then transfixes them with a straight narrow knife from behind forwards, or towards the palm, directing the blade close to the radial side of the articulation. A flap is then formed; and while this is held up by the assistant, the surgeon takes hold of the thumb, cuts through the joint from without inwards, luxates the bone, and with the knife cuts through the middle of the commissure. This method leads to the same result as the former, but, being more difficult, ought not to be preferred.

3d Method.—Velpéau has frequently amputated the thumb in the following manner:—An incision is made along the back of the thumb from the styloid process of the radius to the commissure of the thumb and forefinger. This divides the integuments, the tendon of the long extensor, and a portion of the first interosseous muscle, so as to expose the joint. While an assistant holds aside the edges of the wound, the surgeon opens the capsule and dislocates the bone, which is then removed, care being taken to preserve as much of the flesh on the palmar side as will be required to close the wound immediately. Thus the palm of the hand is not at all wounded.

4th or Oval Method.—The operation is begun as in the foregoing plan. The knife is carried round the anterior aspect of the root of the thumb, and then over the dorsal one, this second cut joining the extremity of the first. The point of the knife is next introduced into the articulation, which is cut through from its dorsal towards its palmar boundary. All that now remains to be done is to detach the bone from any fibres which may yet adhere to it, by carrying the knife in front of it from behind forwards. The wound, when brought together, represents a straight line. (See *Velpeau, Op. cit.* p. 392.) This method was described by Lassus, Beclard, &c.

AMPUTATION OF THE PHALANGES OF THE THUMB

Needs no particular description, as it is performed in the same way as the removal of the middle and last phalanges of the fingers.

AMPUTATION OF THE MIDDLE FINGER OR RING FINGER, TOGETHER WITH THE WHOLE OF THE METACARPAL BONE.

A few years ago Langenbeck first removed by the oval method the middle finger, with its metacarpal bone, from the os magnum. In order to find out the articulation, he draws a line from the upper head of the metacarpal bone of the thumb straight across to the metacarpal bone of the finger about to be removed; and at this place he begins his first incision,

which runs towards one of the digital commissures. From the point where this is begun another cut is made down to the outer commissure, and the two united by carrying the knife round the palmar aspect. While an assistant holds apart the sides of the wound, the surgeon cuts the ligaments of the joint with the point of the knife, and at the same time endeavours to dislocate the bone with his left hand. This having been accomplished, the knife is introduced flat under the carpal end of the metacarpal bone, and all the connections of the bone towards the palm divided from the carpus to the root of the finger. (See *Langenbeck's Bibl.* b. i. p. 575. and plate iii. fig. 1.) It is often difficult to know, however, whether the disease is confined to the metacarpal bone; and, if it be not, and the carpus be affected, the operation will not answer, as was exemplified in one of Langenbeck's own cases.

AMPUTATION OF THE LITTLE FINGER, WITH A PART OR THE WHOLE OF ITS METACARPAL BONE.

A flap is formed by transfixion at the inner side of the joint or part where it is intended to saw through the bone, and by carrying the knife a little beyond the level of the opposite digital commissure. The joint is then opened, the bone separated from the soft parts, and its detachment completed by division of the commissure. If only a portion of the metacarpal bone is to be removed, the cutting pliers are the best instrument for its division.

Modern surgeons never amputate the whole of the hand, when there is a reasonable chance of preserving any useful portion of it. Thus, when a soldier had been struck by a grape shot, which shattered the metacarpal bones of the little and ring fingers, grazed the middle finger, and tore the integuments on the palm and back of the hand, Mr. Guthrie succeeded in saving the two fingers and thumb, although in the removal of the other parts no regular flaps could be made for covering the wounds. (*On Gunshot Wounds*, p. 382.) In the North London Hospital, assisted by Mr. Liston, I also succeeded, in the spring of 1835, in saving the hand and a couple of fingers, after a severe laceration, and comminution of this part of the limb by machinery. The thumb and other injured fingers were amputated.

On this principle of removing as little of the upper extremity as possible, amputation of all the fingers together at the metacarpophalangeal articulation is sometimes practised with a single or double flap.

AMPUTATION OF PARTS OF THE FOOT.

It may happen that the bones of the toes, and only part of the metatarsal bones, are carious, in which case the leg need not be cut off, but only so much of the foot as is disordered. Mr. Liston's cutting-bone forceps will often be found exceedingly useful in such an operation, where it may be necessary to divide a phalanx or the metatarsal bone. When this operation is performed, the heel and the remainder of the foot will be of great service, and the wound heal up safely, of which Mr. S. Sharp says he had seen one example. (*Op. of Surgery* chap. 37. ed. 3.) Mr. Hey confirms this statement of Sharp's concerning the impropriety of removing the whole foot, when the metatarsal bones are carious and every other part of the leg is sound. As the remainder of the foot is of immense

service in walking, the use of the ankle not being destroyed.

Mr. Hey proposed a new mode of removing the metatarsal bones, which on repeated trial fully answered his expectations. By the term *new*, I here mean a particular method, which had not been previously described, though it may have been performed by others sooner than by Mr. Hey himself; for the merit of having first done it is imputed to the late Mr. Turner, of North Yarmouth, who did it with success about the year 1787. (See *Hutchinson's Prac. Obs.* p. 70.) Mr. Hey makes a mark across the upper part of the foot, to denote where the metatarsal bones are joined to those of the tarsus. About half an inch from this mark, nearer the toes, he makes a transverse incision, through the integuments and muscles covering the metatarsal bones. From each extremity of this cut, he makes an incision along the inner and outer side of the foot to the toes: he removes all the toes from the metatarsal bones, and then separates the integuments and muscles, forming the sole of the foot, from the inferior part of the metatarsal bones, keeping the edge of the knife as near the bones as possible, in order to expedite the operation, and preserve as much muscular flesh in the flap as can be saved. He then separates the four smaller metatarsal bones, at their junction with the tarsus, and divides with a saw the projecting part of the first cuneiform bone, which supports the great toe. The arteries being tied, Mr. Hey applies the flap, which had formed the sole of the foot, to the integuments which remain at the upper part, and keeps them in contact with sutures. The cicatrix being situated at the top of the foot, is in no danger of being hurt; while the place, where the toes were situated, is covered with such strong skin, viz. what previously formed the sole of the foot, that it cannot be injured by any moderate violence. (See *Practical Observations in Surgery*, p. 535. &c.)

When the metatarsal bone of the great toe is alone diseased, Mr. Hey recommends dissecting it out from the cuneiform bone, instead of sawing it. The latter plan cannot be easily accomplished, without removing part of the integuments and muscles, and making a transverse, as well as a longitudinal, incision. These disagreeable things may be avoided, however, by employing the cutting pliers, or by following the method of Mr. Hey, or that of Sir Charles Bell. For removing the metatarsal bone, either of the little or great toe, the latter gentleman directs us to carry a scalpel round the root of the toe, and then along the side of the foot. The flaps are then to be dissected back, the metatarsal bone is to be separated from the next; and its square head is to be detached from the tarsus. (*Operative Surgery*, vol. i. p. 390.)

The plan of removing the metatarsal bone of the great or little toe, and leaving the toe itself, is now renounced. Mr. Liston has seen it done, but the result was unsatisfactory. (*Elements*, &c. part iii. p. 398.) The late Mr. Hewson, of Dublin, removed the first metatarsal bone from the foot of a patient in the Meath Hospital, and allowed the great toe to remain. The wound healed, and the patient was dismissed cured; but, in a few months, he returned to the hospital, complaining that he could not use the foot on account of the position which the great toe had assumed. It was drawn downwards and outwards, and lay transversely

under the second and third toes, both which were in a state of ulceration, where they were in contact with it. No power of moving the toe was recovered. (See *Rynd, in Dubl. Journ. of Med. Science, vol. viii. p. 297.*)

Dupuytren objects to the usual method of amputating the great toe at the metatarsal-phalangeal articulation, because, as he states, the head of the metatarsal bone forms, after the operation, a very prominent angle at the inner side of the foot, impeding the bringing of the margins of the wound together, and causing ulceration, &c., from pressure of the shoe on the part after cicatrization. Hence, instead of disarticulating the great toe, Dupuytren prefers amputating in the continuity of the metatarsal bone. In the trials which he made of this plan, the loss of the point of the tripod of the foot, caused by the removal of the head of the metatarsal bone of the great toe, was not followed by any inconvenience. (See *Lçons Orales de Clinique Chir. t. iv. p. 336.*)

The best way of executing either of these operations seems to me to consist in transfixing the soft parts, and making a flap at the inner side of the toe; disarticulating the phalanx from the metatarsal bone, or dividing the latter with Mr. Liston's cutting forceps, and then completing the detachment by cutting the soft parts from the bone, and at the commissure. Dupuytren followed a more complicated plan, and was not in the habit of using the cutting forceps, by which the operation is so materially facilitated. The plan which I have recommended, is also applicable to amputation of the little toe, with a part or the whole of its metatarsal bone.

In winter campaigns, the toes, and more or less of the foot, are often attacked with mortification from cold. In this circumstance, when the disorder does not extend beyond the middle of the foot, or the toes, it is only necessary to cut away the gangrenous part. On the first entrance of the French army into Holland after the revolution, Paroisse met with many of these cases, in which it was requisite merely to take away the metatarsal bones, or sometimes those of the tarsus. All the patients, operated upon in this manner for the effects of cold, were cured; walking afterwards with more or less difficulty, according as the portion of the foot taken had been greater or smaller. (*Opusculs de Chir. p. 218.*)

The method of removing a part of the foot at the junction of the two halves of the tarsus, or Chopart's operation, is one of considerable merit. It is performed in the nearly parallel articulations of the os calcis with the os cuboides, and of the astragalus with the os naviculare. Thus the heel is preserved, on which the patient can afterwards walk. The performance of it is simple. The tourniquet having been applied, the surgeon is to make a transverse incision through the skin which covers the instep, two inches from the ankle joint. He is to divide the skin, and the extensor tendons, and muscles, in that situation, so as to expose the convexity of the tarsus. He is next to make on each side a small longitudinal incision, which is to begin below and a little in front of the malleolus, and is to end at one of the extremities of the first incision. After having formed in this way a flap of integuments, he is to let it be drawn upward by the assistant who holds the leg. There is no occasion to dissect and reflect the flap; for the cellular substance connecting the

skin with the subjacent aponeurosis is so loose, that it can easily be drawn up above the place, where the joint of the calcaneum with the cuboides, and that between the astragalus and scaphoides, ought to be opened. The surgeon will penetrate the last the most easily, particularly by taking for his guidance the eminence, which indicates the attachment of the tibialis posticus muscle to the inside of the os naviculare. The joint of the os cuboides and os calcis lies pretty nearly in the same transverse line, but rather obliquely forward. The ligaments having been cut, the foot falls back. The bistoury is then to be put down, and the straight knife used, with which a flap of the soft parts is to be formed under the tarsus and metatarsus, long enough to admit of being applied to the naked bones so as entirely to cover them. It is to be maintained in this position with three or four strips of adhesive plaster, which are to extend from the heel, over the flap, to the inferior and anterior part of the leg. On the instep, the continuation of the anterior tibial artery will require a ligature; and in the sole, the internal and external plantar arteries, in the thickness of the flap of soft parts, must generally be taken up. One half of each ligature is to be cut away, and the other one is to be left hanging out between the plasters, at the nearest and most convenient point.

Walther and Graefe have given some very precise directions for the performance of this operation. A cut is first made, beginning half an inch below the outer ankle, and extending forwards along the side of the foot two inches. Another similar incision is then made, beginning one inch below the inner ankle. The foot is now to be bent upwards, and the two first cuts united by a transverse incision, two finger-breadths from the front of the tibia. A flap is then dissected up, as far back as the commencement of the lateral incisions, or a line corresponding to the articulation of the astragalus with the os naviculare, and of the os calcis with the os cuboides. An assistant now checks the bleeding by applying the points of his fingers on the mouths of such vessels as bleed profusely, and holds up the flap. The extremity of the foot is then to be firmly inclined downwards, so as to stretch the ligaments connecting the tarsal bones together. The ligaments between the astragalus and os naviculare are to be first cut, when the foot may be twisted somewhat outwards, and the ligaments between the os calcis and os cuboides divided. Lastly, the operation is completed by cutting through the soft parts regularly from above downwards, with the precaution of directing the amputating knife so as to leave a flap composed of part of the sole of the foot. (See *Abhandl. aus dem Gebiete der Prakt. Med. &c. Landshut, 1810. b. i. p. 152. and Graefe, Normen für die Abl. grösserer Gliedm. p. 142.*)

Sometimes, in consequence of the soft parts of the instep being all gangrenous or otherwise destroyed, it is necessary to make the flap entirely from the sole of the foot, as Klein was obliged to do in one of his cases. (*Practische Ansichten bedeutendsten, Chir. Operationen, h. i. p. 28.*) Indeed, Richerand thinks this mode generally advantageous, as the line of the cicatrix is not placed at the lower end of the stump, where it would be most exposed to injury. (*Novogr. Chir. t. ii. p. 502, &c. ed. 4.*) Langenbeck and Klein also disapprove of raising the flap from the instep.

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as advised by Walther and Graefe. Chopart himself, as we have seen, merely drew back the integuments of the instep, without making any detachment of them from the subjacent parts. When the ends of the flexor tendons of the toes project too much from the inner surface of the lower flap, they are to be cut off, as Klein particularly directs; and I consider his advice not to use sutures for keeping the flap applied, but merely strips of sticking-plaster, perfectly judicious. (*Op. cit.* p. 33, 34.) I have seen several patients who had undergone Chopart's operation, and afterwards walked exceedingly well. A black man was lately shown to me by my friend, Mr. Copland Hutchison, who had performed the operation; and in reality scarcely any limping was perceptible.

I mention these facts, because Dupuytren may have expressed himself rather too strongly against Chopart's operation, when he says, that the removal of a part of the tarsus deprives the patient of a point of support essential in walking and standing, and renders the limb nearly useless. He asserts likewise, that, as the attachments of the tibialis anticus and tibialis posticus, the antagonists of the gastrocnemius and soleus, are divided, the heel becomes drawn considerably upwards. For these reasons, and because the nervous and inflammatory disturbance was found by him to be great after Chopart's operation, Dupuytren preferred partial amputation of the foot in the tarso-metatarsian articulations; and insisted on the rule of not cutting any further backwards than the circumstances of the disease or injury required. The latter method is alleged to have been practised as early as 1720. Certainly it was executed by Percy in 1789, and by Hey in 1799. (See *Clinique Chir.* t. iv. p. 346.)

Mr. Wharton disapproves of both the preceding modes of removing parts of the foot; and, when the circumstances of the case will allow, preserves a greater portion of the limb. In one case, an incision, commencing at the root of the fourth toe, was carried in a slightly curved direction towards the extremity of the fifth metatarsal bone, and made to terminate near the outer malleolus. This incision was on the plantar surface. A similar incision, commencing and terminating at the same points, was carried along the dorsum. The flaps being raised, the knife was carried between the two outer metatarsal bones down to the cuboid. The outer edge of the os calcis, being found diseased, was pared off with a scalpel. The second incision removed the next toe, and its metatarsal bone, in a similar manner, leaving three toes with their corresponding metatarsal bones. The hemorrhage was so copious, that the dressings were not applied till the patient had been put to bed. The man was well in twelve weeks; and, after a time, seemed to have the perfect use of the limb. (See *Dubl. Journ. of Med. Science*, vol. viii. p. 193.)

Many years ago, Mr. Dunn, of Scarborough, communicated to me the particulars of a case, in which he removed the cuboid and external cuneiform bones; and a month afterwards, took away from the same patient the os pygidiale and the two other cuneiform bones, and sawed off the diseased tarsal extremities of the metatarsal bones of the second and third toes. A deluge of blood followed the operation, and the boy fainted. As soon as the syncope went off, Mr. Dunn scraped

away some part of the astragalus, which was found to be diseased. Dry lint and a roller put a stop to the hemorrhage; but some secondary bleeding occurred, and it was necessary to secure the dorsal artery of the foot. In about five months, the boy was completely well, and able to walk without any pain, and with very slight lameness. (See *Med. Chir. Trans.* vol. ii. p. 337, &c.) From a note affixed to Mr. Dunn's essay, it appears, that Mr. A. Copland Hutchison obviated all occasion for amputation of an officer's foot, by extracting the fragments of two bones of the tarsus and three of the metatarsus, which had been broken by a musket ball. (p. 346; also *Hutchison's Practical Obs. in Surgery*, 8vo. Lond. 1816.) On this subject, I fully concur with Mr. Hutchison, that, when the foot is extensively diseased, partial amputation of the foot will generally be more prudent than attempts at excision of the diseased bones. In Mr. Dunn's case, however, as every bone of the tarsus was affected, except the os calcis, partial amputation of the foot was out of the question. Either excision of the diseased bones, or amputation above the ankle, was the only alternative.

BIBL. AND REFER. — *Celsus*, De Re Medicâ, lib. 7. Œuvres de Paré, livre xii. chap. 30. and 33. *James Yonge*, *Curus Triumphalis à Icerebintho*, 8vo. Lond. 1679. *R. Weyman*, *Chir. Treatise*, 4to. Lond. 1692. *Sharp's Operations of Surgery*, chap. xxviii.; and *Critical Inquiry into the present State of Surgery*, chap. viii. *Boston*, *Traité des Plaies d'Armes à Feu*, Paris, 1768. *Bertrand*, *Traité des Opérations de Chirurgie*, chap. xxiii. *Le Dravot*, *Obs. de Chir.* Paris, 1731; and *Traité des Opérations de Chirurgie*, Paris, 1749; and the English Translation with the additions of *Cheekenden*, by *Gataker*, Lond. 1749. *Nouvelle Méthode pour faire l'Opération de l'Amputation dans l'Articulation du Bras avec l'Omoplate*, par *M. De la Foye*, *P. H. Dahl*, *Dis. de Humeri Amputatione*, *ex Articulo*, Gott. 1760. *Histoire de l'Amputation*, suivant la Méthode de Verduin et Sabourin, avec la Description d'un nouvel Instrument pour cette Opération, par *M. De la Foye*, *P. H. F. Verduin*, *Dis. Epistolaris de Nova Artium decurtandorum Ratione*, 12mo. Amst. 1696. *Moyens de rendre plus simple et plus sûre l'Amputation à Lambeau*, par *M. de Garengeot*, *Obs. sur la Résection de l'Os après l'Amputation de la Cuisse*, par *M. Veyret*, *Mémoire sur la Saillie de l'Os après l'Amputation des Membres*; où l'on examine les causes de cet inconvénient, les moyens d'y remédier, et ceux de la prévenir, par *M. Louis*, *Seconde Mémoire sur l'Amputation des Grandes Extrémités*, par *M. Louis*. The foregoing Essays are in *Mém. de l'Acad. de Chirurgie*, t. v. edit. 12mo. *R. de Vernalde*, *Obs. et Remarques de Chirurgie pratique*, Mannheim, 1767. *Essai sur les Amputations dans les Artères*, par *M. Brador*, in t. xv. *Mém. de l'Acad. de Chir.* *J. U. Biquier*, *De Membrorum Amputatione rarissima administranda aut quasi abroganda*, 4to. Helm. Magd. 1761. *White's Cases in Surgery*, 1770. *Bromfield's Chir. Obs. and Cases*, vol. i. chap. 2. 8vo. 1773. *O'Halloran's Complete Treatise on Gangrene*, &c. with a new Method of Amputation, 8vo. Dublin, 1765. *Alanson's Practical Obs. on Amputation*, ed. 2. 1782. *J. L. Petit*, *Traité des Maladies Chir.* t. iii. Paris, 1774, or the later edition, 1790. *R. Mynors's Practical Thoughts on Amputation*, Birmingham, 1783. *T. Kirkland*, *Thoughts on Amputation*, &c. 8vo. Lond. 1780. *Loder*, *Comment. de Nova Alansonii, Amputationis Methodo*, Progr. 1. 7. Jen. 1784; or *Chir. Med. Beobachtungen*, 8vo. Weimar, 1794. *Murina*, *Neue Méd. Chir. Beobacht.* Berlin, 1796; *P. F. Walther*, *Abhandl. aus dem Gebiete der Prakt. Medicin, besonders der Chirurgie und Augenheilkunde*, b. i. Landslut, 1810; *Kern*, *Über die Handlungswiese bey der Absetzung der Glieder*. Wien, 1814. *W. Frazer*, *An Essay on the Shoulder-Joint Operation*, 8vo. Lond. 1813. *J. P. Roth*, *Mémoire et Obs. sur la Réunion immédiate de la Plaque après l'Amputation*, 8vo. Paris, 1814. *J. F. D. Evans*, *Practical Obs. on Calcar and closed Pupil*, and on *Amputation of the Arm at the Shoulder*, &c. 8vo. Lond. 1815. *H. J. Browningshausen*, *Erfahrungen und Bemerkungen über die Amputation*, 8vo. Hamb. 1818. *Langenbeck*, *Bibl. für die Chirurgie*, b. i. p. 562, &c. 8vo. Gott. 1816. *P. G. Van Hoorn*, *De his, que in partibus Membri, præsertim ossa, amputatione vulneratæ notanda sunt*, 4to. Lugd. 1813. *Graf*, *Normen für die Abführung grösserer Gliedm.* 4to. Berlin, 1813. *Klein*, *Practische Ansichten bedeutender Chir.* Op. h. 1. 4to. Stutt. 1816. *A. C. Hutchinson*, *Practical*

Obs. in Surgery, 8vo. Lond. 1816; and further Obs. on the proper Period for amputating in Gunshot Wounds, &c. 8vo. Lond. 1819. John Hennen, Principles of Military Surgery, 2d ed. 8vo. Lond. 1820. Pott's Remarks on Amputation. Sabatier, Médecine Opératoire, tom. iii. ed. 2. Hey's Practical Obs. in Surgery, ed. 2. Remarques et Observations sur l'Amputation des Membres, in Œuvre Chir. de Desault, par Bichat, t. ii. P. J. Roux, De la Résection, ou du Rétranchement des Portions d'Os malades, soit dans les Articulations, soit hors des Articulations, 4to. Paris, 1812. Vermischte Chirurgische Schriften, von J. L. Schmucker, band i. Operative Surgery, by Sir C. Bell, vol. i. Richerand, Nosographie Chir. t. iv. Pelletan, Clinique Chir. t. iii. Gooch's, Chirurgial Works, various parts of the three volumes. Larrey, Relation Chir. de l'Armée d'Orient en Egypte et Syrie; also Mém. de Chirurgie Militaire. G. J. Guthrie on Gunshot Wounds, 8vo. Lond. 1815; a publication which cannot be too attentively studied by every surgeon who wishes to know when, as well as how, to amputate in cases of gunshot injury. Roux, Parallèle de la Chirurgie Angloise avec la Chirurgie Française, p. 336, &c. Paris, 1815. John Thomson, Report of Obs. made in the Military Hospitals of Belgium, 1817. C. Averill, Operative Surgery Lond. 1823. Syme, in Edinb. Med. and Surgical Journ. No. 78. Maingault, Méd. Opératoire, fol. Paris, 1822; contains excellent lithographic plates, illustrative of amputation. An English edition of this work has been published by Mr. Wm. Sands Cox, of Birmingham. Pelreau, Nouv. Élém. de Méd. Opératoire, t. i. 8vo. Paris, 1832; a book containing very extended views of the whole subject. J. F. Malgaigne, Manuel de Méd. Opératoire, 32mo. Paris, 1834; a treatise replete with valuable directions. Dupuytren, Leçons Orales de Clinique Chir. t. iv. 8vo. Paris, 1834. R. Liston, Elements of Surgery, part iii. 8vo. Lond. 1832; the description of flap-amputation is particularly interesting. J. J. Chelius, Handb. der Chirurgie, b. ii. 1827. H. Scoutetten, La Méthode Ovaleine, ou Nouvelle Méthode pour amputer dans les Articulations, 4to. Paris, 1827.

AMYLUM. Starch is occasionally employed in clysters. The following is the formula used at St. Bartholomew's Hospital. R Mucilaginis Amyli, Aquæ destillatæ, sing. ʒij : Tinct. Opii guttas quadraginta : Misce. When the starch enema is employed with laudanum for the relief of retention of urine, it is very desirable that it should be retained in the rectum a certain time, in order that it may have the desired effect. This purpose will be more likely to be fulfilled, if the quantity of mucilaginous fluid injected do not exceed two or three ounces.

ANASTOMOSIS (from *ana*, through, and *stoma*, a mouth). Anatomists and surgeons imply, by this term, the communications of the blood-vessels with each other, or their running and opening into each other, by which the continuance of a free circulation of the blood is greatly ensured, and the danger of mortification lessened. The immense importance of this part of our structure, in all cases in which the main artery, or veins of a limb are obliterated, is particularly conspicuous in the disease called aneurism. (See ANEURISM.)

Nay, such has been the providence of nature in this respect, that, even where the thoracic aorta has been completely obstructed, the channels for the conveyance of the blood to the lower extremities have yet been found adequate to that purpose. This was proved in an example where the obstruction had been gradually produced by disease, and the anastomosing vessels of course had had time for enlargement; for this is a very different case from that in which a ligature is suddenly applied to the aorta; though, as far as can be deduced from the particulars of some experiments made on dogs by Sir Astley Cooper, and of three operations in which the human abdominal aorta has been tied by him (*Surgical Essays*, part i. p. 101.), by Mr. James, of Exeter (*Med. Chir. Trans.* vol. xvi.), and Mr. Murray, at the Cape of Good Hope, blood will still pass to the lower extremities in sufficient quantity for their nutrition. At least, this inference is safely

deducible from the very memorable operations to which I have referred, subject to one important condition, viz. that there be no additional cause of impediment to the passage of blood to the lower extremities besides the ligature above the bifurcation of the aorta. When Sir A. Cooper tied the human aorta in the abdomen, the experiment was made as the only possible means of hindering a man from bleeding to death, who had a large aneurism of the external iliac artery actually beginning to bleed, and extending too high to admit of any thing else being done. Now, although the unfortunate patient was not saved, and it must be acknowledged, that the chances of any other result were very small, the case furnished the important proof, that if the abdominal aorta be suddenly and completely obstructed, the blood may yet pass in adequate quantity to the lower extremities, provided there exist no other cause of impediment to the passage of the blood into them; for, on the side occupied by the aneurism, the circulation in the limb was stopped, while, in the opposite limb, the circulation and natural warmth were preserved. To this subject I shall hereafter return. (See AORTA.)

The changes which take place in the arterial system of the limb, when the main artery is rendered impervious by the application of a ligature, are well described by Mr. Hodgson: "The blood, meeting with an obstacle to its progress through the accustomed channel, is thrown in greater quantity, and with greater force, into those branches which arise above the seat of the obstruction. The ramifications of these branches, in consequence of the unusual influx of blood, undergo a remarkable dilatation; the more minute vessels also, by which they anastomose with corresponding ramifications, arising from branches given off below the obstruction, are from the same cause sufficiently enlarged to allow a free passage of the blood into the inferior trunks of the limb. At first, the circulation is in this manner carried on through a congeries of minute anastomosing arteries: in a short time, a few of these channels become more enlarged than the rest: as these increase in size, the smaller vessels gradually collapse, and ultimately a few large communications constitute permanent channels, through which the blood is transmitted to the parts that it is destined to supply. This is one mode by which a collateral circulation is established.

"But, in some situations, more direct and ostensible inosculation is provided; so that when one channel is obstructed, the blood passes at once through the other in a sufficient stream for the nourishment of the part which it is destined to supply. Under these circumstances, no dilatation of the collateral branches is necessary: the circulation, in such instances, may be said to be constantly carried on through inosculating trunks. These great communications principally exist in the extremities of the body, where the dilating impulse, which the blood receives from the heart, is of course diminished. Thus, the radial artery inosculates freely with the ulnar; the anterior with the posterior tibial; and the internal carotid with the vertebral arteries. Two modes therefore exist, by which arteries communicate with each other—the anastomoses of minute ramifications, and the direct inosculations of trunks." (See Hodgson on the Diseases of Arteries and Veins, p. 234. Refer also to INOSCULATION.) The

general account of the inosculation, in relation to aneurism, is contained in Scarpa's *Treatise on Aneurism*; more especially, the Italian edition, which is embellished with beautiful engravings.

ANCHYLOSIS (from *αγκυλος*, crooked). *True or complete anchylosis* signifies the fixed and motionless state of a joint, resulting from the articular surfaces being consolidated together by osseous matter. *False or incomplete anchylosis* denotes the loss of motion, or very considerable rigidity, in an orbicular, or ginglimoid joint, occasioned by adhesions of one synovial surface to the other, or by a thickening of the soft parts on the outside of the joint. By Mr. Mayo, anchylosis is divided into *osseous, cartilaginous, and mixed*, according as the articular surfaces happen to be united through the medium of bone, of cartilage, or of both these substances together. (See *Outlines of Human Pathology*, p. 72.) Of course, this last classification is not intended to comprise some of the varieties of false anchylosis. True anchylosis, then, may be said to denote an intimate osseous consolidation, either of the kind of joint termed *diarthrosis*, where the ends of the bones are tipped with cartilage, and furnished with a capsular ligament, or of the other less movable sort of joint, termed *synarthrosis*, where the bones are united by an intervening layer of fibro-cartilage, and the articulation is strengthened externally by ligamentous bands. The latter kind of joint can hardly be said to be susceptible of false anchylosis; for it naturally has only a very slight degree of motion, which requires a true anchylosis for its interruption.

Anchylosis is more common in the ginglimoid articulations than others; though sometimes met with in every description of joint. In general, only one joint is anchylosed in the same individual; but sometimes several articulations are the seat of anchylosis, and rare instances are recorded, in which every joint in the body was in this state. Thus, Bernard Conner describes an example of a general anchylosis of all the bones of the human body. (*De stupendo Ossium Coalitio*.) The particulars of a child, twenty-three months old, afflicted with universal anchylosis, are given in *L'Hist. de l'Acad. des Sciences*, an 1716. In old age, anchylosis in certain parts of the skeleton is a natural change; and in this period of life, it is common to find the heads of the ribs anchylosed to the bodies of the vertebrae, or the tubercles to the transverse processes, the vertebrae to one another, the ensiform cartilage to the sternum, &c.

Anchylosis, strictly speaking, is not a disease itself, but only an effect or consequence of other affections, and it may follow all those which destroy any one of the conditions, without which the motion of a joint is necessarily interrupted either permanently or for a very considerable time. The author of the article *Anchylosis*, in the *Encyclopédie Méthodique*, refers to a preparation, in which the femur is so anchylosed with the tibia and patella, that both the compact and spongy substances of these bones appear to be common to all of them, without any line of separation being discernible between them. Eustachius, Columbus, and Cruveilhier, have each seen an anchylosis of the lower jaw. In the Museum of the London University is a specimen of anchylosis extending to eleven vertebrae. In the same collection are examples of anchylosis between the occipital bone and the atlas, between the atlas

and the dentata, and between the three upper cervical vertebrae. There may also be seen perfect anchyloses of the three bones of the knee, those of the elbow and hip, of the metacarpal bones to one another, and of the sacrum to the ischium. Cruveilhier has given the particulars of an anchylosis of one of the articulations of the lower jaw in a very old woman. It commenced in her childhood, from a blow on the side of the face. From the engraving of the parts, it appears that the condyle and glenoid cavity were completely consolidated and united by osseous matter.

Referring to anchylosis in general, we may observe with M. Sanson, that its causes are numerous; inasmuch as every circumstance capable of impairing the articular surfaces, stopping the synovial secretion, lessening the suppleness of the ligaments, or of the soft parts around the joint, or of interfering with the action of the muscles, or the play of the tendons, may hinder the articular surfaces, more or less, from moving upon one another. One thing, almost essential to the production of anchylosis, is the part being kept motionless; and, as M. Sanson well observes, this condition has such influence, that it will of itself bring on the changes which terminate in a joint becoming incapable of resuming its functions, in consequence of true, or false anchylosis. An illustration of this fact is afforded by what happens to the Indian Fakirs, who, by way of religious penitence, sometimes condemn themselves to continue motionless in certain attitudes for several years, and whose limbs at the expiration of the term are anchylosed in the posture, in which they happen to have been so long maintained. The same fact is exemplified in persons who meet with fractures of their limbs; for, in consequence of the motionless state in which the part is kept to promote union of the broken bones, the synovial secretion is diminished, and the fibrous capsules and ligaments of the joint all acquire a rigidity, in which the surrounding cellular tissue participates. The sheaths of the tendons are also no longer duly lubricated. All these circumstances make opposition to the free action of the muscles, which, being themselves weakened by protracted inactivity, are incapable of overcoming the resistance to the motion of the joint. On the same principle of a long continued motionless state of an articulation, anchylosis may be induced as a complication and sequel of the contracted state of some particular muscle, or of the growth of various tumours near the joint. The contraction of cicatrices after burns, or after a destruction of the soft parts by gangrene or ulceration; and an unyielding state of the cellular tissue, the effect of extensive and inveterate abscesses in it; certain exostoses; and especially inflammation of the synovial membrane, whether acute, or chronic, idiopathic, scrofulous, or rheumatic, &c., or accidentally excited by mechanical injury of the joints; are all so many circumstances capable of leading to anchylosis. Particular fractures of the joints, or such as are situated near them, if not skilfully treated, are apt to be followed by inflammation of the synovial membrane, absorption of the cartilages, and complete anchylosis. No doubt, in some of these instances, the connection amounts at first only to what authors understand by false anchylosis; but, in the course of time, this becomes converted into complete, or true, characterised by osseous consolidation. On the whole, however, as M. Sanson

has remarked, false anchylosis is far more common than the true form of it.

When a bone is fractured near a joint, and this is kept too long motionless, anchylosis is apt to follow. Here the risk is increased by the synovial membrane being likely to inflame; and, indeed, sometimes the accident brings on ulceration of the cartilages. In the North London Hospital, I lately saw a case, where the olecranon had been broken across its base, and the detached piece had become completely consolidated to the humerus; yet the patient had considerable power of extending the forearm, probably through the medium of the long supinator and other muscles arising from the outer condyle. It is partly in consequence of the risk of inflammation of the synovial membrane and of anchylosis, that fractures of or very near joints are more serious than others differently placed. Wounds and contusions of joints may bring on such changes as terminate in anchylosis. I have already mentioned, that Cruveilhier has seen an instance of anchylosis of the right articulation of the lower jaw. This was brought on by a blow received on the part when the patient (a female) was a child. She lived to a very advanced age, and notwithstanding the anchylosis, was able to speak very well, and to masticate by pressing the food with her tongue against the hard substance covering the alveolar processes, where the teeth were deficient. (See *Cruveilhier, Anat. Pathologique*, livr. ix. pl. 5. figs. 1. & 2.)

With regard both to true and false anchylosis, the surgeon may generally render more efficient service in preventing, than in endeavouring to cure them. In wounds, contusions, and fractures of or near joints, the best means of prevention consist in the rigorous adoption of antiphlogistic treatment at first, and in a later stage in having timely recourse to passive motion of the joint; and then to combine with this plan friction with camphorated and other liniments, in order to promote the secretion of the synovia. When the bones are carious, as in scrofulous disease of the vertebrae, and in advanced stages of ulceration of the cartilages of the knee, elbow, wrist, &c., the surgeon, instead of endeavouring to prevent anchylosis, should promote its occurrence, as the most favourable result which the case now admits of. In fact, the completion of anchylosis will denote the termination of the disease. One important indication, however, under such circumstances, is to try to let the limb be anchylosed in the posture which will allow it to be of the greatest possible use. Thus, when the elbow is likely to be the seat of anchylosis, the forearm should be kept bent; but when the knee is concerned, the leg should be kept extended; and when the hip, the thigh should be maintained in a similar position. If anchylosis should have taken place to a certain extent, with the limb in a disadvantageous posture, this may often be still very much improved by the application of splints, and other mechanical contrivances. The action of any mechanical apparatus, however, must be at first moderate, though unremitting. Perseverance will here succeed, where violence would fail by bringing on excessive pain and a dangerous degree of inflammation. Indeed, where the attempts to remove a false anchylosis by gentle passive motion, embrocations, and the cautious use of mechanical means, fail, it is better not to employ violence, because such an anchylosis is preferable to inflammation, abscesses, and ulceration of the joint.

As for true anchylosis, where a complete osseous consolidation has taken place, it may be set down, not only as incurable, but as admitting of no improvement or alteration in the position of the limb, and whatever that may be, the patient must be content with it. Hence, where there is risk of anchylosis, the great importance of placing the limb in good time in the position, which will let it be of the greatest service to the patient.

Mr. Barton, one of the surgeons to the Pennsylvania Hospital at Philadelphia, made, a few years ago, the bold attempt to cure an anchylosis of the hip-joint by a surgical operation. (See *North American Med. and Surg. Journ.* for April, 1827.) The patient was a young sailor, who had fallen into the hold of a ship, injured the hip, and remained seven months without surgical assistance. He was now admitted into the above hospital, under Mr. Barton. The injured thigh, which was the right one, was in the bent position, with the knee drawn across the lower part of the left femur. The outer edge of the foot was placed forwards, and the sole turned outwards. A suspicion of dislocation was immediately entertained; but so great was the swelling, and so acute the pain in the hip, that Mr. Barton was deterred from making a manual examination to ascertain the fact. As soon as these symptoms had subsided, the limb was kept for several weeks extended in an apparatus, but without producing any elongation, or change in its position. Indeed, a complete anchylosis between the femur and os ilium had taken place. After a year's consideration, Mr. Barton, seeing that the case was beyond all common means of relief, determined to attempt to make an artificial joint. For this purpose he made in the upper part of the thigh an incision six or seven inches long, the middle part of which corresponded to the great trochanter. The centre of this first cut was crossed by another four or five inches in length, at a right angle. These incisions divided, in succession, the skin, the fascia lata, and muscles, so as to expose the anterior and posterior part of the femur, between the great and little trochanters. The femur was then sawed through between the great trochanter and the neck of the bone. The operation was completed in seven minutes; and, as soon as it had been done, the limb was easily brought into its proper position again, and found not to be more than about half an inch shorter than the other. The wound, which bled but little, was now closed, and the limb put up in a suitable apparatus, with one of Desault's splints. At first, the inflammation, swelling, and inflammatory fever were severe; but in nine days these symptoms abated, and the wound suppurated favourably. Suffice it to add, that the patient could move his thigh in all directions, and was able to get up; and in four months he was able to walk a considerable distance. He could, by this time move the foot twenty-four inches forwards, twenty-six backwards, and twenty late rally, and rotate it six inches inwards or outwards. The limb was strong, and so trivially shortened, that the patient walked very perfectly. Behind the new joint was a deposit of bone, supporting the femur in this direction, and preventing its dislocation. Although the successful result of Mr. Barton's operation is what his boldness fully deserved, I agree with M. Sanson in thinking, that doubts will be entertained by many judicious

surgeons, whether the proceeding, which actually put the patient's life in jeopardy, was really indicated.

W. H. Müller, de Anchylol, Lugd. 1707. L'Encyclopédie Méthodique, Partie Chir. t. l. art. *Anchylol*. J. L. Petit, Traité des Mal. des Os, t. ii. J. T. Van de Wynne, De Anchylolosis Pathologica et Curatione, singularibus observationibus et fig. illustr. 4to. Lugd. 1783. Gentleman's Magazine, 1787; Universal anchylolosis, ligaments ossified. Wurz, Wundarsn. p. 224., following the removal of the patella. Sandifort, Exercit. Acad. p. l. &c.; anchylolosis of the occiput with the atlas, and of the atlas with the dentatus. Sandifort, Obs. Patol.; anchylolosis of the jaw. Dumas, Recueil Périodique de la Société de Méd. t. x. p. 30. and t. xii. p. 352. Keenen's Principles of Military Surgery, p. 161, &c. ed. 2. The examples of general anchylolosis are numerous: Ponsquet refers to *Colombus de Re Anatomica*; Connor, *De stupendo Ossium Coalita*, Oxon, 1696; *Deslandes*, in Mém. de l'Acad. des Sciences, 1716; *Frank*, Reise nach Paris, London, &c. p. 157., anchylolosis of all the joints except those of the lower jaw; *Olivier*, in Journ. de Méd. t. xii. p. 273.; *Voigt*, Mag. für den Neuesten Zustand der Naturkunde, 4b. p. 412.; *Portai*, Cours d'Anat. Méd. t. i. p. 14.; *Phil. Trans.* No. 461.; J. C. Smith, Nat. Hist. Hibernia Comit. 1744. Job & Mecklen's Obs. c. 61. p. 297. *Cutlsen*, Systema Chir. Hodiernum, t. ii. p. 699. edit. 1800. *Bayer*, Mal. des Os, t. ii. et Traité des Maladies Chir. t. iv. p. 553. *Verduc*, Traité des Bandages, chap. xxv. p. 172. *Richerand*, Nosogr. Chir. t. iii. p. 223. edit. 4. *Murray*, Diss. de Anchylol, Upsal, 1797. *Crucilhier*, Anatomie Pathologique, t. i. Paris, fol. 1829—1835. A. Sanson, Dict. de Méd. et de Chir. Pratique, art. *Anchylol*.

ANEURISM, or ANEURYSM (from *ἀνεύρισμα*, a dilatation). The tumours which are formed by a preternatural dilatation of a part of an artery, as well as those swellings which are occasioned by a collection of arterial blood, effused in the cellular tissue, in consequence of a rupture, or wound of the coats of the artery, but having no outlet in the integuments (see *Guthrie on Dis. of Arteries*, p. 46.), receive the name of aneurisms. According to these opinions, aneurisms are of two kinds; the first being termed *true*; the second *spurious*, or *false*. Some modern writers reckon another form of aneurism, which is said to happen, when the external coats of an artery being weakened by mechanical injury, or disease, the internal coat protrudes through the breach in the outer coat, so as to form a tumour distended with blood. This case has been denominated the *internal mixed aneurism*, or *aneurisma herniam arterie sistens*. The reality of this form of disease was believed in by Dr. W. Hunter; and some delicate experiments, instituted by Haller on the mesenteric arteries of frogs, appear to have been the first ground of the opinion. Such an aneurism, however, has not been universally admitted: not that any body doubted the correctness of what Haller advanced; but because there might not always be a perfect analogy between the results of an experiment on animals, and those afforded by the observation of the diseases of the human body.

When Haller asserted, that, by separating the muscular from the inner coat of the arteries, he could, when he pleased, produce an aneurism in these animals; and when Hunter declared, that such an experiment made the artery firmer than ever, in consequence of the adhesive inflammation taking place; the character and veracity of these eminent men naturally lead to the question, whether the experiments were conducted exactly in the same manner. Now, says Mr. Wilson, when we know that Haller did not suffer the surrounding parts to unite, and that John Hunter did, we can no longer be at a loss to account for the different conclusions. (See *Wilson's Anatomy, Pathology, &c. of the Vascular System*, p. 378.)

However this may be, with respect to the experiments made on certain animals, I am disposed to consider it fully proved by Mr. J. Hunter, Sir E. Home, and Professor Scarpa, that, in the human subject, an aneurism will not arise from the kind of weakness which is caused by cutting or even stripping off the external coat of a sound artery, whether the wound be closed or not.

This fact would at least appear to be well established, with respect to the generality of the arteries; but, how far it is so in relation to the aorta, is another question, the inner membrane of which vessel is more elastic than that of common arteries. Indeed, in 1804, Dubois and Dupuytren presented to the Faculty of Medicine at Paris, a pathological preparation, exhibiting the lining of the aorta protruding through the middle coat, in the form of a sac filled with blood. (See *Dict. des Sciences Méd. art. Aneurisme*; and *Breschet*, in *Transl. of Mr. Hodgson's work*, p. 130.)

Subsequently to the period here referred to, Breschet has prosecuted this part of the inquiry, and ascertained, beyond all dispute, the reality of mixed aneurisms, and this in other arteries besides the aorta. Thus, his first example was a hernial protrusion of the inner coat of the popliteal artery, through the fibrous coat, and covered by the external tunic. (*Mém. sur l'Aneur.* p. 83.) His second case was a mixed aneurism, situated near the termination of the left iliac artery. (p. 93.)

By the term *mixed aneurism*, Dr. A. Monro, senior, implied the state of a true aneurism, when its cyst had burst, and the blood was diffused in the adjacent cellular substance; an event which is frequent. Besides these varieties of aneurism, the *aneurismal varix*, or *venous aneurism*, and the *aneurism by anastomosis*, constitute diseases which are usually regarded as cases pertaining to the present subject, though incapable of being comprised under the ordinary definition of an aneurism.

An aneurism may then be defined to be a tumour filled with blood, either in a fluid or solid state, usually attended with pulsation, and the sac of which has an opening in it, by which it communicates with the artery, from which the blood is transmitted into it. Lisfranc defines it, "a tumour formed by arterial blood, and communicating with an artery," and divides all aneurisms into *traumatic* and *spontaneous*, according as they happen to be produced by a wound, or disease of the coats of the artery. (*De l'Oblitération des Artères dans les Aneurismes*, p. 6.)

Nothing can be more manifest than the fact, that, previously to the discovery of the circulation of the blood, no correct, nor valuable opinions, could have prevailed respecting the diseases which now go under the name of aneurisms. Indeed, it was not until after the days of Aristotle, that any distinction was made between the swellings of veins and those of arteries; such vessels not having been at that early period distinguished from each other. Their differences were first pointed out by Rufus of Ephesus. Down to Galen, however, nothing like consistency was established in the notions respecting aneurism. His opinion was, that all tumours of this nature were produced either by anastomosis, or by rupture; and though he has described their symptoms, he has not informed us of the characters by which each of these cases was distinguishable, one from the other. Paulus

Egineta divides aneurism into two sorts, both of which, he says, are attended with extravasation, and of course with rupture. Vesalius, who first applied anatomy to the investigation of disease described an aneurism arising from the rupture of a dilated aorta; the first specimen, I believe, on record of this form of disease. (*Bonetus Sepulch. Anat. lib. iv. sect. 2.*)

The combination of rupture with dilatation of the artery, was afterwards more particularly noticed by Nuck (*Oper. Chir. &c. Lugd. 1692*); but it was Fernelius who first promulgated the doctrine, that aneurisms were always dilated arteries. (*Universa Medicina, De Extern. Corp. Affect. lib. vii. cap. 3. Venet. 1564.*)

This opinion was espoused by Forrester, Diemerbroek, and others; but at length, the inaccuracy of attempting to refer every aneurism solely to dilatation of the coats of the vessel, was established by the observations of Lancisi, Freind, Guattani, and Morgagni. In short, as Mr. Hodgson has stated, these authors proved, that aneurism may be produced either by the rupture, or the dilatation of the coats of an artery, or by a combination of both circumstances, the dilatation having preceded the rupture. (*On the Dis. of Arteries, &c. 8vo. Lond. 1815.*)

In truth, this admission of aneurism by dilatation, and of aneurism by rupture of the coats of an artery, together with the frequent combination of both circumstances, became the prevailing undisturbed doctrine of every surgical school, until Professor Scarpa, inclining to the tenets of Sylvaticus (*De Aneurysmate, Tract. Venetiis, 1600, 4to.*), ventured to question the correctness of the common opinion about the dilatation of all the arterial coats. However, after the very clear and satisfactory elucidation of this disputed point by my friend Mr. Hodgson, and others, as well as by several preparations in the Hunterian collection (see *Guthrie on Dis. of Arteries*), the accurate views of the subject, first taken by Morgagni, and the other eminent writers specified above, may be regarded as established beyond the possibility of dispute. At the same time, it is not to be supposed, that Scarpa means to say, that the arteries are not subject to a morbid dilatation; on the contrary, he gives a particular description of this affection, which he carefully discriminates from aneurism.

Previously to offering a more particular account of the doctrine taught by Scarpa, respecting the formation of aneurism, as well as of the chief facts, which may be adduced against a part of such doctrine, it seems proper to make the reader acquainted with the various forms of the disease, their ordinary symptoms, and a few pathological facts.

When any part of an artery is dilated (attended with particular circumstances marking its difference from another form of dilatation, which, as I shall explain, perhaps ought not to be set down as aneurismal), the swelling is commonly named a *true* or *genuine aneurism*. In such cases, the artery is either enlarged at only a small part of its track, and the tumour has a determinate border, or the whole is dilated for a considerable length; in which circumstance the swelling is oblong, and loses itself so gradually in the surrounding parts, that its margin cannot be exactly ascertained. The first case, which is the most common, is termed the *circumscribed true aneurism*; the last, the *diffused true aneurism*; a case,

however, which would be looked upon by Scarpa only as a specimen of dilatation, different in several particulars from aneurism, as will be hereafter noticed. When blood escapes from a wound or rupture of an artery, into the adjoining cellular substance, the opening in the skin having closed, the swelling is denominated a *spurious* or *false aneurism*. In this instance, the blood either collects in one mass, distends the cellular substance, and condenses it into a cyst, so as to form a distinctly circumscribed tumour; or it is injected into all the adjacent cellular substance, and extends along the course of the great vessels, from one end of the limb to the other, thus producing an irregular oblong swelling. The first case is named a *circumscribed false aneurism*; the second, a *diffused false aneurism*. (*Richter's Anfangsgr. b. i.*)

When an aneurismal sac is formed upon a dilated artery, the walls of the vessel are sometimes thinner than usual; and some parts of them may become expanded into pouches, or even engrafted upon the original swelling, the prominent points being always the thinnest. This kind of case is sometimes termed a *sacculated aneurism*, of which there is a good specimen in the Hunterian collection, remarkable also as exhibiting an aneurism opening by ulceration into the pulmonary artery. (See *Guthrie on Dis. of Arteries*, p. 59.)

Aneurism by dilatation is distinguished by Breschet into four varieties, the names of which are determined by the differences in the shape of the expansion of the arterial tube. For instance, 1. *True saciform aneurism*: 2. *True fusiform aneurism*: 3. *True cylindroid aneurism*, subdivided into that of the large arteries, and into that of the small arteries, or the *aneurism by anastomosis* of John Bell, and the *erectile tumours* of Dupuytren: 4. *True varix-like aneurism*, or *aneurisma cyrroidum*. In *saciform aneurism*, the vessel has at one point of its circumference a small sac, consisting of an expansion of the arterial tunics. This variety is most frequent in the aorta, but sometimes on the carotid and iliac arteries, and even on those of the limbs. In this aneurism, all the arterial tunics are simultaneously dilated; but as the internal and middle ones have but a limited degree of extensibility, the saciform aneurism does not generally exceed the size of a filbert, though Breschet has noticed some on the aorta as large as a hen's egg. (See *Breschet sur Différentes Espèces d'Aneurismes*, p. 12, &c.)

In the *true fusiform aneurism*, the dilatation extends over the whole circumference of the vessel: all the coats participate in it. The calibre of the artery, after becoming wider and wider gradually, for a certain portion of the track of the vessel, then lessens in a manner equally gradual, till it has resumed its natural diameter.

The *cylindroid aneurism* of Breschet might be regarded only as a variety of the *fusiform*, inasmuch as an abrupt transition from a given calibre to a much more capacious one is never observed. Yet, according to the investigations of Breschet, cases present themselves in which the artery is uniformly dilated through a track of one or two feet, the cylindrical form being here strictly preserved. This pathological fact has been noticed by Breschet in the arteries of the limbs, and in those of the brain, and of the splanchnic cavities. (*Op. cit.* p. 25.)

In the true worm-like aneurism, the artery is described by Breschet as being not only dilated, but tortuous, and occasionally studded with small saciform tumours. The parietes of the vessel are thin and collapsed; while, in the other case, they are rather thickened. Such is Breschet's classification of true aneurism; a classification, which, embracing, as it does, aneurism by anastomosis and erectile tumours, and these of different kinds, presents a good deal of novelty.

The following are the symptoms of a circumscribed aneurism:—The first thing which the patient perceives, is an extraordinary throbbing in some particular situation, and, on paying a little more attention, he discovers there a small soft pulsating tumour, which in a great measure disappears when compressed, but returns again as soon as the pressure is removed. With the return of pulsation, and of the swelling, a peculiar thrilling-feel is experienced, caused by the passage of the blood into the sac. If the artery be compressed on the distal side of the swelling, this will be rendered still larger and tenser. A spontaneous aneurism is generally slow in its growth, not perhaps exceeding the size of an egg in a year, and rarely that of a flattened orange. (*Guthrie, Op. cit. p. 108.*) At first, it is generally unattended with pain, or change in the colour of the skin. The pulsation is synchronous with the beat of the artery. When once the tumour has originated, it continually grows larger, though very gradually, and at length attains a considerable size. In proportion as it becomes larger, its pulsations become weaker; and, indeed, when the disease has acquired much magnitude, they are frequently either quite lost, or only distinguishable with the stethoscope. The diminution of the pulsation has been partly ascribed to the coats of the artery losing their dilatable and elastic quality, in proportion as they are distended, but chiefly to the lamellated coagulated blood deposited on the inner surface of the sac, particularly in large aneurisms, in which the motion of some of the blood is always interrupted. Immediately such coagulated blood lodges in the sac, pressure can only produce a partial disappearance of the swelling. This deposition of lamellated coagulum in the aneurismal sac is a circumstance of considerable importance; for it has been well explained by Mr. Hodgson, that it is the mode by which the spontaneous cure of the disease is in most instances effected. "One of the circumstances which, in the most early stage, generally attend the formation of aneurism, (says this author,) is the establishment of that process which is the basis of its future cure. The blood, which enters the sac soon after its formation, generally leaves upon its internal surface a stratum of coagulum, and successive depositions of the fibrous part of the blood gradually diminish the cavity of the tumour. At length, the sac becomes entirely filled with this substance, and the deposition of it generally continues in the artery, which supplies the disease, forming a firm plug of coagulum, which extends on both sides of the sac, to the next important ramifications that are given off from the artery. The circulation through the vessel is thus prevented, the blood is conveyed by collateral channels, and another process is instituted, whereby the bulk of the tumour is removed," &c. (*On the Diseases of Arteries, &c. p. 114.*) Whether there is any truth in Kreysig's conjecture,

that some of the lymph may exude from the inside of the sac itself, I cannot presume to say: he owns, however, that the inner concentric layers presenting the appearance of being deposited last, is a circumstance rather against his surmise, though he adverts to some other circumstances which incline him to look upon the opinion as possibly correct. (*German Transl. of Mr. Hodgson's Work, p. 124.*)

When the aneurism has not been caused by dilatation, but by a rupture of the inner coats of the vessel, the patient usually refers to some particular period, and generally to one of exertion, when this rupture was indicated by pain of a more or less acute nature, which either continued with a corresponding degree of lumeness, or left such a sense of uneasiness as made the patient put his hand frequently on the part. On one of these occasions, the pulsating tumour is discovered. If the aneurism, whether of one kind or another, be in the ham, the patient first limps; then the leg becomes permanently bent; and when the tumour begins to press on the nerves, veins, and absorbents, the toes and leg are extremely painful, and the foot and leg cedematous. (*See Guthrie on Dis. of Arteries, p. 109.*)

It is the general belief, that the pulsation of the tumour is produced by the jet of blood into it at each stroke of the heart. This opinion, however, is disputed by an eminent writer, who asks, Is it true, that the pulsation of aneurisms proceeds from the entrance of a more considerable stream of blood into the sac, and the distension of the swelling thereby produced? In aneurisms, which have only a narrow communication with the arterial tube, or which are filled with laminated coagula, the idea, says he, is quite inadmissible: the aneurism is rather shaken, as it were, like other different swellings in the vicinity of an artery, by the stroke of the heart occasioning a stretching of the whole arterial system, and at the same time communicating an impulse to the column of blood. (*Kreysig, Germ. Tr. of Mr. Hodgson's Work, p. 143.*) Here, I am by no means disposed to coincide with this distinguished physician, whose sentiments appear to me to be refuted by the fact, that, whenever any change happens, calculated to lessen, or entirely stop the influx of blood into the sac, the pulsation either diminishes, or ceases in proportion. Thus, when Kreysig adverted to the pulsation of aneurisms, in which much coagulated blood was deposited, he might at the same time have mentioned the effect which such deposition has in weakening the pulsation, the layers of coagulated blood, within the tumour, being, in the natural mode of cure, "the means by which the force of the circulation is removed from the sac, and the fatal termination of the disease by rupture is prevented." (*See Hodgson on Diseases of the Art. and Veins, p. 126.*) In proportion as the aneurismal sac grows larger, the passage of blood into the artery beyond the tumour is lessened. Hence, in this state, the pulse, below the swelling, becomes weak and small, and the limb frequently cold and cedematous. On dissection, the lower continuation of the artery is found preternaturally small and contracted. The pressure of the tumour on the adjacent parts may also produce a variety of symptoms,—ulceration, absorption of bone, &c. Sometimes (says Richter) an accidental contusion, or concussion,

may detach a piece of coagulum from the inner surface of the cyst, and the circulation through the sac be obstructed by it: nay, he asserts, that the coagulum may possibly be impelled quite into the artery below, so as to induce important changes. The danger of an aneurism arrives when it is on the point of bursting, by which occurrence the patient usually bleeds to death, and this sometimes in a few seconds. In an external aneurism, the fatal event may generally be foreseen, as the part about to give way becomes particularly tense, elevated, thin, soft, and of a dark purple colour. (See *Richter's Anfangsgr.* bund i.)

A large axillary aneurism, which I saw burst in St. Bartholomew's Hospital some years ago, did not burst by ulceration, but by the detachment of a small slough from a conical, discoloured part of the tumour, followed at first by an oozing of blood, and at length by one copious and fatal discharge of it; and soon after this case fell under my observation, I had an opportunity of seeing the process, by which an inguinal aneurism burst: at a certain point, the tumour became more conical, thin, and inflamed, and here a slough, about an inch in width, was formed. On the dead part becoming loose, a profuse bleeding began, which was stopped for a short time by pressure, but soon returned with increasing violence, and put an end to the patient's misery. We are then to conclude, that external aneurisms do not burst by ulceration, but, by the formation and detachment of a slough. I believe this is a fact, which was first particularly pointed out in the early editions of my work, and it gives me pleasure to find, that it is a statement which entirely coincides with that subsequently made by several writers of eminence, especially Mr. A. Burns (*On Diseases of the Heart*, p. 225.), and Boyer (*Traité des Maladies Chirurgicales*, t. ii. p. 88.).

As far as my information extends, Mr. A. Burns first explained the very different mode of rupture which happens in internal aneurisms: these, he observed, generally burst by actual laceration, and not by sphacelation of the cyst. (*On Diseases of the Heart*, p. 225.) But a still more particular account of the process, by which external and internal aneurisms burst, is delivered by Mr. Hodgson. When the sac points externally (says this gentleman), it rarely or never bursts by laceration, but the extreme distention causes the integuments and investing parts to slough; and upon the separation of the eschar, the blood issues from the tumour. A similar process takes place, when the disease extends into a cavity, which is lined by a mucous membrane, as the œsophagus, intestines, bladder, &c. In such cases, the cavity of the aneurism is generally exposed by the separation of a slough, which has formed upon its most distended part, and not by laceration. But, when the sac projects into a cavity lined by a serous membrane, as the pleura, the peritoneum, the pericardium, &c., sloughing of these membranes does not take place; but the parietes of the tumour having become extremely thin in consequence of distention, at length burst by a crack, or fissure, through which the blood is discharged. (*On the Diseases of Arteries*, &c. p. 85.) An aneurism, however, which burst into the œsophagus, and which I had an opportunity of examining after the patient's death, was found to have done so by an ulcerative process. The

mucous membrane of the trachea is also sometimes perforated by ulceration, the commencement of which is delineated in Cruveilhier's plates: (See *Anat. Pathol.* livr. iii. pl. 3. et 4.)

When the aneurism is of considerable size, the collateral arteries, which originate above the swelling, are manifestly enlarged. Boyer informs us, that, in dissecting the lower extremity of a patient, on whom Desault had operated eight months previously for a popliteal aneurism, he found in the substance of the great sciatic nerve an artery, whose diameter was equal to that of the radial at the wrist. This vessel had its origin from the ischiatic artery, and descended to the back part of the knee, where it anastomosed with the upper articular arteries. Boyer had also noticed in the same subject before the operation, that one of the branches of the upper internal articular artery was so much enlarged, that its pulsation could be plainly felt on the internal condyle of the thigh-bone. (*Op. cit.* p. 93.) It is such enlargement of the collateral arteries above the disease, which ensures to the limb below the tumour an adequate supply of blood when the obstruction to its passage through the diseased artery becomes considerable, or when this vessel has been rendered totally impervious by a surgical operation performed for the cure of the complaint.

In the advanced stage of an aneurism, the skin is found extremely thin, and confounded, as it were, with the aneurismal sac. The cavities of the cellular substance near the disease are either filled with serum, or totally obliterated by adhesion. The adjacent muscles, whether they lie over the aneurism, or to one side of it, are stretched, displaced, dwindled, and sometimes confounded with other parts. It is the same with the large nervous cords situated at the circumference of the tumour: they are pushed out of their natural situation, diminished in size, sometimes adherent to the outside of the sac, and so changed as scarcely to admit of being known again. Lastly, the cartilages and the bones themselves are not exempt from the mischief, which the aneurismal swelling produces in all the surrounding parts: they are gradually destroyed, and, at length, not the least trace of their substance remains, just in the same way as the bones of the cranium are destroyed by fungous tumours of the dura mater. (See DURA MATER.) Even the cartilages of the larynx, and rings of the trachea, are sometimes destroyed; this tube is pierced, and the blood escapes into it, or the aneurism bursts into the œsophagus. (*Boyer, Traité des Maladies Chir.* t. ii. p. 99.; *S. Cooper, Med. Chir. Trans.* vol. xvi. p. 399., &c.) As I shall hereafter explain, however, the pressure of an aneurismal tumour more quickly produces an absorption of bone, than of cartilage. Aneurism of the arch of the aorta, or of the subclavian artery, (*Guthrie on Diseases of Arteries*, p. 63.), sometimes occasions a dislocation of the sternal end of the clavicle.

While an aneurism is small and recent, it does not generally cause much pain, nor seriously impede the functions of the limb. But when it has increased, several complications are produced. Thus, the dragging of the great saphenous nerve by femoral aneurisms, frequently occasions acute pain in the course of this nerve so far as the great

toe. The distention of the sciatic nerve by the popliteal aneurism, sometimes brings on intolerable pain, which extends to all the parts to which this nerve is distributed, and which can hardly ever be appeased by the topical use of opiate applications. The compression of the veins and lymphatics gives rise to œdema, numbness, and coldness of the limb. And, finally, the long-continued pressure of the aneurism on the neighbouring bones causes their destruction. (*Boyer, t. ii. p. 105.*)

In true aneurism, the coats of the artery are not always in the same state, the kind of changes observed depending upon the progress of the tumour. In the early stage of the disease, either the whole cylinder of the vessel, or only a part of its circumference, is dilated; but this period is generally of short duration, especially in arteries of middling size, because their middle coat is capable of less resistance than that of the larger arteries, like the aorta, where this coat is yellowish, firm, and very elastic. As Breschet remarks, this difference of resistance in the middle coat of the aorta, and the branches given off from it, accounts for the rarity of true aneurisms either in the small arteries, or those of middling size, and their greater frequency in the principal trunk of the arterial system.

At length, in consequence of the increasing distention, some of the coats of the artery possessing the least elasticity give way; and these are found to be the internal and middle coats; while the external one still makes resistance, and continues to be more and more dilated by the lateral impulse of the blood.

The second stage of true aneurism is that in which the surgeon is usually consulted; that, in which the tumour increases more rapidly, and therefore begins to excite greater attention. The disease has now made its way through the internal and middle coats of the artery, and the external coat yields with more facility. In this stage, if the artery be only covered by a serous membrane, which soon gives way, the patient's life is endangered, and death often brought on by the rupture of the tumour. Examinations of the dead subject, under these circumstances, have frequently led to mistaken notions; and, doubtless, if various swellings of this kind had not been found in different degrees, or stages, in the same individual, one might have been disposed to join Scarpa in the belief, that no aneurism consists of a dilatation of all the arterial coats. (*Breschet, Fr. Transl. of Mr. Hodgson's Work, p. 128, 129.*)

*The change of an aneurism from the circumscribed into the diffused state is indicated by a sudden reduction, or stoppage of the pulsations of the tumour, often preceded by a sensation of something breaking, or giving way in the limb, which becomes all at once very painful. The temperature of the foot suddenly falls; and the swelling undergoes a rapid increase, and also becomes more diffused. The two latter circumstances may indeed not be very obvious, when the limb is already very œdematous, or the aneurismal sac has given way in a deep situation, and the blood has escaped into the cellular tissue between the muscles and under the fascia. In these cases, however, there is always some point of the leg or foot marked by a livid discolouration; and as the distention of the cellular tissue with blood, and the augmented interruption

of the circulation in the limb, bring on a tendency to gangrene, the patient's pulse becomes accelerated. Here the danger of mortification is much greater than when the sac bursts, and the blood, instead of passing extensively into the cellular tissue, accumulates in one mass. Mr. Lawrence communicated to the Med. Chir. Society an instance, in which the mass of blood collected in the thigh was so enormous after the giving way of a femoral aneurism under the skin, that, when the coagula were removed, by means of a free incision, some time after the artery had been tied, the finger could be passed nearly all round the thigh-bone. But, notwithstanding this mass of blood, and profuse suppuration, the patient recovered. (*See Med. Chir. Trans. vol. xvi. p. 321.*)

When the sac of an aneurism has burst in the foregoing manner, the propulsion of blood into it from the heart can evidently no longer have the effect of producing a full and sudden distention of it, as more or less of that fluid will either escape from it into the cellular membrane, or collect in one mass out of the aneurismal cavity. In general, however, the pulsations are only weakened at first, and several days elapse before they entirely cease. Another cause that has a powerful effect in putting an end to the pulsations, is the increase in the quantity of coagulated blood and fibrine in the sac; the inevitable result of the stream of blood through it becoming more and more retarded, in proportion as the obstruction of the circulation in the leg augments. In cases of doubt, whether the reduction and stoppage of the pulsation are owing to the circumstances here adverted to, or to the sac having become filled with lamellated blood, without any rupture of it, and change of the aneurism from the circumscribed to the diffused state (a condition promising the accomplishment of a complete cure), the stethoscope should be employed, whereby, in the former case, the sound of the jet of blood into the sac, the bellows-sound, as it is termed, will be perceived. This symptom, with others to which I have adverted, would render the state of things sufficiently clear. (*See Med. Chir. Trans. vol. xvi. p. 320, &c.*)

A false aneurism is always attended with at least a rupture, or giving way of the inner coat of the vessel, and usually with a breach in both this and the muscular coat, the outer elastic tunic forming the pouch in which the blood collects. But, after the swelling has attained a certain size, this coat also bursts, and then the blood either becomes diffused, or a large circumscribed space is formed for it by the condensation of the surrounding cellular membrane. False aneurisms, when produced by a wound, or puncture, are of course from the first attended with a division of all the coats of the vessel. This form of the disease is often seen at the bend of the arm, where the artery is exposed to injury in venesection. (*See Hæmorrhage.*) In this circumstance, as soon as the puncture is made, the blood gushes out with unusual force, and in a bright scarlet, irregular, interrupted current, flowing out, however, in an even, and less rapid stream, when pressure is applied higher up than the wound. These last are the most decisive marks of the artery being opened; for blood may issue from a vein with great rapidity, and in a broken current, when the vessel is turgid, and situated immediately

over the artery, which imparts its motion to it. The surgeon endeavours precipitately to stop the hemorrhage by pressure, and in general a *diffused false aneurism* is the result. The external wound in the skin is closed, so that the blood cannot escape; but, this does not hinder it from passing into the cellular substance. The swelling, thus produced, is uneven, often knotty, and extends upward and downward along the track of the vessel. The pulsation is more feeble than that of a true aneurism, and is sooner lost. The skin is also usually of a dark purple colour. The swelling increases, as long as the internal hemorrhage continues; and if this should proceed beyond certain bounds, mortification of the limb ensues. Such is the *diffused false aneurism* from a wound; a case which Lisfranc regards only as an extravasation of arterial blood, and reluctantly classes with aneurism at all. (*De l'Oblitération des Artères dans le Traitement des Aneurismes*, p. 6.)

The *circumscribed false aneurism*, from a wound or puncture, arises in the following manner. When proper pressure has been made in the first instance, so as to suppress the hemorrhage, but the bandage has afterwards been removed too soon, or before the artery has healed, the blood passes through the unclosed wound, or that which it has burst open again, into the cellular substance. As this has now become agglutinated by the preceding pressure, the blood cannot diffuse itself into its cells, and, consequently, a mass of it collects in the vicinity of the aperture of the artery, and distends the cellular substance in the form of a sac. Sometimes, though not often, the circumscribed false aneurism originates immediately after the opening is made in the artery. This chiefly happens when the aperture in the vessel is exceedingly small, and, consequently, when the hemorrhage takes place so slowly that the blood, which is first effused, coagulates, and prevents the entrance of that which follows into the cavities of the cellular substance, and, of course, its diffusion. A traumatic false aneurism differs materially from one which has taken place spontaneously, or as a consequence of disease; for in the former the artery is generally unound for some distance above and below the tumour. In the aneurism from a wound, the artery is perfectly sound, except inasmuch as the injury is concerned, and no effort is yet made by nature to obliterate the artery below or beyond the aneurism, which frequently takes place, when an aneurism occurs from disease. There are also other important differences in relation to the collateral circulation, and the requisite surgical operation. (See *Guthrie on the Diseases of Arteries*, p. 82.)

In aneurism, the separation of the external from the middle coat of an artery is generally effected with difficulty; the external coat becomes stretched and distended, and an aneurismal tumour is formed. To this, however, there are a few uncommon exceptions; for the blood may be forced along the artery, separating the external and middle coats from each other, and forming a pouch several inches in length, which may or may not completely surround the vessel. In one case, reported by Mr. Guthrie, it formed a pouch on the anterior part of the descending aorta, about six inches in length, extending to the sides, and in one place nearly surrounding it. A horizontal fissure, about half an inch in extent, near the

upper part of the swelling, allowed the blood to pass through the inner and middle coats, and to effect this separation, which, as Mr. Guthrie observes, could only have arisen from disease previously existing in the part. (See *Guthrie on Dis. of Arteries*, p. 40.) Laennec gave an account of a very similar, but of a more extensive case of this kind, in a person who was not suspected during life to have disease of the heart or arteries. (*De l'Auscult.* t. ii. p. 700.) Mr. Guthrie also met with a third example, which is the preparation No. 368. A. in the Museum of the College of Surgeons. Just below the point where the innominate is given off, the inner and middle coats are ruptured along half the circle of the aorta, as clearly as if cut with a knife. The effused blood has separated the outer from the fibrous coat down to the origin of the aorta. The separation is also continued along the descending aorta for an inch beyond the left subclavian, and the interval filled with blood. The arteria innominate had in the front half of it another transverse rent in all its coats, where the hemorrhage took place which killed the patient. The descending portion of the aorta, and the roots of the great vessels, are covered with atheromatous patches, and in part with bony scales. The coats were all easily separable, and softer and more readily broken than natural. (*Guthrie, Op. cit.* p. 43.)

Cases of the foregoing description are sometimes termed *dissecting aneurisms*, of which the late Mr. Sherkelton described one modification, not previously noticed by any other pathologist, and the peculiarity of which was, that after the blood had forced its way through the inner and middle coats of the vessel, it not only detached the middle from the outer coat to the extent of four inches, but then forced its way into the canal of the artery again, through the middle and inner coats: thus, two channels existed for the passage of the blood. In the end, the formation of the new passage led to the obliteration of the original one, or corresponding portion of the arterial tube. (See *Dublin Hospital Reports*, vol. iii.)

FORMATION OF ANEURISMS.

If the doctrines of Scarpa, published in 1804, had proved correct, the grand distinction of aneurism into *true* and *false* must have been rejected as erroneous: "for," says he, "after a very considerable number of investigations, instituted on the bodies of those who have died of internal or external aneurisms, I have ascertained, in the most certain and unequivocal manner, that there is only one kind or form of this disease, viz. that caused by a solution of continuity, or rupture of the proper coats of the artery, with effusion of blood into the surrounding cellular substance; which solution of continuity is occasioned sometimes by a wound, a steatomatous, earthy degeneration, a corroding ulcer, or a rupture of the proper coats of the artery, I mean the internal and muscular, without the concurrence of a preternatural dilatation of these coats being essential to the formation of this disease; and, therefore, that every aneurism, whether it be internal or external, circumscribed or diffused, is always formed by effusion." (*On Aneurism*; transl. by Wisahart, Pref.)

According to Scarpa, it is an error to suppose,

that the aneurism at the curvature or in the trunk of the aorta, produced by a violent and sudden exertion of the whole body, or of the heart in particular, and preceded by a congenital relaxation of a certain portion of this artery, or a morbid weakness of its coats, ought always to be considered as a tumour formed by the distention or dilatation of the proper coats of the artery itself, that is, of its internal and fibrous coats. Scarpa considers it quite demonstrable, that such aneurisms are produced by a corrosion and rupture of these tunics, and, consequently, by the effusion of arterial blood under the cellular sheath, or other membrane, covering the vessel. If ever there be a certain degree of preceding dilatation, it is not essential to constitute the disease, for it is not a constant occurrence; most aneurisms are unpreceded by it, and, in those rare cases in which an aneurism is preceded and accompanied by a certain degree of dilatation of the whole diameter of the curvature of the aorta, there is an evident difference between an artery simply enlarged in diameter, and the pouch which forms an aneurismal sac.

Careful dissections, says Scarpa, will prove that the aorta contributes nothing to the formation of the aneurismal sac, and that this is merely the cellular membrane, which, in the sound state, covered the artery, or that soft cellular sheath which the artery received in common with the neighbouring parts. This is raised by the blood into the form of a tumour, and is covered, in common with the artery, by a smooth membrane.

This eminent professor does not deny that, from congenital relaxation, the proper coats of the aorta may occasionally yield and become disposed to rupture; but he will not admit that dilatation of this artery precedes and accompanies all its aneurisms, or that its proper coats ever yield so much to distention as to form the aneurismal sac. *The root of an aneurism of the aorta never includes the whole circumference of the artery; but the aneurismal sac arises from one side of it in the form of an appendix, or tuberosity.* On the contrary, the dilatation of the artery always extends to its whole circumference, and, therefore, differs essentially from aneurism. Thus he urges, that there is a remarkable difference between a dilated and an aneurismal artery, although these two affections are sometimes found combined together, especially at the origin of the aorta. If we also consider, that the dilatation of an artery may exist without any organic affection, the blood being always in the cavity of the vessel; that, in an artery so affected, there is never collected any grumous blood, or polypous layers; that the dilatation never forms a tumour of considerable bulk; and that, while the continuity of the proper coats remains uninterrupted, the circulation of the blood is not at all, or not so sensibly changed, we shall be obliged to allow, that aneurism differs essentially from one kind of dilatation of an artery.

Some additional remarks on this topic, more recently published by Scarpa, will be presently considered.

By dissections of arteries, both in the sound and morbid state, Scarpa endeavours to demonstrate what share the proper and constituent coats of the artery have in the formation of the aneurismal sac, and what belongs to the cellular covering, and other adventitious membranes surrounding the artery.

The covering of an artery is merely an adventitious sheath, which the vessel receives in common with the parts in the vicinity of which it runs. On cutting an artery across in its natural situation, the segment of the cut vessel retires and conceals itself in this sheath.

This cellular covering is most evident round the curvature and trunk of the aorta, the carotid, mesenteric, and renal arteries; it is less dense round the trunks of the brachial, femoral, and popliteal arteries. The pleura lies over the cellular sheath of the arch of the aorta, and over that of the thoracic aorta; while that of the abdominal aorta is covered by the peritoneum. Both these smooth membranes adhere to, and surround, two thirds of the circumference of the vessel. The great arteries of the extremities are not covered, in addition to the cellular substance, by any smooth membrane of this sort, but by a cellular sheath, which is demonstrably distinct from the adipous membrane, and serves to enclose the vessels, and connect them with the contiguous parts.

When air, or any other fluid, is injected by a small hole, made artificially between the cellular covering and the subjacent muscular coat of the artery, the injected matter elevates into a tumour the cellular membrane, which closely embraces the artery, without properly destroying its cells, which it distends in a remarkable manner. When melted wax is injected, and pushed with much force, the cellular sheath of the artery is not only raised over the vessel, like a tumour, but the internal cells of that covering are also lacerated; and, on examining afterwards the capsule of the artificial tumour, it appears as if it were formed of several layers, rough and irregular internally, smooth and polished externally. The same thing happens when any injection is pushed with such force into an artery as to rupture the internal and muscular coats at some point of their circumference. Nicholls performed this experiment several times before the Royal Society. (*Philos. Trans. an. 1728.*) As soon as the internal coat is ruptured, the muscular one also gives way; but the external cellular sheath, being of an interlaced texture, and the thin laminae of which it is composed being not simply applied to one another, but reciprocally intermixed, is capable of supporting great distention, by yielding gradually to the impulse of the blood, without being torn or ruptured.

Scarpa is farther of opinion, that the same phenomena may be observed, when the internal coat of the aorta becomes so diseased as to be ruptured by the repeated jets of blood from the heart. In this circumstance, the blood, impelled by the heart, begins immediately to ooze through the connections of the fibres of the muscular coat, and gradually to be effused into the interstices of the cellular covering, forming, for a certain extent, a kind of *ecchymosis*, or *extravasation of blood*, slightly elevated upon the artery. Afterwards, the points of contact between the edges of the fibres of the muscular coat, being insensibly separated, the arterial blood, penetrating between them, fills the cellular covering of the artery, and raises it after the manner of an incipient tumour. Thus, the fibres and layers of the muscular coat, being wasted, or lacerated, or simply separated from each other, the arterial blood is carried with great force, and in greater quantity than before,

into the cellular sheath of the artery, which it forces more outwards; and, finally, the divisions between the interstices of the cellular coat, being ruptured, it is converted into a sac, which is filled with polypous concretions and fluid blood, and at last forms, strictly speaking, the aneurismal sac. The internal texture, although apparently composed of membranes placed one over the other, is, in fact, very different from that of the proper coats of the artery, notwithstanding the injured vessel and aneurismal sac are both covered externally in the thorax and abdomen with a smooth membrane.

Scarpa has examined a considerable number of aneurisms of the arch, and of the thoracic and abdominal trunks of the aorta, without finding a single one in which the rupture of the proper coats of the artery was not evident, and in which, consequently, the sac was produced by a substance completely different from the internal and muscular coats.

The aneurismal sac never comprehends the whole circumference of the vessel. At the place where the tumour joins the side of the tube, the aneurismal sac presents a kind of constriction, beyond which it becomes more or less expanded. This would never happen, or rather the contrary circumstance would occur, if the sac were formed by an equable distention of the tube and proper coats of the affected artery. In incipient aneurisms, at least, the greatest size of the tumour would then be in the artery itself, or root of the swelling, while its fundus would be the least. But, *whether aneurisms be recent and small, or of long standing and large, the passage from the artery is always narrow, and the fundus of the swelling greater in proportion to its distance from the vessel.* The sac is always covered by the same soft dilatable cellular substance which united the artery in a sound state to the circumjacent parts. Such cellular substance, in aneurisms of the thoracic aorta, is covered by the pleura, and, in those of the abdominal aorta, by the peritoneum, which membranes include the sac and ruptured artery, presenting outwardly a continued smooth surface, just as if the artery itself were dilated. But, if the aorta be opened lengthwise on the side opposite the constriction, or neck of the tumour, the place of the ulceration, or rupture, of the proper coats of the artery, immediately appears within the vessel, on the side opposite to that of the incision. The edge of the fissure, which has taken place, is sometimes fringed, often callous and hard, and through it the blood formed for itself a passage into the cellular sheath, which is converted into the aneurismal sac. If, as sometimes happens, in the arch of the aorta near the heart, the artery, before being ruptured, has been somewhat dilated, it seems, at first, as if there were two aneurisms; but, the constriction, which the sac next to the artery presents externally, points out exactly the limits, beyond which the internal and muscular coats of the aorta had not been able to resist the distension, and where of course they have been ruptured. The partition, which may always be seen dividing the tube of the artery from the aneurismal sac, and which is lacerated in its middle, consists of nothing else than the remains of the internal and muscular coats of the ruptured artery.

By carefully dissecting the proper coats of the ruptured aorta in its situation, and comparing

them with the cellular substance forming the sac, Scarpa affirms, that the truth of the preceding statement may be indisputably demonstrated.

When an incision is made lengthwise in the side of the vessel opposite the rupture, its proper coats are found either perfectly sound, or a little weakened and studded with earthy points, but, still capable of being separated into distinct layers. On the contrary, in the opposite side of the aorta, where the rupture is, the proper coats are unusually thin, and are only separable from each other with difficulty, or even not at all; they are frequently brittle like an egg-shell, and are disorganized and torn at the place where they form the partition between the ruptured artery and the mouth of the aneurismal sac. Continuing to separate these coats from within outwards, we arrive at the cellular sheath surrounding the aorta. This sheath being much thickened in large aneurisms, and adherent to the subjacent muscular coat of the artery at the place of the constriction of the sac, is likely to be mistaken for a dilated portion of the vessel itself. But, even in such cases, we may at last separate it, without laceration, from the tube of the artery, above and below the injury, and, successively, from the muscular coat, as far as the neck of the aneurism. Then, it is clear, the muscular coat does not pass beyond the partition, separating the cavity of the artery from that of the aneurismal sac, over which it is not prolonged, but terminates at the edge of the rupture like a fringe, or in obtuse points. Errors seem to Scarpa more apt to occur, in consequence of the aorta and sac being both covered by the pleura or peritoneum.

The portion of the aorta within the pericardium being only covered by a thin reflected layer of this membrane, such layer may also be lacerated, when the proper coats give way, and blood be effused into the cavity of the pericardium. Examples of this kind are related by Walter, Morgagni, and Scarpa himself. In the latter instance, on making an incision into the concave part of the aorta, opposite the tumour which had formed under the layer of the pericardium, which had also burst, by a small aperture, its internal coat, corresponding to the base of the swelling, was quite rough, interspersed with yellow hard spots, and actually ulcerated for the space of an inch in circumference. The preparation is preserved in the Museum at Pavia.

But, all other parts of the aorta having, between them and the pleura and peritoneum, a cellular sheath of a stronger and more yielding nature, which allows itself to be distended into a sac, and being strengthened, internally, by polypous layers, and, externally, by the pleura or peritoneum, oppose for a long while the fatal effusion of blood.

Scarpa believes, that what he calls the chronic steatomatous, squamous degeneration of the artery, is more frequently the cause of its bursting than violent exertions of the whole body, blows, or an increased impulse of the heart. This kind of diseased change is very common in the curvature, and in the thoracic and abdominal trunks of the aorta. In the incipient state of such disease, the internal coat of the artery loses, for a certain space, its beautiful smoothness, and becomes irregular and wrinkled. It afterwards appears interspersed with yellow spots, which are converted

into grains, or earthy scales, or into steatomatous and cheese-like concretions, which render the internal coat of the artery brittle, and so slightly united to the adjoining muscular coat, that, upon being merely scratched with the knife, or point of the nail, pieces are readily detached from it, and, on being cut, it gives a crackling sound, similar to the breaking of an egg-shell. This ossification cannot be said to be proper to old age, since it is sometimes met with in subjects not much advanced in life. The whole of the side of the artery, in that portion which is occupied by the morbid affection, is, for the most part, hard and rigid, sometimes soft and fungous; and, in most cases, the canal of the artery is preternaturally constricted. In the highest degree of this morbid disorganization, true ulcerations are found on the inside of the artery, with hard and fringed edges, fissures, and lacerations of the internal and fibrous coats of the artery.

Having presented the reader with an abridged account of the most important remarks made by Scarpa, in support of the doctrine he defends, I now annex his conclusions. 1. That aneurism is invariably formed by the rupture of the proper coats of the artery. 2. That the aneurismal sac is never formed by a dilatation of the proper coats of the artery, but, undoubtedly, by the cellular sheath, which the artery receives in common with the parts contiguous to it; over which cellular sheath the pleura is placed in the thorax, and the peritoneum in the abdomen. 3. That if the aorta, immediately above the heart, appears sometimes increased beyond its natural diameter, this is not common to all the rest of the artery; and when the aorta, in the vicinity of the heart, yields to a dilatation greater than natural, this dilatation does not constitute, properly speaking, the essence of the aneurism. 4. That there are none of those marks regarded by medical men as characteristic of aneurism from dilatation, which may not be met with in aneurism from rupture, including even the circumscribed figure of the tumour. 5. That the distinction of aneurism into *true* and *spurious*, adopted in the schools, is only the production of a false theory; since observation shows, that there is only one form of the disease, or that caused by a rupture of the proper coats of the artery, and an effusion of arterial blood into the cellular sheath, which surrounds the ruptured artery.

Such were the inferences made by Scarpa, in 1804, one of the most distinguished anatomists and surgeons of his time. Great as his authority was, several eminent modern surgeons, as Richerand, Boyer, Dubois, Dupuytren, Sabatier, Breschet, &c. did not yield to it, but still contended that, in some aneurisms, the coats of the artery were dilated. These professors in France coincided with what has been usually taught upon this subject in the surgical schools of Great Britain. Every lecturer here has been accustomed to describe the distinctions of aneurisms into true and false, or into some cases which are accompanied with dilatation, and into others which are attended with rupture of the arterial coats. Many years ago, Mr. Hodgson, of Birmingham, published a valuable treatise, in which he differs from Scarpa, and joins those surgical writers who believe in the occasional dilatation of the coats of the arteries in this disease. He inquires, "Is every aneurism produced by a destruction of the internal and middle coats of the vessel? and does

not a partial dilatation of these coats occasionally precede, and give rise to, their destruction? I believe that this is frequently the case. We have seen, that the disorganization of the coats of an artery, by destroying their natural elasticity, will give rise to permanent dilatation of the whole circumference of the vessel; and there is every reason to expect, that a loss of its elasticity in a portion only of the diameter of the vessel, will give rise to a partial dilatation of its coats. Indeed, the proofs of a partial dilatation of the coats of an artery, particularly of the aorta, are incontestably established by the possibility of tracing the coats of the vessel, throughout the whole extent of the expansion, and by the existence of those morbid appearances in the sac which are peculiar to the coats of the arteries.

"In the year 1811 (says Mr. Hodgson), I dissected an aneurism of the aorta, which was removed from the body of a young woman, by my friend Dr. Farre. The sac was as large as a small melon, and had proved fatal by bursting into the posterior mediastinum, and subsequently into the cavity of the thorax. This aorta exhibited the formation of aneurism by partial dilatation in three distinct stages. The internal coat was throughout inflamed, and presented a fleshy and irregular appearance. At the arch of the aorta, there was a dilatation not larger than the half of a small pea. About two inches lower in the same vessel was a second dilatation, which would have contained a hazel nut; and immediately above the diaphragm was the large aneurism which had proved fatal. I removed that portion of the vessel which contained the smallest dilatation, and macerated it until its coats could be separated without violence. I found that the dilatation existed equally in the three coats of the vessel, and, when separated, each presented the appearance of a minute aneurism. The second dilatation exhibited the same circumstances in a more advanced stage. The coats of the vessels were more intimately adherent to each other than in a natural state, but, it was evident, that the dilatation consisted in a dilatation of the internal, the middle, and the external coats of the aorta. In the large aneurism, the disorganized internal and middle coats could be traced for some distance into the sac, when the parts contained in the posterior mediastinum, and the vertebæ, formed the remainder of the cyst. There can be little doubt that this sac commenced in a dilatation of the coats of the vessel, similar to those appearances which existed in the superior portion of the dissection, and the artery appeared to illustrate the formation of aneurism by partial dilatation in three distinct stages." (*Hodgson on the Diseases of Arteries and Veins*, p. 66. 68. See also *G. Andral, Précis d'Anat. Pathol.* t. ii. p. 361.) (So far as Kreysig's information extends, nobody before Mr. Hodgson had examined the structure of an aneurismal sac in this accurate manner, viz. by maceration, and the results, he thinks, are not liable to the slightest objections. (See the *German Transl. of Mr. Hodgson's Work, with Notes by Kreysig and Koberstein*, p. 109. Hanover, 1817.)

Mr. Hodgson has seen this partial dilatation in almost all the arteries which are subject to aneurism, at the division of the carotids and iliacs, in the arteries of the brain, &c.; and he agrees with Dr. Baillie (*Morbid Anatomy*, &c.), Laen-

neo (*Cerattius, Beschreib. d. Krankh. Preparate d. Anat. Theatres zu Leips. p. 408. 8vo. 1819*), and others, that aneurisms, at the origin of the aorta, are generally formed by dilatation of the coats of the vessel.

"Partial as well as general dilatation (says Mr. Hodgson) frequently precedes the formation of aneurism in the arteries of the extremities. A gentleman had a large aneurism in the thigh, which had undergone a spontaneous cure. Upon examining the limb after death, the popliteal artery was found to be thickened and covered with calcareous matter. A small pouch, which would have contained the seed of an orange, originated from the side of this artery. This little sac was evidently formed by a dilatation of the coats of the vessel. A man died from the sloughing of an aneurism in the ham; in the femoral artery there was a small aneurism, about as large as a walnut. The external coat was dissected from the surface of the tumour to a considerable extent. The internal and middle coats were evidently dilated, and contributed to the formation of the sac. The dilatation of these coats was gradual, and they continued for a considerable distance to form the sac, when they were inseparably blended with the surrounding parts." (*Op. cit. p. 70.*) In one particularly interesting case of popliteal aneurism recorded by Breschet, where the internal coat, and in part also the fibrous, could be traced over the swelling, there was likewise an aortic aneurism, extending from the heart to four inches above the bifurcation of the aorta, where the swelling ended in an abrupt and circular manner. The middle and external tunics were perfectly healthy; and the internal, with the cellular tissue around it, alone diseased. In fact, when the lining of the artery was removed at the points where any morbid alterations were seen, these were also taken away, and the fibrous tunic left unchanged. In the limb, indeed, where the popliteal aneurism existed, all the arteries were aneurismal, and afforded most convincing evidence of all their coats contributing to the dilatations. (See *Breschet, Mém. Chir. sur différentes Espèces d'Aneurysmes, p. 40., &c.*)

While Mr. A. Burns bears testimony to the fidelity and accuracy of Scarpa's general detail, he adds, that perhaps it may not be uniformly found, that "the root of an aneurism never includes the whole circumference of the tube of an artery." We have, says he, a preparation in which the reverse has taken place. In this case, the whole cylinder of the vessel, from the heart to beyond the curvature, is equally dilated; and dilated to such an extent, that the tumour measures no less than ten inches in circumference. Scarpa limits dilatation, says Mr. Burns, to that state of an artery in which the coats remain in their natural relation to each other, and in which they are not altered in their texture, nor lined on their inner surface with "polypous layers." "This, however, was not the case in the instance which I have brought forward. In it you have seen that the coats were much dilated, and also very much altered in their structure. Externally and internally, they had assumed the look of the membranes of the foetus, only they were thicker and denser, but they were equally gelatinous, and nearly as transparent; and, on their inner surface, they were crusted over with laminae of coagulated lymph. By peeling off this incrustation, after the

sac had been inverted, we saw plainly, that, although the internal coats were, round the complete cylinder of the vessel, much diseased, and considerably dilated, yet they were not dilated in the same degree as the external coverings of the artery. At irregular distances, longitudinal rents were formed in the fibrous coats, and these chasms were filled with coagulating lymph. The internal coats, over the whole circumference of the vessel, had assumed the diseased condition which in aneurism is generally confined to a part of the cylinder. In this tumour, all the coats continued for a time to dilate equally; but at length the internal gave way, forming longitudinal rents, through which the external coats could be seen, after the lymphatic coating had been scraped off. In this instance, had the sac been dissected in the early stage, it would have presented precisely the same appearances as those described by Dr. Monro, and the one (the aneurism) lately examined by the surgical editor of the *London Med. Review*." Mr. Burns afterwards expresses doubts, whether the sac ever acquires a large size without dilatation. The case reported in the latter periodical work was the largest that he knew of, in which all the coats were found uniformly dilated. The sac, which was as large as the fist, was lined throughout with flakes of bone; and though the internal coat of the vessel was thus patched, and extremely thin and brittle, it did not, on minute inspection, any where exhibit a solution of continuity. Mr. A. Burns further states, that the above case, reported by himself, was the only one, out of fourteen, which did not corroborate Scarpa's description. (*On Diseases of the Heart, &c. p. 204.*) Mr. Wilson, after mentioning the frequency of aneurism in the aorta, carotid, subclavian, and axillary arteries, and its rarity in the brachial, tells us, that he knows of no example of aneurism below the elbow, where the swelling could not be traced to a wound of the coats of the artery. He adds, that true aneurism has not unfrequently occurred in the internal and external iliac arteries, in the inguinal, femoral, and very frequently in the popliteal. It has taken place in the posterior tibial artery, but he knows of no instance of it in the anterior tibial, or peroneal arteries. "I have (says he) met with only one instance of true aneurism affecting any of the branches of the aorta, which are distributed to the abdominal viscera. In the year 1809, on inspecting the body of a clergyman, in the presence of the late Sir W. Farquhar, a tumour, very much resembling the heart in colour, shape, and size, appeared to hang down from the under surface of the left lobe of the liver. When this tumour was opened, and carefully inspected, it appeared to have been formed by the left branch of the hepatic artery having become very much enlarged and aneurismal. It had burst, and the blood which had escaped was found in an imperfect cyst, partly in a fluid, and partly in a coagulated state, forming a large proportion of the tumour." (See *Lectures on the Blood, and on the Anatomy, Physiology, and Surgical Pathology of the Vascular System, p. 379, 380.* 8vo. Lond. 1819.)

The facts adduced by Mr. Hodgson appear sufficiently conclusive, and from them the following doctrine is clearly deducible:—

First, That numerous aneurisms are formed by destruction of the internal and middle coats of an

artery, and the expansion of the external coat into a small cyst, which giving way from distention, the surrounding parts, whatever may be their structure, form the remainder of the sac.

Secondly, That sometimes the disease commences in the dilatation of a portion of the circumference of an artery. This dilatation increases until the coats of the vessel give way, when the surrounding parts form the sac, in the same manner as when the disease is in the first instance produced by destruction of the coats of an artery. (P. 74.)

The conclusions of Mr. Hodgson are supported by the observations of numerous writers.

The learned Sabatier says, there can be no doubt, that many aneurisms depend upon the dilatation of the arterial coats; but, *in far more numerous examples, the internal tunics are ruptured, and it is the cellular coat alone which separates from them, and enlarges, so as to form the aneurismal sac.*

It is difficult to conceive, he observes, how all the coats of an artery can dilate and yield sufficiently to form the investment of such immense tumours as some aneurisms are. Indeed, that very tunic, which composes the greater part of the thickness of the vessel, and which is termed the *muscular coat*, is known to consist of fibres whose texture is firm, and little capable of bearing extension. However, Haller, in describing a very large aneurism, situated in the aorta, near the heart, relates, that the innermost coat of this vessel was ruptured and torn, the loose jagged edges of the laceration being visible in the aneurismal sac. These were squamous, bony, and of little thickness; while the muscular and cellular coats were quite sound. Donald Monro noticed the same thing in five different aneurisms, in the course of the femoral and popliteal arteries of a man, who had been confined a long while to his bed, after being operated upon for bubonocoele. Monro succeeded in tracing the fibres of the muscular coat over the swellings, so that he had no doubt of this tunic being dilated. (See *Médecine Opératoire*, t. iii. p. 160—162.)

According to Richerand, when an aneurism is recent and of small size, the dissection of the tumour exhibits a simple dilatation of the arterial coats; while, in the other cases, where the aneurism is large, and has existed a considerable time, the internal and middle coats of the vessel are invariably lacerated. In the early stage of the disease, the blood which fills the aneurismal sac is fluid; and, on the contrary, in cases where the internal tunics of the artery are ruptured, the sac contains more or less coagulated lymph. The external, or cellular coat, composes the greater part of the cyst; and the coagulated lymph, with which it is filled, is arranged in layers, the density of which is described as being greater in proportion to the length of time which they have been deposited. Such as are nearest the sac are, therefore, most compact, and contain the smallest quantity of the colouring matter of the blood; more deeply, the concretions of lymph resemble simple coagula; and, lastly, the blood, which is still nearer the arterial tube, retains its fluidity.

After the aneurismal sac has been cleansed from the fibrine and coagulated blood which it contains, its parietes will appear to be almost entirely formed of the cellular coat of the artery.

Towards the bottom may be observed the aperture, arising from the laceration of the internal and middle coats, which, being much less elastic than the external, are ruptured in an early stage of the disease. It is when these two tunics give way, that the aneurismal tumour undergoes a sudden and considerable increase in its size; for, then the cellular coat alone has to sustain all the pressure of the blood, which, now becoming effused into a more ample cyst, loses a great deal of its impetus, coagulates, and forms fibrous masses; circumstances to which may be ascribed the hardness of the swelling, the weakness of its pulsation, &c. (*Nos. Chir.* t. iv. p. 82. ed. 2.)

The reality of true internal aneurisms was insisted upon by C. F. Ludwig, in a programma written expressly on that subject. (*Diagnostices Chir. Fragm. de Aneurysmate Interno*, Lips. 1805.) An interesting case, exemplifying an aneurismal dilatation of all the coats of the abdominal aorta, was published by Professor Nægele of Heidelberg. The swelling was as large as a man's head, and weighed about five pounds. The aorta began to be dilated at the point where it passes into the cavity of the abdomen between the crura of the diaphragm. This dilatation extended gradually down to a point, about four finger-breadths from the bifurcation of the aorta into the iliac arteries, at which point, strictly speaking, the large aneurismal sac commenced. The length of the whole dilated part of the vessel was eleven inches; that of the sac, six; and its diameter five inches. The artery was not equally dilated in every direction, the expansion being most considerable laterally and forwards. Nægele and Ackermann found that the three coats of the aorta, the internal, muscular, and cellular, were all equally dilated. These professors traced the muscular coat with the scalpel from the top to the bottom of the tumour, and not the slightest doubt could be entertained that the case was a true aneurism. (F. C. Nægele, *Epistola ad T. F. Baltz, quâ Historia et Descriptio Aneurysmatis, quod in Aorta abdominali observavit, continetur*. Heidelb. 1816.)

In the valuable cases collected by H. F. Janin, convincing evidence will be found of there being one kind of aneurism attended with rupture of the coats of the artery, the cellular coat alone forming the aneurismal sac; and another with an equal dilatation of all the coats of the artery. Of the latter, Janin relates three unequivocal cases. (See *Annales du Cercle Médical*, t. i. art. 2. 1820.) Breschet's investigations, which are supported by the evidence of *post mortem* examinations, leave also no doubt about the truth of aneurism by dilatation, of which he describes not less than four kinds, as already stated, viz. the *aneurisma verum sacciforme*; the *aneurisma verum fusiforme*; the *aneurisma verum cylindricum* (comprising aneurism by apatomosis and erectile tumours); and, lastly, the *aneurisma cyrsoideum*, or the *varix arterialis* of Dupuytren; a rarer affection, in which the arteries undergo very similar changes to those exhibited in varicose veins. (Breschet, in *Mém. Chir. sur différentes Espèces d'Aneurysmes*, 4to. Paris, 1834.) Lisfranc also admits, with all the best modern surgeons, the reality of aneurism accompanied by dilatation of all the coats of the arteries. (*De l'Obturation des Artères dans les Aneurismes*, p. 11.)

After the clear demonstration of an aneurismal sac being occasionally composed of all the coats

of an artery, as afforded in the dissections and pathological preparations, to which a reference has been made, the reader will be better prepared to judge of the difference existing upon this subject between Scarpa and other modern writers; and, so far as I can judge, the question is now reduced to one,—whether any of the dilatations on record, said to comprise all the arterial coats, merit the name of aneurism. We have seen, that he has always unequivocally admitted, that the arteries may be dilated; though the kind of dilatation, to which he alludes, is thought by him, as well as by A. Burns, and my friend Mr. Hodgson (*On Diseases of Arteries, &c.* p. 58.), to require discrimination in a pathological point of view. "It is proved (says Scarpa) by dissection, that the morbid dilatation is circumscribed by the proper coats of the diseased artery; and that the inner surface of the sac, formed by the *partial*, or total protrusion of the arterial tube, is never filled with polypous laminæ, or layers of fibrine disposed over each other; (a fact particularly dwelt upon by Mr. Hodgson, p. 82.) which layers never fail to be formed in greater or smaller quantity in the cavity of an aneurism." The opinion, that these layers of coagula are not met with in small dilatations of arteries, but are found in large expansions of them, he says, is contradicted by numerous careful observations, and especially by a specimen, actually before him when he was writing, where a morbid dilatation of the arch of the aorta, in the vicinity of its origin from the heart, six inches in length, and five in breadth, was entirely free from any of the lamellated coagula always found in aneurisms. On the contrary, the sac of the aneurism is formed from the parts surrounding the wounded, or ruptured artery, into which pouch the blood, entering as into a natural receiver, and quite out of the current of the circulation, moves only slowly, and constantly deposits these layers of fibrine, and this sometimes in such quantity as to fill the whole cyst. Scarpa at the same time particularly explains, that, if accidentally furrows, or fissures, exist on the inside of the morbid dilatation, the fibrine may be deposited in these rough places, but only in them. These fissures and inequalities of the internal surface of the morbidly dilated artery, he regards strictly as so many beginnings of another disease of the vessel, quite different from dilatation, that is, of aneurism subsequent to dilatation. (See *Memoria sulla Legatura delle principali Arterie degli Arti, con una Appendice all' Opera sulle Aneurisma*, fol. Pavia, 1817; or the *Treatise on Aneurism*, transl. by Wishart, ed. 2. p. 119. Edinb. 1819.)

In this manner, no doubt, Scarpa would account for the presence of lamellated coagula in the case reported by Mr. A. Burns (*On Diseases of the Heart*, p. 306.); though the latter gentleman himself, for reasons already detailed in the foregoing pages, did not regard the expansion of all the coats of the artery as corresponding to the morbid dilatation implied by Scarpa. Thus Scarpa further agrees with other modern writers, in admitting the possibility of aneurism becoming ingrafted, as it were, on one of these unnatural dilatations; more than one example of which combination were, indeed, recited in his first work. In that treatise he has asserted, that what he calls morbid dilatation always extends to the whole circumference of the vessel. But this point seems,

from the Appendix, to be renounced, as he now observes, "Where the morbid dilatation is *partial*, or on one side of the artery, like a thimble, (for very frequently, even in the arch of the aorta, this partial dilatation does not exceed the size of half a bean,) the entrance for the blood into this capsule is as large as the bottom of the sac" (*Transl. by Wishart*, p. 120. ed. 5.) According to Scarpa, when the morbid dilatation occupies the whole circumference of the arterial tube, the tumour always retains a cylindrical or oval form; and, if situated in such manner that it can be compressed, it yields very readily to pressure, and almost disappears; and, after death, is found much smaller than during life. On the contrary, *aneurism*, whether preceded by dilatation or not, constantly originates from one side of the ruptured artery. The entrance for the blood is small, compared with the size of the fundus of the sac; the tumour assumes an irregular shape; yields with difficulty to pressure; retains nearly the same size in the dead that it had in the living body; and its sac, instead of becoming thinner as the swelling enlarges—as the coats of an artery do, when they are simply affected with dilatation—attains greater thickness the larger the aneurism grows. These essential differences between the two diseases are illustrated by an interesting case, met with by Vacca, where a patient died with an aneurism of one subclavian artery, and a simple morbid dilatation of the whole circumference of the other. (See *Sprengel, Storia delle Operaz. di Chir. trad. Ital. Parte ii. p. 294.*)

When these two different affections are situated in the thorax, or abdomen, it is impossible to discriminate them from each other before death. The symptoms, occasioned by the pressure of the tumour on the viscera must be nearly the same, whether caused by a morbid dilatation, or an aneurism. The means for retarding their fatal termination is also the same in both forms of the disease. With regard to the possibility of cure, however, Scarpa says, that there is great difference; for, when the case is an internal aneurism, there may be some slight hope of a radical cure by the efforts of nature and art, which hope can never be entertained in a case of morbid dilatation; a fact which is accounted for by no laminated coagula being deposited in the latter disease. (*On Aneurism*, transl. by Wishart, p. 124. ed. 2.) A great deal of the latter statement coincides with the observations of Mr. Hodgson, who particularly notices, that he has never met with lamellated coagula in such sacs as consist either in a general or partial dilatation of the coats of the vessel. (*On Diseases of Arteries, &c.* p. 82.) Whether this ever takes place in such cases may still be a question, because, if Professor Nægele has given a correct description of the aneurism of the abdominal aorta, already mentioned—which aneurism was of large size, and consisted of a dilatation of all the coats of the vessel—there was in this rare example a large quantity of these layers of coagulated blood. Yet, whether the Professor actually means the fibrine arranged in laminæ, or only common coagulated blood, which, as every one knows, may be found either in the cysts of dilated or of ruptured arteries, may admit of doubt. The statement, therefore, made by Hodgson and Scarpa, and which agrees with the later observations of Breschet (see *Mém. Chir. sur différentes* &c.

pèces d'Aneurismes, p. 70.), may not be contrary to what was really seen by Nægele and Ackermann. The following case, however, observed by Laennec, and quoted by a modern writer, must (if correctly reported) afford not only an unequivocal specimen of aneurism-by dilatation of all the coats of the aorta, but of laminated coagula within its cavity. "In homine enim, qui repente sub atrocissimis pectoris doloribus corruit, præter aortam adscendentem in aneurysma ita expansam, ut neonati infantis caput æquaret, cystidem aneurismaticam immediatè suprà arteriam cœliacæ ortam magnitudine nucis juglandis invenit, quæ luculenter ostendit sinum communicantem cum arteriæ cylindro per foramen magnitudine amygdalæ, diametro totius arteriæ illo loco non mutato. Sacculus hic cultro anatomico accuratè ac subtiliter subjectus, eandem structuram, eandem ostendit membranas, quibus gaudet arteria, e cujus latere exereverat; cæterum nussis grumosis sive fibrosis erat impletus. Inde igitur patet, hoc aneurysma sacroforme et laterali et partiali quidem tunicarum aortæ dilatatione ortum esse." (J. H. G. Ehrhardt, *De Aneurysmate Aortæ*, p. 13. 4to. Lips. 1820.)

Certainly, it seems difficult to explain in what the difference consists, which prevails between the state of the internal coat, in *preternatural* dilatation, and in *true* aneurism, so that the blood does not coagulate in the former, while it is deposited in concentric layers, in the latter. (See *Guthrie on Dis. of the Arteries*, p. 85.) Perhaps, says the latter gentleman, there is not at a late period any difference between a preternatural dilatation or bulging on one side of an artery, and a true aneurism; a state remarkably well shown in one of the preparations in the College Museum, No. 411, H.; and he adds, "At all events, preternatural dilatations of a large size, and departing from the course of the vessel from which they arise, do generally lose their distinguishing character of freedom from concentric layers of coagula, so that the distinction between them, under these circumstances, is lost;" unless we regard it, with Scarpa, as essentially founded on the existence of fissures in the internal coat in the aneurism, and of the absence of such change in the simple dilatation.

From what has been stated, then, it appears, that there is only one principal point of difference between Scarpa and other writers; and this resolves itself into the question, whether a dilatation of an artery, arising at one particular side of the vessel, and lined by its internal coat, ought not to be regarded as an aneurism, because its communication with the tube of the artery is more capacious than what exists in other aneurisms, where the inner coat has given way, and because it rarely (perhaps never) contains laminated coagula, unless fissures happen to exist at some points of the inner arterial tunic thus expanded?

The greater number of aneurisms increase gradually, and sooner or later incline to the side on which the least resistance is experienced. De Haen mentions an aneurism of the aorta, which first made its appearance between the second and third ribs of the left side, and which, instead of growing larger, as is usual, sphered, and could neither be seen nor felt, for more than a month before the patient's decease, although, on opening the body, a tumour of the arch of the aorta was found, three times as large as the fist. De Haen

imputes the sudden disappearance of the swelling to its weight, the yielding of the parts with which it was connected, and to its gravitating into the chest when the patient lay on his right side; for the difficulty of breathing, and other complaints, produced by the pressure on the lungs, underwent a material increase as soon as the tumour ceased to protrude.

The pulsations, which accompany true aneurisms, continue to be strong, until the inner coats of the vessel give way, or the layers of coagulated blood lodged in the sac are numerous. Hence, when soft swellings, situated near any large arteries, lose their pulsatory motion, their course, precise situation, and other circumstances, ought to be most carefully investigated, before any decision is made about the mode of treatment.

A few years ago, I saw a man in St. Bartholomew's Hospital, who had a large swelling of great solidity, occupying the hum, and apparently extending a good way forwards round the condyles of the femur. Its hardness, shape, large size, and entire freedom from pulsation, not only then, but at an earlier period, so far as could be collected from the patient's own account, led to the belief that the case was probably a tumour complicated with exostosis of the femur; and as this opinion seemed to be confirmed by no fluid escaping from a puncture made with a lancet, amputation was performed. To our surprise, however, dissection proved that the disease was a large popliteal aneurism, in which the spontaneous cure by an obliteration of the sac with coagula was taking place. (See *Lawrence, Med. Chir. Trans.* vol. viii. p. 497.)

In many instances, the most fatal accidents have happened, in consequence of incisions having been made in aneurisms, which were mistaken for abscesses, because there was no pulsation. Vesalius was consulted about a tumour of the back, which he pronounced to be an aneurism. Soon afterwards, an imprudent practitioner made an opening in the swelling, and the patient bled to death in a very short time. Ruysch relates, that a friend of his opened a tumour near the heel, not supposed to be an aneurism, and the greatest difficulty was experienced in suppressing the hemorrhage. De Haen speaks of a patient, who died in consequence of an opening, which had been made in a similar swelling at the knee, although Boerhaave had given his advice against the performance of such an operation. Palfin, Schlitting, Warner, Dupuytren, and others, have recorded mistakes of the same kind. (*Sabatier*, t. iii. p. 167.) Ferrand, surgeon of the Hotel Dieu, mistook an axillary aneurism for an abscess, plunged his bistoury into the swelling, and killed the patient. "J'ai été témoin d'erreurs semblables, commises par les praticiens non moins fameux; et si des anéurismes externes on passe à ceux des artères placées à l'intérieur, les erreurs ne sont ni moins ordinaires ni de moindre conséquence." (*Richerand, Nosogr. Chir.* t. iv. p. 75. ed. 2.)

Notwithstanding a pulsation is one of the most prominent symptoms of an aneurism, it is not to be inferred, that every swelling which pulsates is unquestionably of this description; for, as Mr. Warner has explained, it does happen that mere impositions, or collections of matter, arising from external as well as internal causes, are sometimes so immediately situated upon the heart

itself, and at other times upon some of the principal arteries, as to partake, in the most regular manner, of their contraction and dilatation. He details the particulars of a boy, about thirteen years of age, whose breast-bone had been badly fractured, and who was admitted into Guy's Hospital, a fortnight after the accident had happened. The broken parts of the bone were removed some distance from each other. The intermediate space was occupied by a tumour of a considerable size; the integuments were of their natural complexion. The swelling had as regular a contraction and dilatation as the heart itself, or the aorta, could be supposed to have. Upon pressure, the tumour receded; upon a removal of the pressure, the tumour immediately resumed its former size; all these are allowed to be distinguishing signs of a recent true aneurism. The situation and symptoms of this swelling were judged sufficient reasons for considering the nature of the disease as uncertain; on which account it was left to take its own course. "The event was, the tumour burst in about three weeks after his admission; discharged a considerable quantity of matter; and the patient did well by very superficial applications." (*Cases in Surgery*, ed. 4. p. 155.)

An extraordinary form of disease, having very much the appearance of an aneurism, sometimes presents itself. A swelling, attended with considerable pain, and a strong pulsation, is gradually produced high up the arm; and, at length, attains a very large size. The strength of the throbbings at first leads to the suspicion, that the case must be an aneurism; but, on careful examination, the humerus is found to have given way at a point involved in the disease, and here to be as flexible as if there were a fracture. This circumstance, and the extension of the swelling too far away from the track of the artery, in time raise doubts about the case being an aneurism. The patient ultimately falls a victim to the effects of the disease on the constitution, and, when the arm is dissected after death, the tumour is found to consist of a sarcomatous, or medullary mass, occupying the central portion of the limb, and accompanied with a solution of continuity extending completely through the whole thickness of the bone. Two cases of this description were admitted into St. Bartholomew's Hospital in the year 1820. One of these patients, a woman, I had an opportunity of seeing; and, after her death, the real nature of the disease was proved by dissection. My friend, Mr. Vincent, has seen a similar disease in the leg, resembling aneurism in the circumstance of pulsation, but attended with destruction of a part of the tibia, and a moveableness of the separated ends of the bone. This form of disease has sometimes led very experienced surgeons to mistake the disease for aneurism, and to take up the artery. Thus, Dr. Nicol of Inverness, who was deceived in this way, has laid the particulars of the case before the profession, with a kind of candour, which I sincerely admire, as ten times more useful in the promotion of surgical knowledge, than a boastful recital of nothing but fortunate practice. (See *Case of Medullary Sarcoma, engaging the upper Portion of the Os Humeri, considered Aneurismal, and for which the Subclavian Artery was tied above the Clavicle*, *Edin. Med. and Surg. Journ.* No. 120. p. i. 1834. See also J. G.

Guthrie on a Case of Malignant Tumour, simulating an Aneurism, in which the common Iliac Artery was tied, *London Med. Gaz.* for 1834, p. 590.)

Under certain circumstances, a psoas abscess may be mistaken for an aneurism; as, for instance, when it occasions a small, soft, moveable swelling over the femoral artery in the groin, accompanied by a strong pulsatory motion. The tumour may be lessened by pressure, even in the erect position, and rapidly returns on the discontinuance of such pressure, as would be the case in aneurism. The pulsation is manifest; but, after the swelling has been lessened by pressure, its sudden resumption of size in the erect position is not accompanied by the peculiar pulsatory thrill felt in an aneurism. In a psoas abscess, the swelling does not return in the same degree on the removal of the pressure, as in a case of aneurism. During the retrocession of the purulent fluid, the course of the artery may be more readily examined. In cases of psoas abscess, the swelling has generally been preceded by pains in the back and loins, of some standing, which continue with weakness of one or both extremities. (See *Guthrie on Dis. of Arteries*, p. 120.)

I remember a large abscess in the situation of the quadratus lumborum muscle, which pulsated so strongly, that the case was supposed by several experienced men to be an aneurism of the abdominal aorta. The patient was a boy in Christ's Hospital, and under the care of the late Mr. Ramsden, surgeon to that establishment, by whose discernment the real nature of the case was detected. It is curious, that, in this instance, the pulsations of the swelling suddenly ceased, after having continued in a very strong and manifest way, and without interruption, for several weeks, during which it was under the observation of the above eminent practitioner. Four or five years ago I was consulted by Mr. Gilbertson of Egham, about a young man who had a vast swelling in the epigastric, hypochondriac, and superior part of, the umbilical regions, attended with strong and regular pulsations. The disease had come on without much pain, or any derangement of the functions of the abdominal viscera. A fluctuation was perceptible in it, and one part of the tumour was tending to point, and very thin. The patient, when a child, had had a scrofulous disease of the hip. We inferred, therefore, that the case was a chronic abscess. The tumour soon burst; the quantity of matter discharged was several quarts; but the patient ultimately recovered.

As Mr. Wilson has observed, any encysted, or even solid tumour, situated in the neighbourhood of, or upon, a large artery, may have a considerable degree of motion communicated to it from the pulsation of the artery. The thyroid gland, when a bronchocele is formed, occasionally receives a pulsatory motion from the carotid arteries. This may be mistaken for an aneurism; from which disease, however, it can be discriminated by placing our fingers behind the tumour, and drawing it forwards, when the pulsation ceases. But there are other criteria for distinguishing a swelling, on or near an artery, from an aneurism. In such a case, the whole tumour moves at once, without any alteration of size. In an aneurism, the swelling does not simply move, it expands. A tumour of the thyroid gland, having apparently a pulsatory motion, may be known not to be

an aneurism of the carotid, by observing, that, from its connection with the larynx, it follows the movements of the latter in deglutition. Aneurisms, not of very long standing, and not containing a large mass of laminated coagula, may also be diminished, or rendered more or less flaccid, by pressing the artery leading to the disease. (See *Wilson on the Blood, Anatomy, Pathology, &c. of the Vascular System*, p. 385.; and *Burns on the Heart*, p. 257.) In cases of much ambiguity, the stethoscope will sometimes convey the necessary information. In a doubtful instance of aneurism of the groin, Sir Benjamin Brodie found all obscurity cease on the application of this instrument. (Sir A. Cooper's *Lectures*, vol. ii. p. 46.)

The following case, recorded by Pelletan, shows that an artery, running more superficially than natural, may, under particular circumstances, give rise to the suspicion of an aneurism. A strong robust man, about forty years of age, was in the habit of going on foot to dine three leagues from Paris, every day, on the completion of his business. One day, having been this distance, and returned, he felt an acute pain along the leg, and in the right ankle. The pain did not subside, and a tumour appeared at the lower third of the leg, opposite the space between the two bones. The skin was of a yellowish colour from effused blood, and a pulsation existed, by which the hand of an examiner was lifted up. There seemed great reason for concluding, that the case was an aneurismal swelling. In comparing the affected limb with the sound one, however, Pelletan perceived in the latter a similar kind of throbbing. In short, in both legs, the pulsation of an arterial tube could be felt for three inches; and Pelletan distinctly ascertained, that, in the diseased member, the throbbing did not extend to the whole of the tumour, but only lengthwise. By a particular disposition in this individual, the anterior tibial artery, which usually runs along the interosseous ligament, covered by the tibialis anticus, and extensor communis digitorum pedis, came out from between these muscles, at the middle of the leg, and lay immediately under the skin and the fascia.

The swelling and ecchymosis gradually dispersed, and the symptoms were supposed to originate from the rupture of some muscular fibres. (*Clinique Chir. t. i.* p. 101, 102.)

Whenever an aneurism of immoderate size beats strongly, and for a long while, against the bones, as the sternum, ribs, clavicle, and vertebrae, they are in the end injured or destroyed, the aneurismal tumour elevating the integuments of the thorax, or back, and pulsating immediately under the skin. Scarpa, with the best modern writers, attributes the effect to absorption, in consequence of the pressure.

J. L. Petit saw the condyles of the femur, and the upper head of the tibia, almost destroyed by an aneurism of the popliteal artery; and another case, in which the absorption of bone was remarkably extensive, is reported by Rosenmüller. (*Anhang zu Scarpa's u. d. Pulsdergeschwulste*, p. 364.) The curious and corroded state of the bones in aneurism is never attended with the formation of pus; "at least, the discovery of pus in its vicinity has not been remarked by those who have examined such cases. In this respect, therefore, it

differs essentially from common caries, or ulceration of bones. Exfoliation also is very rarely attendant upon it; from which circumstance, one important practical observation is deducible, namely, that if the aneurism be cured, the bones will recover their healthy state, without undergoing those processes which take place in the cure of caries or necrosis. (See *Hodgson on the Dis. of Arteries and Veins*, p. 80.) That this process of absorption in bone, in consequence of the pressure of an aneurism, may be caused by other tumours, is finely exemplified in a thigh-bone preserved in the Museum of the London University. The bone has been reduced by the pressure of a tumour, which grew at the back of the limb, to a mere spindle, that has not been able to resist the efforts of the muscles, by which it has been twisted in a singular degree. The absorption of bone from the pressure of aneurisms, is of that description, termed by Mr. Hunter *progressive* (see *Absorption*), in which, as Mr. Guthrie observes, the action of the small arteries, necessary to constitute inflammation, is wanting, and consequently there is little comparative pain at the commencement of the process, and no formation of matter. (See *Guthrie on Diseases of Arteries, &c.* p. 57.)

Mr. Hodgson confirms the remark made by Dr. W. Hunter (*Med. Obs. and Inquiries*, vol. i. p. 384.), Scarpa (*On Aneurism*, p. 100. ed. 2.), and others, that cartilage is less rapidly destroyed by the pressure of an aneurism than bone. This fact is strikingly illustrated in a case of aneurism of the thoracic aorta recorded in another modern publication. the bodies of the vertebrae, from the fourth down to the ninth, were carious; the four lowest in particular: yet the intervertebral cartilages were not materially affected. (*F. L. Kreysig, Die Krankheiten des Herzens*, b. iii. p. 176. 8vo. Berlin, 1817.) In the museum of the London University are fine specimens of the perfect state of the intervertebral substance, though the bodies of the vertebrae have greatly suffered.

A case is related by Pelletan, to which I refer the reader, as exemplifying not only the degree, in which internal aneurisms may injure the vertebra, but also the occasional possibility of such diseases being mistaken for rheumatism, or a lumbar abscess. (See *Clinique Chir. t. i.* p. 97—100.)

CAUSES OF ANEURISM.

An aneurism will not follow the kind of weakness of its sides, which must necessarily arise from removing its external and middle coat, some morbid changes seeming to be essential to bring on a protrusion of the inner coat. Neither will a mechanical division of the inner tunics lead to an aneurismal dilatation of the outer coat. The latter fact is proved by what happens when a tight ligature is placed upon an artery, as well as by the experiments of M. Amussat, who purposely broke the internal coats in numerous places, by pinching the vessels with forceps, and detaching the inner coats from the outer, by a process somewhat similar to what he adopts in torsion of the arteries. By proceedings of this kind, he never succeeded in producing the beginning of an aneurism. The inference, therefore, is, that some description of morbid change in the coats of the artery is necessary for the formation of aneurism, so long as the occurrence is resisted by a perfect state of one of those coats; or else we must

arrive at the still more certain conclusion, that in the experiments undertaken by Hume, Amussat, and others, the irritation of the artery was followed by inflammation of it, coagulation of the blood, and such an effusion of fibrine, within and around it, as would fully account for no aneurismal tumour being the result.

One very interesting point, in relation to spontaneous aneurism, and particularly adverted to by M. Malgaigne, is the almost exclusive restriction of this disease to the aortic system. Thus, in more than three hundred aneurisms, observed by M. Lisfranc, or recorded by others, he has met with only two instances of an aneurismal disease of the pulmonary artery, and these not free from objection. (*Lisfranc, des diverses Méthodes, &c. pour l'Oblitération des Artères*, p. 8. 8vo. Paris, 1834.) This remarkable fact is suspected to depend upon the aortic arteries containing, between their inner and fibrous coats, a dense, hard, fragile tissue, only capable of being taken off in scales, and designated by M. Malgaigne the *sclerous coat*. When concretions of different kinds, calcareous, steatomatous, or cartilaginous, present themselves in the aorta, they are seated, according to M. Malgaigne, almost exclusively, in this sclerous coat, a texture not existing in the pulmonary artery or its branches.

In many instances, it is difficult to assign any cause for the commencement of aneurism. Among the circumstances, which predispose to the disease, however, the large size of the vessels may undoubtedly be reckoned. Those trunks, which are near the heart, have much thinner parietes, in relation to the magnitude of the column of blood with which they are filled, than arteries of smaller diameter; and since the lateral pressure of this blood against the sides of the arteries is in a ratio to the magnitude of these vessels, it follows, that aneurisms must be much more frequent in the trunks near the heart, than in such as are remote from the source of the circulation. (*Richerand, Nosogr. Chir.* t. iv. p. 72. edit. 2.) The whole arterial system is liable to aneurisms; but, says Pelletan, experience proves, that internal arteries are much more frequently affected, than such as are external. (*Clinique Chir.* t. i. p. 54.)

The curvatures of the arteries are another predisposing cause of the disease, and have a manifest effect in determining the formation of the great sinus of the aorta, the dilatation, which exists between the arch and the origin of this large artery, and which is the more considerable the older the person is: Monro even thought, that one half of old persons have an aneurism at the beginning of the aorta. And with respect to aneurisms in general, which are preceded by calcareous depositions, thickening, and disease of the coats of the vessel, they are most frequent in persons of advanced age. Aneurisms from wounds are of course often seen in individuals of every age. In old people, the coats of the arteries are subject to a disease, which renders them incapable of making due resistance to the lateral impulse of the blood. The disease here alluded to is what is described in a foregoing part of this article; one common effect of which is the deposition of calcareous matter between the inner and muscular coats of the arteries, or in the sclerous coat of Malgaigne. "People in the early part of life," says Mr. Wilson, "are not very subject to these calca-

reous depositions; but, I have occasionally met with them in the arteries of very young people. I have seen a well-marked deposition of the phosphate of lime in the arteries of a child under three years of age." He adds, that few persons, above the age of sixty, are free from these ossifications. (*On the Blood, and on the Anatomy, Pathology, &c. of the Vascular System*, p. 375. Lond. 1819.)

Though spontaneous aneurisms are most common in old persons, the disease is not absolutely confined to them; for I assisted Mr. Docker of Canterbury in an operation for the cure of a popliteal aneurism in a postilion, whose age must have been under thirty; and Mr. Wilson says that he has met with several instances of the disease in the aorta and other vessels, where the patients were not more than forty years of age. (*Op. cit.* p. 376.)

According to Sir Astley Cooper, the time of life when aneurism generally occurs, is between the ages of thirty and fifty; an age, when exercise is considerable, and strength on the decline. In very old age the disease is not so common. However, he operated successfully on a case of popliteal aneurism, where the patient was eighty-four or eighty-five years old. He operated, with success, on another man, sixty-nine years of age. He has also seen a boy, only eleven years old, with aneurism of the anterior tibial artery. The man of more than eighty is the oldest, and the boy of eleven the youngest, aneurismal patients he has ever seen. (*See Lectures*, vol. ii. p. 40.)

On the subject of the comparative frequency of aneurism at various periods of life, M. Lisfranc refers to 120 cases, in which the age of the patient is specified, and from which he drew up the annexed table:—

Age.	Cases.	Age.	Cases.
13 - - -	1	40 to 45 - -	20
15 to 20 - -	3	45 to 50 - -	17
20 to 25 - -	5	50 to 55 - -	11
25 to 30 - -	12	55 to 60 - -	6
30 to 35 - -	24	60 to 70 - -	3
35 to 40 - -	15	70 to 80 - -	3

Thus, M. Lisfranc finds, what Sir Astley Cooper had ascertained long ago, that aneurisms are most common between the ages of thirty and fifty; that ten years on one side or the other of these ages make a remarkable difference,—under twenty, and after sixty, the disease being exceedingly rare. Aneurism by anastomosis, however, which are entirely a different affection from the cases now under consideration, are chiefly met with in children and young persons under fifteen, and seldom in adults. M. Lisfranc knows of no example of aneurism by anastomosis in an old person. (*De l'Oblitération des Artères, &c.* p. 12, 13.)

Richerand affirms, that, out of twelve popliteal aneurisms, which he had seen in hospital or private practice, ten were caused by a violent extension of the leg. This statement, he says, will derive confirmation from the following experiment. Place the knee of a dead subject on the edge of a firm table, and press on the heel, so as forcibly to extend the leg, far enough to make the ligaments of the ham snap. Now dissect the parts, cut out the artery, and examine its parietes in a good light, when the lacerations of the middle coat will be observable, and rendered manifest by the

circumstance of those places appearing semitransparent, where the fibres are separated, the parietes at such points merely consisting of the internal and external tunics. (*Nosogr. Chir.* t. iv. p. 73, 74. ed. 2.) But the insufficiency of this explanation, is clear enough from the fact, that such violence, as is requisite to break the ligaments of the knee, cannot be imagined to happen in the accidents which ordinarily bring on aneurism in the ham.

The implicit belief of Richerand, that the laceration of the middle coat of an artery will bring on an aneurism, while the inner coat is perfect, will appear to be unfounded, when Amussat's experiments are remembered, and also those of Hunter, Home, and Scarpa, who even dissected off the external and middle coats of arteries, without being able in this manner to cause an aneurism. Nay, where the experiment has been made of applying a tight ligature to an artery, and immediately removing it again in order to determine whether the division of both the inner coats of the vessel would terminate in an obliteration of the tube of the vessel, no aneurism has been the consequence.

Pelletan accounts for the frequency of popliteal aneurisms somewhat differently from Richerand: speaking of the two principal motions of the knee, viz. extension and flexion, he remarks, that the first of these is so limited, that it is actually an incipient flexion necessarily produced by the curvature backward both of the condyles of the femur, and those of the tibia. This curvature, which would seem to protect the popliteal artery against any dangerous elongation, that might otherwise be caused by a forcible extension of the joint, becomes the very source of such an elongation, in persons who are accustomed to keep their limbs bent, or who, from this state, proceed hastily and violently to extend the leg. The arterial tubes are really shortened, when the limbs are in the state of flexion, and lengthened, when the extension of the members renders it necessary. Hence, says Pelletan, it is manifest, that an habitually shortened state of these vessels, and their sudden elongation, must be attended with hazard of rupturing their parietes. (*Clinique Chirurgicale*, t. i. p. 112.)

The opinion of Pelletan, however, is quite untenable; because Mr. Hodgson has several times repeated the experiment mentioned by Richerand, and found, as this gentleman did, that the coats of the artery were never lacerated, unless the degree of violence had been such as to rupture the ligaments of the knee. (*On Diseases of Arteries*, &c. p. 64.)

Aneurisms are exceedingly common in the aorta, and they are particularly often met with in the popliteal artery. The vessels, which are next to these most usually affected, are the crural, common carotid, subclavian, and brachial arteries. The temporal and occipital arteries, and those of the leg, foot, forearm, and hand, are far less frequently the situations of the present disease. But, although it is true, that the larger arteries are the most subject to the ordinary species of aneurisms, the smaller arteries seem to be more immediately concerned in the formation of one peculiar aneurismal disease, now well known by the name of aneurism by anastomosis, of which I shall hereafter speak.

According to surgical writers, the causes of aneurisms operate either by weakening the arterial parietes, or by increasing the lateral impulse of the blood against the sides of these vessels. It is said to be in both these ways, that the disease is occasioned by violent contusions of the arteries, the abuse of spirituous drinks, frequent mercurial courses, fits of anger, rough exercise, exertions in lifting heavy burthens, &c. In certain persons, aneurisms appear to depend upon a particular organic disposition. Of this description was the subject, whose arteries, on examination after death, were found by Laucisi affected with several aneurisms of various sizes. I have known a person have an aneurism of one axillary artery, which disease got spontaneously well, but was soon afterwards followed by a similar swelling of the opposite axillary artery, which proved fatal. I have seen another instance, in which an aneurism of the popliteal artery was accompanied with one of the femoral in the other limb. Boyer mentions a patient, who died of a femoral aneurism in La Charité, at Paris, and who had also another aneurism of the popliteal artery, equal in size to a walnut. (*Traité des Maladies Chir.* &c. t. ii. p. 102.) The greatest number of aneurisms that Sir Astley Cooper has seen in one patient is seven; and it is a remark made by this eminent surgeon, that when an aneurism occurs in the ham, the disease is frequently of a local nature; but that, when it is between the groin and ham, disease of other arteries is very commonly met with. (*See Lectures*, vol. ii. p. 37.) One memorable case, proving the existence of a disposition to aneurisms in the whole arterial system, is mentioned by Pelletan: "J'ai pourtant vu plusieurs fois ces nombreux aneurismes occupants indistinctement les grosses ou les petites artères, mais surtout celles de capacité; j'en ai compté soixante-trois sur un seul homme, depuis le volume d'une aréline jusqu'à celui de la moitié d'un œuf de poule." (*Clinique Chir.* t. ii. p. 1.) M. Jules Cloquet relates a case, in which all the arteries were covered with aneurismal tumours, from the size of a hemp-seed to that of a large pen. Some existed on the aorta; but larger numbers on the arteries of the limbs. Altogether, there were some hundreds of them. Excepting in the situations of the tumours, the structure of the arterial coats had undergone no alteration. Here they were dilated and thinned. In none of them was any rupture of the internal or middle coat observed. The dilatations were continued into the small arteries, in which, however, they were less conspicuous than in those of superior size. (*See J. Cloquet, Pathologie Chir.* p. 86, pl. 2. 4to. Paris, 1831.) These aneurisms corresponded to the saciform aneurisms of Breschet.

Aneurisms, and those diseases of the coats of arteries which precede the formation of aneurism, are much less frequently met with in women than in men. (*Lassus, Pathologie Chir.* t. i. p. 348.) A few years before John Hunter died, Mr. Wilson heard him remark, that he had only met with one woman affected with true or spontaneous aneurism. (*Anatomy, Pathology, &c. of the Vascular System*, p. 376.) Mr. Hodgson drew up the following table, exhibiting the comparative frequency of aneurisms in the two sexes, in different cases of this disease, and also in the different arteries of the body, as deduced from examples, either seen by

himself, during the lives of the patients, or soon after their death :—

	Total.	Males.	Females.
Of the ascending aorta, the arteria innominata, and arch of the aorta -	21	16	5
Descending aorta -	8	7	1
Carotid artery -	2	2	0
Subclavian and axillary -	5	5	0
Inguinal artery -	12	12	0
Femoral and popliteal -	15	14	1
	63	56	7

This table does not include aneurisms arising from wounded arteries, nor aneurisms by anastomosis. (*On the Diseases of Arteries and Veins*, p. 87.) Sir Astley Cooper confirms the fact of the much greater frequency of aneurism in the male, than the female sex. Women, he says, rarely have aneurism in the limbs. In forty years' experience, he has seen only eight cases of popliteal aneurism in women, but an immense number in men. Most of the aneurisms, which he has seen in females, have been in the ascending aorta, or the carotids. (*Lectures*, vol. ii. p. 41.) Mr. Guthrie has met with but three popliteal aneurisms in women; and he calculates that aneurism of the ham occurs from twenty to thirty times in men for once in women. "The structure of the vessels (he observes) is the same, but the mode of life is different. The exertion in general is infinitely greater in the man than the woman; and, I think this, combined with the freer use of ardent spirits, a much more likely cause, than either syphilis or mercury." (*On Dis. of Arteries*, p. 87.)

In relation to the comparative frequency of aneurism in the two sexes, M. Lafranc states, that in 154 cases, the particulars of which have been collected by him, and whose situations brought them within the reach of operative surgery, the proportion of male patients was 141; of females 13; or nearly as 11 to 1.

With respect to the comparative frequency of aneurism in different arteries, M. Lafranc refers to 179 cases, all spontaneous, those of the aorta not entering into the computation; from which 179 cases he gives the following table :—

1. Popliteal artery -	59
2. Femoral { in the groin -	26
at other points -	18
3. Carotid -	17
4. Subclavian -	16
5. Axillary -	14
6. External iliac -	5
7. Brachio-cephalic -	4
8. Brachial -	3
9. Common iliac -	3
10. Anterior tibial -	3
11. Gluteal -	2
12. Internal iliac -	2
13. Temporal -	2
14. Internal carotid -	1
15. Ulnar -	1
16. Peroneal -	1
17. Radial -	1
18. Palmar arc -	1

It was observed by Morgagni, and it has been noticed in this country, that popliteal aneurisms

occur with particular frequency in postilions and coachmen, whose employments oblige them to sit a good deal with their knees bent. In France, the men, who clean out dissecting-rooms, and procure dead bodies for anatomists, are said almost all of them to die of aneurismal diseases. Richerand remarks, that he never knew any of these persons, who were not addicted to drinking. (*Nosogr. Chir.* t. iv. p. 74. ed. 2.)

Aneurisms are supposed by M. Roux to be much more frequent in England than in France; a circumstance, which he refers to the mode of life, and kind of labour, to which a large part of the population of England is subjected. Indeed, he connects this surmise with a reason for the very cultivated state of this part of knowledge in England; thinks that we have been placed in favourable circumstances for perfecting the treatment of aneurisms; and acknowledges, that we have contributed more than his countrymen, both in the last and present century, to the improvement of this branch of surgery. (*Roux, Parallèle de la Chirurgie Angloise avec la Chirurgie Française*, &c. p. 249.) But, ere M. Roux ventured into such conjectures, he ought at least to have specified what particular occupations and kind of labour are known by Englishmen themselves to be frequently conducive to aneurism; for, with the exception of postilions and coachmen, of whom there is also abundance in France, I am not aware, that any determinate class of persons is found in this country to be affected with particular frequency.

In some instances, axillary aneurisms seem to have arisen from violent extension of the limb. (See *Pelletan, Clinique Chir.* t. ii. p. 49. and 83.) In other examples, related by the same practical writer, aneurism arose from reiterated contusions and rough pressure on parts. (*Op. cit.* p. 10. and 14. Also *Guthrie on Dis. of Arteries*.)

The extremity of a fractured bone may injure an artery, and give rise to an aneurism; instances of which are recorded by Pelletan (*Op. cit.* t. i. p. 178.) and Duverney (*Traité des Mal. des Os*, t. i.). In Pelletan's case, the disease followed a fracture of the lower third of the leg. An aneurism of the anterior tibial artery, from such a cause, is also described by Mr. C. White. (*Cases in Surgery*, p. 141.)

The following case of an aneurism of the humeral artery after amputation, is recorded by Warner:—C. D. was afflicted with a caries of the joint of the elbow, which was attended with circumstances rendering amputation necessary. The operation was performed at a proper distance above the diseased part, and the vessels were taken up with needles and ligatures. — In a few days the humeral artery became so dilated above the ligature upon it, as to be in danger of bursting. Hence it was judged necessary to perform the operation for the aneurism, which was done, and the vessel secured by ligature, above the upper extremity of its distended coats. Every thing now went on, for some time, exceedingly well; when suddenly the artery again dilated, and was in danger of bursting above the second ligature. These circumstances made it necessary to repeat the operation for the aneurism. From this time every thing went on successfully, till the stump was on the point of being healed; when, quite unexpectedly, the artery appeared a third time diseased in the same manner as it had been

previously, for which reason, a third operation for aneurism was performed, followed by no relapse. "Could the several aneurisms of the humeral artery (says Mr. Warner) be attributed to the sudden check alone, which the blood met with from the extremity of the vessel being secured by ligature? or is it not more reasonable to suppose, that the coats of the artery, nearly as high up as the axilla, were originally diseased and weakened?" The latter seemed, to this judicious writer, the most probable way of accounting for the successive returns of the disease of the vessel; since it is found from experience, that such accidents have been very rarely known to occur after amputation, either of the arm or thigh, where nearly the same resistance must be made to the circulation in every subject of an equal age and vigour, who has undergone such operation. If it were supposed, that the several dilatations of the coats of the vessel arose merely from the check in the circulation, it appeared to Mr. Warner not easy to account for the final success of this operation; especially when we reflect, that the force of the blood is increased in proportion to its nearness to the heart. (See *Cases in Surgery*, p. 139, 140. ed. 4.) Ruysch has related an observation somewhat similar. (*Obs. Anat. Chir.* t. i. p. 4.) In 1813, M. Roche published another occurrence of this kind, which happened in the posterior tibial artery. (See *Lifjunc, De l'Obtillation des Arteres*, p. 97.)

Aneurisms sometimes follow the injury of a large artery by a gunshot wound. The passage of a bullet through the thigh, in one example, gave rise to a femoral aneurism. (See *Parisian Chirurgical Journal*, vol. ii. p. 109.) The same cause produced an aneurism high up the thigh of a soldier, who was under the care of my friend Mr. Collier, at Brussels, after the battle of Waterloo.

PROGNOSIS.

In cases of aneurism, the prognosis varies according to a variety of important circumstances. The disease may generally be considered as exceedingly dangerous; for, if left to itself, it almost always terminates in rupture, and the patient dies of hemorrhage. There are some examples, however, in which a spontaneous cure took place; and aneurismal swellings have been known to lose their pulsation, become hard, smaller, and gradually reduced to an indolent tubercle, which entirely disappeared. After death, the artery, in such instances, has been found obliterated, and converted into a ligamentous cord, without any vestige of the aneurism being left. Aneurisms are also sometimes attacked with mortification; the sac and adjacent parts slough away; the artery is closed with coagulum; and thus a cure is effected. Lastly, tumours, having all the characters of aneurisms, have been known to disappear under the employment of such pressure as was certainly too feeble to intercept entirely the course of the blood. Such examples of success, however, are not common; and whenever they happen, it is because the entrance of blood into the sac is prevented by the coagulation of that already contained in it, and because the artery above the swelling is filled with coagulum. They must, in fact, have been cured on the very same principle which renders the surgical operation suc-

Nothing is subject to more variety, than the duration of an aneurism previously to its rupture; the tumour bursting sooner or later, according as the patient happens to lead a life of labour, or ease, temperance, or moderation. Even the bursting of an internal aneurism may not immediately kill the patient. A stonecutter died in the hospital Saint Louis with an enormous aneurism, situated on the left side of the lumbar vertebrae. The body was opened by Richerand, who found, that the external tumour consisted of blood, which, after making its way through the muscles, had been effused into a cyst, formed in the midst of the cellular substance of the loins. The track, through which it came, led into another aneurismal sac, contained in the abdomen, and situated behind the peritoneum, on the left side of the lumbar vertebrae. In endeavouring to discover whence the extravasated blood proceeded, Richerand found that the abdominal aorta was entire, though in contact with the swelling. The original affection consisted of an aneurismal dilatation of the thoracic aorta which had burst at the point where it lies betwixt the cava of the diaphragm. The blood had probably escaped very slowly, and it had accumulated in the cellular substance round the kidney, so that three cysts had burst successively, before the patient died. (*Nosogr. Chir.* t. iv. p. 82. ed. 2.)

Every aneurism, so situated, that the artery can neither be compressed, nor tied above the swelling, has generally been considered absolutely incurable, except by a natural process, the establishment of which is not sufficiently often the case to raise much expectation of a recovery on this principle. But it should be recollected, that sometimes the size of the swelling appears to leave no room for the application of a ligature above it, while things are in reality otherwise, in consequence of the communication between the sac and the artery bearing no proportion to the magnitude of the tumour itself. At the present day, also, enlightened by anatomical knowledge, and encouraged by successful experience, surgeons boldly follow the largest arteries, even within the boundaries of the chest and abdomen, as I shall presently relate; and numerous facts have now proved, that few external aneurisms are beyond the reach of modern surgery. It being certain, that aneurisms cannot be commonly cured, except by an obliteration of the affected artery, it follows, that the circulation must be carried on by the superior and inferior collateral branches, or else the limb would mortify. Experience proves, that the impediment to the passage of the blood through the diseased artery, obliges this fluid to pass through the collateral branches, which gradually acquire an increase of size. It is therefore a common notion, that it must be in favour of the success of the operation, if the disease be of a certain standing; and, in direct opposition to the sentiments of Kirkland, Boyer even asserts, that the most successful operations have been those performed on persons, who have had the disease a long while. (*Maladies Chirurg.* t. ii. p. 116.)

There is this objection to delay, however,—the tumour becomes so large, and the effects of its pressure so extensive and injurious, that, after the artery is tied, great inflammation, suppuration, and sloughing, often attack the swelling itself, and the

patient falls a victim to what would not have occurred, had the operation been performed sooner?

The large size of an aneurism, as Mr. Hodgson has rightly observed, is a circumstance, which materially prevents the establishment of a collateral circulation. When the tumour has acquired an immense bulk, it has probably destroyed the parts, in which some of the principal anastomosing branches are situated; or by its pressure it may prevent their dilatation. (*On the Diseases of Arteries and Veins*, p. 259.) The practice of permitting an aneurism to increase, that the collateral branches may become enlarged (says this gentleman), is not only unnecessary but injurious, inasmuch as the increase of the tumour must be attended with a destruction of the surrounding parts, which will render the cure of the disease more tedious and uncertain. (P. 266.)

The most successful operations which I have seen, were performed before the aneurismal swellings were large. However, notwithstanding the great disadvantages of letting the swelling become bulky before the operation, the fact is not always made due impression, and a few surgeons are yet blinded with the plausible scheme of giving time for the collateral vessels to enlarge. I remember a patient who had been advised to let the operation be postponed on such a ground, though the swelling in the limb was already as large as an egg.

Mr. Guthrie is of opinion, that the collateral branches begin to enlarge shortly after the commencement of the disease, as a part of the curative process, which nature, in most instances, endeavours to set up; "the essential points of which are, in an extremity—1. The obliteration of the artery above and below the tumour. 2. The coagulation of the blood within it. 3. The enlargement of the collateral branches above and below it."

"It is necessary (he afterwards observes), that this enlargement of the collateral branches should take place, because, in many cases, the artery beyond or below the tumour is obliterated long before any operation is performed. The main supply of blood is already cut off from the extremity, and the operation adds very little to the derangement of the circulation which has already taken place below the tumour."

These facts appear to Mr. Guthrie to prove, what, indeed, cannot be doubted, that the collateral circulation is not in the same stage of preparation, in a limb whose main artery has been divided, as one where an aneurism has existed for some time. They also explain why amputation is more common after wounded arteries, than after operations for aneurism. (See *Guthrie on Dis. of Arteries*, p. 139.)

In a case of wounded artery, I should say, that the greater tendency to mortification is likewise promoted by the following circumstances:—The common injection and distention of the cellular tissue with blood, the frequent simultaneous injuries of the collateral vessels and considerable veins, and sometimes of important nerves, the weakness often resulting from profuse external hemorrhage, and the depth and extent of the wound to various other textures.

Although Mr. Guthrie considers, that the doctrine of the power of the collateral vessels always to carry on the circulation in aneurism has been carried rather too far, and that the allowance of

some little time for them to enlarge themselves for that purpose is useful; there may appear but a trivial difference between him and other surgeons, or, perhaps, none at all, when his belief is recollected, that such enlargement occurs in an early stage of the disease, and his precept is remembered, "that an aneurism should never be allowed to attain that size, which may render it injurious to the surrounding parts." (*Op. cit.* p. 140.) As I believe, that the early editions of my surgical writings contain the first condemnation of the old plan of delaying the operation till the collateral vessels had had time to increase in size, this is a practical point in which I feel some interest; and the more I have seen and read of the present disease, has only served to confirm the accuracy of the practical advice long ago delivered in my works on the advantages of early operations for aneurism.

The surgeon should not be afraid of operating, although appearances of gangrene may have taken place on the tumour; for, as Mr. Hodgson remarks, should it burst afterwards, it is probable, that both extremities of the artery in the sac will be closed with coagulum. (*Hodgson*, p. 305.) Sir Astley Cooper tied the external iliac artery in two cases of inguinal aneurism, when gangrene existed; and though the tumours burst, no hemorrhage ensued. The coagulum was discharged; the sac granulated; and the sores gradually healed. (*Medico-Chir. Trans.* vol. iv. p. 431.)

The effects of the pressure of aneurisms upon the bones, are justly regarded as an unpleasant complication, when they take place in an extensive degree, and, according to some writers, they may sometimes induce a necessity for amputation. (*Boyer, Traité des Mal. Chir.* t. ii. p. 117.) However, I have never seen a case of this description; and Mr. Hodgson, as we have already explained, informs us, that the affection of the bones is hardly ever attended with exfoliations, or the formation of pus, so that if the aneurism can be cured, the bones will generally recover their healthy state, without undergoing those processes which take place in the cure of caries, or necrosis. (*On Diseases of Arteries and Veins*, p. 80.) At the same time, there can be no doubt, that where the tumour has been allowed to attain a large size, before an attempt is made to cure it, and where, from this cause, both the neighbouring soft parts and the bones have suffered considerably, the completion of a cure—that is to say, the full restoration of the use of the limb—must be far more distant than in other cases, where the cure is attempted in an earlier stage. Here, then, we see another reason against the pernicious doctrine of waiting for the enlargement of the anastomosing vessels, in addition to that which has been urged in the previous column.*

The age, constitution, and state of the patient's health, are also to be considered in the prognosis; for they undoubtedly make a great difference in the chance of success after the operation.

The operation, however, should not be rejected on account of the age of the patient, if the circumstances of the case in other respects appear to demand it; for it has often succeeded at very advanced periods of life. "I have seen several aneurisms cured by the modern operation, in patients above sixty years of age." (*Hodgson*,

p. 304.) Similar cases have fallen under my own notice. In cases of popliteal aneurism, Sir Astley Cooper operated with success on one patient aged eighty-five, and on another sixty-nine years old, with the same favourable result.

When an aneurism exists in the course of the aorta, the violent action of the heart, excited by an operation in the extremities, may cause it to burst, and prove instantaneously fatal. Two cases occurred a few years ago in this metropolis, in which the patients died from such a cause during operations for popliteal aneurisms. (See *Hodgson on Diseases of Arteries*, p. 306.; *London Med. Rev.* vol. ii. p. 246.; and *Burns on Diseases of the Heart*, p. 228.) Were the co-existence of the internal aneurism known, the operation for the other tumour would be improper, and the surgeon should limit the treatment to palliative means.

Experience proves, however, that the circumstance of there being two aneurisms in the limbs should not prevent the operation, which is to be practised at separate periods. Facts, in support of this statement, are quoted by Mr. Hodgson. (P. 310.)

An aneurism may form spontaneously, and yet the person may recover after an operation, without having a recurrence of the disease in any part. Mr. Guthrie knew a man who survived the operation for popliteal aneurism in both limbs for twenty-five years, and died at last of fever. (*On the Diseases and Injuries of Arteries*, p. 61. and 121.)

OF THE SPONTANEOUS CURE, AND GENERAL TREATMENT, OF ANEURISMS.

The obliteration of the sac, in consequence of a deposition of lamellated coagulum in its cavity, as Mr. Hodgson has well described, is the mode by which the spontaneous cure of aneurism is in most instances effected. The blood soon deposits upon the inner surface of the sac a stratum of coagulum; and successive depositions of the fibrous part of the blood by degrees lessen the cavity of the tumour. At length the sac becomes entirely filled with this substance, and the deposition of it generally continues in the artery on both sides of the sac as far as the giving off of the next large branches. The circulation through the vessel is thus prevented; the blood is conveyed by collateral channels; and another process is instituted, whereby the bulk of the tumour is removed. (*On the Diseases of Arteries*, &c. p. 114.) Such desirable increase of the coagulated blood in the sac is indicated by the tumour becoming more solid, and its pulsation weak, or ceasing altogether. In aneurisms of the limbs, the cure by coagulation is believed by Mr. Guthrie to be promoted by two natural processes, viz. the enlargement of the collateral branches, and the effort by the lower openings from the aneurism. He states, that in the Hunterian collection there are several examples of all the openings into the aneurism, save the upper one, having been closed during life. It does not appear to him, however, that the coagulation of the whole of the blood in an aneurismal tumour is the necessary consequence of the closure of the lower opening; and unless this happens, the swelling will continue to increase. (See *Guthrie on Diseases of Arteries*, p. 90.)

Amongst Mr. Hodgson's plates may be seen one representing an aneurism of the femoral artery, or rather a dilatation of it, involving the whole of its circumference, and where the blood continued to pass through a narrow channel in the centre of the lamellated blood, nearly in its natural course. Had nature been allowed more time for the completion of her processes, what would have been the mode of cure? Probably, the obstruction of the central channel by solid blood, the determination of the circulation to the collateral vessels, and then the gradual removal of the tumour by the absorbents. Whether a case, reported by Mr. Guthrie as one of an external aneurism, cured with the artery remaining pervious, is an unequivocal example of this occurrence, I cannot undertake to determine. (See *Guthrie on Diseases of the Arteries*, p. 100.)

Another mode, in which the disease is spontaneously cured, happens as follows:—An aneurism is sometimes deeply attacked with inflammation and gangrene; a dense, compact, bloody coagulum is formed within the vessel, shutting up its canal, and completely interrupting the course of the blood into the sac. Hence, the ensuing sphacelation, and the bursting of the integuments and aneurismal sac, are never accompanied by a fatal hemorrhage; and the patient is cured of the gangrene and aneurism, if he has strength sufficient to bear the derangement of the health necessarily attendant on so considerable an attack of inflammation and gangrene. I remember a femoral aneurism in the York Hospital, where a cure was accomplished in this manner. Mr. Guthrie has seen three cases of inguinal aneurism, attacked by inflammation and sloughing. (*On Diseases of Arteries*, p. 96.) One was the case under Mr. Albert, in the York Hospital, where the patient recovered: in the two others, the patients died, worn out by the discharge and the extension of ulceration to the hip-joint; without which last complication, Mr. Guthrie deems it probable that both patients would have recovered—the ends of the artery, above and below the disease, having been obliterated.

When a patient dies of hemorrhage, after the mortification of an aneurism, it is because only a portion of the integuments and sac has sloughed, without the root of the aneurism, and especially the arterial trunk, being similarly affected. For cases illustrative of this statement, refer to *Hodgson on Diseases of Arteries*, p. 103., &c.

All surgeons will concur with Mr. Guthrie, that the attempt at a cure by sphacelation is attended with so much peril, that, if possible, it should be prevented by a surgical operation. Yet, "the operation should never be had recourse to after mortification (that is to say, a deeply extending sphacelation) has begun. If the patient dies of the mortification, the operation is useless; and if he survives it, the operation is unnecessary." (See *Guthrie on Dis. of Arteries*, p. 98.) When the inflammation and sloughing are superficial and very limited, the operation would be indicated, because, unless the arteries were first taken up, the patient would die of hemorrhage on the slough being loosened.

A third way in which an aneurism may be spontaneously cured, is by the tumour compressing the artery above, so as to produce adhesion of its sides, and obliteration of this cavity. This mode

of cure must be uncommon: it has been adverted to by Sir E. Home, Scarpa, Dr. John Thomson, and others; but some facts, tending to prove it, have been collected by Mr. Hodgson, and are published in his meritorious work. (See p. 107, &c.)

Rare as this mode of cure is, I do not coincide with Mr. Guthrie in looking upon this account as a mere theory (*Op. cit.* p. 98.); for we know by dissection, that the pressure of an aneurismal tumour upon the artery connected with it, may lead to the obliteration of the part or vessel pressed upon. Mr. Lawrence has mentioned in his lectures the particulars of a case, where the pressure of the sac of an aneurism in the groin, upon the artery lower down, had rendered the artery in this situation impervious.

A fourth mode of cure is illustrated in a case, related by Sir Astley Cooper: a man, in Guy's Hospital, had an aneurism just below the groin. He was sitting before the fire, when he felt something burst in the upper part of his thigh. On examination, he found no blood had escaped, and, in fact, the aneurism had not yet reached the skin, so as to be adherent to it. His thigh, however, was enormously swelled; he was unable to use his limb, and was put to bed. For three days afterwards a pulsation was perceptible in the aneurism; but it then ceased, and the size of the limb began to diminish. At the end of four months, the aneurismal swelling had considerably subsided; he could use the limb; and in less than six months, he was discharged from the hospital. He afterwards fell a victim to the rupture of another aneurism in the abdomen. On examination of the body, it was found, that the aneurism in the thigh, just below Poupert's ligament, had burst under the fascia lata, and the femoral artery had been obliterated by the pressure of the large quantity of effused blood.

"The surgical treatment of aneurism (says Mr. Hodgson) consists in the obliteration of the cavity of the artery communicating with the sac, so that the ingress of the blood into the latter is either entirely prevented, or the stream which passes through it is supplied only by anastomosing branches, and consequently the force of the circulation is so much diminished, that the increase of the tumour is prevented, and the deposition of coagululum is promoted. By the absorption of its contents, and the gradual contraction of the sac, the cure is ultimately accomplished. The blood is conveyed to the parts, which it is destined to supply, by collateral vessels, some of which, being gradually enlarged, constitute permanent channels for the circulation. The obliteration of the artery is effected by the excitement of such a degree of inflammation in its coats, as shall produce adhesion of its sides. These objects have been attempted by the compression, or the ligature, of the artery. The latter method constitutes the operation for aneurism." (P. 165.)

Such are the principles of the ordinary mode of cure: but it appears, from certain facts recorded by Mr. Wardrop, Dr. Bush, Dr. Mott, and other practitioners, that some aneurisms may be cured by a surgical operation, which was first suggested by Bransdor, or, according to Richat, by Desault, and the design of which is to hinder the free transmission of blood through the aneurismal sac by tying the artery on that side of it which is most re-

mote from the heart. This practice, however, is only allowable in certain examples, in which the application of a ligature in the common way is no longer practicable, because its success is much less probable, as might easily be anticipated, since the plan does not comprise the very desirable object of directly preventing the entrance of blood into the aneurismal sac. To this subject, however, we shall presently return.

According to Scarpa, a complete cure of an aneurism cannot be effected, in whatever part of the body the tumour is situated, unless the artery, from which the aneurism is derived, be, by nature or art, obliterated, and converted into a perfectly solid, ligamentous substance, for a certain extent above and below the place of the ulceration, laceration, or wound. When aneurisms are cured by compression, the cure is never accomplished, as some have supposed, by the pressure strengthening the dilated proper coats of the artery, and restoring, especially to the muscular coat, the power of propelling the blood along the tube of the artery, as it did previously to its supposed dilatation. Petit and Foubert thought, that the natural curative process sometimes consisted in a species of clot, which closed the laceration, ulceration, or wound of the artery, and resisted the impulse of the blood, so as still to preserve the continuity of the coats of the artery, and the pervious state of the vessel. Haller imbibed a similar sentiment, from experiments made on frogs.

If the foregoing statement of Scarpa, respecting the obliteration of the tube of the adjacent portion of the artery, when an aneurism is cured, had been delivered merely as what is the most common course of things, it would not have been incorrect; but when he denies the possibility of the calibre of the vessel being ever preserved, whether the disease be cured by art or nature, he is exceeding the bounds of accuracy.

Notwithstanding aneurisms cannot in general be cured, as Scarpa has explained, unless the artery be rendered impervious for some extent above and below the tumour, I believe we must make an exception to this observation, with respect to the few aneurisms of the aorta (especially those of its arch), which, according to the records of surgery, have been diminished and cured by Valsalva's treatment. In such examples, we are not to suppose that the aorta becomes obliterated at its very beginning; but that the diminution of the quantity of circulating blood, the reduced impetus of this fluid, the lessened distention of the aneurismal sac, the general weakness induced in the constitution, and the increased activity of the lymphatic system, — all necessary effects of Valsalva's method, — have combined to bring about a partial subsidence of the tumour.

"It is a common opinion (says Mr. Hodgson), that the radical cure of an aneurism cannot take place, without the obliteration of the artery from which the disease originates. It is probably owing to this idea, that aneurisms of the aorta have generally been considered as incurable diseases, and consequently that so little attention has been given to their treatment." (P. 118.) The facts, however, which this gentleman has related, satisfactorily prove—1st, That a deposition of coagululum may take place in an aneurismal sac, to such an extent as entirely to block up the communication between its cavity and that of the artery from

which it originates. 2dly, That a sac, thus filled with coagulum, cannot prove fatal by rupture; and, 3dly, That the gradual absorption of its contents, and the consequent contraction of the sac, may proceed to such an extent as to effect the cure of the disease, without any obstruction taking place in the calibre of the vessel from which it originates. (See cases 20, 21, 22, &c. *Hodgson on Diseases of the Arteries*, &c. p. 119, &c.) In support of this doctrine, some facts are also cited from Corvisart. (*Essai sur les Maladies du Cœur*, p. 313, &c.)

A part of these cases, it is true, are not viewed exactly in this light by Kreyzig, who argues (as I think, without much probability), that they might have been only adipose swellings, connected with, or formed in, the parietes of the artery,—a disease described by Stenzel. (*German Transl. of Mr. Hodgson's book*, p. 174.)

Corvisart himself, instead of regarding such tumours as aneurisms in the progress of cure, conceived them to be aneurisms in the course of formation; and, on this point, Mr. Guthrie suspects that he was correct; because "the contents of the tumour were a substance of less consistence than suet, whilst, in all the cases of spontaneous cure, in which, from the history, the previous existence of aneurism was known, the contents have always been firm, or very firm." (*Guthrie on Dis. of Arteries*, p. 88.) But whatever may have been the nature of the swelling referred to by Corvisart, the fact of saciform aneurisms of the aorta being sometimes entirely filled up by solid blood, and the disease cured on this principle, with the great channel of the aorta itself remaining pervious, is now universally acknowledged.

That a punctured artery may occasionally be healed, and still continue pervious, Scarpa himself proves, by a case which he examined, where an aneurism took place from the wound of a lancet in bleeding. In the article HÆMORRHAGE, we shall see, that Jones's experiments show the same thing, and the particular circumstances in which it may happen. But the occurrence is rare, and Scarpa says, that it can hardly be called a radical cure, as the cicatrix is always found in a state ready to burst and break, if the arm be, by any accident, violently stretched or struck where the wound was situated.

In the spontaneous cure of aneurisms, arising from arteries of inferior size to that of the aorta, repeated examinations have proved, that the deposition of coagulum does not merely fill up the sac, but obliterates the tube of the artery above and below the disease to the next important ramifications. Yet, even here, exceptions probably take place; for Mr. Hodgson has brought forward one instance, in which a small sac, which originated from the anterior artery of the cerebrum, was completely filled with firm coagulum, which did not extend into the cavity of the vessel. (*On Diseases of Arteries*, p. 132.) And he reports the particulars of a true femoral aneurism, communicated to him by Sir A. Cooper, in which, after the patient's death, the femoral artery was found dilated into a sac, which was lined on all sides with very firm layers of coagulum, in the centre of which was an irregular canal, through which the circulation was continued. As the inside of this canal presented a membranous appearance, it was inferred that the aneurism had been cured. (*Op.*

cit. p. 134.) Here I may be permitted to remark, that, if this case be correctly reported, viz. if it were a true aneurism by dilatation of all the arterial coats, and the inside of it was every where lined by firm layers of coagulum, it amounts to a proof, that such a deposition is not entirely confined to aneurisms by rupture, as Scarpa supposes. And, in addition to this fact, I may mention, as referring to the same question, a case of aneurism from dilatation of the arterial coats, observed by Guattani, where the same process took place. "Arteria iliaca ovalem hanc partem aneurysmaticam polyposa substantia variæ densitatis adeo infarctam esse denotebam, ut tunicarum ejusdem forma penitus destructa in uniformem massam, spongiæ cera imbutæ similem, transformata videretur." (*Hist. xvii. Collect. Lauth. p. 158.*)

Whenever the ulcerated, lacerated, or wounded artery is accurately compressed against a hard body, like the bones, it ceases to pour blood into the surrounding cellular sheath, because its sides, being kept in firm contact, for a certain extent above and below the breach of continuity, become united by the adhesive inflammation, and converted into a solid ligamentous cylinder. Mollinelli, Guattani, and White give examples and plates illustrative of this fact. When aneurisms get well spontaneously, the same fact is observed after death, as Valsalva, Ford, &c. have demonstrated. I have myself seen, in St. Bartholomew's Hospital, an instance in which a man had had a spontaneous cure of an aneurism in the left axilla, but afterwards died of hemorrhage from another aneurismal swelling under the right clavicle: the artery on the left side was found completely impervious. Dr. Albert had under his care, in the York Hospital, Chelsea, a dragoon, who recovered spontaneously of a very large aneurism of the external iliac artery: the tumour sloughed, discharged about two quarts of coagulated blood, and then granulated, and finally healed up. Paoli relates a similar termination of a popliteal aneurism, and Moinichen and Guattani give other examples. Hunter found the femoral artery quite impervious, and obliterated, at the place where a ligature had been applied fifteen months before. Boyer noticed the same fact in a subject, eight years after the operation. Petit describes the spontaneous cure of an aneurism at the bifurcation of the right carotid: the subject having afterwards died of apoplexy, the vessel, on dissection, was found closed up and obliterated from the bifurcation, as far as the right subclavian artery. Desault had an opportunity of opening a patient, in whom a spontaneous cure of a popliteal aneurism was just beginning: he found a very hard, bloody thrombus, extending for three finger-breadths into the tube of the artery, above the sac, and so firm, that it resisted an injection, and made it pass into the collateral branches.

Both the spontaneous and surgical cures of aneurisms have generally two stages: in the first, the entrance of the blood into the aneurismal sac is interrupted; in the second, the parietes of the artery approach each other, and, becoming agglutinated, the vessel is converted into a solid cylinder. This doctrine is corroborated by the tumour first losing its pulsation, and then gradually diminishing and disappearing.

In order that compression may make the opposite sides of an artery unite, and thus produce a

radical cure of an aneurism, Scarpa says, the degree of pressure must be such as to place these opposite sides in firm and complete contact, and such as to excite the adhesive inflammation in the coats of the artery. The point of compression must also fall above the laceration or wound of the artery; for when it operates below, it hastens the enlargement of the tumour: and Scarpa adds, that, in practice, bandages which are expulsive and compressive, are more useful for making pressure than any tourniquets or instruments, many of which are contrived to operate, without retarding the return of blood through the veins.

In order that pressure may succeed, the coats of the vessel, at the place where it is made, must be sufficiently free from disease to be susceptible of the adhesive inflammation. When the arterial coats, round the root of the aneurism, are much diseased, Scarpa considers them as insusceptible of the adhesive inflammation, although compressed together in the most scientific manner, and even when tied with a ligature, which only acts by making circular pressure on the vessel.

This statement would appear to derive confirmation from the following fact:—Mr. Langstaff amputated the thigh of a person seventy-five years of age; but the vessels were so ossified, that they could not be effectually tied, and the patient died within twenty-four hours. It is generally supposed, says Mr. Lawrence, that this condition of the arterial coats is incompatible with their union under the application of the ligature. The opinion should be received, however, with some limitation. In a man of fifty-nine years of age, bleeding took place nearly a month after amputation, from the ossified femoral artery, and Mr. Lawrence was therefore obliged to expose and tie that vessel again for the suppression of the hemorrhage; when he found a hard tube, which cracked immediately the ligature was tightened: the bleeding, however, never returned. (See *Med. Chir. Trans.* vol. vi. p. 193.) This case is mentioned, not with any view of encouraging surgeons to apply ligatures round diseased portions of arteries, — a thing which should always be avoided, when possible, — but to let them be aware, that an ossified artery is sometimes susceptible of being permanently closed, when a ligature is put round it. With respect to Scarpa's idea of making pressure operate so as to place the two opposite parietes of the artery at the mouth of the aneurismal sac completely in contact, in order that they may be united by the adhesive inflammation, and the cavity of the vessel be obliterated, I should think with Mr. Hodgson, that if pressure will succeed only under these circumstances, it will answer very seldom; because, in almost all aneurismal sacs, a sufficient deposition of coagulum will have taken place to prevent the possibility of placing the opposite sides of the artery at the mouth of the aneurism in a state of complete contact. (*On Diseases of Arteries*, &c. p. 172.) Possibly, however, Scarpa's directions refer to a point of the vessel, rather beyond the usual limits of the laminated coagula; and he is particular in recommending the practice only where the aneurism is soft and small.

Some advise trying compression in every case of aneurism, whether small, circumscribed, soft, flexible, indolent, or elevated, diffused, hard, and painful. But, in the latter case, Scarpa represents

compression as decidedly hurtful. He says also, that every bandage which compresses the aneurism, and also circularly constricts the affected part, is always injurious. The bandage, likewise, which compresses only the aneurism, and directs the point of pressure below the rupture in the vessel; that which, on account of the great size, exquisite sensibility, depth of the root of the aneurism, and fleshy state of the surrounding parts, cannot effectually compress the artery against the bones, so as to bring the opposite sides of the vessel into contact; and, lastly, the compression applied to a spontaneous aneurism, attended with a statomatous, ulcerated, earthy disease of the arterial coats; — ought to be considered as more likely to do harm than benefit. In cases of a completely opposite description, bandages have produced, and may produce, a radical cure, and should not be entirely disused. (*Scarpa on Aneurism*, ed. 2. p. 221.)

Guattani first employed compression systematically for the cure of aneurisms; and out of fourteen cases in which he adopted the plan, four were cured by it. Be it remarked, that this distinguished surgeon applied, first charpie and compresses over the tumour, and then a roller, with only moderate tightness, from the lower part of the swelling to the upper part of the limb. The bandage, which was kept wet with an astringent refrigerant lotion, was changed about once in three weeks. The patient was kept on a very low diet, perfectly quiet in bed, and a few general bleedings were practised. Mr. Freer details some other examples of success, and so does Lisfranc (*Op. cit.* p. 29.); but, in general, pressure has hitherto been applied to the tumour itself, — a method less likely to answer than that of making pressure on a sound part of the artery. Mr. Freer recommends the employment of Sennio's instrument, or the following method:—First place a bandage, moderately tight, from one extremity of the limb to the other; then put a pad upon the artery, a few inches above the tumour; next, surrounding the limb with a tourniquet, let the screw be fixed upon the pad, having previously secured the whole limb from the action of the instrument, by a piece of board, wider than the limb itself, by which means the artery only will be compressed, when the screw is tightened. The tourniquet should now be twisted till the pulsation in the tumour ceases. In a few hours the limb will become œdematous and swelled, when the tourniquet may be removed, and the pressure of a pad and roller will afterwards be enough. In experiments, which this gentleman made on the radial arteries of horses, these vessels were found to become inflamed, and to be rendered impervious, by such a process. (*Freer*, p. 112.) Dubois is stated to have cured an aneurism of the thigh by steady pressure on the vessel for twenty-four hours. (*Med. Chir. Trans.* vol. iv. p. 437.)

Sir A. Cooper describes another machine for compressing the femoral artery, in cases of popliteal aneurism: it was used by Sir W. Blizard. — "The points of support for this instrument, were the outer part of the knee, and the great trochanter, a piece of steel passing from one to the other; and to the middle of this a semicircular piece of iron was fixed, which projected over the femoral artery, having a pad at its end, moved by a screw, by turning which, the artery

was readily compressed, and the pulsation in the aneurism stopped, without any interruption to the circulation in the smaller vessels." But although the patient, on whom it was tried, possessed unusual fortitude, he was incapable of supporting the pressure of the instrument longer than nine hours. (*Med. and Phys. Journal*, vol. viii.) Mr. White, of the Westminster Hospital, tried pressure, by means of a newly invented spring, supposed to possess peculiar advantages. "The woman bore the pain heroically for five days,* but the parts compressed sloughed deeply. The cure was completed; but (says Mr. Guthrie), the pain, danger, and risk incurred, were infinitely greater than any, which could have been sustained from the usual operation." (*On Dis. of Arteries*, p. 142.) Few patients, indeed, can endure the pressure of such instruments a quarter of this time, when they are put on sufficiently tight to afford any chance of obliterating the artery; and, on account of the suffering which they produce, they are rarely used by modern surgeons.

When the treatment by pressure is attempted, the plan may be assisted with repeated bleedings, an exceedingly spare diet, and perfect quietude in bed. Digitalis has also been sometimes prescribed, with the view of lessening the impetus of the circulation. The superacetate of lead has often been tried on theoretical principles. Even at the present day, Mr. Guthrie recommends it, as a remedy, "which may possess the power of removing chronic inflammation of the coats of the arteries, and of inducing a return to a state of health. In the proportion of a grain of it to a quarter or half a grain of opium, he says, he has never seen it do any thing but good; and he has given it in much larger doses without any bad effect. (*On Dis. of Arteries*, p. 125.) I confess that my own confidence in the efficacy of the superacetate of lead in the cure of aneurism is much less, than that which has now been adverted to. It is likewise a favourite plan with some practitioners, to apply snow, or powdered ice, to the tumour, as I shall notice in describing Valsalva's treatment of aortic aneurisms. These last applications have been employed for the purpose of promoting the coagulation of the blood within the aneurismal sac, and the consequent obliteration of the cavity of the aneurism and the artery. Various examples, in which it produced a cure, are recorded by Guérin, Larrey, Sabatier, Pottan, &c. (*Recueil Périod. de la Soc. de Santé de Paris*, No. 3. *Polletan, Clinique Chir.*; and *Ribes, Bulletins de la Faculté de Méd. de Paris*, 1817. No. 1. and 2. p. 284.)

Lisfranc is acquainted with several cases, in which ice was tried, either alone, or in combination with general means, and compression. The successes were nearly equal to the failures—so that, according to Lisfranc, experience ascribes a good deal of efficacy to this treatment. He refers, however, to some recent investigations made by M. Mouligné, principal surgeon of the Hôpital St. André, at Bordeaux, which give a very different view of the subject. (See *Lisfranc, Des diverses Méthodes pour l'Oblitération des Artères*, p. 25.) The latter surgeon is, on the whole, rather in favour of the practice: he observes, that in all the examples in the Bordeaux Hospital, the application of ice was not aided by other means; and that it was tried without discrimination. When an aneurism is free from pain, and is neither inflamed nor

too large, he thinks that the plan can hardly produce any dangerous effects. In order not to occasion sloughing, he advises the use of ice to be suspended every two or three hours, or oftener.

When the swelling is large, the parts very tense, their texture changed, and the skin thin, the practice is likely to accelerate the formation of a slough; and Bresschet confirms a remark made by Mr. Hodgson, that some patients cannot continue this treatment beyond a few minutes, while others find it absolutely insupportable. (*Fr. Transl. of Mr. Hodgson's Work*, t. i. p. 212—229.) Galvanism was proposed a few years ago by M. Pravaz (see *Lisfranc, De l'Oblitération des Artères*, p. 34.), and by Mr. Benjamin Phillips (see *Experiments showing that Arteries may be obliterated without Ligature, Compression, or the Knife*, 8vo. 1833). Mr. Benjamin Phillips transfixed arteries with common sewing needles, with the view of exciting inflammation within them, and rendering them impervious. He proposes that the action of the needle may be assisted with galvanism. The extremely dense mass of albumen, which forms around the positive pole in using electro-puncture, seems to prove the rationality of this suggestion. M. M. Pravaz and Guérard punctured the aorta of a rabbit, and on bringing the galvanic conductors to the opening, a brownish clot was instantly formed, which suspended the hemorrhage for a time. However, as M. Lisfranc observes, the plan of electro-puncture, as a means of curing aneurism, in the absence of practical facts, can only be looked upon at present as an ingenious idea. (See *Lisfranc, Op. cit.* p. 34.)

The grand means, most to be depended upon, for curing aneurisms, is tying the artery above the tumour. This more certainly prevents the great ingress of blood into the sac, and, what is quite as important, more certainly excites adhesive inflammation within the tied part of the vessel, and, by holding the opposite sides of it steadily in contact, brings about their union, and an obliteration of the tube of the vessel, with tolerable regularity. The chief current of blood into the sac is thus stopped, the contents of the aneurism are afterwards gradually absorbed, and the tumour dwindles away in proportion. The natural course of the blood being now permanently interrupted in the arterial trunk, it passes more copiously into the collateral branches; and these enlarging and anastomosing with others, which originate from the large arteries beyond the obstruction, the necessary circulation is carried on. (See ANASTOMOSIS, and LIGATURE.)

The ligature of the superficial femoral artery may be performed with the same confidence of success, as the ligature of the brachial artery; that is, without any fear of destroying the circulation, or depriving the subjacent limb of its vitality. Indeed, the numerous and conspicuous anastomoses, which are met with all round the knee, correspond exactly with those which are observed round the elbow, and at the bend of the arm. This is not a peculiarity of the arteries of the extremities; but it is a general rule, which nature has followed in the distribution of all the arteries, that the superior trunks communicate with the inferior, by means of the lateral vessels. After the principal trunk of an artery is tied, its lateral branches not only carry on the circulation in the parts below the ligature,

but do so with greater quickness and activity than they did previously, while the course of the blood was unimpeded through the principal trunk. This evidently arises from the increased propulsion of blood into the lateral vessels, as well as from the enlargement of the diameter of these vessels. After the amputation of the thigh, while the blood flows in a full stream from the superficial femoral artery, very little or no blood is poured out of the lateral vessels; but as soon as that artery is tied, the blood issues with impetuosity from the small arteries, which run along within the vasti and cruræus muscles; and on these smaller arteries being also tied, the blood immediately oozes out from the minute arterial vessels of the muscles and cellular membrane. When the principal trunk of an artery is tied, its lateral branches gradually acquire a much larger diameter. After amputation of the thigh, on account of popliteal aneurism, the size and situation of which could not fail materially to impede the course of the blood through the trunk of the femoral artery, it has been often remarked, that although both the trunk and the greater and smaller branches had been tied with the nicest accuracy, the patients have been in danger of losing their lives, on account of the repeated copious hemorrhages from the innumerable small lateral vessels that had become unusually enlarged. In several cases, during the treatment, and especially after the radical cure of popliteal aneurism, by tying the superficial femoral artery, in the upper third of the thigh, all the ramifications of the recurrent popliteal arteries have been felt beating strongly round the knee. In a man, who had been operated on for a popliteal aneurism, but a few years afterwards died from necrosis of the tibia, Boyer found the arterial branch, which runs in the substance of the sciatic nerve, equal in diameter to the radial artery. C. White, in dissecting the arm of a lady, who, fifteen years before, had been operated on for an aneurism in the bend of the arm, found the brachial artery obliterated, and converted into a solid cylinder, for three inches below the place of the ligature, and as far as the division into the radial and ulnar arteries; but the recurrent radial and ulnar branches had become so much enlarged, that, taken together, they exceeded the size of the brachial artery, above the situation of the ligature. In the dead body it is found, that an anatomical injection will pass more freely from one extremity to the other of an aneurismatic, than of a sound limb, and this even when no vessels are visibly enlarged. Although it be self-evident, that the circulation through the collateral vessels ought to be much more easy and quick, the lower down the ligature is applied to the principal trunk; yet experience shows, that this difference is not to be estimated very high; for in cases of popliteal aneurism, *cæteris paribus*, the success is the same, whether the femoral artery be tied low-down or high up in the thigh. (Scarpa.)

This facility of the passage of the blood through the lateral vessels is not the same in subjects of all ages; and, in the same subject, it is not the same in the inferior, as in the superior extremity. An age under forty-five, and the operation being done in the arm, which is nearer the source of the circulation than the lower extremity, increase the chance of success. However, notwithstanding these are the opinions of Scarpa, and, as general ones, may not be incorrect, surgeons in England

now operate for aneurisms of the lower extremity, and on patients much older than forty-five, with a degree of confidence, which nothing but great success could inspire.

According to Scarpa, the circumstances chiefly preventive of success, especially in the popliteal and femoral aneurisms, are the following: rigidity, atony, or disorganization of the principal anastomoses, between the superior and inferior arteries of the ham and leg; sometimes depending on advanced age, or on it, together with the large size of the aneurism, which, by long-continued pressure, has caused a great change in the neighbouring parts; or sometimes on steatomatous, ulcerated, earthy, cartilaginous disorganization of the proper coats of the artery, not confined to the seat of the rupture, but extending a great way above and below the aneurism, and also to the principal popliteal recurrent arteries, tibial arteries, and, occasionally, to portions of the whole track of the superficial femoral artery. Sometimes, the pressure of a large aneurism renders the thigh-bone carious. In such circumstances, the ligature is apt to fail in closing the trunk of the artery; and, if it should succeed, the state of the anastomosing vessels will not admit of a sufficient quantity of blood being conveyed into the lower part of the limb. Hence, when the patient is much advanced in life, languid, and sickly; when the internal coat of the artery is rigid, and incapable of being united by a ligature; when the aneurism is of long standing, and considerable size, with caries of the os femoris, or tibia; when the leg is weak and cold, much swelled, heavy, and oedematous; — Scarpa considers the operation contra-indicated. I must, however, declare in this place, that I have seen large aneurisms, as well as aneurisms in persons of advanced age, cured by the Hunterian plan; and, with respect to the affection of the bones, though it may be an unfavourable circumstance, its consequences are generally less serious than those of ordinary caries.

It appears, then, that the obliteration of the artery, for a certain extent above and below the tumour, forms the primary indication in the radical cure of aneurism, whether compression or the ligature be employed: all other means are only auxiliary. Internal remedies may be useful, inasmuch as they tend to moderate the determination of the blood towards the place where the artery has been tied or compressed.

In the articles HEMORRHAGE, and LIGATURE, I have described the effects of the ligature upon a tied artery, and particularly the various processes which arise from its application, and terminate in the permanent obliteration of the vessel. There, I have explained what are the best ligatures for use, as well as the safest manner of applying them. Confining myself at present to what expressly relates to aneurisms, I shall merely annex the following general directions:—

First, The cord should be thin and round, such a ligature being most likely to effect a clean division of the internal and middle coats of the vessel, and not liable to produce extensive ulceration or sloughing. Lisfranc and others, who apprehend that a very thin silk ligature may make its way too rapidly through the external coat, prefer a strong round thread, or several united together, the flattened form being avoided. (Lisfranc, *Op. cit.* p. 52.)

Secondly, The ligature should be tight, in order to insure the complete division of the internal and middle coats, and to prevent its detachment; it being almost impossible, even with the thinnest ligature, entirely to cut through a healthy artery.

Thirdly, The vessel should be detached from its connections only to such an extent as is necessary for the passage of the ligature underneath it.

Fourthly, The immediate adhesion of the wound should be promoted by all such means, as are known to promote that process in general. (See *Hodgson on Dis. of Arteries*, p. 225, 226.)

Fifthly, The ligature should be applied, if possible, to a sound portion of the artery. When the artery is affected with atheromatous or calcareous depositions at the part where some method must be tried for its obliteration, M. Lisfranc rejects the ligature and prefers compressing, or plugging the vessel, or at all events some means which will not occasion so much risk as the ligature of rapidly dividing the artery. (*De l'Oblitération des Artères*, p. 64.) If we were compelled to tie a diseased portion of artery, the chance of secondary hemorrhage, I believe, would not be lessened by following M. Lisfranc's advice. It is right to state, however, that the plan of plugging an ossified artery was sometimes adopted by Baron Dupuytren and M. Roux, though probably not in cases of aneurism. According to M. Manec, they used as a plug a piece of bougie, and then applied a common ligature.

Sixthly, It should not be placed too near a collateral branch, which would prevent the formation of the internal clot, and the process of obliteration of the vessel would be likely to be interfered with.

In the course of his experiments upon brutes, to ascertain the operation of the ligature, Dr. Jones arrived at a fact, which offered the probability of leading to an improvement in the operation for aneurism. (*Treatise on Hemorrhage*, chap. iii.) When a small firm ligature is applied to an artery, it causes the division of the internal and middle coats; and if it be afterwards removed, an effusion of lymph takes place between the cut surfaces into the cavity of the vessel. If several divisions of the internal and middle coats be thus effected in the vicinity of each other, the effusion of lymph was found by Dr. Jones to be sufficiently extensive to obliterate the cavity of the vessel. Dr. Jones mentions several divisions as necessary; an important fact, which has generally been overlooked, and the application of one ligature supposed to be all that was specified. Indeed, several divisions of the inner coat constitute in reality the process introduced by M. Amussat, and termed by him *Des Mûchures*. In the year 1800, Mr. A. C. Hutchison tied the brachial arteries of two dogs, and removed the ligatures immediately after their application: in both instances, as he assures us, the complete obliteration of the canal of the artery was the consequence of the operation. (See *Pract. Obs. in Surgery*, p. 103.) If, immediately after the operation for aneurism, the ligature could be removed, and yet the vessel become obliterated, it would be highly advantageous, as there would then be left in the wound no extraneous substance to prevent its union, or promote secondary hemorrhage, by extending the sloughing, or ulcerative process, too far. It is to be regretted, that the repetition of the experiment by others has not been attended with success. Mr. Hodgson tried it, but

the artery did not become impervious. (See *Experiments A. and B.*, p. 228, 229. of this gentleman's work.) Mr. Dalrymple of Norwich made the experiment not less than seven times on horses, and three times on sheep, and failed, in every instance, to obtain the same result as Dr. Jones. Not only was no coagulum formed, but, even when the animal had been suffered to live until the thirteenth, fifteenth, and eighteenth days after the operation, the canal of the artery was not found obliterated. In each case, indeed, its calibre was contracted; but it was still capable of transmitting a lessened column of blood. (*Travers, in Med. Chir. Trans.* vol. iv. p. 442.) Thus, it appears that an effusion of lymph is an invariable consequence of the operation, and, as Mr. Travers has observed, the want of union is therefore owing to the opposite sides of the vessel not being retained in a state of contact, so as to allow of their adhesion. The presence of the ligature, in the common mode of its application, effects this object; and for the success of Dr. Jones's experiment, it appeared only necessary, that the opposite sides of the wounded vessel should be retained in contact, until their adhesion was sufficiently accomplished to resist the passage of the blood through the tube. This object might probably be effected by compression; but the inconveniences attending such a degree of pressure, as would retain the opposite sides of an artery in contact at the bottom of a recent wound, are too great to permit its employment. It occurred to Mr. Travers, that if a ligature were applied to an artery, and suffered to remain only a few hours, the adhesion of the wounded surfaces would be sufficiently accomplished to insure the obliteration of the canal; and by the removal of the ligature at this period, the inconveniences attending its stay would be obviated. The danger, produced by the residence of a ligature upon an artery, arises from the irritation, which, as a foreign body, it produces in its coats. Ulceration has never been observed to commence in less than twenty-four hours after the application of a ligature; whilst it is an ascertained fact, that lymph is in a favourable state for organization in less than six hours, in a wound the sides of which are preserved in contact. (*Jones, chap. iv. exp. 1.*) If it be sufficient, therefore, to insure their adhesion, that the wounded coats of an artery be kept in contact by a ligature only three or four hours, ulceration and sloughing may in a great degree be obviated by promoting the immediate adhesion of the wound. Justified by this reasoning, Mr. Travers performed several experiments, by which he ascertained, that if a ligature were kept six, two, or even one hour upon the carotid artery of a horse, and then removed, the adhesion was sufficiently advanced to effect the permanent obliteration of the canal. It appeared probable, that the same result would be obtained upon the healthy artery of a human subject. (See *Travers's Obs. in Med. Chir. Trans.* vol. iv.; and *Hodgson on the Diseases of Arteries and Veins*, p. 228. et seq.)

Sir Astley Cooper performed one operation for a popliteal aneurism, with the view of ascertaining the efficacy of such a method on the human subject. He completely stopped the flow of blood for thirty-two hours, and then removed the ligature; but the pulsations of the tumour commenced again. He next applied the ligature forty hours

longer, at the end of which time no pulsation recurred on the ligature being taken away. On the twelfth day, however, a considerable bleeding took place, and it was necessary to take up the vessel anew.

Mr. A. C. Hutchison tried this method, as modified by Mr. Travers, in an operation, which he performed for a popliteal aneurism in a sailor, in Nov. 1813. A double ligature was passed under the femoral artery. The ligatures were tied with loops, or slip knots, about a quarter of an inch of the vessel being left undivided between them. All that now remained of the pulsation in the tumour, was a slight undulatory motion. Nearly six hours having elapsed from the application of the ligatures, the wound was carefully opened, and the ligatures untied and removed, without the slightest disturbance of the vessel. In less than half a minute afterwards, the artery became distended with blood, and the pulsations in the tumour were as strong as they had been before the operation. Mr. Hutchison then applied two fresh ligatures; hemorrhage afterwards came on; amputation was performed, and the patient died. (See *Practical Obs. in Surgery*, p. 102, &c.) Now, as Mr. Hutchison chose to apply other ligatures, on finding that the pulsation returned, the above case only proves that the artery is not obliterated in about six hours, and we are left in the dark respecting the grand question, namely, whether the vessel would have become obliterated by the effusion of coagulating lymph and the adhesive inflammation, notwithstanding the return of circulation through it. As for the hemorrhage which occurred, I think it might have been expected, considering the disturbance and irritation which the artery must have sustained in the proceedings absolutely necessary for the application of not less than four ligatures, and the removal of two of them. According to my ideas, only one ligature ought to have been used, and none of the artery detached. We also have no description of the sort of ligatures which were employed; an essential piece of information in forming a judgment of the merits of the preceding method. The application, removal, and reapplication of ligatures are not consistent with the wise principles inculcated by the late Dr. Jones, and have in more instances than that recorded by my friend Mr. Hutchison, brought on ulceration of the artery, and hemorrhage.

The limits of this work prevent me from entering into the particulars of the interesting experiments, undertaken by Mr. Travers, upon the arteries of animals, for the purpose of ascertaining the earliest period when a ligature might be removed from an artery, without any risk of the vessel not being duly obliterated. A full detail of them may be seen in another work (see *Med. Chir. Trans.* vol. iv. and vi.); and others, in relation to the same question, may likewise be perused in Scarpa's appendix to his great work on aneurism (*Memoria sulla Legatura delle principali Arterie degli Arti*, &c. fol. Pavia, 1817). The cases above related, and other considerations, long ago satisfied me, that, flattering as the suggestion of Dr. Jones was, the plan of removing the ligature, previously to its natural separation, would never answer in the operation for the cure of aneurism, unless either an obliteration of the arterial tube would follow with reasonable certainty the taking away of the

ligature directly after it had been applied and it had divided the inner coats of the vessel; or, at all events, unless the ligature could be withdrawn at a determinate period, when either the same obliteration would surely ensue, or be already complete; and all this, with such regularity and infallibility in every case, that the surgeon would have no chance of being called upon to apply another ligature, do a second operation, or disturb the artery in any kind of way whatsoever.

At length, in the prosecution of this inquiry, in which Mr. Travers evinced a full determination to be guided by no motive but the love of truth, he tried the temporary application of the ligature in a case of brachial aneurism, which was operated upon Feb. 14. 1817. The artery was tied an inch and a half above the bend of the elbow with a noose ligature. The pulsation in the radial artery immediately ceased. On the 16th, at four o'clock in the afternoon, the ligature was removed with little difficulty, after having remained on the artery *fifty hours*. No pulsation ensued in the vessel below the point, where the ligature had been applied, and the cure was completely successful.

On the 28th November, 1817, in a case of popliteal aneurism, Mr. Travers tied the femoral artery at one o'clock. On the 29th, at four in the afternoon, the ligature was removed without difficulty, after having been on the vessel *twenty-seven hours*. At this period no pulsation could be felt in the sac; but, at seven in the evening, a faint pulsation was perceptible. On the 30th, the pulsation, though very distinct, was less strong than before the operation. On the 2d, 3d, and 6th of December, the pulsation is described as still continuing. On the latter day, pressure was applied by means of a roller from below the knee to the groin, and was continued for a month, during which time the pulsation in the sac evidently became more feeble. On the 10th of January, the tumour became tense, and severely painful, and no pulsation in it could be distinguished. The next day, the swelling was more diffused and less prominent; and on the 12th, as the disease underwent no amendment, Mr. Travers tied the artery again, about two inches above the place where the former ligature had been applied. The next day the pain had diminished. The ligature was afterwards allowed to separate of itself; and the case went on favourably to the cure. According to Mr. Travers, the first of these cases tends to prove, that the *continuance of the ligature upon the artery, for a period of fifty hours*, as certainly and completely answers the purpose of its application, as if allowed to remain until thrown off by the natural process.

In the second case, Mr. Travers infers from the suspension of pain, and the diminished strength of the pulsation, for a month after the application of the temporary ligature, that a degree of impediment to the current of blood in the artery had been produced; circumstances, which once led him to entertain hopes, that the cure of the aneurism was gradually accomplishing. At length, however, the increase of the tumour, and the aggravation of pain, and inflammatory symptoms, dispelled such expectation, and it was thought necessary to tie the femoral artery a second time, and adopt the common mode.

There are one or two points about this case, on which the author does not particularly dwell,

though they require consideration, are one can form a correct judgment of the accuracy of one of his positions, "that non-pulsation of the sac is a sign auspicious, or otherwise, simply as it stands connected with increase or diminution of bulk, and pain." (*Med. Chir. Trans.* vol. ix. p. 415.) The first question is, how are we to account for the sudden accession of pain, the absence of pulsation, the increase of the swelling, and the other changes which happened on the 10th of January? Judging from the particulars given, I should say, that at this period, the aneurismal sac gave way, and the disease changed from the circumscribed into the diffused form; an alteration which would account for the pulsation being entirely lost, the increase of pain, and the extension of the swelling, &c. Now, although the circumstance of the sac giving way, or the increase of pain, swelling, &c. on the 10th of January, may be taken as an argument, that the application of the ligature for *twenty-seven hours* had failed in producing obstruction enough in the vessel to retard the progress of the disease, we ought to remember, that at the time when these changes happened, a trial of pressure was making, to which one might impute the change of the aneurism from the circumscribed to the diffused form, with quite as much probability, as to the enlargement of the sac by blood sent into it through the imperfectly obliterated artery. However this may be, certain it is, that the second operation was done, when no pulsation existed in the swelling; and, perhaps, therefore, the case would have been doubly interesting, had the artery not been tied a second time, until circumstances had unequivocally proved, that this cessation of pulsation, attended as it was with an inflammatory state of the tumour, would not ultimately have ended in the cure of the disease.

Here, however, I may be speaking rather in the spirit of an experimenter, whose curiosity has not been fully satisfied, than as a surgeon, who should always be governed by the paramount consideration of extricating his patient from danger; and, this will appear the more likely, when I add, that my mind has long been made up about the inexpediency of the temporary ligature, as an innovation in surgery. The last case induced Mr. Travers to relinquish the temporary ligature; and, amongst other reflections, which inclined him to give up the practice, he candidly states, "that the adhesive union is prevented by the enclosure of a foreign body in the wound, long before suppuration has commenced. Suppuration is as certain to take place, though the ligature be removed after a few hours, as if it were left to be cast off; and the granulating process is more languidly performed, after an interruption in its early stage, for the purpose of removing the obstacle to union, than where no such interruption has been given, and the obstacle has been removed by nature's own means. Hence, it follows, that the theory, which, in removing the ligature within a given time, proposed the double advantage of a quicker as well as a surer process, fails in both points, when brought to the test of practice upon the human subject." (*See Med. Chir. Trans.* vol. ix. p. 416, 417.)

We have seen, that when a temporary ligature, which had been applied to the brachial artery *fifty hours*, was withdrawn by Mr. Tra-

vers, pulsation in the aneurismal tumour at the bend of the elbow did not return, and the disease was cured; but, that, in another instance, where the ligature had been allowed to remain on the femoral artery only *twenty-seven hours*, a feeble pulsation was renewed a few hours afterwards in a popliteal aneurism, and as the swelling became painful and more diffused, some weeks after this experiment, though no pulsation could then be perceived, the femoral artery was tied a second time, and the ligature left to separate in the usual manner.

But, from a case more recently published, it would seem, that the employment of a temporary ligature for only *twenty-four hours* on the femoral artery, may obliterate the vessel, and accomplish the cure of a popliteal aneurism. The patient was a sea-faring man, aged thirty-two; and the operator, Mr. Roberts, of Carnarvon; Mr. Evans and Mr. Carrey, other surgeons of that town, being present at the application, and also at the removal of the ligature. No pulsation recurred in the tumour; the edges of the wound were brought together with adhesive plaster; and in eleven days the part was quite healed. (*Med. Chir. Trans.* vol. xi. p. 100.) This is the strongest case, I believe, which has been adduced in support of the use of the temporary ligature, whether we consider the little time which it was applied, the permanent cessation of all pulsation, the quickness with which the wound healed, or the complete recovery of the use of the limb; for when the patient was met six months after the operation, "he could go to the must-head with as great facility as at any period of his life." This fact proves also, that there is a degree of irregularity in the period when the temporary ligature may be removed, without the pulsation in the tumour below the constricted part ever returning. Whether the variety is to be referred to temperament, the kind of ligature used, its greater tightness in one case than another, or other circumstances, is not at present determined.

The greatest advocate, which this practice has gained, is Scarpa, whose sentiments, however, about the most advantageous form of ligatures, and mode of applying them in cases of aneurism, are at variance with what is inculcated by the best and most experienced surgeons in this country. Instead of using a fine ligature, composed of a single piece of thread, twine, or silk, he employs a cord consisting of from four to six threads, according to the size of the artery which is to be tied; and, instead of aiming expressly at the division of the internal coats of the vessel with his ligature, as the generosity of English surgeons do, for reasons explained in another part of this work (see HÆMORRHAGE), he prefers a largish ligature, and interposes between the artery and the knot a small cylinder of linen spread with ointment, with the view of preventing the inner coats of the vessel from being divided. His reasons for this practice may be explained in a few words: he admits, that whenever there is a concurrence of all the circumstances, capable of inducing, in the tied artery, the proper degree of adhesive inflammation, above and below the place where a single circular ligature has been applied, this method is adequate to produce a speedy and steady closure of the arterial tube. But, says he, it sometimes happens, at least in man, that the

pressure made by the circular ligature produces the ulcerative process more quickly in the artery than the adhesive inflammation. In fact, the circular ligature ulcerates the artery in general about the third day after the operation; and the adhesive inflammation does not always complete its course in this period of time. During this delay of the adhesive inflammation, the ulcerative process, occasioned by the pressure of the ligature, attacks more quickly even than surgeons generally suppose, the external cellular sheath of the artery, and penetrates into the cavity of the yet pervious vessel; and this of course with increased quickness, when the inner coats of the artery are already divided by the ligature. The dangers of non-adhesion and too rapid ulceration of the artery, Scarpa thinks, are placed at the greatest distance by preserving undivided all the three coats of the vessel under the pressure of the ligature; and hence his partiality to larger ligatures than are now used by the best surgeons in England, and to the interposition of a cylinder of linen between the knot and the vessel, as recommended by Paré, Heister, and Plutner. If, however, he has had reason to suspect that a simple circular ligature has frequently failed in England, because other innovations have been occasionally substituted for it, and because *we should not have sought for a better, if we had already had the best*, how much more vulnerable is his own practice on a similar principle; since, generally speaking, it has not retained half so many approvers as they who still express their preference to other methods, and more especially to the use of a single ligature, uncomplicated with other extraneous substances! Is it probable, he asks, that the single circular ligature, which was formerly used with doubtful success by the greatest surgeons, should now have become, as is pretended, the most certain means of preventing secondary hemorrhage? "It is now wished (says he) to ascribe the failures of Mr. Hunter, and of many other operators, not to the circular ligature, but to the improper treatment of the wound in general, and in particular to the introduction into it of lint, and, more especially, to the irritation occasioned by the ligature of reserve." On the contrary, it is argued by Scarpa, that, though Mr. Hunter, after his first trials, simplified the local treatment, though all skilful surgeons merely covered the wound with a pledge of soft ointment, and most of them omitted the reserve-ligature, yet, notwithstanding these reforms, secondary hemorrhage after the use of a simple circular ligature was not rendered less frequent. (*On Aneurism*, p. 23. ed. 2.) With respect to the latter general assertion, its incorrectness may be learned by reference to the details of Mr. Hunter's own operations, and by going into the principal hospitals of this metropolis, where the use of a simple circular ligature for the cure of aneurisms rarely fails, so far as secondary hemorrhage is concerned. Why then did the operation more frequently fail here in former times? The answer is plain: the kind of ligature now employed in England cannot be compared to what was used in Mr. Hunter's time, or even to what was here in fashion forty years ago. And, besides the universal rejection of ligatures of reserve, practitioners now have a more thorough comprehension of what ought to be avoided in the operation, have a just

fear of separating and disturbing the artery too much, know how to appreciate the advantage of closing the wound, and attach due importance to the choice of smaller or more eligible ligatures. (See HEMORRHAGE and LIGATURE.) When, therefore, Scarpa supposed, that in England the practice with the circular ligature in the treatment of aneurism is materially the same now as heretofore, and that secondary hemorrhage is as frequent, he did not avail himself of all the information on the subject which he might have acquired from Mr. Wishart, the able translator of his writings on aneurism, or from an attentive perusal of Mr. Hodgson's valuable treatise.

In an equality of circumstances, conducive to the success of the Hunterian operation, Scarpa thinks that the fact is not proved, as it is presumed to be, that the rupture of the internal and middle coats of the artery does excite the adhesive inflammation and union of the artery more effectually, than is done by the simple compression and close contact of its two opposite internal parietes in a sound and uninjured state. This remark is partly true, and partly incorrect, at the same time that it involves a question, which must be deferred till we come to the article HEMORRHAGE. The truth in the observation is, that an artery may generally be rendered impervious with tolerable certainty, by compressing its opposite parietes steadily and firmly together for a certain time, without dividing its inner coats: the inaccuracy, of it depends upon the fact, that surgeons have no instrument, nor contrivance (not excepting even the ligature of four or six threads, with the interposition of the cylinder of linen spread with ointment), which can retain the opposed undivided surfaces of the inner coats of the vessels closely together in the manner commended by Scarpa, and for the due time, without the objection of denuding more of the artery than need be done in the application of a small ligature; or without the serious inconvenience and risk necessarily attending the introduction of a larger quantity of extraneous matter into the wound than is desirable, with the view of averting all chance of the ulceration of the artery reaching beyond prudent limits. And, when metallic instruments are used for the same purpose, objections not less real are incurred, as will be hereafter more particularly explained.

Scarpa considers, that his mode of ligature ought to be preferred, as combining the triple advantage of preserving entire all the three coats of the artery; of exciting quickly, and in a proper degree, the adhesive inflammation in them; and of retarding, as much as possible, the ulcerative process of the arterial tube.

Partly impressed, however, with the truth of the tenets laid down by Dr. Jones (see HEMORRHAGE), Scarpa enjoins attention to the following rules. 1. *Not to incise and detach the artery any further than is necessary for allowing a ligature to be passed around it.* 2. *Not to let the cylinder of linen exceed a line in length, or a little more above and below the breadth of the tape, which is about a line for the large arteries of the extremities.* 3. *That the ligature be not too tight.* 4. *And that it be never applied immediately below the origin of a large lateral branch.* (See Scarpa on Aneurism, p. 44. ed. 2.)

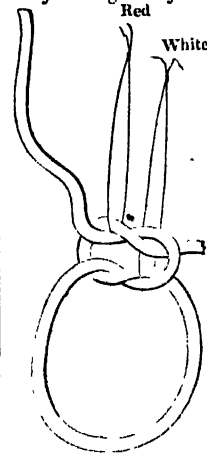
Some further consideration of Scarpa's mode of applying the ligature will be introduced in the,

article HEMORRHAGE; and I now proceed to notice his sentiments concerning the advantage which may be derived from removing the ligature in cases of aneurism, as soon as the tube of the vessel has been obliterated by the adhesive inflammation. From the facts recorded by Scarpa, it is inferred, that, with the kind of ligature and the cylinder of linen used in his practice, the closure of the artery by the adhesive inflammation and the two internal coagula is sufficiently far advanced on the third or fourth day after the operation, to resist the impulse of the blood; and hence (says he) there is no rational motive for waiting beyond this time for the spontaneous separation of the ligature, or for allowing it, by its further presence, to ulcerate, and even open the artery at the principal point of adhesion. He then comments on the advantages to the wound, derived from the removal of all extraneous matter from it on the third or fourth day. With respect to the general opinion of such removal, however, he makes one exception, viz. the case of great and evident debility from sickly constitution, or very advanced age, as it is observed that, in such patients, the reunion of a simple wound is frequently protracted to the sixth day. In cases of this description, Scarpa recommends delaying the removal of the ligature to the completion of the fifth, or sixth day, but under the express condition, that the ligature has been applied with the interposition of a cylinder of linen; as it is proved that a common circular ligature causes ulceration of the artery before the third day, and it is not till the sixth day that the external coat of the vessel begins to ulcerate, when the other modification of the ligature is adopted. (P. 50.)

Scarpa supports the preceding advice by four cases, in which his kind of ligature was applied, and withdrawn at the end of the third, or fourth day, and the arterial tube obliterated. However, I do not think that, in England, these cases, when minutely and attentively considered, will be regarded as inducements to persevere in the use of temporary ligatures. In every instance, the wound is described as suppurating, and sometimes *plentifully*. In one, the foot mortified, and amputation became necessary. In another, the very day after the disturbance of removing the ligature, the thigh was attacked with erysipelas, and, on the eighth day, the wound is represented as being *foul*, and the erysipelas not yet cured. It is but fair to add, that M. Roux seems to have operated on Scarpa's plan with results much more encouraging; for he is stated to have taken up the principal arteries of the neck and limbs in this way nearly fifty times, and lost but five or six of the patients from hemorrhage or sphacelus. (See *Lisfranc, de l'Obliteration des Artères*, p. 71.)

Independently of the uncertainty of the period, when the arterial tube is closed by the adhesive inflammation in various patients, it appears to me that the disturbance of the vessel and wound, by the steps necessary for the loosening and removal of the ligature, will ever form an inseparable objection to the practice. Scarpa appears to have some apprehension of this kind himself; for he remarks, "In the act of removing the ligature, there can be no doubt it is of great consequence that the artery be not rudely handled, or stretched. And, indeed, if, on untying the running knot, the subjacent knot could be with the same facility

untied, we could not wish for a better mode of performing this part of the operation. But, the knot, although a simple one, is not so readily untied as the running knot, on account of the moisture, with which the threads forming the ligature are soaked, or because the ligature has been previously waxed." (P. 64. ed. 2.) In fact, his apprehensions then lead him to of placing, previously to making longitudinally, on each side of the time of removing the ligature, the threads are to be drawn in opposite directions, in order to undo the knot, without displacing or stretching the artery. This reminds me of the ingenious contrivance of Mr. John Barker, of Ipswich, whereby the ligature, at any period judged advisable, is removed without any disturbance of the wound: it is rendered perfectly intelligible by the annexed diagram.



Instead of one small ligature, which is all that an English surgeon leaves in the wound, Scarpa recommends his ligature of four or six threads, a roll of linen, and two other threads; a quantity of extraneous substances, which cannot fail to be a source of serious irritation and mischief. I shall therefore take leave of the proposal of removing the ligature on the third or fourth day, or any other particular day, with expressing my belief, that, if there were only the following objection to the plan, it would never be adopted in this country; namely, all the advocates for this practice, excepting Mr. John Barker, whose plan has considerable merit, renounce the infinite advantage of bringing the edges of the wound together directly after the operation. Had the suggestion of Dr. Jones proved invariably correct, and the ligature admitted of being withdrawn immediately after the inner coats of the vessel had been divided by it, the case would have been very different, as there would then have been no foreign body at all left in the wound; the parts might have been immediately brought together with the greatest chance of union by the first intention, and no subsequent disturbance, either of the artery, or of the wound, would have been incurred. At the same time, I admit, that if the removal of the ligature at the end of a given time should ever prove the best practice, then Mr. Barker's ingenious contrivance for undoing and extracting the ligature without any irritation of the parts, or keeping the wound open for the purpose, may become a proposal of great practical importance. At present, I am decidedly of opinion, that it is best to leave the ligature till it becomes loosened, which usually happens between the tenth and twentieth days after the operation. (See *Lisfranc, de l'Obliteration des Artères*, p. 63.)

The next practice which I shall notice, is that of applying two ligatures to the artery, and cutting it through in the interspace. This suggestion may be said to be as ancient as the time of Celsus, who advised the method to be followed in the treat-

ment of a wounded artery. (*De Medicinâ*, lib. v. c. 26. § 21.) The fact is curious, though I mention it without the least intention of detracting from the great merits of several modern surgeons, that the Greeks were acquainted with the practice of tying the artery with two ligatures, and dividing it between them, high above the tumour, as will appear by a reference to *Ætius* (4 *Serm. tetr.* 4. cap. x.) In the same ancient work, we are directed to open the aneurismal tumour at the bend of the elbow, and when the blood has been evacuated to tie the artery twice and divide it.

This method of applying two ligatures to the artery, and dividing the vessel between them, a method spoken of by *Ætius*, was revived in France about sixty years ago by *Tenon*, who, as well as some later surgeons, was totally unacquainted with its antiquity. (See *Pelletan, Clinique Chir.* t. i. p. 192.) At one time, it had also modern advocates in *Abernethy* and *Maunoir*, each of whom supposed the plan an invention of his own. (See *Surgical and Physiol. Essays*, part iii. 8vo. Lond. 1797; and *Mémoires Physiologiques et Pratiques sur l'Aneurisme*, &c. 8vo. Genève, 1802.) Some of its advocates suspected that too rapid an ulceration of the artery, and secondary hemorrhage, arose from the traction exercised in opposite directions by the upper and lower portion of the vessel; and they conceived that each end of the divided artery formed a circular prominence beyond the ligature, calculated to hinder it from slipping. Hence, according to their view, the less frequency of secondary hemorrhage after amputations, than after operations for aneurism.

When an artery is laid bare, and detached from its natural connections, and the middle of such detached portion tied with a single ligature, as was *John Hunter's* practice, *Abernethy* conceived that the vessel, so circumstanced, would necessarily inflame, and be likely to ulcerate. The occurrence of bleeding from this cause at first led to a practice, which this gentleman justly censures, viz. applying a second ligature above the first, and leaving it loose, but ready to be tightened in case of hemorrhage. As the second ligature, however, must keep a certain portion of the artery separated from the surrounding parts, and must, as an extraneous substance, irritate the inflamed vessel, it must make its ulceration still more apt to follow. The great object, therefore, which *Abernethy* insisted upon, was that of applying the ligature close to that part of the artery which lies amongst its natural connections: a just principle, the truth and utility of which still remain incontrovertible, though there may be a better way of accomplishing what *Abernethy* intended, than the measures which he was led to recommend.

The peculiarity in *Abernethy's* first operation consisted in applying two ligatures round the artery, close to where it was surrounded with its natural connections. For this purpose, he passed two ligatures of middling size beneath the femoral artery; and having drawn one upwards, the other downwards, as far as the vessel was detached, both the ligatures were firmly tied. The event of this case was successful. An uneasy sensation of tightness, however, extending from the wound down to the knee, and continuing for many days after the operation, made *Abernethy* determine, in any future case, to divide the artery between the two ligatures, so as to leave it quite lax.

Abernethy next relates the particulars of a popliteal aneurism, for which *Sir Charles Blincke* operated, and divided the artery between the ligatures. The man did not experience the above kind of uneasiness; and no hemorrhage ensued when the ligatures came away, although there was reason to think that the whole arterial system had a tendency to aneurism, as there was also another tumour of this kind in the opposite thigh.

The reasoning, which induced *Abernethy* to revive this ancient practice, was ingenious; for, when the artery was tied with two ligatures, and divided, in the foregoing manner, it was argued that it would be quite lax, possess its natural attachments, and be as nearly as possible in the same circumstances as a tied artery upon the face of a stump. Strictly speaking, however, as *Mr. Hodgson* first pointed out, an artery tied in two places, and divided in the interspace, cannot be regarded as placed exactly in the same condition as an artery tied in amputation. In the latter case, the retraction of the vessel corresponds with that of the surrounding parts, which are divided at the same instant, and therefore its relative connections stand as before the operation. But, in the operation for aneurism, the retraction of the artery takes place without being attended with a corresponding retraction of its connections. How far the retraction of the artery is beneficial, or injurious, is by no means evident; and the advantages arising from it may in most situations be obtained, without dividing the vessel, by placing the limb in a bent position. One important objection, however, is gained by the division of the artery; namely, that it is generally in that case tied close to its connections, and it is very evident how liable the application of the ligature in the middle of a denuded extensive portion of the vessel must be to produce ulceration or sloughing of its coats. The same object, however, will be gained by tying the undivided artery close to its connections at the end nearest to the heart; and the existence of a single ligature at the bottom of the wound will be less liable to give rise to suppuration and the formation of sinuses, than the employment of two. When an artery is divided, the portions situated beyond the ligatures must slough, and prove an additional cause of suppuration in the wound. Experience has amply proved the safety of employing a single ligature, and it is at present used by many of the most experienced operators in this country. (See *Hodgson on the Diseases of Arteries*, &c. p. 221, &c.)

According to *Scarpa*, numerous examples of the failure of the plan of applying two ligatures, and cutting through the artery in the interspace, are already generally known. He speaks of one failure, which occurred to *Abernethy* himself. But I entertain doubts how far any inference against the method can be drawn from *Monteggia's* instance, in which a ligature of reserve was used. Nor can I understand how a circumstance which *Scarpa* strongly insists upon, can be well founded; I mean, the danger of the ligature being forced off the mouth of the artery by the impulse of the blood. Any risk of this kind cannot exist if the ligature be duly applied, as *Dr. Jones* has particularly explained; and, at all events, how can it be greater here than after amputation, where it is not usually made a subject of complaint? Indeed, the several examples of secondary hemorrhage

rhage, after this method, quoted by Scarpa from the practice of Monteggia, Morigi, and Assalini, may be more rationally imputed either to reserve-ligatures having been also used, or the common fear in Italy of applying the ligatures tightly; in which event, one can readily suppose that the ligature might really slip, or by remaining a long time on the vessel give rise to dangerous ulceration. Thus, Morigi speaks of one case, in which the bleeding occurred on the nineteenth day. (*Scarpa on Aneurism*, p. 14. ed. 2.) On the whole, I am disposed to believe, that when this method has been executed precisely according to Abernethy's directions, it has not often failed; and I am acquainted with only one case in London, in which it was followed by secondary hemorrhage. However, in the year 1807, Mr. Norman, of Bath, tied the femoral artery with two ligatures, and divided the vessel between them; the upper ligature came away on the sixteenth day after the operation; the lower one on the fifteenth; and the following day a profuse hemorrhage came on, the patient losing a pound of blood. Pressure with a compress and wet bandage was continued for some time, and the wound healed. (See *Med. Chir. Trans.*, vol. x. p. 123.) This is the only case of secondary hemorrhage, which Mr. Norman has met with after operating for aneurisms.

Scarpa very properly remarks, that the application of two ligatures, and dividing the artery in the interspace, can never be an eligible mode, where the smallness of the space, the depth of the artery, and the importance of the surrounding parts do not permit the vessel to be separated and insulated to such an extent as is required for dividing it, with a probability of the division of it being sufficiently distant from the two ligatures. Such, for example, are the cases of ligature of the carotid in the vicinity of the sternum; of the iliac above Poupart's ligament; of the internal iliac, a little below its origin from the common iliac; of the axillary artery between the point of the coracoid process and the acromial portion of the clavicle; or of the subclavian in its passage between the scaleni muscles. Scarpa then comments on the difficulty and even impossibility of taking up the end of the truncated artery again in many situations where hemorrhage to ensue; and he joins Mr. Houlston in thinking the advantages of the method, even where it is practicable, by no means demonstrated. Nay, he goes further; for he agrees with Hoister, Callisen, and Richter in setting it down as worse than useless, on account of the portion of the artery between the ligatures being converted into a dead and putrid substance, which rests upon the bottom of the wound, from which it cannot be removed, until the two ligatures are separated. Here, deeply impressed with the truth of principles, which perhaps he has rather lost sight of in speaking of his own particular method, he comments on the little probability of the wound uniting, under the disadvantage of two ligatures hanging out of it, and of sloughs at its bottom. He argues correctly, that the laying bare, and insulating a large portion of artery, would often be objectionable on the ground, that it could not be done without the surgeon being obliged to apply the principal ligature too near the origin of a large lateral branch; as would happen in a case of inguinal aneurism, situated an inch and a quarter below the origin of the profunda. Thus, a coagulum could not be

formed, and the artery would be in danger of not being closed. On the contrary, by employing only a single ligature at an inch and a quarter below the origin of the profunda, the operation would be simple and successful. (*Scarpa on Aneurism*, p. 19—21. ed. 2.)

The above considerations would certainly lead me to avoid the practice of detaching an artery from its surrounding connections any more than is absolutely necessary for the conveyance of a single ligature under it; but I fully concur with Sir Astley Cooper, in the prudence of using two ligatures, and applying them in the way recommended by Mr. Abernethy, whenever the artery has been extensively separated from its sheath in the operation.

The frequent occurrence of accidents after the introduction of Mr. Hunter's operation might have been ascribed to more probable causes than the condition of an undivided artery, upon which the ligature was applied. The employment of numerous ligatures gradually tightened, or the introduction of extraneous bodies into the wound, were alone sufficient to produce ulceration of the artery: and such practices were adopted in most of the cases, in which secondary hemorrhage took place.

After the reasons, which have been specified against the plan of tying the artery with two ligatures, and dividing it in the interspace, it may appear superfluous to notice a modification of this practice, intended as a security against the slipping of the ligature. But, as the proposal has had the approbation of some men of eminence, the subject may still be worthy of notice.

Sir Astley Cooper published a case of popliteal aneurism, in which the femoral artery had been tied with two ligatures, as firmly as could be done without risk of cutting it through. "But (says he) as I was proceeding to dress the wound, I saw a stream of blood issuing from the artery, and when the blood was sponged away, one of the ligatures was found detached from the vessel. Soon after, the other was also forced off; and thus the divided femoral artery was left without a ligature, and unless immediate assistance had been offered him, the patient must have perished from hemorrhage." The same kind of accident occurred in Mr. Cline's practice. For the prevention of it, Sir Astley at first tried the method of conveying the ligatures, by means of two blunt needles, under the artery, an inch asunder, and close to the coats of the vessel, excluding the vein and nerve, but passing the threads through the cellular membrane surrounding the artery. When these were tied, and the artery had been divided between them, the ligatures were prevented from slipping by the cellular membrane through which they passed. Afterwards, however, he tried a different mode of securing the ligature, suggested to him by Mr. H. Cline. "An incision being made on the middle of the inner part of the thigh, and the femoral artery exposed, the artery was separated from the vein and nerve, and all the surrounding parts, to the extent of an inch; an eye-probe, armed with a double ligature, having a curved needle at each end, was conveyed under the artery, and the probe cut away. The ligature nearest the groin was first tied; the other was separated an inch from the first, and also tied. Then the needles were passed through the coats

of the artery, close to the ligatures between them, and the ends of each thread were again tied over the knots made in fastening the first circular application of the ligatures. Thus, a barrier was formed, beyond which the ligature could not pass." This operation was successful. (*Med. and Phys. Journ.* vol. viii.) A similar proposal appears to have been mentioned by Dionis, and some subsequent writers, especially by Richter, in the 13th chapter of his *Anfangsgründe der Wundarzneikunst*, b.i. ed. 3. 1799.

Where ligatures slip off directly after their application, I conclude that the arteries either cannot have been tied with sufficient tightness, or else that the noose becomes slack, from causes which will be understood by considering what is said on this matter in the article HEMORRHAGE. The inner coats of the artery, we know from the experiments of Dr. Jones, ought to be cut through when the artery is properly tied, because the circumstance is always useful in promoting the effusion of lymph within the vessel, and the process of obliteration by the adhesive inflammation: it may also be advantageous in keeping the ligature from slipping.

The preceding method is so contrary to the grand principle of always avoiding the detachment of the artery from its surrounding connections, and is so inconsistent with the wise maxim of completing the operation with as little disturbance of the vessel as possible, that it is not surprising that it should have met with only a small number of followers. In fact, it is not only liable to every objection which can be urged against the double ligature and division of the artery, as formerly proposed by Celsus, and a few of the moderns, but, on account of its greater tediousness, more extensive separation and destruction of the vessel, and other reasons, is still less worthy of imitation.

With respect to ligatures of reserve, the interposition of aguric, cork, and other hard substances between the knot and the artery, these contrivances are now so fully rejected by all good surgeons, for reasons which will be quite intelligible after the perusal of another part of this work (see HEMORRHAGE), that I shall not at present detain the reader with animadversions on their danger. As for several kinds of metallic compressors intended to be applied to the exposed artery, for the purpose of rendering it impervious, they are inventions which have been made and extolled by some surgeons of high repute, whose names would give importance even to a less meritorious proposition.

Dubois conceived that hemorrhage might sometimes proceed from the circumstance of a ligature making its way too fast through the artery. He thought, also, that the sudden stoppage of the current of blood by a tight ligature might bring on gangrene of the limb, particularly when the aneurism was not of long standing, so that the collateral branches had not had time to enlarge. Dubois, therefore, proposed a method of gradually stopping the flow of blood through the artery; and, by this ingenious imitation of the process of nature, to promote the gradual dilatation of the collateral arteries, and obviate all risk of gangrene in the lower part of the limb. This gentleman put his plan in execution, and two instances of success are recorded. The cases were

popliteal aneurisms. A ligature was passed under the artery in the manner of Hunter; its two ends were then put through an instrument called a *serre-nœud*, with which the compression was gradually increased. It is stated, that, in one of these cases, the plan made the artery inflame and become impervious, in the course of the first night, so that on the following day the throbbing of the tumour had ceased. (*Richerand, Nosogr. Chir.* t. iv. p. 109. edit. 4.) Here, however, it is to be suspected, that the pressure of the apparatus was greater than was calculated; and that the stoppage of the pulsation was more owing either to this cause, or to the coagulation of the blood, in the sac and adjoining portion of the artery, than to the process of obliteration, which could hardly have been so rapidly accomplished.

Assalini's compressor is an instrument, calculated, as its inventor states, to produce an obliteration of the trunks of arteries, without dividing or injuring their coats. It is nothing more than a small pair of silver forceps, the blades of which are broad and flat at their extremities, between which the artery is compressed. A spring, composed of a piece of elastic steel, is attached to the inside of one of the handles, and, by pressing against the opposite handle, retains the flat ends of the blades in contact. This spring is intended to be very weak in its operation; but, by means of a screw, which passes through the handles, the pressure admits of being regulated and increased at the option of the surgeon.

A representation of Assalini's compressor may be seen in his *Manuale di Chirurgia, parte prima*, p. 113. In the same book, or in my friend Mr. Hodgson's valuable *Treatise on the Diseases of Arteries and Veins*, which every practical surgeon ought to possess, a case may be perused, in which this instrument was successfully employed by Professor Monteggia, and withdrawn entirely, as early as sixty hours after its application. This last distinguished surgeon also used the compressor in an example, in which the femoral artery was wounded, and bled in an alarming degree. After forty hours, the pressure was lessened; and, in four hours more, as not a drop of blood issued from the vessel, and there seemed to be no good in leaving an extraneous body in the wound any longer, the instrument was taken out altogether. (See *Assalini's Manuale di Chirurgia*, p. 110.)

When Assalini was in England, he acquainted Mr. Hodgson, that, in two cases of popliteal aneurism, in which he had himself employed this means of obliterating the femoral artery, the instrument was removed at the expiration of twenty-four hours; no pulsation returned in the tumours; and the patients were speedily cured.

With respect to the particular merit of this invention, it certainly possesses the recommendation of ingenuity; but it operates much in the same manner as several other mechanical contrivances, the *serre-nœud* of Desault, the *presse-artère* of Deschamps, that of Mr. Crumpton (see *Med. Chir. Trans.* vol. vii.), the pincers of Baron Percy, &c. If there be a real advantage in the division of the internal coats of an artery by the ligature, as the experiments of Jones seem to prove, and as many of the best surgeons in this country inculcate (see HEMORRHAGE and LIGATURE), then the compressor cannot be an eligible

means of obliterating an artery. It may be said, however, that experience has proved its efficacy; but, let it be recollected that almost every method of operating upon aneurisms has sometimes answered. Further experience is requisite to determine whether Assalini's compressor would succeed as often as, or more frequently than, the scientific application of the right kind of ligatures (see *LIGATURE*), which may perhaps seem slower in their effect, only because they are not in general removed as early as Assalini's instrument. In fact, the experiments of Mr. Travers have now proved, that the ligature is the quickest in its operation. (See *Med. Chir. Trans.* vol. vi. p. 643, &c.)

In 1816, some ingenious observations were published by Mr. Crampton, on the effects of the ligature and of compression in obliterating arteries. The purport of his remarks is to prove, like the later observations of Scarpa: 1st, That the obliteration of an artery can *very certainly* be effected, independently of the rupture or division of any of its coats; 2dly, That this operation of the ligature, so far from being essential to the process, not unfrequently defeats it. (See *Med. Chir. Trans.* vol. vii. p. 344, 345.)

With respect to the first of these assertions, I presume, that all practical surgeons have known and admitted it, especially if the words *very certainly* be left out. Every system of surgery, for half a century past, has recorded the occasional cure of aneurism by different modes of compression, by which the adhesive inflammation is excited in the artery, or the coagulation of the blood in the aneurismal sac brought about. As, however, the most experienced surgeons have found the method less certain than the use of the ligature, it is not represented, by any modern writers, as deserving equal confidence; though there are circumstances in which simple pressure may be sometimes tried, with the hope of doing away all occasion for an operation. The cases, however, in which compression is applied directly to the artery itself by means of ligatures, with the intervention of other substances, as advised by Scarpa, &c., or by various contrivances, like those of the *serre-neud*, the *presse-artère*, and Assalini's forceps, all require the exposure of the artery; and if commendable, therefore, cannot be so on the principle of saving the patient the pain of an operation, but because they are more effectual than the employment of the ligature. This last point remains to be proved. From the comparatively small number of instances, in which the preceding modes of compression have been practised, several examples of failure might be quoted.

With regard to Mr. Crampton's second assertion, that the division of the inner coats of the vessel, so far from being essential to the process of obliteration, not unfrequently defeats it, I think the last part of the observation is altogether unproved. We must admit, that the division of the inner coats is not essential, because arteries sometimes become obliterated under a variety of circumstances in which such division is not made; but still, the great question remains, whether it renders the process more certain. Mr. Crampton founds his conclusion, that it not unfrequently prevents the obliteration, and gives rise to secondary hemorrhage, upon a few very

uncommon cases, in which aneurismal swellings have taken place above the ligature. (See *Warner's Case*, p. 119. of this Dictionary.) Here Mr. Crampton presumes that the occurrence happened from the division of the inner coats of the artery, though Warner himself suspected, with more probability, that it proceeded from a diseased state of the vessel. Besides, this event, be it produced in whatever manner it may, is so rare, that I only know of three examples of it on record, and have never known it occur during the many years that I have been in the constant habit of seeing numerous operations performed. In Warner's time also, the ligatures used were so thick, that they must have been more likely just to press the sides of the artery together, like Mr. Crampton's *presse-artère*, than effect a complete division of the inner coats of the vessel, as is accomplished by the small ligatures in modern use.

Those metallic instruments, intended to be applied directly to an exposed artery, for the purpose of obliterating it by compression, are liable, as Scarpa remarks, to all the inconveniences which are inseparable from the presence of hard bodies, introduced and kept for several days in the bottom of a wound; especially when this is recent, in which case they cannot be retained in a proper direction without difficulty, or exactly at such a depth as will not be attended with hurtful pressure upon the wound itself, and important parts in its vicinity. And, with regard to the forceps of Assalini, Monteggia has observed, "*if the obliteration of the artery is retarded, the forceps equally divides the artery by causing the death of the included portion. I also saw, in one case, the extremity of the instrument resting at the bottom of the wound on the subjacent femoral vein, rupture its anterior half also, although we were sure it had not been included by it.*" (*Instituz di Chir.* ed. 2. t. ii.) And although Cumano, in a case of popliteal aneurism, obtained, on the fourth day, the closure of the femoral artery, by means of Assalini's forceps, he does not conceal that the cure of the wound was rather difficult; and, in comparing the ligature with the forceps, he adds his belief, that if an equal result is derived from both, the preference will be given to the ligature, unless the other instrument be brought to such perfection that the inconveniences will be removed, from which he found it not exempt, though the operation succeeded. (*Annali di Med. del Dottore Umodei*, Settembre, 1807, p. 309.; and *Scarpa on Aneurism*, p. 45. ed. 2.) Some experiments were a few years ago instituted by Mr. Travers, in order to determine the merit of Assalini's forceps, compared with the ligature; and his conclusion from the facts elucidated in the investigation is, that the ligature is a more powerful means of effecting the obliteration of the tube of an artery. (See *Med. Chir. Trans.* vol. vi. p. 643, &c.)

The substance called *'silkworm gut*, used by anglers, was proposed to the profession for securing arteries, in the year 1818. (See *Experiments in favour of a new Substance for tying Arteries, and for Suture*, by Joseph M'Sweeney, M. D. in the *Edinburgh Medical and Surgical Journal*, vol. xiv. p. 597.) It is described as round, smooth, amazingly strong, only as thick as horse-hair, thus adapted for cutting the internal coat of an artery; and it admits of being firmly knotted when moist-

ened. In all the experiments where it was used, the wound healed kindly over it, and on killing the animal it was found unchanged. In the year 1826, Mr. Fielding drew the attention of surgeons to the subject of silkworm gut, not aware of Dr. M'Sweeny's experiments. This substance was employed for securing arteries, in various operations, with complete success; the wounds healed quickly over it. Mr. Fielding has the merit of having first used it successfully in operations on the human body. (See *Trans. of the Medico-Chirurgical Society of Edinburgh*, vol. ii. p. 340.)

A few years ago, Mr. Lawrence extended to operations for aneurism, the method of tying the artery with a small firm silk ligature, the whole of which is immediately afterwards cut off, with the exception of the noose and knot, and an endeavour then made to heal the wound by the first intention. In a case of popliteal aneurism, Mr. Carwardine, late of Thaxted, tied the femoral artery in this manner, and the wound united entirely by the first intention, not a particle of pus having been formed at any time; and the part continued perfectly sound at the distance of some months from the operation. On the 29th of March, 1817, I saw Mr. Lawrence try the practice in a similar case: with the exception of the integuments, the wound united by adhesion. However, it continued to discharge a small quantity of matter till the end of May, when the ligature came away, and it healed firmly. In an aneurism of the brachial artery, Mr. R. Watson, of Stourport, Worcestershire, tied that vessel and cut off the ends of the ligature, as proposed by Mr. Lawrence. The operation was done on the 2d of March, and the wound was quite healed by the 10th of April. On the 3d of May, a small tubercle which had been felt under the skin, in the centre of the cicatrix, appeared above the skin, and proved to be the knot of the ligature. There was no inflammation, nor discharge; but the ring of the ligature was firmly impacted in the centre of the cicatrix. In about a week from this time, the whole of it was expelled. In another case, where Mr. Hodgson tied the ulnar artery, and cut off the ends of the small ligature, the skin healed over the vessel, but a firm almost cartilaginous knot gradually formed, from the centre of which the bit of ligature was extracted five or six months afterwards by a small puncture. (For additional observations, see *Med. Chir. Trans.* vol. viii. p. 490. &c.)

Although Mr. Carwardine's case is a strong one in favour of this method, I apprehend that, on the whole, the cures on record thus effected cannot be said to have been completed sooner than others generally have been, in which one end of the small circular ligature was left for the removal of the noose. Thus, in two cases, where the practice was tried by Mr. Norman, of Bath, the results were by no means encouraging. In one of these instances, a part of the wound appeared to have united by the first intention, but matter afterwards formed, and it was a considerable time before the ulcer healed. The ligature was never seen to come away; but from the circumstance of the suppuration, Mr. Norman apprehends that it must have been voided. In a second example, the attempt to procure a permanent adhesion of the parts over the ligature did not succeed; a long and troublesome suppuration ensued, and the

wound was not healed till the latter end of April, though the operation was done on the 7th of March. (Norman, in *Med. Chir. Trans.* vol. x. p. 120, 121.) As catgut, however, was employed for the ligatures in these two operations, I do not know that it is fair to consider the method exactly like that recommended by Mr. Lawrence, who particularly directs very small ligatures of dentist's silk to be used. But, besides the different material employed, we are left uninformed of the thickness of the catgut; and, in this respect also there would probably be no greater similarity between the ligatures of these gentlemen, than there was in regard to the substances of which such ligatures were made. In favour of catgut, as a ligature, when the ends of it are to be cut off, a case published by Sir Astley Cooper deserves particular notice. The wound was found completely united on the fourth day after the operation, notwithstanding the patient was eighty years of age. The catgut, previously to its application, was softened in warm water. The recovery was complete; a fact, strongly proving the propriety of not rejecting an operation on account of age, if no other objection exists. (See *Surgical Essays*, part i. p. 126.) Sir Astley afterwards renounced both the use of catgut ligatures, and the plan of cutting off both ends of each ligature. With respect also to silk ligatures, it seems that little abscesses and hard knots occur even after their use in this manner, and these inconveniences have deterred surgeons generally from adopting the innovation. M. Manec tried the plan with ligatures composed of various animal substances, silk, catgut, filaments of nerves, tendons, &c.; and the result was, that the wound was never healed by adhesion over the extraneous substance, without abscesses afterwards forming for its discharge. Dupuytren observed the same thing. Lisfranc was a witness of two cases, in which the ligature was not absorbed, and severe consequences ensued. (*De l'Oblitération des Artères*, p. 55.) Some American surgeons, and especially Drs. Physic and Levert, tied the artery with lead, gold, silver, or platina wire, and then cut off the ends of such ligature. They were led to adopt this plan by the consideration of the little irritation sometimes resulting from the presence of a metallic substance in the textures of the body, as illustrated in gunshot wounds. In experiments on animals, the artery was obliterated by the metallic wire, the part of which, left in the wound, became inclosed in a kind of little cyst, where it remained without inconvenience. It does not appear that the practice was ever tried on the human subject. However, I join Lisfranc in the belief, that if it were tried, it would be found liable to the objections urged against silk and catgut ligatures used in this way. (*De l'Oblitération des Artères*, p. 57.) Be it recollected also, that a bullet, or other metallic body, only occasionally lies in parts without causing inconvenience: much more frequently it tends to make its way outward, and bring on suppuration and ulceration. I coincide, then, with M. Lisfranc, and the great body of English and French surgeons, that, as the plan of removing both ends of the ligature brings no advantage to counterbalance its inconveniences, it should be relinquished, and the preference given to the method of cutting off only one end, and leaving the other hanging out of the wound. (*Op. cit.* p. 58.)

In cases of aneurism, a single small ligature, composed of dentist's silk, common silk, thread, inkle, or twine, is now usually preferred by the majority of surgeons in England; but, as the right qualities of ligatures are elsewhere considered (see HEMORRHAGE AND LIGATURE), I need not here dwell upon the subject. It is not meant to assert, that the use of a single ligature is never followed by secondary hemorrhage; for this would be untrue. The accident, I believe, will sometimes happen after this, or any other mode, under certain circumstances, and in unfavourable subjects. A fact of this kind we find recorded, which happened in the practice of a truly eminent and experienced surgeon (see *A. Burns on Diseases of the Heart*, p. 230.); but, it appears to me, that, *ceteris paribus*, a single small ligature, applied with as little disturbance and detachment of the artery as possible, will be more rarely followed by secondary hemorrhage, abscesses, sinuses, &c., than any other known method. Thus, in the several cases, reported by Mr. Norman, the single ligature was never followed by any of those inconveniences which, he justly thinks, will be rarer after this practice than any other, "if the artery be not removed from its situation, or more detached, than the ligature separates it." (See *Med. Chir. Trans.* vol. x. p. 123.)

I have already insisted on the importance of tying a sound portion of the artery. Even a dilatation of it, unattended with calcareous or atheromatous depositions, is unfavourable to the success of the ligature. M. Lisfranc, in one instance of carotid aneurism, had only room for a ligature on a dilated portion of the common carotid, between the aneurism and the sternum: in a few days the artery gave way below the ligature, which had not quitted its place. (See *Lisfranc, de l'Obturation des Artères*, p. 65.)

Before entering into the consideration of particular aneurisms, I wish to mention a few other circumstances, worthy the attention of every practical surgeon. The first is, the partial entrance of blood into the aneurismal sac, after the artery has been tied at some distance from the tumour. This fact was first particularly pointed out, and its reasons explained by Sir E. Home, who published three examples of its occurrence. (See *Trans. for the Improvement of Med. and Chir. Knowledge*, vol. i. p. 173. and vol. ii. p. 239.) But I believe that it had never been considered with due attention, until Mr. Hodgson made it one of the subjects of his reflections in his valuable treatise.

"When an artery is tied close to an aneurismal sac, the ingress of blood into the latter is in most instances prevented; the coagulum, which it contains, is absorbed, and the membranes of which the sac is composed, gradually contract, until its cavity is permanently obliterated. But, when the artery is tied at a distance from the disease, the ingress of blood into the latter is not altogether prevented; for, the anastomosing branches, which open into the trunk, below the seat of the ligature, convey a stream, which passes through the aneurism. The impulse of this current, however, is so trifling, that the enlargement of the sac not only ceases, but the deposition of coagulum in it increases, in consequence of the languid state of the circulation. The coagulum accumulates, until the cavity of the sac, and the mouth of the artery leading into it, are obliterated," &c. (See *Hodgson on the Diseases of Arteries*, p. 266.)

This fact, which is of great importance, both in a practical and a pathological point of view, is proved (says this gentleman), 1st, by the occasional recurrence of pulsation in the tumour after the operation; 2dly, by cases in which the cavity of the sac has been exposed, and hemorrhage has been the consequence; and, 3dly, by dissection, in which it has been found, that the cavity of the aneurism, as well as that of the artery, from which it originated, was pervious, from the part which was obliterated by the direct operation of the ligature. For a detail of the facts relative to this interesting point, the reader is referred to Hodgson's valuable publication (p. 267. *et seq.*)

Some very uncommon instances are recorded, in which the return or continuance of pulsation in the tumour is said to have prevented the cure; the aneurismal sac having begun to enlarge again. The two cases of this kind, however, which happened in the practice of Pott and Guerin (*Trans. of a Soc. for the Impr. of Med. and Chir. Know.* vol. i. p. 172.; and *Journ. de la Soc. de Santé*, No. iii. p. 197.), cannot be well depended upon, as it may be doubted whether the artery was really tied. Some better established facts, relating to this part of the subject, have been very recently published. One is a case by Dr. Monteath, jun. of Glasgow, which is very remarkable; as the disease, viz. a popliteal aneurism, recurred nine months after the femoral artery had been unequivocally tied in the upper third of the thigh. On the 27th of February, 1819, this gentleman performed the operation, using a single ligature; the pulsation of the tumour in the ham instantly ceased; and the wound healed by the first intention, except where the ligature was situated, which came away on the thirtieth day. By this time the tumour was diminished to one half of its original size, and, in two months more, only a hard knot was perceptible, in which no pulsation whatever could be felt. After the considerable lapse of time above specified, the patient informed Dr. Monteath, that the tumour had reappeared, being rather larger than a plum. The pulsation in it was distinct, though not so strong as in ordinary aneurism. As the size of the swelling, and strength of the pulsation, increased gradually, a compress and bandage were applied, without confinement; but, as this treatment was ineffectual, the patient was afterwards kept in bed, bled, and put on a spare diet. A thick compress was placed over the tumour, and the limb was firmly bandaged from the toes to the groin. A trial of this plan for three days, not having produced any benefit, a tight tourniquet was applied over the tumour; but the pain was such in half an hour, that the instrument was taken off, from which moment no pulsation was felt. Next day the tumour not only did not throb, but had a firm feel; and, the bandage being continued, the cure was gradually completed. Had the disease not yielded to these means, Dr. Monteath meant to have tied the inguinal or external iliac artery, with the view of cutting off the supply of blood to the sac, through the anastomosing branches. (*Scarpa on Aneurism by Wishart*, p. 510—512. ed. 2.)

The following cases were mentioned by Sir Astley Cooper: A man underwent the operation for aneurism; the femoral artery was tied; the pulsation ceased; and the patient in a little while

was supposed to be cured of the aneurism, and discharged. Upon his return to labour, however, a swelling arose in the ham, without pulsation. The swelling subsided in consequence of rest; but afterwards, while the man was at work, the swelling returned with great pain. At length, as Sir Astley conceived that there was no prospect of the limb becoming useful again, it was amputated. Upon an examination of the parts, he found that the femoral artery, below the place of the ligature, had been conveying blood. It does now and then happen (says he), that a blood-vessel will arise from the artery close above the ligature, and pass into the artery immediately below it, by which means the circulation is produced. Sir Astley then referred to a specimen in the hospital museum, where this fact is illustrated in the brachial artery. (See *Lancet*, vol. i. p. 298.) Mr. Jeffreys had a gardener under his cure in St. George's Hospital, who had been operated upon by Mr. Gunning for a popliteal aneurism four years previously, and which appeared to have been cured; but the tumour returned a few weeks before the patient's re-admission. The limb was amputated, but the result was fatal. In the *post mortem* examination, the femoral artery was found obliterated for the space of half an inch, at the part where the ligature had been applied four years previously; and immediately below the impervious part, two branches, equal to half the diameter of the femoral artery, were observed to enter the continuation of that trunk. It was inferred, that the circulation through the aneurism had never been wholly suspended, and that the disease was a reproduction of the original tumour. (See *Guthrie on Dis. of the Arteries*, p. 157.)

The external iliac artery was taken up by Mr. Norman, of Bath, for the cure of an inguinal aneurism, and when the collateral circulation was fully established a few days after the operation, the tumour was again supplied with blood in sufficient quantity to produce a distinct pulsation; "a fact (says Mr. Norman) of practical importance, as it shows, that though the ligature on the iliac artery stops the direct influx of blood into the tumour, and is the means by which the disease is cured, yet that there exists a necessity for employing strict rest, the antiphlogistic regimen, and, in some cases, the abstraction of blood, to assist nature in her operation of obliterating the aneurism." And, in another instance, after the same gentleman had tied the femoral artery for the cure of popliteal aneurism, the pulsation, though stopped for a time in the tumour, afterwards recurred in such a degree, that much doubt was entertained whether the disease would have been cured by the ligature on the femoral artery, had not continued and rather powerful pressure been adopted. (*Med. Chir. Trans.* vol. x. p. 99, 118, &c.) Mr. Briggs also had a case exemplifying the recurrence of a popliteal aneurism some time after an apparent cure by the operation, and the successful employment of pressure on the artery in bringing about a permanent stoppage of the renewed pulsation, and the removal of the tumour. (See *Guthrie on Dis. of the Arteries*, p. 157.) Another instance of the good effect of this practice, I shall presently notice: it was in a case under Mr. Liston.

M. Roux, in a late work, has offered some criticisms on the English method of operating for aneurisms. It would hardly be fair play to en-

deavour to offer a serious refutation of them, because, when he wrote, it was his misfortune not to be duly informed of all the facts and experiments recorded in the inestimable treatise on hemorrhage by the late Dr. Jones. "Still less confident than we are (says M. Roux) in the treatment by compression and in the use of topical remedies for the cure of external aneurisms, the English surgeons have immediate recourse to the operation with the ligature. Hunter's method is that which they universally practise. They will not even allow, that there are any cases in which the operation by opening the sac should be preferred. And it is singular, the very same motive, which would incline us in some cases of aneurisms, properly so called, to adopt the operation of opening the sac, is alleged by the English surgeons as a circumstance in favour of the Hunterian method. Let us suppose an aneurism so formed that near the centre of the tumour, or rather near the opening, by which the artery communicates with the swelling, are situated the orifices of the collateral arteries, which would be useful for the re-establishment of the circulation. Here, it is clear that in practising the operation by the Hunterian method, that is to say, in tying the artery above the tumour, the last ramifications are not indeed sacrificed; but the orifices and first branches of these collateral arteries. Let there be, for example, at the upper part of the femoral artery an aneurism, which, though formed originally below the origin of the profunda, now extends above it. Here it is manifest that, in tying the femoral artery above the swelling, we should lose the important resource of the profunda for re-establishing the circulation in the lower part of the limb. The desire and hope of saving the profunda would, in such a case, make us adopt the operation of opening the sac, in preference to the Hunterian method; and Scarpa himself, so great an advocate for this last mode,—Scarpa, who seems only to have composed this work to cry up this method, makes an exception of the case, which I have just been supposing. The English surgeons, on the contrary, would urge the following objection to the operation by opening the sac in this and other analogous examples. They contend, that the ligatures would be applied too near to the origin of the collateral arteries, which are to receive the blood after the operation. They are prepossessed with the idea, that, when an arterial trunk is tied at a given point, the too great proximity of the principal collateral arteries disposes to subsequent hemorrhage." &c. (p. 256, 257.), a circumstance which M. Roux seems to doubt.

Now, before attempting to reply to these observations, we ought to know what exact distance Roux means, when he speaks of the profunda, or a large collateral artery, originating near the opening by which the aneurism communicates with the main artery. Here he is not at all precise; and were he to tie the femoral artery immediately below the point where the profunda arises, he would expose his patient to great danger of bleeding. I say this, well aware of the case which he has adduced to prove the contrary. In the example brought forward, he applied several ligatures (p. 260.), some of which were the *ligatures d'attente*, or loose ligatures left ready to be tightened in case of need. These were of course higher up than the ligature which was tightened. It is

therefore impossible that this last could have been close to the origin of the profunda. There must have been room left for the application of the *ligatures d'attente*; and be it also recollected, that when this operation was done, the French still persisted in the use of large flat cords, and not small firm round ligatures, which are now found to be most advantageous. (See HEMORRHAGE.) In that article, it is explained that the nearness of a collateral vessel impedes the formation of the internal coagulum, which has a material share in the process by which the artery is closed.

With respect to the circumstance of hemorrhage being more likely to follow, when the ligature is placed close below, than at some distance from a great collateral artery, there cannot be a doubt of the fact. M. Roux, when in London, saw an occurrence of this kind himself, and has published it in his book. It was a case in which Sir Astley Cooper tied the external iliac artery; but the patient died of hemorrhage a fortnight afterwards, and, on opening the body, it was ascertained that the obturator artery, which usually arises either from the trunk of the internal iliac, or from the epigastric, proceeded from the external iliac, and arose immediately above the point to which the ligature was applied. (See *Parallèle de la Chir. Anglaise avec la Chir. Française*, &c. p. 278, 279.)

From a preparation, spoken of by Mr. Travers, from others in different museums, especially in that of the London University, and from some experiments which were made, it would appear that the presence of a collateral branch hinders the formation of the internal coagulum, but will not always prevent the closure of the vessel by the adhesive inflammation. In the preparation referred to by Mr. Travers, a ligature was applied to the external iliac, between the epigastric and circumflex iliac arteries, "and having been in contact with the former at the angle which it makes at its origin from the iliac, ulceration had taken place, and the bleeding had proved fatal. *There was no coagulum formed in the iliac trunk*, though the operation had been performed several days, the circulation through the epigastric having continued. *But the lymph-plug at the seat of the ligature on the iliac artery was complete.*" (*Med. Chir. Trans.* vol. vi. p. 656.) Indeed, it must be admitted that the fluidity of the blood does not prevent the adhesive process, a fact which, as Mr. Travers observes, is also proved by the indirect obstruction of a vessel, by means of a temporary ligature, or compressor. When, therefore, the vicinity of a large branch to the ligature is spoken of as a circumstance conducive to secondary hemorrhage, I mean that it is so inasmuch as the internal coagulum is useful in promoting the closure of the vessel, and its formation is prevented.

It was either Braslor or Desault, who first conceived, that, when an aneurism was so situated, that a ligature could not be applied to the artery leading to the swelling, a cure might possibly arise from tying the vessel on that side of the tumour, which was most remote from the heart. Desault conjectured that, by this means, the circulation through the sac would be stopped, the blood in it would coagulate, that the circulation would go on by the collateral arteries, and that the tumour would be finally absorbed. Deschamps tied the femoral artery below an inguinal aneurism, but the progress of the disease, instead of

being checked, seemed to be accelerated by the experiment. The operator was obliged, as a last resource, to open the tumour, and try to take up the vessel. In this attempt the patient lost a large quantity of blood, and died eight hours afterwards. (See *Œuvres Chir. de Desault par Bichat*, t. ii. p. 563.; and *Recueil Périodique de la Société de Médecine de Paris*, t. v. No. 17.)

The operation of tying the artery below the tumour was repeated by Sir A. Cooper, not for an aneurism of the femoral artery in the groin, but for an aneurism of the external iliac, where tying the artery above the swelling was impracticable. The femoral artery was therefore tied immediately below Poupert's ligament, between the origins of the epigastric and the profunda. The pulsations of the tumour continued; but the progress of the disease was checked. After a time, indeed, the swelling decreased, and this in so considerable a manner, that hopes began to be entertained that perhaps the external iliac artery might soon admit of being tied above the disease. The ligatures came away without any unfavourable occurrence; and when the wound was healed, the patient was sent into the country for the benefit of the change of air. Afterwards, however, the tumour gave way; an extravasation of blood took place in the cellular membrane of the pelvis, and the patient died. Sir A. Cooper had no opportunity of seeing the case; and as the body could not be opened, further particulars were not obtained.

I believe no additional trials of this practice were made in any part of the world, and that, in fact, the general feeling of the profession was decidedly against it, until my friend, Mr. Wardrop directed his particular attention to the subject, and both by reasoning and facts exemplified that Braslor's method of operating ought to be adopted in certain aneurisms, the circumstances of which forbid the application of a ligature on the cardiac side of the tumour. Experience has amply proved what I have already repeatedly mentioned, that, after the Hunterian operation, some flow of blood frequently continues through the aneurismal sac, owing to the anastomoses; but that the impetus of the stream having been sufficiently reduced by the effect of the ligature, the curative process is not prevented from taking place. The pulsation, which is sometimes felt for the first few days, at length subsides, in consequence of the circulation being stopped by the increased quantity of coagula, and the tumour begins to diminish. It is from facts of this kind that Mr. Wardrop deduces what he calls "a new principle for operating in aneurisms, so situated as hitherto to have been considered beyond the reach of art, and to which the Hunterian principle of operating is totally inapplicable." (*On Aneurism*, p. 15. 8vo. Lond. 1828.) Mr. Wardrop observes, that the changes produced by Braslor's method, both in the artery and the sac, are precisely those which nature employs when she cures the disease by a spontaneous process. No sooner is the ligature applied on the distal side of the aneurismal tumour, than, as after the Hunterian plan, the anastomosing vessels dilate, and perform the function of the obliterated or obstructed trunk. The cases in which the operation has been done, prove also what would not have been expected, that the tumour, directly after the application of the ligature, diminishes, instead of undergoing enlargement. "If the circulation be turned into

a new channel, and if that channel completely fulfil the purpose, the sac, with its contents, as well as the portion of artery extending between the aneurism and the ligature, and also the blood contained in it, will now be in a passive state; and though the blood will continue, for a certain time, to be influenced by the impulse of the circulation, carried on in that part of the vessel, which passes into the tumour, still its motion must become not only languid, but its current irregular, a state which, we know, admits of its speedy coagulation. Whenever the coagulation of the blood does take place, then the cure of the aneurism may be said to be accomplished; the sac will contract; the coagulum will be absorbed; some portions in contiguity with the sac will become organized, and consolidate; others, if the quantity be very large, will escape by a process of ulceration through the skin; and ultimately, a gradual coalescence of the tumour will thus take place." (*Wardrop*, p. 20.) In the summer of 1825, this gentleman first tried Brasdor's method. The case was a carotid aneurism in a female seventy-five years of age. The disease was so close to the clavicle, that it was quite impracticable to tie the vessel on the cardiac side of the tumour. Immediately the artery was tied, the swelling underwent a diminution. On the fourth day, it had lessened by one third. Afterwards the throbbing continued strong for a few days, at the expiration of which it became obscure, and at the same time the tumour began to diminish again. Previously to the complete cure, ulceration occurred, and several large masses of coagulated blood were discharged, along with some healthy pus. Three years after the operation, the patient continued to enjoy good health.

December 10. 1826, Mr. Wardrop attempted a similar operation for the cure of a carotid aneurism in another woman, aged fifty-seven. Some reduction of the throbbing, and other relief, are stated to have ensued; but the patient died of a complication of complaints on the 23d of the following March, 1827. "Up to the day of her death, a tumour remained in her neck, of about the bulk of an almond, which pulsated strongly, felt very thin in its coats, and its contents could be readily squeezed out of it, but returned rapidly when the pressure was removed." (P. 33.) In the dissection, it deserves notice that the carotid was found completely pervious, and that no cicatrix, nor other appearance, enabled Mr. Bennet to ascertain the precise point to which the ligature had been applied. (P. 35.) These circumstances might raise a doubt about the artery having been tied at all; but, supposing the ligature to have been duly applied, they prove to my mind the failure of the operation, inasmuch as the tumour and carotid artery were probably in almost the same state as if nothing had been attempted. The blood passed freely through them, and was not compelled to circulate through new channels. Without wishing, however, to enter into the question whether the artery were tied or not, I shall dismiss this example with two plain inferences: first, that, if the artery were tied, the operation failed to bring about the desired obliteration of the vessel, and coagulation of the blood in the swelling; secondly, that if it were not tied, what was done is neither favourable, nor unfavourable, to the practice of which we are now considering the merits. A third example of

the operation is reported in vol. xii. of the *Lancet*. The carotid was tied above the aneurism by Mr Lambert, March 1st, 1827, in the presence of Mr. Wardrop, Mr. B. Cooper, and Mr. Callaway. On the third day, the tumour seemed much consolidated, and reduced in size. On the tenth day, there was some bleeding from the wound; but it was suppressed by the application of a compress wet with cold water; and, in a few days the swelling had entirely disappeared, and all that could be felt of it, on pressing the finger deeply down, was a small hard tumour, having a very faint undulatory thrill. Unfortunately, this patient, also a female, fell a victim to hemorrhage on the 1st of May, in consequence of ulceration extending from the cicatrix through the platysma myoides to the artery. Without detailing other appearances noticed in dissection, suffice it to mention, that "at the root of the right common carotid artery was a consolidated tumour, of a pyramidal shape. A probe could not be passed upwards from the arteria innominata, and water forcibly injected at this part would not pass, so completely and effectually closed was the lower part of the carotid artery. On making a longitudinal section of the tumour, we observed at its lower part a firm coagulum of blood, of about the size of a French olive. It accurately closed the opening at the base of the carotid, and it was this which afforded the resistance to the probe and injection of water passing upward from the arteria innominata. The coats of the artery surrounding the coagulum were thickened to about four times their natural size, and lined by a thin layer of fibrine. Above the coagulum, the coats of the artery were thickened to the extent of at least six times their natural size; and, in addition to a layer of fibrine closely adherent to the inner surface of the artery, and continuous with that surrounding the coagulum at the lower part of the tumour, there were three other layers of coagulated lymph. — At the upper part of the thickened portion of the artery, and just above the os-hyoideus, where the ligature had been applied, was an ulcerated opening on the anterior and tracheal surface of the carotid artery, a quarter of an inch in length, and rather less in breadth, covered by a coagulum of dark-coloured lymph, communicating with the opening in the integuments." This case, according to my judgment, must be received as another proof that Brasdor's method is capable of producing those changes in the tumour, artery, and circulation, which, if not succeeded by some accidental untoward occurrence, like the ulceration, leading in this case to fatal hemorrhage, may bring about the perfect cure of the disease.

If any doubt remained of this fact after the cases already cited, it would be dispelled by the results of some other trials of the practice, and more particularly by the history of the case of Mary Covis, aged 36, on whom Dr. Hush operated, under very trying and difficult circumstances, with complete success. (*Lancet*, vol. i. 1828.) The tumour extended from the clavicle, on the right side, upwards nearly to the os-hyoideus, pressing the trachea towards the opposite side, and passing under the sterno-mastoid muscle, to nearly an inch beyond its outer border. For nine days previously to the operation, the patient had not been able to swallow any thing; her respiration was alarmingly obstructed, and her voice nearly lost. In the

operation, the artery immediately above the aneurism was found dilated, not more than half an inch of its extremity being sound, and on this a single silk ligature was placed. As soon as the artery was tied, the tumour became softer and less prominent; and though she had not swallowed any thing for nine days, she took, before the wound was dressed, about ten ounces of wine and water. The operation was performed September 11th, 1827. April 19th, 1828, the woman was in perfect health. There was then scarcely a remnant of the tumour; the inordinate action of the heart had ceased; and respiration and deglutition were natural. The facts recorded seem to Mr. Wardrop to prove, that the future growth of an aneurismal tumour may be arrested, and the disease cured, by placing a ligature on the distal side of the sac, especially if no branch of the artery intervene between the sac and the ligature; for, if a considerable branch, and one that afterwards enlarged sufficiently, were to be in this situation, the operation would have little or no effect in producing any diminution of the impetus of the blood in the aneurism, from the cavity of which the blood would pass as freely into the enlarged branch, as it previously did along the trunk itself. Hence we see why Brasdor's operation will probably be attended with greater success on carotid than other aneurisms, the common carotid artery giving off in its course no branches which would interfere with the principles of the practice. Of five operations of this description, which had been performed on the carotid artery at the period when M. Lisfranc published on aneurism, three were completely successful; and of the other two, one performed by Mr. Wardrop in December 1826, and the other by Mr. Montgomery, at the Mauritius, in 1829, the particulars leave doubts whether, in one instance, the carotid artery had been tied, and whether the case was a carotid aneurism; and whether, in the other, the disease had not been an aneurism of the arch of the aorta. (See *L'Obli-tération des Artères*, pp. 100. 150.; and *Dupuytren, Clin. Chir.* t. iv. p. 593.)

Mr. Wardrop himself regards Brasdor's operation as not merely applicable to examples, in which it is impracticable to place a ligature on the cardiac side of the sac, but as likely to merit the preference when the tumour is large, and likely to inflame after the circulation through the sac is interrupted. This inference he makes from the fact of the immediate diminution of the swelling, which has usually followed the application of the ligature on the distal side of the aneurism. He also deems it probable that, in this method, there is less risk of hemorrhage from the part of the vessel on which the ligature is applied, than in the Hunterian operation. On the principle that it is sufficient for the cure of an aneurism, that the impetus of the blood through it be diminished, as the deposit of lamellated coagula within the sac will then increase, Mr. Wardrop urges the propriety of extending Brasdor's method to aneurisms of the arteria innominata; but, the very interesting and valuable cases, which are adduced in confirmation of his views of these particular aneurisms, will be more conveniently noticed in the sequel, where reference will also be made to some instances in which Brasdor's operation was practised for the cure of inguinal and subclavian aneurisms. As an admirer of the improvement of sur-

gery, I must not quit this part of the subject, without expressing the conviction that I entertain of the service which Mr. Wardrop has rendered the profession and the public by his able and enlightened view of a valuable operation, which, without his exertions and example, might long have remained quite neglected, or briefly mentioned in the history of surgery as a dangerous proceeding, unworthy of further trials.

That Brasdor's operation must sometimes fail, and particularly that it should have failed in the trials made of it by Deschamps, Sir A. Cooper, and Mr. Anthony White (see *Guthrie on Dis. of Arteries*, p. 90.), is not surprising. All these cases were inguinal aneurisms; and, it does not follow because the method will answer in carotid aneurisms, that it will answer in aneurisms in every other situation. I should say, indeed, that unless it retard, in a certain degree, the circulation through the sac, or bring on considerable and deep inflammation of the parts, it will never answer in any case; and how much the first of these occurrences must depend upon the existence, or not, of one or more branches between the sac and the ligature, is completely obvious. It is no trivial consideration, in favour of this method, that it had the approbation of the celebrated Dupuytren, who observes, that it is the only resource when an aneurism, situated too near the centre of the circulation, continues to increase, notwithstanding debilitating treatment and cold applications. As for the operations performed by Deschamps and Sir Astley Cooper, he expresses his conviction that their failure was owing to the origin of some important branch between the ligature and the aneurismal sac. When, however, no branch, capable of maintaining the circulation in the sac, is situated between this and the ligature, Dupuytren joins Wardrop, and others, in representing the probabilities of a cure as very great. The result, he adds, may also be favourable, although a few small branches may originate near the aneurism, because the coagulum, which is formed in the sac and internal trunk, will be likely to extend into them. But, says he, the presence of considerable branches, such as are capable of impeding the blood in the tumour from assuming a solid consistence, must evidently render the operation useless. Nay, what is worse, it may accelerate the fatal progress of the disease; because, when the blood has only a narrow outlet on the distal side of the aneurism, nature will make a perpetual effort to enlarge it, and in this process the sac will be more and more distended. (*Dupuytren, Clin. Chir.* t. iv. p. 592.) The example, in which this eminent surgeon tried this practice on the axillary artery, will be presently noticed. The fact of the general failure of Brasdor's operation when any considerable vessels arise from the sac, or artery, on the cardiac side of the ligature, and the greater success that has attended such operations when performed for carotid aneurism than any other form of this disease, seem to me to justify the view of the principles on which this operation sometimes brings about a cure, entertained by Hodgson, Wardrop, and Dupuytren. I make this remark, fully aware of the suggestion of Mr. Guthrie, that the cure, so far as it goes, is effected by inflammation of the artery and sac, and not by the mere coagulation of the blood in them. (See *Guthrie on Dis. of the Arteries*, p. 179.) He also enters into an inquiry,

how far the communicating of inflammation to an aneurism so near the heart as an aneurism of the innominate or lower part of the carotid, is an advisable proceeding. He argues, that too much inflammation kills the patient, while too little is insufficient to effect a cure. In support of his reasoning, Mr. Guthrie takes a different view of Mr. Montgomery's case from what that gentleman himself does, and on the following grounds. An aneurismal sac, of the size described in the first part of the case, never could disappear in four months by any of the processes of nature, or after any operation performed for its cure, with which we are at present acquainted; more particularly as the remains of the artery and vein were discoverable, although obliterated, by which I understand them to have become impervious. *There never was then an aneurism of the carotid; but, the aneurism, which was found to exist between the origin of the left carotid and the innominate, had formerly extended up the neck, so as to resemble an aneurism of the carotid.* The operation on the carotid gave rise to inflammation, which extended first to the arch of the aorta, and to the aneurismal sac, and afterwards along the aorta to the heart and pericardium, which, in the end, destroyed the patient." (See *Guthrie on Dis. of Arteries*, p. 198.) Whatever may have really happened in this instance, it will not form an adequate ground for the rejection of Brasseur's operation in examples where the aneurism is truly one of the carotid, and a ligature cannot be applied below the tumour. Indeed, M. Lisfranc argues, that Mr. Guthrie's objection of the inflammation being likely to be propagated to the heart, has no weight at all; for, says he, "if this consequence is so greatly dreaded after the ligature is placed on the distal side of the sac, how much more so must it be, when Anel's method is pursued! Besides, is the fear of such inflammation, which is after all very uncertain, a sufficient reason for renouncing the only hope of saving the patient?" (*Lisfranc, De Oblitération des Artères*, p. 97.)

The memorable instance, in which Sir A. Cooper tied the aorta, in a case of inguinal aneurism, extending very high up, and already burst, I shall notice under the head AORTA. There I shall also advert to my friend Mr. James's and Mr. Murray's repetitions of the same bold operation.

In this article I have not yet mentioned the proposal made by Dr. Jameson, of Baltimore, to substitute for the ligature a seton composed of thread, or of a piece of doe-skin. The carotid of a sheep was transfixed with a needle, armed with a slip of doe-skin of a conical shape, three lines broad at its greatest extremity. The two ends of it were cut off three lines from the vessel. There was no hemorrhage during the operation. The animal was killed on the 22d day; and the coats of the artery were found considerably thickened for an inch above and below the seton. On one side of the vessel, there was no trace of the wound; but, on the other, there was a slight depression, containing a yellowish substance, which proved to be a small particle of doe-skin. The parietes of the artery were in contact, and every where united, excepting a flattened aperture, capable of admitting a small probe. The same experiment was repeated on the carotids of dogs by Dr. Jameson, and also by M. Worms, at the Val de Grace, in Paris, with similar results. M. Amussat varied

the process by puncturing the artery with a curved needle, armed with a common thread, which was conveyed up within the tube of the vessel about an inch, and then brought out through the side of the vessel, by means of the needle. Then the ligature was drawn further up, till its lower end was entirely within the artery. A knot was next made near the vessel, and the rest of the ligature cut off. In small arteries, a clot was produced round the thread, and the artery became obliterated. In vessels above a certain size, no clot was found.

With respect to setons, as substitutes for the ligature in the treatment of aneurism, I am of opinion that they promise no advantage whatsoever, and, as being less likely to produce the desired obliteration of the artery, should never be employed on the human subject. I entertain the same opinion of acupuncture, which has been tried by M. Velpeau, M. Amussat, and Mr. Benjamin Phillips, on the arteries of animals. In some of these experiments, one or more needles or pins were thrust through the arteries without any preliminary exposure of these vessels; while, in others, the arteries were first laid bare. The accounts given of these experiments prove, that the obliteration of the vessel by the plan is a matter of great uncertainty; and that in several instances, where the attempt was made to transfix the artery through the undivided coverings, either it was not hit at all, or only pierced very near one of its sides. (*Lisfranc, De l'Oblitération des Artères*, p. 77.; also *Mr. B. Phillips on the Cure of Aneurismal Tumours without the Knife or Ligature*.) Besides, it is doubtful whether the arteries of the human body can be so easily rendered impervious, or the process of reparation be so favourably carried on in them, as in the arteries of animals. As Mr. Guthrie observes, it is probable that a simple puncture with a needle would sometimes heal; but he has seen two instances, "in which the femoral artery was wounded with a tenaculum, and ulceration followed by hemorrhage took place in both, requiring application of a ligature." (See *Guthrie on Dis. of Arteries*, p. 212.)

I shall finish these general observations on the treatment of external aneurisms, or such as admit more particularly of surgical treatment, with observing, that, in England, surgeons now lose few patients either from gangrene of the limb or secondary hemorrhage; and this, notwithstanding they may sometimes prefer applying a ligature above the profunda to cutting open the aneurismal tumour. I firmly believe, that such matchless success is to be ascribed to the perfection in their mode of operating; the choice of a proper kind of ligature; the right plan of applying it; the rejection of the employment of several ligatures at a time; the great care taken to promote the healing of the wound as quickly as possible; the avoidance of all unnecessary and hurtful extraneous substances in the wound; and, above all, the relinquishment of the formidable proceeding of cutting open the tumour.

In the consideration of particular aneurisms, I shall begin with those which may be cured by a surgical operation; and here we shall be fully satisfied that, "*l'art de guérir ne triomphe jamais plus heureusement que lorsqu'il peut employer la médecine efficace, c'est à dire, les moyens chirurgicaux ou opératoires.*" (*Pelletan, Clinique Chir.* t. i. p. 110.)

OF THE POPLITEAL ANEURISM, AND OPERATION FOR ITS CURE.

Notwithstanding the solitary example in which M. A. Severinus, early in the 17th century, tied the femoral artery near Poupart's ligament in a case of aneurism (*De Efficac. Med.* lib. i. p. 2. c. 51.), the practice of tying arteries wounded either by accident or in the performance of surgical operations, and even the plan of tying the brachial artery for the cure of the aneurism at the bend of the arm, were known long before the operation for the relief of the popliteal aneurism was attempted. The considerable size of the femoral artery, its deep situation, the urgent symptoms of the disease, and ignorance of the resources of nature for transmitting blood into the limb after the ligation of the vessel, are the circumstances which appear to have deterred former surgeons from this operation.

Valsalva treated popliteal aneurisms on the debilitating method, and published one or two equivocal proofs of its success. In Pelletan's first memoir on aneurism, and in the 3d vol. of Sabatier's *Médecine Opératoire*, as I shall hereafter notice again, are two cases of axillary aneurisms, which were cured by Valsalva's treatment. But, encouraging as such examples may be, experience is not yet sufficiently favourable to this practice to allow it to bear a comparison, in point of efficacy, with the surgical operation, or to justify the general rejection of this last more certain means of cure. As Pelletan admits, Valsalva's treatment is extremely severe; the event of it doubtful; and were the plan to fail, the patient might not be left in a condition to bear an operation, for the success of which it seems necessary that a certain strength of vascular action should exist, in order that the blood may be freely transmitted through such arterial branches as are to supply the places of the main trunk after it has been tied. The time, therefore, has not yet arrived when surgical operations for the relief of aneurisms can be relinquished. (*Clinique Chir.* t. i. p. 114.)

The cure of popliteal aneurisms by means of compression is occasionally effected; but it happens so seldom in these cases to claim a great deal of confidence, or to lessen in any material degree the utility and importance of operative surgery. Pelletan records the cure of one popliteal aneurism by compression and absolute repose, during eleven months (t. i. p. 115.); Boyer relates two instances (*Traité des Mal. Chir.* p. 204. t. ii.); one is mentioned by Richerand (*Dict. des Sciences Méd.* t. n. p. 96.); the practice of Dubois is said to have furnished several examples of the same success (vol. cit. p. 97.); and a case, in which Dupuytren effected a cure by compressing the femoral artery by means of an instrument applied just above the place where the vessel perforates the tendon of the adductor magnus, is detailed by Breschet (*Fr. Transl. of Mr. Hodgson's Work*, t. i. p. 249, &c.). Dupuytren's tournaient, improved by Colombat, was tried, however, by Professor Regnoli; and, although the greatest care was taken to tighten it only gradually, the part became so painful that, after two or three applications, the instrument was obliged to be discontinued. (See *Storia e Riflessioni intorno un Aneurisma Popliteo*, &c. p. 7. Svo. Pisa, 1833.)

The circumstances under which the employment of compression affords the best chance of success have been already mentioned, as well as

the prudence of assisting this plan with perfect quietude, venesection, spare diet, and cold anæsthetic applications, especially ice, which was first recommended by Donald Mouro, and subsequently praised by Guerin.

Aneurisms in general, and, among them, the popliteal case, are all attended with some little chance of a spontaneous cure; yet this desirable event is too uncommon to be a judicious reason for postponing the operation, especially as it is the usual course of the disease to continue to increase; while, in the early stage, the cure may be more speedily accomplished. In fact, when the patient is not too much debilitated, the experience of modern operators leaves no ground for apprehending, that the anastomoses will not suffice for the due nourishment of the leg, and consequently proves, that waiting beyond a certain time for the enlargement of the collateral vessels to take place is altogether an unnecessary and a disadvantageous method. Popliteal aneurisms, as well as other external tumours of the same nature, stand some chance of a spontaneous cure, when any cause induces a general, violent, and deep inflammation all over the swelling; for, then the communication between the sac and the artery is likely to become closed with coagulating lymph, and the pulsation of the tumour to be suddenly and permanently stopped. If, in this state, the disease sloughs, and the patient's constitution holds out, the coagulated blood in the sac and the sloughs are gradually detached, leaving a deep ulcer, which ultimately heals. An example, in which a popliteal aneurism was cured by such a process, is related in the *Trans. for the Improvement of Med. and Chir. Knowledge*, vol. ii. p. 268.

In former times, when all hopes of curing a popliteal aneurism by Valsalva's method, by compression, or a natural process, were at an end, amputation of the limb was considered as the sole and necessary means of saving the patient's life. But, about fifty years ago, the confidence of surgeons in the sufficiency of the anastomosing vessels for the continuance of the circulation began to increase; and, in opposition to the tenets of J. L. Petit and Pott, experience soon proved, that, in general, not only might the patient's life be saved, but his limb also, and this, without any operation that could be compared with amputation, in regard to severity. On looking back to the history of amputation, we shall find that A. N. Guenault was one of the earliest writers who disapproved of amputation as not truly necessary in cases of popliteal aneurism.

It is alleged that Teislere, Molinelli, Guattani, Mazotti, and some other celebrated Italian surgeons, were the first who ventured to tie the popliteal artery for the cure of aneurism. The path, as Pelletan remarks, had been pointed out to them by Winslow and Haller, whose valuable descriptions and plates of the arterial anastomoses about the knee-joint showed by what means the lower part of the limb would be nourished, after a ligation had been placed on the principal arterial trunk. For almost thirty years, however, the practice of tying the popliteal artery was confined to the Italian surgeons. Pelletan believes, that he was the first who attempted such an operation at Paris, nearly thirty years ago (alluding to about the year 1780, the *Clinique Chirurgicale* being dated 1810).

However, this operation of opening the tumour (the popliteal artery itself, was a severe a fatal proceeding, and does not admit of being compared with the Hunterian operation, in point either of simplicity, safety, or success, as I shall explain, after the detail of a few particulars relating to the popliteal aneurism.

On whatever side of the artery the tumour is produced, it can be plainly felt in the hollow between the hamstrings, and in general its nature is as easily ascertained by the pulsation in every part of it. In the early stage of spontaneous aneurism, the swelling is soft, not usually accompanied by pain, and capable of being lessened by pressure, and more particularly by compression of the artery above the tumour, whereby the flow of blood into it is stopped, or materially diminished. The pulsation then ceases, but is restored on the compression being removed; and with the return of the pulsation, and that of the swelling to its original size, a peculiar thrilling feel is experienced, arising from the passage of the blood into the aneurism again from the artery, and termed by the French *bruissement*, because attended with a confused rattling sound. After the swelling has existed a little while, the *bruit de soufflet*, or bellows sound, is likewise more audible, especially when the stethoscope is employed. At length, the tumour becomes firmer, and the blood cannot be entirely pressed out of it, because the interior of the sac is now more or less covered by solid lamellated blood. The patient, in order to avoid bearing much on the affected limb, limps in the early stage of the case; but, "as the aneurism increases, he does so from two causes,—the pressure which takes place on the nerves passing to the toes, and which gives rise to pain, not in the part affected, but in that to which the terminations of the nerves are distributed; and, from the same cause, giving rise to contraction of the muscles, and rigidity of the tendons passing behind the joint, the leg is permanently bent; the toes and leg are extremely painful; and the foot and leg, incapable of bearing the weight of the body, become swelled and oedematous." (See *Guthrie on Dis. of the Arteries*, t. i. p. 109.) Sometimes, however, the patient, even in the spontaneous form of the disease, does complain of great pain in the ham, and of numbness in the leg and foot, instead of pain in those parts. (See *Case by Collis, in Dublin Journ. of Med. Science*, vol. v. p. 33.) The symptoms of a popliteal aneurism, as they present themselves, when the sac gives way under the integuments and fascia, or under the heads of the gastrocnemius, I need not repeat, as they have been noticed in the general observations on aneurism. The progress of a popliteal aneurism differs in different examples; being sometimes slow, in other instances rapid. Mr. Collis had a patient with an aneurism in each ham, and the disease continued almost stationary from 1818 to 1833, during all which time so little inconvenience was experienced by the patient, that he was able to discharge the fatiguing duties of an infantry soldier. (See *Dublin Journ. of Med. Science*, vol. v. p. 32.) I had a patient with popliteal aneurism, who, in his business of an organ-builder, used to ascend ladders, and lead a very active life for a considerable length of time; indeed, until the sac gave way, and the disease changed into the diffused form. (See *Trans.* vol. xvi.) Though the disease may occur in the popliteal artery so

often as in the aorta itself, it certainly is seen more frequently in the former vessel, than any other branch derived from the aorta. As Sir E. Home has observed, this circumstance has never been satisfactorily explained; and, what is rather curious, in many instances of this disease, the patients have been coachmen and postillions. Morgagni found aneurisms of the aorta most frequent in guides, post-boys, and other persons who sit almost continually on horseback; a fact, which he imputes to the concussion and agitation to which such persons are exposed. Some allusion to this subject has already been made in the foregoing pages. Whether an explanation of the frequency of popliteal aneurisms can be correctly referred to the force with which the blood must be impelled against the bend of the artery when the knee is in a state of flexion, seems questionable, though it is on a similar principle that the great frequency of aneurisms of the curvature of the aorta is attempted to be solved. (*Home in Trans. for the Improvement of Med. and Chir. Knowledge*, vol. i., &c.; and *Monro in Ed. Med. Essays*, vol. v.) Were this the only, or even the principal cause, surely one would have reason to expect aneurisms to be at least as frequent in the axilla, and in the bend of the elbow, as in the ham.

The popliteal aneurism was once supposed to arise from a weakness in the coats of the artery, independently of disease. If this were true, we might reasonably conclude, that, except at the dilated part, the vessel would be sound. Then the old practice of opening the sac, tying the artery above and below it, and leaving the bag to suppurate and heal up, would naturally present itself. As the arterial coats were found to be altered in structure higher up than the tumour, and the artery, immediately above the sac, seldom united when tied, but, when the ligature came away, the patient was destroyed by hemorrhage, Mr. Hunter concluded, that some disease affected the coats of the vessel, before the actual occurrence of aneurism. Dissatisfied with Haller's experiments on frogs, showing that weakness alone could give rise to aneurism, he tried what would happen in a quadruped, whose vessels were very similar in structure to the human. Having denuded above an inch of the carotid artery of a dog, and removed its external coat, he dissected off the other coats, layer after layer, till what remained was so thin, that the blood could be seen through it. In about three weeks, the dog was killed, when the wound was found closed over the artery, which was neither increased, nor diminished in size.

It being conjectured that the prevention of aneurism, perhaps, arose from the parts being immediately laid down on the weakened portion of the artery, Sir E. Home stripped off the outer layers of the femoral artery of a dog, placed lint over the exposed part of the vessel to keep it from uniting to the sides of the wound, and, in six weeks, killed the animal, and injected the artery, which was neither enlarged nor diminished, its coats having regained their natural thickness and appearance.

These experiments strengthened Mr. Hunter's belief, that aneurismal arteries are diseased; that the morbid affection frequently extends a good way from the sac along the vessel; and that the cause of failure, in the old operation, arose from tying a diseased artery, which was incapable of

waiting before the ligature separated. These reflections led him to propose taking up the artery in the anterior part of the thigh, at some distance from the diseased portion, so as to diminish the risk of hemorrhage, and be enabled to get at the vessel again, in case it should bleed. The stream of blood into the sac being stopped, he concluded that the sac and its contents would be absorbed, and the tumour gradually disappear, so as to render any opening of it unnecessary.

The first operation of this kind, ever done, was performed on a coachman, by Mr. Hunter, in St. George's Hospital, December, 1785. An incision was made on the anterior and inner part of the thigh, rather below its middle, which wound was continued obliquely across the inner edge of the sartorius muscle, and made large, in order to facilitate the performance of whatever might be necessary. The fascia covering the artery was then laid bare, for about three inches, after which the vessel itself could be felt. A cut, about an inch long, was then made through the fascia, along the side of the artery, and the fascia dissected off. Thus the vessel was exposed. Having disengaged it from its connections by means of the knife and a thin spatula, Mr. Hunter put a double ligature under it with an eye-probe. The double ligature was then cut, so as to make two separate ones. The artery was now tied with both these ligatures, but so slightly as only to compress the sides together. Two additional ligatures were similarly applied a little lower, with a view of compressing some length of artery, so as to make amends for the want of tightness, as it was wished to avoid great pressure on any one part of the vessel. The ligatures were left hanging out of the wound, which was closed with sticking-plaster. On the second day the aneurism had lost one third of its size, and, on the fourth, the wound was every where healed, except where the ligatures were situated. On the ninth, there was a considerable discharge of blood from the apertures of the ligatures, but it ceased on applying a tourniquet, and did not recur. On the fifteenth day after the operation, some of the ligatures came away, followed by a small quantity of matter; and about the latter end of January, 1786, the man went out of the hospital, the tumour having become still less. In the course of the spring, abscesses in the vicinity of the cicatrix followed, and some pieces of ligature were occasionally discharged. In the beginning of July, a piece of ligature, about one inch long, came away, after which the swelling went off entirely, and the man left the hospital again on the 8th perfectly well, there being no appearance of swelling in the ham. This subject died of a fever in March, 1787, and, on dissection, the femoral artery was found impervious from the giving off of the arteria profunda down to the place of the ligature, and an ossification had taken place for an inch and a half along the course of this part of the vessel. Below this portion, the vessel was pervious, till just before it came to the aneurismal sac, where it was again closed. What remained of the sac was somewhat larger than a hen's egg, and its communication with the popliteal artery was obliterated. The rest of the particulars of the

operation are very interesting (See *Trans. for the Benefit of Med. and Chir. Knowledge*, vol. i.

This celebrated case completely established the important fact, that simply taking off the force of the circulation is sufficient to cure an aneurism, the tumour being afterwards diminished and removed by the action of the absorbent vessels. In order to confirm the same fact, Sir E. Home related a case of femoral aneurism, which got well without an operation, but, on a similar principle to what occurs when the artery is tied. A trial of pressure had been made without avail. The tumour became very large, and such inflammation took place in the sac and integuments, that mortification was impending; no pulsation could now be felt in the tumour, or the artery above it. The correct inference of Sir E. Home was, that a coagulum, which we know always occurs in an artery previously to mortification, seemingly to prevent bleeding, had formed in this instance, and, in conjunction with the effusion of coagulable lymph about the root of the aneurism, had kept the blood from entering the sac.

Mr. Hunter's second operation was on a trooper. Instead of using several ligatures, which were found hurtful, he tied the artery and vein with a single strong one; but, unluckily, the experiment was made of dressing the wound from the bottom, instead of attempting to unite it at once, and the result was, that the man died of hemorrhage.

After this case, Mr. Hunter's practice was to tie the artery alone with one strong ligature, and unite the wound as speedily as possible.

Having recorded Mr. Hunter's cases, which first established the present method of operating for the cure of popliteal aneurisms, I shall not repeat the strong reasons which exist against the employment of reserve-ligatures; metallic compressors; two ligatures, in the division of the vessel between them; the interposition of pieces of linen, wood, cork, agate, &c. between the knot and the vessel; the use of large ligatures; and other contrivances, the merits, or rather demerits, of which have been already fully considered in the preceding section. My next duty is to explain the method of performing the Hunterian operation, as brought to its modern state of improvement, and adapted to the wise principles which first emanated from the valuable experiments and investigations of Dr. Jones. (See HEMORRHAGE.)

In the arrangement of the assistants, one of whom should be so placed, that, if required, in consequence of any accidental wound of that vessel in the operation, he can compress the femoral artery as it passes over the brim of the pelvis; but, as Scarpa justly observes, no pressure of this kind is to be made, unless the accident referred to should happen, because the pulsations of the artery, inasmuch as they indicate the track of the vessel, must tend materially to facilitate the operation. The surgeon is to explore with his forefinger the course of the artery from the crural arch downwards, and when he comes to the place where the vibration of this vessel begins to be less distinctly felt, this point is to be fixed upon for the lower end of the external incision. This angle of the wound will fall nearly on the inner edge of the sartorius, just where this muscle crosses the track of the femoral artery, and at the very apex of the triangle formed by the convergence of the triceps and vastus internus. A little more than three inches above the place here fixed upon, the surgeon is to begin, with a con-

vex-edged bistoury, the incision through the integuments and cellular substance, and carry the wound down the thigh, in a slightly oblique line, from without inwards, so as to make it follow the course of the artery, as far as the apex of the above-mentioned triangular space, or the point where the vessel passes under the inner edge of the sartorius muscle. In order to make this first external incision with correctness, I consider it a good rule always to take particular notice of the line described by the sartorius on the thigh, the inner margin of which muscle, at the place where it meets the artery, as we have seen, forms at once the lower boundary of the incision, and an important guide to the vessel itself. By observing the track of the sartorius attentively, we shall likewise avoid all chance of making the wound too low down, so as to have this muscle intervening between the incision and the artery; a greater source of embarrassment in the operation, and of troublesome consequences afterwards, than, perhaps, any other error; for, when this has happened, and the surgeon has not room enough afforded by the higher part of the wound to get at the artery above the sartorius, he is compelled to dissect and raise up this muscle from its natural connections, ere he can plainly discover the vessel. This inconvenience made a deep impression on me in the first case, where I tied the femoral artery; for the intervention of the sartorius in a stout soldier, upon whom the operation was done, threw me into the dilemma of either dissecting at the outer edge of this muscle, and drawing it inwards, or of enlarging the wound upwards. The latter proceeding was that to which I gave the preference, because it seemed to me an excellent maxim in this operation, to avoid making any further detachment of parts from their natural connections than is absolutely necessary; and I knew, that when the wound was extended a little higher up, the artery would present itself more superficially, quite unconcealed by any muscle whatever. In fact, in the superior third of the thigh, the anterior surface of the artery is covered only by the common integuments, the superficial fascia, the inguinal glands, the fascia lata, a little cellular tissue, and the arterial sheath. But in the middle third of the limb, the vessel is more deeply seated, as, in addition to the skin, superficial fascia, fascia lata, cellular tissue, and arterial sheath, it is covered by the sartorius muscle, beneath which is a fascia composed of oblique fibres, passing from the tendon of the adductor longus and magnus muscles to the vastus internus. (See *Dr. Quain's Elements*, p. 506. ed. 2.) This last fascia begins superiorly at the point where the sartorius first passes in front of the artery, and is here thin; but, about the middle of the thigh, it is very dense. It terminates at the upper part of the inferior third of the thigh, in a well defined edge, beneath which passes the *nervus saphænus major*. If this fascia be divided, the femoral artery and vein will be exposed. (See *Harrison's Surgical Anatomy of the Arteries*, vol. ii. p. 136. ed. 2.) Anatomy teaches us, then, that the femoral artery may be more readily taken up in the superior third of the thigh than in the middle. Strongly, therefore, as my principles lead me to condemn Scarpa's modification of the ligature, his use of from four to six threads, and his interposition of a roll of linen between the knot and

the vessel, I feel pleasure in expressing my conviction of one excellence in his mode of operating; an improvement which is now obtaining, if it has not already obtained, the universal approbation of the surgical profession. This amendment consists in making the incision in the upper third of the thigh, or a little higher than the place where Mr. Hunter used to make the wound. Scarpa's reason for this practice is to avoid the necessity of removing the sartorius muscle too much from its position, or of turning it back, to bring the artery into view, so as to be tied. I have seen the best operators, even professors of anatomy, embarrassed, by having the sartorius muscle immediately in their way after the first incision; and as the vessel is more superficial a little higher up, not being covered there by the sartorius, or the dense fascia extended from the adductor muscle to the vastus internus lower down the thigh, while the place is further from the diseased part of the artery, and there is no hazard of the anastomoses failing to keep up the circulation, this part of Scarpa's practice is highly deserving of imitation.

"The part of the limb (observes Mr. Hodgson) in which the femoral artery can be tied with the greatest facility, is between four and five inches below Poupart's ligament. The profunda generally arises from the femoral artery an inch and a half, or an inch and three quarters, below Poupart's ligament; it very rarely arises so low as two inches. If, therefore, the ligature be applied to the femoral artery at the distance of four or five inches below Poupart's ligament, the surgeon will not be embarrassed by meeting with the profunda during the operation, and the chance of causing secondary hemorrhage, by tying the artery close to the origin of this vessel, will be obviated." (*On the Dis. of Arteries*, &c. p. 434.)

The trouble, arising from cutting too low down, so as to have the sartorius between the outer wound and the artery, may be more accurately estimated, when it is known that Desault, for the removal of this inconvenience, considered it right to make a complete transverse division of that muscle, a thing which, it is said, may be done without ill consequences. (*Boyer, Traité des Mal. Chir.* t. ii. p. 145.) I shall not presume, however, to second this last piece of advice, because the artery can always be taken up very well, without such a proceeding.

A few years ago, Mr. A. C. Hutchison published a tract, in which he is an advocate for the practice of making the incision at the outer edge of the sartorius, and then raising that muscle, and drawing it inwards, in order to arrive at the artery. This advice proceeded from the apprehension, that the plan of taking up the femoral artery at the inner edge of the sartorius was attended with risk of injuring the saphæna vein, and large lymphatics. (*Letter on the Operation for Popliteal Aneurism*, 1811.) When the operation is done low down the thigh, the same method is commended by Boyer and Roux. (*Nouveaux Elémens de Méd. Opératoire*, t. i. p. 729.) But, as operating in this situation is liable to the several objections of approaching too near the disease, of aiming at taking up the artery where it lies more deeply than it does higher up, and, of every inconvenience which may arise from the interposition, dissection, and reflexion of the sartorius muscle, the method

ought to be rejected, unless it can be proved that so many disadvantages are fully counterbalanced by other considerations. If the plan which I shall presently recommend be adopted, there will never be the slightest risk of wounding the saphena vein: and, therefore, I do not consider it advisable or necessary, for the avoidance of this accident, to make the wound *precisely* upon the sartorius, as my intelligent friend Mr. Hodgson suggests; a method attended with the inconvenience of having the fibres of that muscle between the external wound and the artery, and perhaps inconsistent with the excellent directions which he afterwards delivers, concerning the right mode of performing the external incision, when he says, with Scarpa, that this cut should be "continued down to the fibres, which form the inner margin of the sartorius." (*On Diseases of Arteries*, &c. p. 436.) Indeed, the sartorius crosses over the artery so obliquely, that while it is quite external to this vessel above, it covers it in the middle third of the thigh, and lies internally to it below.

Now, if the point where the inner margin of the sartorius first lies over the artery be the proper place for the lower termination of the external incision, we shall clearly be deviating from the precise course of the vessel by letting the higher portion of the wound be over the fibres of that muscle. And, when it is further reflected, that the serious evils of wounding the trunks of the lymphatics in this operation are not demonstrated in modern practice, while the saphena vein may always be avoided with certainty and facility, I cannot admit, that there is any solid reason for letting the situation and direction of the external wound be determined by such apprehensions. At all events, for the motives above explained, it should be a fixed maxim in the operation, in the upper third of the thigh, never to extend the wound lower than the point where the inner margin of the sartorius crosses the artery; and then all detachment and displacement of this muscle will be unnecessary, and every embarrassment, which might proceed from its interposition between the outer wound and the artery, will be completely avoided. The first incision should be made in the direction of the artery, that, is along part of a line extending from the middle of Poupart's ligament to the point where the inner margin of the sartorius and the artery meet; or, as I should say, in a direction inclined a little more out, in order to avoid the risk of cutting the great saphænal vein where it is passing through the fascia lata to discharge its blood into the femoral vein. In the living subject, the course of the great saphænal vein is often rendered very conspicuous when distended with blood, and its exact situation should be attended to by every operator.

With the view of preventing injury of the femoral vein, Mr. Carmichael recommended a plan, which is now always followed, namely, that of introducing the needle on the pubic side of the artery, where the vein presents itself to view, and can be most easily avoided. He remarks, that the only part of the thigh, from Poupart's ligament to the tendon of the adductor magnus, in which the femoral vein is not completely covered by the artery, lies within the space which extends from Poupart's ligament to the point where the artery meets the sartorius muscle. At the part of this space, most distant from Poupart's ligament, the vein begins to dis-

close itself at the pubic side of the artery, from beneath which it emerges more and more as it ascends. (*See Trans. &c. of the Fellows, &c. of the King's and Queen's College of Physicians, Ireland*, vol. ii. p. 357.)

The femoral vein, in a few rare instances, has been found double. Thus, in the case recorded by Mr. Macready, the popliteal vein, in the lower part of the popliteal space, "consisted of but one trunk, as usual, and held its natural situation, with respect to the surrounding parts; but, in the upper third of the popliteal space, it divided into two branches, which passed off at an acute angle, having one of the muscular branches supplied by the popliteal artery in the apex of the angle. The veins then ascended; one, the internal and posterior, holding its usual position, with respect to the artery, namely, posterior to it at first, but getting internal as it ascended; the other branch crossed the artery, and ascended anteriorly, and a little externally to it, which relation it held until it arrived at the upper third of Scarpa's space, where it crossed the artery again, and then, uniting with the internal, formed the femoral, which appeared dilated into a sinus. The vein then had the usual relation to the artery, but was somewhat larger." (*Macready, in Dublin Journ. of Med. Science*, vol. ix. p. 318.) In the same volume, p. 325., Mr. Goodall has recorded another example of double femoral vein. In the latter, the external branch crossed the artery twice. This occasional variety in the femoral vein is important, in relation to the operation for popliteal aneurism.

The skin and superficial fascia are to be divided, in the situation and to the extent above specified, down to the femoral fascia, under which the artery lies, and may be felt beating. The next object, therefore, is to divide the fascia, which is here much thinner than at the outer side of the limb, and may be cut with another stroke of the bistoury; or, (what is safer, with the view of abstaining from all chance of wounding the artery,) a slight cut may first be made in the fascia, the division of which may then be made to the requisite extent by introducing under it a grooved director, on which the further incision may be made with perfect security. The fascia is to be divided in the direction of the external wound; but, to what extent, is a point on which surgical writers differ, and, indeed, they must here differ, so long as they are not unanimous about the method of applying the ligature round the artery; because, if it be intended to use a broad ligature, with a cylindrical piece of linen interposed between it and the artery, or especially if it be designed to apply two ligatures and divide the vessel in the interspace, more of the artery must be exposed, and of course more of the fascia must be cut, than when it is simply meant to surround the vessel with a single small ligature. Such operators also as have contracted the pernicious habit of insulating the artery all round sufficiently far to let them thrust their fingers under it, will likewise require an extensive opening in the fascia. This detachment of the vessel for an inch or more, for the purpose of placing the finger under it, is a measure which deserves to be condemned in the strongest terms, as it is the very thing which produces some risk of injuring the saphena vein, and has a tendency to bring on secondary hemorrhage, inasmuch as it occasions unnecessary handling, stretching,

and disturbance of the surrounding parts, and an inevitable division of the vessels, by which the arterial coats are supplied with blood.

According to Mr. Hodgson, who wisely avoids all unnecessary separation of the artery from the surrounding textures, the extent of the cut in the fascia should be about an inch. On the contrary, Scarpa, who insulates and raises the vessel, previously to tying it, insists upon the prudence of cutting the fascia the whole length of the external wound; for, says he, if this practice be neglected, it most frequently happens, that, in the succeeding inflammatory stage, the bottom of the wound swells and becomes very tense, and the matter, which is formed under the fascia, not finding a ready exit, occasions abscesses which seriously retard the cure. But Scarpa, instead of planning a method of relieving the consequences, might have employed himself more to the purpose in considering how they were to be prevented, and why in his method they most frequently happened. Now, without laying any stress upon two waxed ligatures, each composed of six threads, with an additional extraneous substance, viz. a roll of linen in the noose, we should be more surprised to hear, that the wound after his method did not become affected with swelling, tension, and suppurating, than that these were the usual effects. After describing the division of the fascia, he observes: "*With the point of the forefinger of the left hand, already touching the femoral artery, the surgeon will separate it from the cellular substance, which lies it laterally and posteriorly to the contiguous muscles; and making the point of the same finger pass gradually under and behind the femoral artery (supposing the surgeon has not enormously large fingers), he will raise it alone from the bottom of the wound, or (when it cannot be avoided) along with the femoral vein. If it is along with the femoral vein, the surgeon, holding the artery and vein thus raised, and almost out of the wound, will cautiously separate the vein from the artery with a bistoury, or spatula, or simply with his fingers,*" &c. (See Scarpa on Aneurism, p. 280. ed. 2.)

When we combine the irritation and mischief of all this work with the ill effects of filling the bottom of the wound with soft lint, I would ask what more certain plan could Scarpa or any other person have suggested for bringing on the unpleasant state of the wound, which he describes as most frequently taking place?

According to my views, Scarpa is right, however, in recommending a free division of the fascia, not only for the reasons stated by him for this practice, but because such division may be made without disturbing the artery, or detaching it from its natural connections, and particularly because, unless a free cut be made through the fascia, as well as the integuments, the finding of the artery, and the placing of a ligature under it, cannot be so promptly accomplished. Dupuytren even recommends dividing the fascia more extensively than the skin, which seems to me to be a step too far. (*Clin. Chir. t. iv. p. 517.*)

I shall suppose the fascia has now been divided, under which the surgeon distinctly feels the pulsations of the femoral artery, which is still invested by the cellular sheath. The femoral vein lies directly under this vessel, while the branches of the anterior crural nerve, separated from it by

dense cellular substance, are more externally, yet somewhat more deeply, situated. The two long descending branches incline inwards as they descend, and come in contact with the sheath of the femoral vessels, where these are crossed by the sartorius: consequently, if the ligature be applied above the inner edge of the sartorius, they require no attention; but, if the artery be tied lower down, the larger of them, the nervus saphenus major, which runs for some way upon the sheath of the vessels, and then penetrates it so as to get into contact with the anterior and external side of the vessel, in the middle third of the thigh, care should be taken not to include it in the ligature. The next object, therefore, is to pass a single ligature round the artery, without including, or in any manner meddling with, the subjacent femoral vein, or detaching and disturbing the artery. For this purpose, the best direction is that given by my friend Mr. Lawrence, especially when combined with Mr. Carmichael's plan of letting the needle be introduced on the pubic side of the artery. "After dissecting down to the artery, a slight scratch or incision may be made through the sheath, close to the side of the vessel. Then, with a narrow aneurism needle, nearly pointed at the end, and made as thin at its edge as it can be without cutting, a single silk ligature is to be conveyed round it, the point of the needle being kept in contact with the artery. A needle of this form makes its way easily through the cellular substance, and the vessel is detached only in the track of the instrument." (*See Med. Chir. Trans. vol. vi.*)

Dupuytren, and several other eminent French surgeons, first pass a bent director under the artery, and then, by means of an eye probe, which is pushed along the groove, convey the ligature under the vessel. This is an eligible method, when it is particularly desirable to see, before the ligature is passed, that nothing is raised but the artery itself.

Of the kind of ligature to be employed, I need only say here, that it should be a single one, composed of firm materials, in order to avoid the necessity for increasing its diameter more than would be desirable for reasons elsewhere considered. (See HEMORRHAGE and LIGATURE.) The ligature having been put under the artery, one end of it is to be drawn completely through the track made for it by the needle, which instrument is then to be taken away, leaving the ligature under the vessel. The ligature is now to be tied in a steady firm manner, but without any immoderate force, which can never be necessary even for the division of the inner coats of the vessel. In this part of the operation, a few practitioners give the preference to what is termed the *surgeon's knot*, and commend this plan of fastening the ligature; a plan, which consists in putting the end of the cord twice through the noose, before the constriction is made. The only good of the surgeon's knot is, that it does not so readily slip and loosen as a common one; but Scarpa thinks a simple knot best, as it does not, like the other, prevent the surgeon from calculating the force with which the artery is constricted. (*On Aneurism, p. 281. ed. 2.*) A better reason against the surgeon's knot, is the irregularity with which a ligature in this form will lie round the vessel. A simple noose should therefore be first

made and tightened, and then a second one, so as to form a common knot; and now, as a matter of precaution against the possibility of the ligature slipping and becoming loose, the surgeon, if he pleases, can tie the knot once again. One end of the ligature is next to be cut off near the knot; and the sides of the wound are to be brought together with strips of adhesive plaster, the irritation of sutures being carefully avoided. The remaining end of the ligature should always be brought out at the nearest point of this external wound to the knot on the artery.

If by any accident the arteries were pricked in the operation, a double ligature should be passed under the vessel, and one part of it tied above, the other below the puncture. Thus, Mr. Collis, in endeavouring to separate the artery from the vein, "made a small opening, about the size of a pin's point, into the artery, from which a rapid jet of blood took place. The artery was immediately compressed against the os pubis, and a double ligature applied, one part of which was tied upon the highest exposed portion of the vessel, and the other upon the lowest, leaving between both about a quarter of an inch of the artery." (See *Dublin Journ. of Med. Science*, vol. v. p. 31.) The case ended favourably, and illustrates what should be done under similar circumstances in other operations for aneurisms. The manner of taking up the femoral artery in the middle third of the thigh, and in the groin, will be described under the head of ARTERIES.

The effects, which in general immediately follow the operation, are a total cessation of the pulsation of the aneurismal tumour; a manifest sinking and flaccidity of the swelling; a diminution of pain in the seat of the disease; and a strong vibration of the articular arteries round the knee. As Mr. Hodgson has remarked, the unusual influx of blood into the minute ramifications, when a main artery is suddenly rendered impervious, is generally attended with a remarkable increase in the temperature of the limb. After tying the femoral artery for the cure of popliteal aneurism, the same phenomenon occurs, at least after a short time, during which the temperature of the leg and foot frequently continues lower than that of the sound limb. But, in a few hours, it generally rises, and is sometimes several degrees higher than that of the opposite member. This state lasts several days, at the end of which time, the heat of the limb which had been operated upon will be found to be about the same as that of other parts of the body. (*Hodgson on Diseases of Arteries*, &c. p. 356.) It is only while the limb is colder than natural, that it ought ever to be fomented, or covered with flannel. In particular examples, there is no increase of temperature in the limb at any period after the operation; a fact, which Mr. Hodgson refers to the probability of a collateral circulation having already been established, in consequence of the obstruction to the passage of the blood through the main artery by the accumulation of the coagulium in the aneurismal sac. Of course, unless a collateral circulation be established, the operation cannot succeed, as the limb will mortify; it behoves us, therefore, to be aware of the circumstances which may prevent the due transmission of the blood to the inferior part of the limb. These are fully explained and commented upon in Mr. Hodgson's work: 1st, An

extensive transverse wound, by which the principal anastomosing branches are divided. 2dly, Tight bandages and pressure operating so as to obstruct the same vessels. 3dly, The immense bulk of the tumour, and the pressure upon the principal collateral arteries. 4thly, Calculous depositions in the coats of the arteries of the limb. 5thly, Advanced age. 6thly, A languid state of the circulation; a fact, indicating the wrongness of venesection, as a general practice after the operation, though it may yet be right to adopt this treatment, where the pulsations return in the tumour with unusual strength, and appear to stop the diminution of the swelling. 7thly, The abstraction of heat from the limb by cold evaporating lotions; a plan, which can only be right, when there is a great increase of heat in the limb, a tendency to inflammation, or a return of strong pulsations in the tumour.

Sir Astley Cooper saw a case, in which the application of white-wash occasioned mortification, and the patient's death. In cold weather, he always covers the limb with flannel, or a stocking, and sometimes puts jars filled with hot water to the feet. (See *Lancet*, vol. ii. p. 42.)

If secondary hemorrhage were to occur, ought we to take up the artery higher up, or have recourse to direct pressure on the bleeding point? In one case under Mr. Collis, he applied a compress, pressed down with a screw affixed to an iron hoop, about half an inch in breadth, and sufficiently long to encompass the thigh. With this instrument, any degree of pressure could be made on the artery, whilst little or none was made on other parts, and the collateral circulation remained free. The bleeding returned once, but was at length permanently stopped. "My chief object (says Mr. Collis) in recording this case, is to show the advantage to be derived from pressure properly made, in arresting secondary hemorrhage from such a vessel as the femoral artery, and the greater benefit likely to arise from such a mode of proceeding than from tying the artery higher up, which, in the majority of cases in which it has been tried, has failed of saving the life of the patient. (See *Dublin Journ. of Med. Science*, vol. v. p. 36.) Sometimes pressure will answer, and then the ligature of the artery higher up becomes unnecessary; but pressure may not succeed. In an interesting case under Professor Regnoli, the femoral artery was tied in the upper third of the thigh, and secondary hemorrhage took place about a week after the operation. The bleeding was suppressed for a time by pressure on the bleeding point, and the application of a bladder filled with ice to the wound. The hemorrhage returned, however, and Regnoli decided to take up the external iliac artery. This measure permanently stopped the bleeding; and, though the artery was so completely ossified, where it was tied, that on tightening the ligature a remarkable crepitation was distinctly heard, and it was even apprehended that the ligature had broken the vessel completely through, the ligature came away on the eighteenth day, without any bleeding. The artery, in fact, had become obliterated. In the end, however, the patient died of gangrene of the leg. (*Istoria, &c. intorno un Aneurisma Popliteo*, Pisa, 1833, p. 26, &c.)

When the operation is done according to the principles laid down in this article, the patient is

not too old nor enfeebled, and the after-treatment is properly conducted, mortification cannot be said to be a frequent event. In one case, operated upon by Sir Astley Cooper in 1823, the whole of the foot and part of the leg mortified; but it should be noticed, that, in this instance, the whole limb was extremely swollen previously to the artery being taken up. (See *Lancet*, vol. i. p. 436.) In all his extensive practice, he has seen but three or four instances of a failure of the operation from gangrene. (*Lectures, &c.*, vol. ii. p. 60.) Mr. Liston has related one example, which he ascribed to the improper use of fomentations with hot salt water. (See *Edinb. Med. Journ.* No. 90. p. 3.) As, however, the patient seems to have been of a very phlogistic diathesis, and to have been attacked with inflammation of other parts, the reality of the alleged cause appears questionable. I have seen but one example of gangrene, and in that only one toe, and a portion of the skin of the instep, sloughed in a very debilitated subject. This partial gangrene of the foot was particularly noticed by Deschamps and Scarpa, the latter of whom regards it as an unusual thing, only likely to happen in old, weak, or unhealthy subjects; and "at any rate (says he), if this should happen in any of these enervated individuals, the patients may console themselves for the loss of one or two of their toes, with the cure of a popliteal aneurism, and the avoidance of a painful and dangerous incision in the ham, and of the tedious suppuration which would have followed it."

Sir Astley Cooper has known retention of urine brought on by the operation in one or two examples, and the use of the catheter indispensable. (*Lectures, &c.*, vol. ii. p. 58.) Sir Charles Bell met with a case, in which the femoral artery divided below the profunda into two equal branches, the most superficial of which was alone noticed and tied in the operation. The patient died of constitutional disturbance, arising from inflammation in the whole course of the sartorius. After two or three days, the pulsation of the tumour, which had been very strong, ceased in consequence of the coagulation of the blood within the sac; another fact, exemplifying that this desirable change will not be prevented by a current of blood being still propelled through the aneurismal cavity. (See *Quarterly Journ.* vol. iii. p. 607.)

Mr. Liston has recorded a case, in which the pulsation and tumour returned several months after the operation. "On consulting with Dr. Thomson, it was agreed to try the effect of methodical bandaging, from the points of the toes upwards, and a compress over the tumour, with rest, cold applications, and moderate diet." These means had the desired effect; and the patient did not complain much of those pains which so frequently remain after the operation for aneurism.

According to Mr. Liston, these pains are in general distinctly referrible to the sacro-sciatic nerve and its branches, and are explained by the state of the vessels in the substance of the nerve. In the natural state, the neurilemmal vessels, when injected, are not larger than sewing threads; but, when the enlargement of the collateral branches is requisite, owing to the obstruction of the trunk, they also are called on to contribute their share in the new circulation; and they become enormously distended. In one remarkable specimen, in which

the limb was injected and examined fifteen years after the superficial femoral artery had been cured for aneurism in the ham, the sacro-sciatic nerve had attained the size of quills, and were convoluted in an extraordinary manner. The pains in the limb, noticed by Mr. Liston as occurring after the operation, he acknowledges, however, are by no means so severe as those experienced previously, and which are produced by the compression and stretching of the nerves by the sac. (*Edinb. Med. Journ.* No. 90. p. 2.)

When the operation succeeds, a considerable portion of the artery above the aneurismal tumour is rendered impervious, the vessel indeed being sometimes converted into a solid cord from the origin of the profunda to that of the tibial arteries. (*A. Cooper, Med. Chir. Trans.* vol. ii. p. 254.) In general, however, the obliteration of the artery is less extensive; a fact, particularly noticed in one of Mr. Hunter's cases (*Trans. of a Soc. for the Improvement of Med. and Chir. Knowledge*, vol. i. p. 153.), and vainly urged by Deschamps, as a proof of the insufficiency of the new method. (See *Obs. et Réflexions sur la Ligature des principales Artères blessées, et particulièrement sur l'Aneurisme de l'Artère poplitée*, p. 76. Paris, 1797.) It appears from the observations of Mr. Hodgson, that the artery generally becomes impervious, for the space of three or four fingers' breadth, at the place where the ligature is applied; below which part its tube is free, and continues so for some distance, when the obliteration again commences, and descends along a considerable extent of the popliteal artery to the origin of the inferior articular, or tibial arteries. Thus, says this author, an insulated portion of the femoral artery preserves its cavity, from each extremity of which considerable anastomosing branches arise; the upper branches convey blood into the vessel, and the lower transmit it into anastomosing channels, that originate below the knee. (*On Diseases of Arteries, &c.*, p. 278.) Now, as Mr. Hodgson is unacquainted with any case, except that recorded by Sir Astley Cooper, where, after the modern operation, the artery was obliterated from the seat of disease in the ham to the part at which the ligature was applied, he thinks it probable that, in most instances, a double collateral circulation exists in the limb, after this method of cure.

In consequence of the motion of the blood being more or less impeded in the aneurismal sac by the application of the ligature to the femoral artery, the aneurismal cavity soon becomes completely filled with coagula, which even block up the adjoining portion of the arterial tube. The coagulated blood in the sac is afterwards absorbed; and a gradual diminution, and final disappearance of the aneurism in the ham ensue; with the exception of a slight induration, which sometimes remains, composed of a remnant of the sac itself, or of the fibrous part of the blood. This slight hardness in the cavity of the ham occasions no inconvenience, and does not hinder the patient from performing the motions of the knee and leg with quickness and safety. (*Scarpa*, p. 257. edit. 2.)

After the operation, the circulation is carried on principally by the arteria profunda, whose branches communicate with the articular arteries of the popliteal, and with arteries sent to the knee by the anterior and posterior tibial. Large branches in

the sciatic nerve, sent off by the *arteria profunda*, communicate very freely with the popliteal artery, the articular, and branches of the posterior tibial. As Sir Astley Cooper has further explained, the freedom of anastomosis sometimes leads to a reproduction of an aneurism. The femoral artery was tied by Mr. Key, and the patient, after being discharged cured, returned with a painful tumour in the ham, attended with an obscure pulsation. The limb was amputated, and a large artery, passing to the tumour, and situated nearly in the usual place of the femoral, required a ligature. (*Lectures, &c.* vol. ii. p. 60.)

When the advantages of the foregoing method of operating are contrasted with the dangers and severity of the practice of laying open the aneurismal tumour, and applying ligatures round the diseased part of the vessel, it is surprising to find any modern surgeons still expressing a preference to the latter mode of treatment under any circumstances whatsoever. Yet, Boyer, Roux, and a few French surgeons, are in this way of thinking, which reminds me of their slowness to adopt, at every opportunity, union by the first intention, one of the greatest and most decided advances to perfection ever made in the practice of surgery. The severity and difficulties of the old method of operating, in cases of popliteal aneurism, are most faithfully depicted by Scarpa. In the ham, says he, the artery lies very deep. The space is limited and narrow, within which it can be brought into view and tied, without risk of tying along with it, or of destroying, some of the principal anastomoses formed by the articular arteries of the knee. On account of the depth of the artery, it is difficult to pass any instrument round it, without including other parts; and it is no less difficult to draw the ligature on the vessel with a proper degree of tightness. Scarpa then comments on the disadvantages of tying the lacerated, diseased part of the vessel, which is sometimes so high up, that, in order to apply the ligature above it, it is necessary to cut through the long head of the triceps, and make a passage through into the thigh. Or, the diseased or lacerated part of the artery is situated so low down in the calf of the leg, that it is impossible to avoid including, either in the incision, or the ligature, the lower anastomosing articular arteries, on the preservation of which the circulation and life of the subjacent part of the limb in a great measure depend. We must add to all this the violence unavoidably done to the great sciatic nerve, which an assistant must hold drawn to one side of the wound nearly the whole time of the operation. The proceeding is also liable to other great difficulties, as may be seen from a case reported by Masotti (*Dis. sul Aneurisma* p. 53.), where the popliteal artery was so firmly united, and, as it were, confused with the vein, the nerve, the tendons of the neighbouring muscles, and the peritoneum, that the cavity of the ham presented the appearance of an intricate mass of parts, not easily separable from one another. Lastly, the operation leaves a large deep wound, laying open the whole cavity of the ham, and followed by copious suppurations, abscesses, and necrosis of the heads of the femur and tibia. If the patient be not hurried into his grave by these affections, and even if the parts in the ham heal, he is almost always left with an incurable contraction of the knee, and perpetual lameness. Thus, Masotti

(*Op. cit.* p. 17.) relates one case, where the subsequent effect caused such destruction of the soft parts in the ham, that not a vestige of artery, vein, or sciatic nerve was left, and the patient remained all the rest of his life with a paralytic leg, and ulcers and fistulae all round the knee. (*Scarpa on Aneurism*, p. 251—253. ed. 2.)

I shall now advert to a few facts in the history of surgery, which eventually led to the bold and successful operations performed at the present day, for the cure of aneurisms of the femoral and popliteal arteries. The earliest case, of which the particulars are recorded, amounting to a satisfactory proof that the lower extremity might be duly supplied with blood, notwithstanding the femoral artery had been tied high up in the thigh, is the example, related by M. A. Severinus, of a false aneurism of the thigh, about eight fingers' breadth below the groin, caused by a musket-ball wound. In this instance, Severinus tied the femoral artery above and below the aperture in it, and not only was the patient's life saved, but the use of the limb also preserved. (*Chirurgia Efficacia*, p. 2. *Enarratoria*.) The next authentic case of the ligature of the femoral artery, is that reported by Saviard, where Bontentant, in 1688, tied this artery on account of a false aneurism, the result of a sword-wound, at the inner and upper part of the thigh. The surgeons, called into consultation, were immediately convinced that the only thing to be done was to take up the femoral artery; but they were fearful lest the patient should perish of bleeding, ere the opening in the vessel could be found; and, in case the artery were secured, they apprehended that the obstruction of the circulation would be followed by mortification of the limb. The patient was therefore first prepared for his fate by the administration of the sacrament. A band was then applied round the upper part of the limb, and tightened by means of a stick, with which it was twisted, a piece of pasteboard being put under the knot, in order to render the constriction less painful. The tumour was then opened, the clotted blood extracted, and the opening in the artery detected by slackening the tourniquet. A curved needle, armed with a double ligature, was then introduced under the femoral artery, and one of the cords was tied above, and the other below, the wound in the vessel. Then follows a curious passage, showing the operator's judgment at that time, respecting the impropriety of interposing any cylinder of linen between the knot of the ligature and the artery, as some of the old surgeons at that time used to do, as well as a few of the moderns. "*On ne mit point de petites compreses sur le corps de l'artere au-dessus du nœud, comme font quelques uns, parceque l'on jugea qu'il étoit d'une grande conséquence de lier très-étroitement une artère si considérable, ce que l'on n'auroit pas été sûr de faire en interposant la petite compresse,*" &c. For greater security, assistants, who relieved each other in turn, kept up constant pressure on the tied part of the vessel for twenty-four hours. In six weeks the patient recovered, and afterwards enjoyed such good health, that he went through several campaigns. (*Saviard, Nouveau Recueil d'Observations Chir. Obs.* 63. 12mo. Paris, 1702.)

Now, with respect to these two cases, it merits attention, that, though Heister, Morgagni, and others, endeavoured to explain the success, by

supposing that each of the patients in question must have had a double superficial femoral artery in the limb operated upon, both Severinus and Saviard were wise enough to avoid making any such erroneous inference themselves. At a later period, Guttani laid bare the femoral artery, as it passed under Poupart's ligament; compressed it against the ramus of the pubes, by means of graduated compresses, retained with a firm roller; and thus obtained the speedy obliteration of the vessel, and cured an aneurism, which had been first injudiciously opened. (*De Eternis Aneurysmatibus*, Hist. 15. 4to. Romæ, 1772.) In the same book is given the case of an inguinal aneurism, which, when it had continued three months, and become equal in size to a large fist, was attacked with gangrene, whereby the aneurismal sac was quickly destroyed, and the femoral artery obliterated for a considerable extent from the crural arch downwards. The sloughs were thrown off, however, and the ulcer had in a great measure healed, when the patient fell a victim to debility. (Hist. 17.) Here it is to be remarked, that, during the five weeks this man lived after the obliteration of the femoral artery, above the origin of the profunda, not only the circulation and life of the whole limb were preserved, but the auxiliary arteries, coming from within the pelvis, proved capable of limiting the progress of the mortification of the parts round the aneurism, and of commencing the healing process in a manner which raised great hopes of a cure. A similar fact is also recorded by Dr. Clarke. (*Duncan's Med. Comment.* vol. iii.)

These, and other cases which might be quoted, furnished ample proof of the efficiency of the anastomosing vessels in the support of the limb, though the femoral artery had been tied, or obliterated in a very high situation.

Besides these facts, surgeons derived every encouragement to attempt the cure of popliteal aneurism, by the ligation of the artery above the tumour, from the elucidations given by Winslow and Haller, concerning the numberless inosculations which exist between the upper and lower articular arteries. Haller even drew the conclusion, that, if the course of the blood were intercepted in the popliteal artery, between the origins of the two orders of articular branches, such anastomoses would suffice for carrying on the circulation in the leg. And at length Heister, weighing the anatomical observations of Winslow and Haller, and the facts recorded by Severinus and Saviard, first proposed applying to popliteal aneurisms an operation, which, with the exception of those two cases, had until his time been restricted chiefly to aneurisms of the brachial artery. (*Dis. de Cenuum Structurâ eorumque Morbis*. Dis. Chir. Halleri, t. iv.)

It was in Italy that the earliest operations were undertaken for the cure of popliteal aneurisms, by Guattani, or rather by a German surgeon, named Keyser, as would appear from a letter written by Testa to Cotunni. (See *Pelletan, Clinique Chir.* t. i.) The practice of tying arteries for the cure of aneurism was also adopted in Italy by Molinelli and Mazotti, at a period, when, in other countries, amputation was the measure to which the patient was always subjected. The success, obtained by these surgeons, soon led others to imitate them, and by degrees the practice of tying the femoral artery became common both in cases of aneurism

and wounds; and from the observations of Heister (*Haller, Disp. Chir.* t. v.), Acrell (*Murray de Aneurysm. Femoris*), Leslie (*Edin. Med. Comment.*), Hamilton (*B. Bell's Surgery*, vol. i.), Burschall (*Med. Obs. and Inq.* vol. iii.), Leber (*Dehaen, Ratio Medendi*, t. vii.), and Jussy (*Ancien Journ. de Méd.* t. xlii.), it was proved, beyond the shadow of a doubt, that the circulation might continue in the limb, after the obliteration of the femoral artery, whether such obliteration were effected by direct pressurè, or the ligature.

The exact period when the first operation of laying open the tumour and tying the popliteal artery was performed in England, is not, as far as I know, particularly specified. However, judging from the observations made on this practice in the writings of Pott (*Remarks on Palsy*, &c. 8vo. Lond. 1779), of Wilmer (*Cases and Remarks in Surgery*, 8vo. Lond. 1779), of Kirkland (*Thoughts on Amputation*, 8vo. Lond. 1780), and of others, it is clear, that this method of treatment had been often done in this country earlier than the dates of those works, and, as would appear, with little or no success. The earliest attempt of this kind in France was made by Chopart in 1781 (*Roux, Nouveaux Elémens de Méd. Opératoire*, t. i. p. 556.), about five and twenty years after the examples set by Guattani in Italy; but Chopart failed in his endeavours to repress the bleeding from the exposed cavity of the tumour, and was therefore obliged to amputate the limb. Subsequently to this attempt, the operation was undertaken by Pelletan in two instances, the terminations of which were successful: consequently, this surgeon may be regarded as entitled to the honour of having proved to his countrymen the possibility of curing the popliteal aneurism by laying open the tumour, and securing the artery in the lani.

The severity and frequent ill success of this method of operating I have already noticed, nor shall I repeat the objections to it. With respect to the Hunterian practice, the great peculiarities of which were tying the artery at some distance above the disease, and not opening the swelling at all, Richerand seems offended that Hunter's name should be affixed to an operation, which he conceives was in reality the invention of Guillemeau. Here we observe Aëtius again puts in a prior claim, and with much more effect, because the method, of which he speaks, truly resembled Mr. Hunter's, inasmuch as the vessel is directed to be tied at some distance above the swelling, while Guillemeau only tied the artery close above the disease, and opened the swelling, a serious deviation from the Hunterian practice.

Guillemeau, a disciple of Ambrose Paré, having to treat an aneurism at the bend of the arm, the consequence of bleeding, exposed the artery above the tumour, tied this vessel, then opened the sac, took out the coagulated blood, and dressed the wound, which healed by suppuration. After more than a century, Anel, on being consulted about a similar case, tied the artery above the swelling, which was left to itself. The pulsation ceased, the tumour became smaller, and hard, and after some months no traces of the disease were perceptible.

In 1785, Desault operated in the same manner for a popliteal aneurism: the swelling diminished by one half, and the throbbings ceased; on the twentieth day it burst; coagulated blood and pus

were discharged in large quantities; and the wound, after continuing a long time fistulous, at length healed. Towards the end of the same year, Hunter applied the ligature somewhat differently; instead of placing it close to the swelling, or directly above it, he put it on the inferior part of the femoral artery. (See *Richerand Nosogr. Chir.* t. iv. p. 98, 99. edit. 2.) Unquestionably Anel did, in one solitary instance, tie the brachial artery immediately above an aneurism at the bend of the arm, and effected a cure without opening the swelling (*Suite de la Nouvelle Méthode de guérir les fistules lachrymales*, p. 251. Turin, 1714); but he did not think of applying the plan to the femoral artery, or draw the attention of French surgeons sufficiently to the matter, to make them imitate his operation: on the contrary, the method fell into oblivion, and was never repeated. With regard to Desault's operation, said to have been done in an earlier part of 1785 than Mr. Hunter's first operation, it is only necessary to say, that Desault tied the popliteal artery itself, while the grand object in Mr. Hunter's method was to take up the femoral artery, at a distance from the disease, and that it is this last mode alone, which has gained such approbation, and been attended with unparalleled success.

The French surgeons have not practised the Hunterian operation with the same degree of success with which it has been performed in England, and, consequently, they have often returned to the old method of opening the sac, &c. Even Boyer avowed, a few years ago, his relinquishment of what he calls Anel's plan. (*Traité des Mal. Chir.* t. ii. p. 148.) But we shall not be surprised at this ill success, when we hear that some of them neglected, for a long while, the right principles on which ligatures ought to be applied to arteries, as explained by Dr. Jones in his work on hemorrhage. Even Baron Dupuytren, until a late date, adhered to the use of ligatures of reserve; while Boyer applied not less than four loose ligatures round the artery, besides two tight ones; and consequently a large portion of the vessel lay separated from its natural connexions, and irritated by these extraneous substances. Hunter's first operation nearly failed also on account of so many ligatures, none of which were tightened so as to cut through the inner coats of the artery, and thus promote its closure. (See *Hæmorrhagæ*.) At length, however, Dupuytren, and several other distinguished surgeons in France, convinced of the utility and danger of ligatures of reserve, totally discontinued their employment. (See *Leçons Orales de Clin. Chir.* t. iv. p. 531.) The following passage also shows the valuable reforms, which have taken place in France in the mode of tying arteries, and the treatment of aneurism. "The process generally employed at the present day," says Baron Dupuytren, "is that of Anel & Hunter. When an artery is tied in this plan, it is exposed, if possible, at a point far enough from the aneurism for the vessel to be perfectly healthy, and in a situation where it is superficial; so that the neighbouring veins and nerves may be more easily separated from it, and the ligature more conveniently tightened, in a proper degree. Another, not less important precept, is to preserve, above the wound, a sufficiency of collateral branches to keep up the circulation in the lower part of the limb after the operation, and to make the incision so that the

ligatures may not be applied too near any large collateral vessels, particularly the superior ones, because their immediate proximity to the ligatures is one of the causes most to be apprehended of secondary hemorrhage. The incision should be extensive enough to let what is requisite be easily done to the artery, and the fascia should be even more freely divided than the integuments." (*Op. et vol. cit.* p. 516.) With reference to the operation for popliteal aneurism, *Rosenmüller's Chir. Anat. Plates*, part iii. tab. 8 and 9.; Scarpa's and Tiedemann's matchless engravings; Haller's *Icones*; *Manec, De la Ligature des Artères*, pl. 9 and 10.; and Elias Bujalsky, *Tubule Anat. Chir.* Petropol. 1828; deserve to be consulted.

ANEURISMS OF THE LEG, FOOT, FOREARM, AND HAND.

It is not long since doubts were entertained of the possibility of curing an aneurism at the upper part of the calf of the leg by tying the femoral artery in the middle of the thigh. (*Istituto Ital. di Scienze ed Arti*, vol. i. parte ii. p. 266.) The author, here referred to, was led by this uncertainty to have recourse in one instance to the severe method of laying open the tumour, in order to get at the vessel lower down. On this case, Scarpa makes some correct reflections: the operator (says he) assured himself, that, on compressing the femoral artery at the upper part of the thigh, the tumour at the top of the calf ceased to pulsate; and that, when the compression was continued for some time, the swelling partly disappeared, and became softer. It ought to have been evident, therefore, that the aneurism might have been cured by tying the trunk of the femoral artery, as described in the foregoing section. In Scarpa's work is a case, in which an aneurism at the bifurcation of the popliteal artery was cured by the ligature of the femoral artery. (See p. 541. edit. 2.) Mr. Hodgson has seen three aneurisms, situated at the commencement of the tibial arteries, cured by the same operation. (*On Diseases of Arteries*, &c. p. 437.) But, as Scarpa remarks, though the Hunterian operation answers in the cure of aneurism in the bend of the arm, and at the upper part of the calf of the leg, it is not so effectual for aneurisms situated on the back or palm of the hand, or the dorsum, or sole of the foot. The free communication, which the ulnar and radial arteries keep up with each other in the hand, and the tibial arteries have with each other in the foot, prevent the operation from succeeding, whether the brachial, or femoral artery, or one of the two large arteries of the forearm, or leg, be tied. In proof of this statement, Scarpa cites two cases of aneurism seen by himself; one on the instep, the kind of case seen also by Guattani; the other in the sole of the foot; and a third case of the same disease in the latter situation; all of which were found to be incurable by the ligature of the anterior tibial artery. (P. 311.) Scarpa thinks, however, that the operation of tying this vessel where it passes over the dorsum of the foot might succeed, if aided by compression, applied so as to stop the current through the other main channel; and he seems to approve of this practice, because the plan of tying the artery above and below the disease (which is the most certain means of cure) could not be done, without extensive incisions in the

sole of the foot. In an aneurism at the lower part of the leg, Mr. Hodgson judiciously insists upon the prudence of tying the artery, as near as possible to the tumour, because the recurrent circulation, through the large inosculation in the foot, might still cause the swelling to enlarge, in consequence of the blood sent into the sac from the lower extremity of the vessel passing through the aneurismal cavity into branches arising from the artery between the aneurism and the ligature. (P. 438.) However, in one case of aneurism of the anterior tibial artery, Mr. H. Cline applied a ligature just above the tumour without success, and Sir Astley Cooper expressly recommends making an incision in the sac, and applying a ligature both above and below the swelling. (*Lectures, &c.* vol. ii. p. 63.) When an aneurism arises from the radial, ulnar, or interosseous arteries near the elbow, tying the brachial will suffice; but if the disease be lower down, the vessel from which it proceeds must be taken up near the swelling. (Hodgson, p. 393.) A case, strikingly illustrative of this truth, is recorded by Mr. Liston. J. M. P., aged nineteen, applied to him on the 28th of July, on account of an aneurism of the left radial artery, about the middle of the forearm, occasioned by a wound. The tumour was as large as a walnut, and so compressible that it could easily be made to disappear. Pressure was tried at first, with apparent benefit; but, as it did not succeed, the humeral artery was tied on the eighth of August, and with the effect of completely removing the tumour. On the eighteenth day afterwards, however, a small slough was detached from the cicatrix, and about three o'clock next morning a violent hemorrhage took place. Mr. Liston then deemed it necessary to lay open the sac, and tie the artery above and below the wound in it. (*See Edin. Med. Journ.* No. 90. p. 4.)

Scarpa mentions a case, where the dorsal artery of the thumb was wounded; but, as the hemorrhage returned several times, and pressure failed in suppressing it, the surgeon took up the radial artery at the wrist. After cutting off this direct current of blood towards the injured vessel, pressure on the wound proved effectual. Three months afterwards, the patient having died, the radial artery was found impervious for three fingers' breadth below where the ligature had been applied, and the dorsal artery was likewise obliterated from the root of the thumb to the beginning of the palmar arch.

Mr. Todd has published a case, in which he cured a large aneurismal swelling of the posterior side of the forearm by tying the brachial artery. From the description, I conclude that the disease was an aneurism by anastomosis, as it is termed; but the particulars given by the author leave some doubt on this point. (*See Dublin Hospital Reports*, vol. iii. p. 135.)

The manner of exposing and tying the principal arteries of the leg and forearm will be described under the term *ARTERIES*.

OF ANEURISMS HIGH UP THE FEMORAL ARTERY.

Several facts, already specified in the preceding columns as having occurred many years before the operation of tying the external iliac artery was attempted, amounted to a full proof, that the circulation might go on in the lower extremity, notwithstanding the artery in the groin were tied,

or obliterated. On this point, some of Guattani's cases were most decisive.

The ligation of the external iliac artery, for aneurisms of the femoral artery in the bend of the groin, has now been practised so frequently, and the instances of success are so numerous, that all doubt concerning the propriety and utility of the attempt has entirely ceased. The French, who evinced great backwardness in espousing the Hunterian method of operating for aneurisms, though it is decidedly one of the greatest improvements in modern surgery, at one period showed great reluctance to practise the operation of tying the external iliac artery. M. Roux, however, who was in London about twenty years ago, saw the thing done, and his testimony, no doubt, had considerable influence in quickening the adoption of this bold, but, on the whole, very successful measure, by his brethren in the capital of France. Still, as M. Roux remarks, "We cannot but blame the indifference with which the operation is mentioned in some of the latest French surgical publications. At this moment (1815) we can reckon twenty-three facts, relative to tying the external iliac artery, and, on fifteen of the patients, it has perfectly succeeded. In these twenty-three operations, I comprehend the two which were done in France; one at Brest, by Delaporte, and the other at Lyons, by Bouchet; cases the authenticity of which cannot be doubted. In the number of successful cases, is to be comprised Bouchet's operation, since the patient lived more than a year afterwards, and then died of the consequences of an inguinal aneurism of the opposite side.

"Sir A. Cooper alone had tied the external iliac artery six times before my journey to London, and during my stay there I saw him perform the operation once. Four of his patients were entirely well; one of the three others died, the thirteenth week after the operation, of the bursting of an aneurism of the aorta. At this period, the circulation in the limb had been re-established. I saw the limb after it had been injected, amongst Sir A. Cooper's anatomical preparations. Large and beautiful anastomoses existed round the pelvis, between the dilated branches of the internal iliac and femoral arteries. With respect to the sixth patient, the leg mortified, and the thigh was amputated without success. The seventh died of hemorrhage, which took place on the fourteenth or fifteenth day after the operation." (*Parallèle de la Chir. Angloise avec la Chir. Française*, p. 275, 276.) Sir Astley Cooper had tied the external iliac artery in nine cases (see *Lancet*, vol. ii. p. 44.); and the operation is now so common, that scarcely a week passes without some record of its performance in one part of the world or another.

The many facts exemplifying the propriety of this operation must have been highly gratifying to Mr. Abernethy, by whose judgment it was first suggested, and by whose enterprising hand it was first performed.

Mr. Abernethy was called upon on several occasions to take up the external iliac artery, and every one of these cases proved that the anastomosing vessels were fully capable of conveying blood enough into the limb below, and that a vessel even of this size could become permanently closed after being tied. Three of the operations in which Mr. Abernethy took up the external iliac artery, the very first examples of this practice, &c.

was an eye-witness of, the cases having occurred at St. Bartholomew's Hospital at the time when I was an articulated student there. (See *Abernethy's Surg. and Physiol. Essays, and Surgical Obs.*, 1804; *Edin. Med. and Surg. Journal* for January, 1807.)

In Mr. Abernethy's first operation, performed in 1796, an incision, about three inches in length, was made through the integuments of the abdomen, in the direction of the artery, and thus the aponeurosis of the external oblique muscle was laid bare. This was next divided, from its connection with Poupart's ligament, in the direction of the external wound, for the extent of about two inches. The margins of the internal oblique and transverse muscles being thus exposed, Mr. Abernethy introduced his fingers beneath them to protect the peritoneum, and then divided them. Next he pushed this membrane, with its contents, upwards and inwards, and took hold of the external iliac artery with his finger and thumb. It now only remained to pass a ligature round the artery and tie it; but this required caution, on account of the contiguity of the vein to the artery. These Mr. A. separated with his finger, and introducing a ligature under the artery with a common surgical needle, tied it about an inch and a half above Poupart's ligament.

The following was the method, which Mr. Abernethy adopted in the second instance of tying the external iliac artery.

An incision, three inches in length, was made through the integuments of the abdomen, beginning a little above Poupart's ligament, and extending upwards; it was more than half an inch on the outside of the upper part of the abdominal ring, to avoid the epigastric artery. Here I may remark, that as the epigastric artery ascends obliquely inwards between the fascia transversalis and the peritoneum, near the internal border of the inner ring, the usual distance between which and the abdominal ring is an inch and a half, the place chosen by Mr. Abernethy for the incision did not in reality leave the epigastric artery unexposed to danger. The aponeurosis of the external oblique muscle was next divided, in the direction of the external wound. The lower part of the internal oblique muscle was thus uncovered; and the finger being introduced below the inferior margin of it and of the transversalis muscle, they were divided with the crooked bistoury for about one inch and a half. Mr. Abernethy now introduced his finger beneath the bag of the peritoneum, and carried it upwards by the side of the psoas muscle, so as to touch the artery about two inches above Poupart's ligament. He took care to disturb the peritoneum as little as possible, detaching it to no greater extent than was requisite to admit his two fingers to touch the vessel. The pulsations of the artery made it clearly distinguishable, but Mr. Abernethy could not put his finger round it with facility. In order to be able to do so, he was obliged to make a slight incision on each side of it. Mr. A. now drew the artery gently down, so as to see it behind the peritoneum. By means of an eye-probe, two ligatures were conveyed under the vessel; one of these was carried upwards as far as the artery had been detached, and the other downwards; they were firmly tied, and the vessel was divided in the interspace between them. (*Surg. Observ.* 1804.)

Mr. Freer, of Birmingham, who may claim the

honour of having seconded Mr. Abernethy in this new practice, made an incision about one inch and a half from the spine of the ilium, beginning about an inch above it, and extending it downwards about three inches and a half, so as to form altogether an incision four inches and a half long, extending to the base of the tumour. The tendon of the external oblique being exposed, was carefully opened, and also the internal oblique, when the finger, being introduced between the peritoneum and transversalis, served as a director for the crooked bistoury, which divided the muscle. Avoiding all unnecessary disturbance, Mr. Freer separated the peritoneum with his finger, till he could feel the artery beating, which was so firmly bound down that he could not get his finger under it without dividing its fascia. The vessel having been separated from the surrounding parts, curved blunt needle, armed with a strong ligature, was put under it, and tied very tight, with the intention of dividing the internal coats of the vessel. The operation led to a perfect cure. (*Freer's Aneurism*, p. 83. 4to. 1807.) Mr. Tomlinson, of the same town, was also an early performer of the operation: he applied only one ligature, and, of course, left the artery undivided; the event was completely successful.

The following is Sir Astley Cooper's mode of operating:—A scapular incision is made "through the integuments, in the direction of the fibres of the aponeurosis of the external oblique muscle. One extremity of this incision will be situated near the spine of the ilium, the other will terminate a little above the inner margin of the abdominal ring. The aponeurosis of the external oblique muscle will be exposed, and is to be divided throughout the extent and in the direction of the external wound. The flap, which is thus formed, being raised, the spermatic cord will be seen passing under the margin of the internal oblique and transverse muscles. The opening in the fascia, which lines the transverse muscle, through which the spermatic cord passes, is situated in the midspace between the anterior superior spine of the ilium, and the symphysis pubis. The epigastric artery runs precisely along the inner margin of this opening, beneath which the external iliac artery is situated. If the finger, therefore, be passed under the spermatic cord, through this opening in the fascia, it will come into immediate contact with the artery, which lies on the outside of the external iliac vein. The artery and vein are connected together by dense cellular membrane, which must be separated to enable the operator to pass a ligature, by means of an aneurism needle, round the former." (See *Hodgson on Diseases of Arteries*, p. 421, 422.)

The foregoing incision, the convexity of which is turned outward and downward, I think, should extend from within and a little above the anterior superior spinous process of the ilium to above and a little within the middle part of Poupart's ligament, the exact point under which lies the internal ring, behind which the external iliac artery is to be found. As soon as the tendon of the external oblique muscle has been divided, the internal oblique and transverse muscles may be cautiously cut with the aid of a director; and then the fascia transversalis either divided in the same way, or torn through with the end of the scalpel, or director. Care must be taken to avoid the epigastric artery, which runs from the pubic side of the external iliac to the

inner side of the incision. Baron Dupuytren, in performing the operation at the Hôtel-Dieu, in 1821, wounded the epigastric artery. (See *Averrill's Operative Surgery*, p. 37.) The hemorrhage was so copious, that two ligatures were required. The patient afterwards died of peritonitis, which, in all probability, was brought on by the disturbance of the parts in the proceedings requisite for securing the ends of the wounded vessel. Hence, in operating according to Sir A. Cooper's plan, after pushing upwards the lower border of the internal oblique and transversalis, together with the spermatic cord, if the fascia transversalis is to be cut, and not torn, or if the inner ring, the opening in that fascia, is to be dilated, the requisite incision should be made with a probe-pointed bistoury in the direction towards the anterior superior spinous process of the ilium, and away from the epigastric artery. Mr. Guthrie has seen the epigastric artery divided in this operation, and two ligatures placed upon it without any inconvenience occurring. When such practice is adopted, he rates the importance of the accident much lower than I am inclined to do; for he observes, "I have reason to know that this artery is made a greater bugbear of, than there is any occasion for, in all operations on these parts. If the surgeon has unluckily divided it, either in this or any other operation, all that he has to do is to enlarge the incision, and tie both the divided ends; and I have no hesitation in saying, it will not be of any consequence, either in this operation, or one for hernia. If a man has been so unfortunate as to have a wound in his peritoneum, of a quarter or half an inch in extent, two ligatures on the epigastric artery, and a slight increase in the extent of the external incisions, add little or nothing to the danger, which only takes place in reality when the wound is closed up, and the artery is allowed to bleed internally." (*Guthrie on Dis. of Arteries*, p. 376.) While I approve of the practice of securing the two ends of the epigastric artery in a case of this description, the accomplishment of it would not be so easy as the delivery of the proper advice; and where the peritoneum is cut, as in examples of hernia, blood would be likely to be effused in the cavity of the peritoneum, before the ends of the vessel could be secured. In taking them up, also, a considerable disturbance and irritation of the parts would necessarily be produced. For such reasons, and on account of the generally fatal termination of a wound of the epigastric artery, I cannot but view this accident as a truly perilous one. The external iliac vein must never be included in the ligature, as such a proceeding would cause a dangerous interruption of the return of the blood.

Mr. Norman, of Bath, who has tried both modes of operating, found that proposed by Sir A. Cooper a more easy way of finding the external iliac artery, than the longitudinal incision practised by Mr. Abernethy. "The objection (says Mr. Norman) to Sir A. Cooper's mode of operating in cases where the tumour extends high up, is by no means well founded; for the lower part of the bag of the peritoneum, lying on the edge of Poupart's ligament, must in every case be exposed and detached, in order to get at the artery, which lies behind the posterior part of that membrane, and this is most easily effected by an incision in the direction of Poupart's ligament; whilst two thirds of the longitudinal incision are

made on a part of the peritoneum, which lines the abdominal muscles, and the lower portion only of the incision reaches that part of the membrane which is to be separated. The consequences of this are, that the peritoneum is in much greater danger of being wounded, and that the probability of a hernia forming after the cure is much increased by the extensive division of the oblique muscles." (*See Med. Chir. Trans.* vol. x. p. 101.) These remarks are well founded, and they coincide with some observations, made many years ago by M. Roux, who, while he inclined to Mr. Abernethy's method, saw the disadvantage of letting the direction of the wound in this instance correspond to the course of the artery. Hence, after many trials on the dead subject, he laid down the rule, that the beginning of the wound should never be further than half an inch from, and a very little higher than, the anterior superior spine of the ilium, and that it should be carried very obliquely downwards, to the middle of Poupart's ligament. (*See Nouveaux Elémens de Méd. Op.* t. i. p. 747, &c.)

Mr. Todd, also, after repeated trials of Mr. Abernethy's and Sir Astley Cooper's methods on the dead subject, concluded that the plan, recommended by the latter, afforded the greatest facility of applying the ligature to the artery, because more room was obtained by it, and with less disturbance of the peritoneum, than in the other way. Where, however, it becomes necessary to apply a ligature to a higher part of the artery, in consequence of secondary hemorrhage, Mr. Todd conceives that Mr. Abernethy's method should be adopted. (*See Dublin Hospital Reports*, vol. iii. p. 92.)

In a case, operated upon by Mr. Kirby, a hernia followed, in the situation where the abdominal muscles had been divided. (*See Cases with Obs.* p. 109. 8vo. Lond. 1819.)

In one case, Dr. Post found the peritoneum so thickened and diseased, that he could not raise it from the subjacent parts, and he was obliged to make an opening in it. The protruding viscera then pushed back, and, with a needle, a ligature was introduced under the artery, the peritoneum being also included in the ligature. Notwithstanding the disadvantageous method of operating, and the return of pulsation in the swelling, the patient had so far recovered in three months, that he had regained the use of the limb. (*See American Med. and Phil. Reg.* vol. iv. p. 443.) Both the external iliac arteries of the same individual were tied in succession by Mr. Tait; one on the 8th of May, 1825, and the other on the 16th of April, 1826; and this with entire success, notwithstanding the peritoneum was wounded in one of these operations. M. Arendt also took up both the external iliac arteries in one patient, and, though there was only an interval of a week between the operations, the case had a very favourable termination. (*See Velpeau, Nouv. Elem. de Méd. Opér.* t. i. p. 175.)

In one remarkable case, Mr. Newbiggin, by tying the external iliac artery, cured both an inguinal and a popliteal aneurism together. (*See Edin Med. and Surg. Journal for Jan. 1846*, p. 71, &c.)

The many operations, which have now been done on the external iliac artery, impress me with a conviction, that, in subjects under a certain age, there is no reason to fear, that the anastomoses will not generally suffice for the supply of the lower

extremity. Out of twenty-five cases, the particulars of which I formerly collected, there were only three in which the limb was attacked by gangrene. These three were patients of Sir A. Cooper, M. Bouchet, of Lyons, and Mr. Collier. The proportion is not so much as one in eight. The three instances of gangrene were not all in the circumstances which permitted the event to be imputed to the anastomoses not having had sufficient time to enlarge, though perhaps Mr. Collier's case was such. On the other hand, we are to notice that Dr. Cole's patient was operated upon a few days after the wound, and yet the limb was duly supplied with blood, and did not become gangrenous. The same important facts were likewise exemplified in the remarkable case, where M. Velpeau was suddenly called upon to tie the external iliac artery, which had been accidentally wounded with a knife. Here, although there had been no preliminary dilatation of the collateral vessels, either by a trial of pressure, or by the presence of an aneurism, a ligature was at once put on the external iliac artery, with a perfectly successful result. (See *Velpeau, Nouv. Élém. de Méd. Opér.* t. i. p. 175.) It appears therefore to me, that the occasional occurrence of gangrene cannot be admitted as a just reason for delay, until the collateral vessels have had time to enlarge. I believe, that in all aneurismal diseases, early operating is the best and most judicious practice. This was one principal cause, as Kirkland observes, which occasioned the bad success of the old surgeons in the treatment of popliteal aneurisms, and he foretold, many years ago, that operations for the cure of aneurisms would answer better, if not deferred so long as formerly. (See *Thoughts on Amputation*, &c. 8vo. Lond. 1780.) I join Kirkland in this sentiment, not without recollecting that all aneurisms are attended with a chance of getting well spontaneously in the course of time. I saw the inguinal aneurism which did so, under Dr. Albert, in the York Hospital; but as this is a rare incident, I do not believe that it ought to influence us against having speedy recourse to an operation. Besides, the cure by inflammation and sloughing appears to me to be attended in reality with more peril than a well executed operation, and, consequently, has less recommendations than many may imagine. Had not Dr. Albert's patient been a very strong man, he would certainly have fallen a victim to the extensive disease, which the bursting and sloughing of the tumour created. Thus, Delaporte's patient died of the mass of disease, which the tumour itself made; for it had been suffered to attain too large a size, so that, when it inflamed, the effects were fatal. (See *Richerand, Nosogr. Chir.* t. iv. p. 113. edit. 4.)

I believe Dr. Wilmot's observation is perfectly correct, that, if a comparison were made, between the operation of tying the external iliac artery and that of tying the artery in the thigh, we should find the recoveries after the first more frequent, in proportion to the number of times it has been done, than after common operations lower down. (See *Dublin Hospital Rep. &c.* vol. ii. p. 214.)

The greatest artery that conveys blood into the lower extremity, after the external iliac has been tied, is the gluteal; but, besides it, the ischiatic, the obturator, and the external pudic, which anastomoses freely with the internal pudic, are important vessels in keeping up the circulation.

In one case, operated upon by Mr. J. C. Warren, the epigastric artery arose from the anterior and inner part of the sac, and gave origin to the obturator, while the circumflexa ili originated from the outer part of the sac. All these vessels were greatly enlarged, and the epigastric rendered the necessary detachment of the external iliac very difficult. (See *New England Journ.*)

Some particulars of inguinal aneurisms, in which Sir A. Cooper, Mr. James, and Mr. Murray tied the aorta, will be hereafter noticed. (See *Aorta*.)

Rosenmüller's Chir. Anat.; *Tiedemann's Tabulæ Arteriarum*, Carlsruhe, 1822; the plates in Scarpa's great work, *Sull Aneurisma Reflessioni*, &c. Par. 1804; J. P. Manec, *De la Ligature des Artères*, pl. ix.; and *Elias Bujalsky's Tabulæ Anat. Chir.* Petropol, 1828, tab. x. et xi., in illustration of the operation of tying the external iliac artery; all merit notice. Under the head of *ARTERIES*, additional instruction will be offered on the mode of taking up the external iliac artery.

CASES OF GLUTEAL ANEURISM CURED BY TYING THE INTERNAL ILIAC ARTERY.

The gluteal artery is large; from its situation, liable to wounds; from its size, subject to aneurism. Dr. Jeffray, of Glasgow, was consulted in a case, where the gluteal artery had been wounded. He urged the propriety of tying the vessel where it had been injured. This sensible advice was at first rejected; and when the friends at last consented, the operation was too late, as, while preparation was making for it, the tumour burst, and the patient expired in a few moments. Theden also mentions an instance, in which the gluteal artery was wounded in the dilatation of a gunshot wound, and the patient lost his life. (See *Scarpa on Aneurism*, p. 407. ed. 2.) Mr. John Bell, however, tied the gluteal artery in a case where it was wounded, and the patient was saved.

Mr. Stevens, surgeon in Santa Cruz, the gentleman who has proved the practicableness of putting a ligature round the internal iliac artery, informs us, that one of the first surgeons in London had a patient with gluteal aneurism. The tumour was large; allowed to burst; and the person bled to death. "I sincerely trust," says he, "that the following case may be the means of preventing such an occurrence in future. Mailla, a negro woman, from the Bambara country in Africa, was imported as a slave into the West Indies in the year 1790. She was purchased for the estate Enfield Green; now the property of the heirs of P. Ferrall, Esq. I saw her first in the beginning of December, 1812. She had a tumour on the left hip, over the sciatic notch. It was nearly as large as a child's head, and pulsated very strongly. She could assign no cause for the disease. It had commenced about nine months before, with slight pain in the part; and had gradually increased to its present size. She was now much reduced, in great misery, and ready to submit to any operation." (See *Medico-Chir. Trans.* vol. v. p. 425.) Mr. Stevens had tied the internal iliac on the dead body, and believed, that it might be done with safety on the living. The following is the account of the operation: 'On the 27th of December, 1812, (says Mr. Stevens,) I tied the artery, in the presence of Dr. Lang, Dr. Van Brackle, Mr. Nelthropp, and Mr. Ford, the manager of the estate. An incision, about five

inches in length, was made on the left side, in the lower and lateral part of the abdomen, parallel with the epigastric artery, and nearly half an inch on the outer side of it. The skin, the superficial fascia, and the three thin abdominal muscles, were successively divided; the peritoneum was separated from its loose connection with the iliacus internus and psoas magnus; it was then turned almost directly inwards, in a direction, from the anterior superior spinous process of the ilium, to the division of the common iliac artery. In the cavity, which I had now made, I felt for the internal iliac, insinuated the point of my forefinger behind it, and then pressed the artery betwixt my finger and thumb. Dr. Lang now felt the aneurism behind; the pulsation had entirely ceased, and the tumour was disappearing. I examined the vessel in the pelvis; it was healthy, and free from its neighbouring connections. I then passed a ligature behind the artery, and tied it about half an inch from its origin. The tumour disappeared almost immediately after the operation, and the wound healed kindly. About the end of the third week, the ligature came away, and in six weeks the woman was perfectly well."

This is the first example, in which the internal iliac was tied. The operation was not attended with much difficulty or pain, and not an ounce of blood was lost. Mr. Stevens had no difficulty in avoiding the ureter, which, when the peritoneum was turned inwards, followed it. Had it remained over the artery, he could easily have turned it aside with his finger. (*See Med. Chir. Trans. vol. v. p. 422, &c.*)

The woman enjoyed good health for ten years, and then died of an affection of the chest. The body was opened, and the internal iliac artery found impervious. The ischiatic artery had the appearance of a ligamentous cord, but the gluteal artery was pervious. The pelvis was then removed, brought from Santa Cruz, and deposited in the Museum of the Royal College of Surgeons in London. In the further examination of the parts, the ilio-lumbar artery was found to have arisen just above the part where the ligature had been applied, and consequently the external iliac had not been obliterated. The particulars of the dissection, as given by Mr. Richard Owen, are remarkably interesting. I shall only notice those circumstances, which strike me as peculiarly deserving of record. An incision being made into the common iliac, and continued down to the part where the internal iliac became contracted, it was found there to have become completely obliterated. In the state of a ligamentous cord, the internal iliac descended towards the ischiatic notch for the space of an inch, and then suddenly resuming its natural diameter, it again became pervious, and so continued for the extent of half an inch; the gluteal artery arising from the lower part of this space, a sacro-interval vessel from about the middle, and the obturator artery from the upper part of it. The latter vessel was entirely obliterated; but the sacro-lateral was pervious, of the size of a crow-quill, and passed inwards to the second sacral foramen; whilst the gluteal artery received, close to its origin, two vessels, as large as the preceding, given off from the sacro-lateral artery. The ischiatic was impervious. The gluteal artery was of its natural size. An oblong tumour of the sciatic artery was detected, three

inches and a half in length; between the tuberosity of the ischium and the great trochanter, doubtless the remains of the original disease. It was filled with dark-coloured, granular, not lamellated blood. From the ischiatic notch to the tumour, the artery was completely obliterated, its texture altered, and the remains of its cavity filled with indurated and partly calcareous matter. From the lower part of the swelling, the sciatic artery proceeded down the posterior part of the thigh, and was nearly as large as the femoral. Its calibre did not, however, correspond to its apparent magnitude, its coats being vastly thickened. It was obliterated for about the space of an inch below the sac, but became pervious again after receiving an anastomosing vessel from the profunda. Mr. Owen infers from several circumstances, which he specifies, that the aneurism was of the true kind. Amongst the things, highly deserving notice in this case, was the open space maintained by the collateral circulation in the trunk of the artery, between the ligature and the aneurism. (*See Med. Chir. Trans. vol. xvi. p. 221, &c.*)

A second instance, in which the internal iliac artery was tied, was some time ago communicated to the public. The operation was performed by Mr. Atkinson, of York, on account of a gluteal aneurism. The following are a few of the particulars:—Thomas Cost, aged 29, presented himself at the York County Hospital, April 29th, 1817. He was a tall, strong, active bargeman, not corpulent, but very muscular. He was enduring great pain from a large, elastic, pulsating tumour, situated under the glutæus of the right side; an obvious aneurism. It had existed about nine months, and was the consequence of a blow from a stone. In a consultation with Dr. Lanson and Dr. Wake, the necessity of the operation was determined upon, and it was performed on the 12th of May, without any material difficulty or interruption, except such as was the consequence of the division of, and bleeding from, the small muscular arteries. Having got command of the internal iliac artery within the pelvis, which, says Mr. Atkinson, required the complete length of the fingers to accomplish, it was tied. Sufficient proof of its being the identical artery was repeatedly obtained, by the pressure upon it stopping the pulsation, and causing a subsidence of the tumour. Dr. Wake, Mr. Ward, and all the pupils, were quite assured of the circumstance. The artery being then tied, the pulsation of the swelling entirely ceased. Some delay in placing the ligature arose from the needle not being sufficiently pliable; but, for future operations of this kind, Mr. Atkinson very properly recommends the ligature to be put round the artery by means of an instrument, resembling a catheter, the wire of which has a little ring at its extremity, and can be pushed out some way beyond the end of the tube.

The patient went on tolerably well for some time after the operation; the pulse never exceeded 130, and after a time sunk to 85 or 90. He became exhausted, however, partly by the discharge, and partly by hemorrhage, and died on the 31st of May, about nineteen days after the operation. In the dissection, the cavity, on the external part of the peritoneum, in the situation of the incision, was completely filled with coagulated blood. "The ligature, on moving a part of this (blood) with a sponge, readily followed it, and, without doubt,

had been disengaged for some days." The internal iliac, which appeared to have been tied, had separated about an inch and a half from the bifurcation with the external iliac. By "separated," I conclude Mr. Atkinson means, that the upper part of the internal iliac was separated from the continuation of the same vessel. (See *Medical and Phys. Journ.* vol. xxxviii. p. 267, &c.) Although this gentleman has not given a very clear account of some part of the dissection, and he has also omitted to describe the place of his external incision, or the exact parts which he divided in the operation, yet, I think that all the circumstances of the case, taken together, leave not the smallest doubt of the internal iliac artery having been actually tied. The complete stoppage of the pulsation, as soon as the ligature was applied, and the testimony of several respectable practitioners, who were present, remove, indeed, all ambiguity. The profession is much indebted to Mr. Atkinson for this important communication, which was in some measure required, in order to confirm Mr. Stevens's similar case, as it is well known that some distinguished anatomists and surgeons in this metropolis formerly expressed strong doubts of the practicable nature of the operation.

The internal iliac artery has since been tied with success by an army surgeon in Russia, upon whom the late Emperor Alexander settled a pension, as a reward for the skill displayed in the treatment of the case. (See *Auer's Operative Surgery*, p. 39.)

The operation of tying the internal iliac was also performed by Mr. Thomas, of Barbadoes, who sent the preparation of the parts to Sir Astley Cooper, and it is in the Museum of Guy's Hospital. (*Med. Chir. Trans.* vol. xvi. p. 230.) A fifth instance of the application of a ligature to the internal iliac artery took place in the practice of Mr. Hudson, of New York. (See *American Journ. of Med. Sciences* for Feb. 1828, art. v. p. 304.) A semilunar incision, seven inches in length, was made, with its convexity towards the ilium, from the vicinity of the umbilicus to that of the abdominal ring. After dividing the parietes of the abdomen, and tying some arteries which bled, the peritoneum was pushed upwards and inwards, and the handle of a scalpel passed under the trunk of the internal iliac artery, which was tied an inch below its origin. The patient recovered.

It is very justly observed by M. Velpeau, that the ligature of the internal iliac artery, with regard to its influence on the circulation, is in reality less serious than that of the external iliac, or even the femoral. In fact, it leaves undisturbed all the vessels appertaining to the corresponding limb, while the great pelvic arteries anastomose with one another so freely, that, when one is obliterated, an abundance of blood is promptly conveyed by the others to the organs which the obliterated one is designed to nourish. But the ligature of the internal iliac artery is dangerous in another point of view: first, on account of the difficulties in its performance; and secondly, on account of the unavoidable detachment of parts from one another which are connected together by a large quantity of loose cellular tissue, - texture in which inflammation and suppuration are disposed to spread to a great extent. (See *Velpeau, Nouv. Élém. de Méd. Opér.* t. i. p. 185.)

In a modern publication are given a few particulars of a case, which was supposed to be an aneurism of the gluteal artery, and cured by

means of pressure, a light vegetable diet, gentle laxatives, and digitalis. (See *Lectures of the Fellows, &c. of the King's and Queen's College of Physicians in Ireland*, vol. i. p. 41. 8vo. Dub. 1817.) From the very imperfect account here given of the tumour, it is impossible to form any conclusion respecting its nature. Mr. Mayo also briefly mentions a case which was believed to be a false aneurism of the gluteal artery, and which got well without an operation. (*Outlines of Pathology*.)

Sandifort has recorded an instance of an aneurism of the internal iliac artery itself. (See *Tabula Anatomica, &c. Præcedit Obs. de Aneurysmate Arteriae Iliacæ internæ, rariores ischiadis Nervosa causa*. fol. Lugd. 1804.)

ANEURISM REQUIRING LIGATURE OF THE COMMON ILIAC ARTERY.

Professor Gibson had occasion to put a ligature round the common iliac artery, in an example of gunshot wound. "The patient lived fifteen days after the operation, and then died from peritoneal inflammation, and from ulceration of the artery. The circulation in the limb of the injured side was re-established about the seventh day after the artery had been tied." (See *American Med. Recorder*, vol. iii. p. 185; and *Gibson's Institutes of Surgery*, vol. ii. p. 145. Philadelphia, 1825.)

In March, 1827, Dr. Mott took up the common iliac artery in a case of aneurismal tumour, protruding considerably in the iliac region, and causing excruciating pain. Dr. Mott's incision, about eight inches in length, extended from the external abdominal ring, to one or two inches above the anterior superior spine of the ilium. The tendon of the external oblique muscle was divided, and also a part of the insertion of the internal oblique and transverse muscles. The operator then cautiously raised the peritoneum with his fingers, and detached it from the tumour and vessels, without doing it the slightest injury. The aneurismal dilatation was found to terminate about half way between the bifurcation of the aorta and the origin of the internal iliac trunk. The ligature was passed from the outside of the vessel, with the aid of an instrument invented by Drs. Parish and Hewson. The protrusion of the intestines rendered this part of the operation most difficult. The exact situation of the ligature was just below the bifurcation of the aorta, and at the side of the sacro-vertebral promontory. As soon as the ligature was tightened, the pulsation of the tumour ceased, its size was lessened, and the agonizing pain previously felt subsided. The limb having become cold, was wrapped in cotton and well covered, and, in little more than half an hour, its circulation and temperature were entirely restored. The operation was completely successful. In 1828, the operation of tying the common iliac artery was performed by Mr. Crampton, of Dublin; but the patient died of hemorrhage on the fourth day. In this case, the circulation, heat, and sensibility, which had been seriously interrupted in the limb for a time, were perfectly re-established, and every thing seemed to promise a favourable result, when, on a sudden, the ligature became displaced, and the patient died of internal hemorrhage. In the year 1833, the common iliac artery was taken up by Mr. Guthrie, for a tumour, supposed by him and some other surgeons to be aneurismal, but which proved to be

of a medullary malignant character. The temperature of the limb after the operation diminished, but not much. It was constantly rubbed, day and night, and a hot brick and bottles of hot water applied to the feet. The tumour subsided directly.

After the ligature of the common iliac, the lower extremity is supplied with blood through the anastomoses of the internal mammary with the epigastric, of the uppermost lumbar arteries with the circumflexa ilii, or even the ilio-lumbalis; and, lastly, of the branches of the internal iliac of the sound side with those of the diseased one.

The unsuccessful application of a ligature to the femoral artery by Sir Astley Cooper and Mr. Anthony White, where the aneurism extended very high up the trunk, I have already noticed in the previous columns. The ligature of the aorta will be hereafter considered. (See AORTA.)

ANEURISMS OF THE BRACHIAL ARTERY.

Surgical writings contain many histories of aneurisms in the bend of the arm, produced by the puncture of the brachial artery in venesection, or caused by a deep wound inflicted at the bend of the arm, along the inner side of the humerus, or in the axilla. Such cases must indisputably be formed by effusion; but the blood extravasated may spread widely in the cellular tissue, so as to constitute a diffused false aneurism; or it may be confined in one mass, and be bounded by the adhesive inflammation, so as to form a circumscribed false aneurism. Morand and others found, that, along with aneurisms, caused by a wound of the brachial artery, the diameter of the vessel was sometimes enlarged through its whole length, above the seat of the tumour.

The proximate cause of these cases may invariably be traced to the solution of continuity in the two proper coats of the artery, and the consequent effusion of blood into the cellular substance. The effect is the same, whether from an internal morbid affection, capable of ulcerating the internal and fibrous coats of the artery, the blood be effused into the neighbouring cellular sheath surrounding the artery, which it raises after the manner of an aneurismal sac; or, the wound of the integuments having closed, the blood issue from the artery, and be diffused in the surrounding parts. The cellular substance, on the outside of the wounded vessel, is first injected, as in ecchymosis; the blood then distends it, and elevates it in the form of a tumour, and, the cellular divisions being destroyed, converts it at last into a firm capsule, or aneurismal sac. (Scarpa, p. 167.)

The circumscribed or the diffused nature of the aneurism, and the rapidity or slowness of its formation, depend on the greater or less resistance to the impetus of the blood, during the time of its effusion, by the interstices of the cellular substance surrounding the artery, and by the ligamentous fasciæ and aponeuroses, lying over the sac. The aponeurosis of the biceps muscle, being only half an inch broad, and situated lower than the common place for bleeding, cannot, at least in most cases, materially strengthen the cellular substance surrounding the artery, as is commonly supposed. (Scarpa, p. 168—170.) This author refers the greatest resistance to the intermuscular ligament, which, after having covered the body of the biceps muscle, extends over the whole course of the

humeral artery, and is implanted into the internal condyle. This ligamentous expansion has a triangular shape, the base of which extends from the tendon of the biceps to the internal condyle, while the apex reaches upward along the inner side of the humerus towards the axilla, in the course of the artery. The humeral artery, and median nerve, kept in their situation by the cellular sheath and this ligamentous expansion, run in the furrow, formed between it and the internal margin of the biceps. (Scarpa, p. 171.) Many circumstances relative to the diffusion, circumscription, shape, &c. of brachial aneurisms, are explained by Scarpa by reference to this intermuscular ligament. Mr. Guthrie differs from Scarpa in imputing the diffused or circumscribed state of the aneurism after venesection to the aponeurosis of the biceps confining the blood or not. (On Dis. of Arteries, p. 333.) While aneurisms, from an internal cause, are not unfrequent in the aorta, thigh, and ham, they are exceedingly rare in the brachial artery; though a few such instances are recorded. (Scarpa, 174.; Pelletan, Clinique Chir. t. ii. p. 4.) Dupuytren, in noticing the great rarity of true aneurisms of the brachial artery, expresses his belief that Pelletan's is the only well authenticated instance of it. The cases, quoted by Scarpa from Paletta and Flajani, do not appear to him precise enough, and he takes the same view of those reported by Savard and Hodgson. (See Clinique Chir. t. i. p. 265.)

The mode of distinguishing a wound of the brachial artery, in attempting to bleed, and the method of trying to effect a cure by pressure, are described in the article HÆMORRHAGE. From the cases published by Mr. Cusack, it appears that the brachial form of aneurism to which pressure is most applicable, and in which it is most likely to effect a cure, is that of circumscribed false aneurism, unattended by inflammation either of the sac or of the surrounding parts. The pressure should be applied to the tumour alone, and not to the artery above; and it should be but slight, until the diminished pulsation and solidity of the swelling indicate that conglobula fill the sac; for otherwise the aneurism will become diffused, as happened in one of Mr. Cusack's cases. (See Dublin Journ. of Med. Science, vol. i. p. 124.)

And was the first who tied the brachial artery, for the cure of the aneurism at the bend of the arm, in the same way that Hunter did the femoral, for the cure of aneurisms in the ham, viz. with one ligature above the tumour, without making any incision upon, or into, the sac itself.

The operation is performed as follows:—The surgeon having traced the course of the brachial artery, and felt its pulsations above the aneurism, may either cut down to the vessel immediately above the tumour, or much higher in the long space between the origins of the superior and inferior collateral arteries. The integuments are to be divided in the course of the artery, and also the fascia for the space of about two inches and a half. The surgeon, now introducing his left forefinger to the bottom of the wound, will feel for the hard cord, formed by the median nerve, and closely under, or at the side of which, is the artery within its sheath, which is to be opened. The surgeon should cut chiefly on the side next to the internal margin of the biceps, to avoid dividing any of the numerous muscular

branches, which go off from the opposite side of the artery. He is then to separate the artery from the median nerve and the brachial veins, and with an eye-probe is to pass a ligature under the artery, and then tie it with a simple knot.

In the operation, it should always be recollected, that the median nerve lies in the lower part of the arm, on the inner side of the artery; and, therefore, that the instrument, used for putting the ligature under the vessel, should be passed from within outwards, by which means the inclusion of the nerve will be avoided. (See *Boyer, Traité des Maladies Chir. &c.* t. ii. p. 193.)

The operation is well described by Mr. Hodgson: "The surgeon divides the integuments along the ulnar margin of the biceps muscle by an incision two inches and a half in length. The thin fascia, which surrounds the arm, will thus be exposed, and must be cautiously divided in the direction of the external wound. The artery lies immediately under the fascia, close to the margin of the biceps. The median nerve is situated on the ulnar side of the artery, which lies between its two venæ comites. The internal cutaneous nerve is also situated under the fascia in the middle of the arm, and lies near the ulnar edge of the median nerve. The cellular membrane, connecting these parts, is to be divided, until the coats of the artery are fairly exposed. This part of the operation will be effected with facility, if an assistant compress the artery above the wound, so as to stop the circulation through it, and render it in some degree flaccid. The point of an aneurismal needle is then to be introduced close to the ulnar, and brought out on the radial side of the artery, so as to avoid including the median nerve, or the veins which accompany the artery." (*On Diseases of the Arteries, &c.* p. 391.)

Sometimes the surgeon has a difficulty in discriminating the artery from the median nerve. When there is no pulsation perceptible in the artery, the firmer feel of the nerve is one of the best criterions. Indeed, after dividing the integuments, the hard cord felt under the fascia may be regarded, without any risk of mistake, as the median nerve. However, the best operators are sometimes perplexed. Thus, Dupuytren was operating on a patient who fainted, and, for more than a quarter of an hour, he remained doubtful which was the nerve, and which the artery, and he did not venture to tighten the ligature till the circulation had revived. (*Dupuytren, Clin. Chir.* t. i. p. 282.) And, in another instance, after making an incision, two inches and a half long, in the course of the artery, above the bend of the elbow, he found the subcutaneous cellular tissue gorged with blood, and the cellular sheath, inclosing the median nerve and brachial artery, thickened and easily torn. A large vein lying across the artery, was cut through. The fasciculus, composed of the artery and nerve, were next exposed, and an eye probe passed under the guidance of a director beneath the artery, as Dupuytren supposed; but, on raising up the probe to ascertain what lay over it, severe pain was felt, followed by numbness in the trunk of the nerve. Dupuytren then, by very careful dissection, detached the nerve from the artery, to which he next applied a ligature. (*Op. et vol. cit.* p. 288.)

The importance of avoiding the inclusion of the median nerve in the ligature is great, not only with reference to paralysis, but to gangrene, which Du-

puytren never knew follow the ligature of the brachial artery, except when that nerve had been tied together with it. (See *Clin. Chir.* t. i. p. 286.)

Whoever, says Scarpa, shall have the treatment of a circumscribed aneurism in the bend of the arm, will no longer, it is to be hoped, follow the method of those, who, supposing the tumour to be formed by the dilatation of the artery, used first to divide the integuments over the tumour, insulated the sac, and sought the vessel above and below the aneurism, in order to tie it in two places; and then endeavoured to make the sac flaccid away. The operation is now reduced to the greatest simplicity, viz. tying the artery merely above the tumour. (See *Scarpa*, p. 358, 359.)

The ligature should be placed as near the aneurism as possible, the principal reason for doing it at a distance from the swelling in some other cases not being here applicable. (See *Harrison on the Arteries*, vol. i. p. 167.; *Guthrie on Dis. of Arteries*, p. 333, &c.) The correctness of Scarpa's recommendation of tying the artery only in one place above a circumscribed brachial aneurism is confirmed by the experience of Dr. Colles, who observes, "I have operated repeatedly, and with success, for the cure of brachial aneurism, in consequence of injury to the arteries in performing venesection. I have also frequently assisted others in operating for the same case, and with the same result; and I never yet found it necessary, to open the aneurismal sac, or to apply more than one ligature round the artery, and which, I think, ought always to be tied as near as possible to the seat of the disease." (See *Harrison's Surgical Anatomy of the Arteries*, vol. i. p. 170. ed. 2.)

When the aneurism is diffused, and accompanied with violent inflammation and swelling of the whole arm, from the excessive distention of the clots of effused blood, Scarpa recommends the old operation of opening the tumour, and tying the artery at the bottom of the sac, above and below the wound made by the lancet. In this method, a tourniquet must be applied to the upper part of the arm, near the axilla; or if the limb be very painful and swelled, it is better to let an assistant compress the artery from above the clavicle, against the first rib. The incision having been made into the tumour, and the blood discharged, a probe is to be introduced into the puncture in the vessel, from below upwards, so as to raise the artery. This, being separated from the parts beneath, and the median nerve, for a small extent, is to have two ligatures put under it; one of which is to be tied above, the other below, the wound in the vessel. Then the tourniquet, or pressure, is to be taken off; and if there be no bleeding, the wound is to be brought together. (See *Scarpa*, p. 359.) With reference to this operation, Rosenmüller's *Chir. Anat. Plates*, part. ii. tab. 11.; Scarpa's plates; Tiedemann's beautiful engravings of the arteries; *Manec, De la Ligature des Arteries*, pl. vi.; and *Cumper's Demonstr. Anat. Pathol.* lib. i., are worth consulting.

From observations made by Mr. Harrison, a doubt may be entertained, whether, even in these circumstances, the adoption of the foregoing plan is always necessary. Indeed, he distinctly declares, that "in no case of diffused or circumscribed aneurism at the bend of the elbow, have I seen it necessary to open the sac, or the artery below the tumour." "Brachial aneurism," says he, "which

commences at the bend of the elbow, in consequence of a wound, is not always circumscribed. Sometimes the tumour extends up the arm between the biceps and triceps muscles, the fascia of the arm preventing its increase in a lateral direction. In one instance I saw the disease extend from the elbow nearly to the axilla. In this diffused aneurism, the surgeon must tie the brachial artery in the upper part of its course, and apply moderate compression along the aneurismal sac. This plan succeeded in the case to which I have alluded, and in which the operation was performed by Mr. Wilmot, in Jervis Street Infirmary; and a perseverance in moderate compression for some weeks, caused the total disappearance of the disease." (See *Harrison's Surgical Anat. of the Arteries*, vol. i. p. 169. ed. 2.) Still, exceptions to the preceding advice may present themselves. Thus the brachial artery has been wounded in venesection precisely at its bifurcation into the radial and ulnar branches. The brachial artery was tied close to the wounded part; but as the bleeding returned, it was secured a little higher up. Amputation was performed, and the patient lost his life. Here it was ascertained that a ligature could scarcely have been applied below the opening in the vessel, so near was this to the bifurcation; and perhaps the radial and ulnar arteries should have been secured. (See *Guthrie on Dis. of Arteries*, vol. i. p. 332.) While Baron Dupuytren expresses himself in favour of the preference, which should generally be given to a single ligature above the tumour in aneurism at the bend of the arm, he admits the possibility of this method failing, the pulsations being only temporarily suspended by it. In simple aneurism it will answer; in what he terms the arterio-venous aneurism, or varicose aneurism, it will not stop the throbbings. (See *Clinique Chir.* t. i. p. 274.)

A high division of the brachial artery is well known to be a frequent occurrence. If, in consequence of this, two arteries should be exposed in the operation (see *J. G. Crosse, in Prov. Med. and Surg. Trans.* vol. v.), the surgeon should endeavour to ascertain by pressure, which vessel communicates with the wound, or sac, and apply the ligature accordingly; but, if the pulsation, or bleeding, cease only when both vessels are compressed, he will be justified in tying both. (See *Harrison's Surgical Anat. of the Arteries*, vol. i. p. 166. ed. 2.)

It was on the brachial artery that Mr. Lambert (*Med. Obs. and Inquiries*, vol. ii.) made the experiment of closing the puncture in the vessel by means of the twisted suture, under an idea that the plan would not, like compression, obliterate the arterial tube, and therefore that the risk of gangrene would be lessened. Now, although in the trial which was made, the bleeding was permanently stopped, Lambert was mistaken in supposing, that the previous state of the wounded part of the artery was preserved by the adoption of the twisted suture, instead of pressure, or the ligature. If ever a small puncture in an artery heal, so as to leave the tube of the vessel pervious, it is under the circumstances pointed out by Dr. Jones. (See *HEMORRHAGE*.) Had Lambert had an opportunity of examining the state of the vessel, some time after the above operation, he would have found its canal obliterated; and had he known the freedom with which the collateral arteries anastomose with the recurrent arteries of

the forearm, he would have known how to explain more correctly the re-establishment of the pulse. From the pulsation under the cicatrix having continued to be strong and natural in three examples of aneurism of the brachial artery after bleeding, which were cured by compression, Mr. Cusack infers, that the opinion, hitherto entertained respecting the obliteration of the artery at the part wounded, is, in the majority of cases, erroneous. (See *Dublin Journ. of Med. Science*, vol. i. p. 124.) Such pulsation may not, however, be a satisfactory proof of the artery being pervious. I need merely add, that as the false idea of preserving the perviousness of the artery was the only foundation for Lambert's method, the practice ought never to be revived, as not affording equal security against hemorrhage to what is obtained by the ligature, or even compression.

AXILLARY ANEURISMS.

Aneurisms occasionally take place in the axilla, and make it necessary to tie the subclavian artery. A question, here naturally presenting itself, is, whether the surgeon should attempt the operation in an early period of the disease, or wait till circumstances are urgent—the aneurism large and far advanced; the arm cedematous and insupportably painful, from the stretching of the axillary plexus of vessels; the patient worn out by suffering and loss of rest; and the tumour in danger of bursting? In all cases of aneurism, unquestionably, there is a certain chance of the disease getting well spontaneously; and one axillary aneurism, in a man in St. Bartholomew's Hospital a few years ago, had certainly disappeared of itself, as was proved by the account which the patient while living gave of his case, and by the obliteration of the artery, found on inspection after death. We may also find a few instances of subclavian aneurism being cured by Valsalva's treatment. (See *Pelletan, Clin. Chir.* t. i. p. 77.; *Cloquet in Archives*, 1834, t. vi. p. 511.)

I believe, however, we ought not to suffer our conduct to be too much influenced by the hope of events which are so unfrequent; and, from the observations which I have made on this subject, it is my decided opinion that the operation should never be delayed, so as to allow the tumour to acquire an immoderate size. The operation is always difficult; but the difficulty is seriously increased, when the swelling has extended far towards the breast, and has become so large as to press the clavicle considerably upwards. The several examples, in which the subclavian artery has now been successfully tied, furnish abundant proof that the anastomoses are fully competent to the supply of the limb with blood. The plan, therefore, of delaying the operation long, with the view of allowing the inoeculating arteries to enlarge, must be as questionable here, as in some other cases of aneurism, and, at all events, the maxim may be safely advanced, that, previously to the operation, the tumour should never be suffered to acquire an enormous size.

That the limb would receive an adequate supply of blood was well proved, even without the performance of the operation, by cases in which the axillary and subclavian arteries had been rendered impervious by disease; as, for instance, by the pressure of an aneurism of the aorta. (For an

account of such facts, the reader is particularly referred to *Hodgson's Treatise on the Diseases of Arteries*, p. 111.; *Journ. de Médecine*, by *Corvisart, Leroux, and Boyer*, t. ii. p. 29.; *Corvisart, Essai sur les Maladies du Cœur*, p. 215.)

"In these cases," says Mr. Hodgson, "the only unusual circumstance, which was observed during the life of the patients, was the deficiency of the pulse at the wrist. The limbs were well nourished, although a considerable extent of the main artery (the subclavian) was obliterated even before it had given off any branches." (P. 47.)

This vessel was tied by Mr. Hall, in Cheshire, when it had been wounded with a scythe, and its ends exposed; the arm was preserved, though it remained somewhat weakened, which might be owing to the division of some large nerve. (See *J. Bell on Wounds*, p. 60., edit. 3.; and *Scarpa*, p. 372.) Mr. White, of Manchester, relates another instance of this vessel being tied, in the case of a wound; but mortification of the limb and death followed. Three of the nerves were found included in the ligature. (*Lond. Med. Journ.* v. 4.) In cases of wounds of the axillary, or any other large arteries of the extremities, the surgeon, before proceeding to apply a ligature, should first ascertain the precise place of the wound in the artery; and, for this purpose, it may sometimes be proper, in certain wounds of the shoulder, to make an incision in the axilla so as to expose the injured part of the vessel; or, if circumstances do not forbid it, the external wound may be dilated, until the exact part, where the artery has been wounded, is discovered. In proof of the propriety of acting in this manner, and applying a ligature above and below the wound in the vessel, Scarpa quotes a case, in which such practice was successful on a patient under M. Maunoir of Geneva: the artery had been injured with a sabre near the head of the humerus; but, after the wounded part of the vessel had been traced, and secured in the way above suggested, the patient, a boy fourteen years of age, was saved from the dangers of hemorrhage, and recovered the use of his arm, as fast as this was possible, with the loss of the first phalanges of the three last fingers from gangrene. (See *Scarpa on Aneurism*, p. 412., ed. 2.; and *Jour. de Méd.* t. xi., Mars, 1811.)

There are two modes of operating for axillary aneurisms: one, by cutting below the clavicle, in order to take up the axillary artery itself; the other, by making the wound above the bone, for the purpose of securing the subclavian artery at the point where it emerges from behind the anterior scalenus muscle.

The first of these methods has been attempted by Desault, Pelletan, the late Mr. Keate, Mr. Chamberlaine, &c. In a case of wound of the axillary artery, Desault made an incision, six inches long, below the external third of the clavicle; two thoracic arteries cut were immediately tied; the two lower thirds of the great pectoral muscle were next divided with a bistoury guided on a director: a large quantity of coagulated blood was now discharged; and the artery was directly taken hold of, and tied, together with the brachial plexus of the nerves. The arm mortified, and the patient died. This case, we must agree with Scarpa, was not a fair trial of the operation, inasmuch as the inclusion of the plexus of nerves in the ligature, was an improper measure, and must have pro-

moted the occurrence of sphacelus. It seems also probable, from the account, that the vein was likewise tied; another serious and objectionable proceeding. Besides, it is worthy of notice, that the case was a wound of the axillary artery, attended with a copious effusion of blood in the cellular membrane. In all examples of this kind, gangrene is more readily induced, than when the case is merely a circumscribed aneurismal tumour. (See *Euvres Chir. de Desault*, par *Bichat*, t. ii. p. 553.) As for Pelletan's example, it hardly deserves recital, because the operation in fact was not achieved. His colleagues objected to dividing the pectoral muscle; a random thrust was made with a needle and ligature; and the artery was not included. (See *Clinique Chir.* t. ii. Obs. 7. p. 49.)

In a case of axillary aneurism, which had actually burst, and the hemorrhage from which could only be stopped by pressing the artery against the first rib, the late Mr. Keate, surgeon-general, practised the following operation, which was attended with complete success. His plan was to take up the artery, above the diseased and ruptured part, in its passage over the first rib. Accordingly he made an incision obliquely downwards; divided the fibres of the pectoral muscle that were in his way; and, when he came to the artery, passed a curved, blunt-pointed silver needle, armed double, as he conceived, under the artery, and tied two of the ends. After a careful examination, finding that the artery pulsated below the ligature, he determined on passing another ligature higher up, and nearer to the clavicle: he, therefore, passed the needle more deeply, so as evidently to include the artery. In a few days the swelling of the arm began to subside, the wound suppurated, and the ligatures came away with the dressings. The arm afterwards recovered its feeling, and the patient regained, in a great measure, the entire motion of the shoulder, &c. (See *Med. Review and Magazine* for 1801.) This method is objectionable, inasmuch as it was a dive made with a needle, and attended with great danger of wounding and tying parts, which should be left undisturbed.

Mr. R. Chamberlaine, of Kingston, Jamaica, took up the axillary artery below the clavicle, in a patient, who had an aneurism in the left axilla, occasioned by a wound with a cutlass on the 5th of October, 1814. On the tenth of January, the tumour had considerably increased, and was less compressible, than it had been when first seen by Mr. Chamberlaine. The operation was done on the 17th of January, 1815. "A transverse incision, of three inches in length, was made through the skin and platysma myoides, along and upon the lower edge of the clavicle, three fingers' breadth from the sternal end of that bone, and terminating about an inch from the acromion scapulae. This incision divided a small artery, which was immediately secured. A second incision, of three inches in length, was also made obliquely through the integuments over the deltoid and pectoral muscles, meeting the first nearly in the centre. The cellular membrane and fat, lying between them at the upper part, were now removed. The next step consisted in detaching the clavicular portion of the pectoralis major, and taking away the fat and cellular membrane lying over the subclavian vessels. The artery was now brought into view,

and its pulsations made it clearly distinguishable from the contiguous parts." After several ineffectual efforts, Mr. Chamberlaine succeeded in conveying a ligature under it, by means of an eye-probe, curved for the purpose, and the point of which was brought up with the aid of a pair of forceps. On the 22d of February, the wound was completely healed; the aneurismal tumour reduced to the size of a turkey's egg, and very solid; the arm smaller than its fellow, but its muscular power improving. (See *Medico-Chir. Trans.* vol. vi. p. 128, &c.) Mr. Chamberlaine expresses his conviction, that the operation would have been much facilitated, had he been furnished with the instruments described in Mr. Ramsden's work for passing the ligature under the artery: a still better invention, however, for passing a ligature under a deep artery, is the needle constructed by Mr. Weiss, surgeon's instrument-maker, in the Strand. An engraving and description of this valuable instrument may be found in the *Edin. Med. and Surgical Journal*, No. 76.

Mr. Hodgson's directions for the performance of this operation are very clear: A semilunar incision through the integuments, which is to have its convexity downwards, and to begin about an inch from the sternal end of the clavicle, being continued towards the acromion for the extent of three or four inches, so as to end near the anterior margin of the deltoid muscle, without reaching into the space between the deltoid and pectoral muscle, in order to avoid wounding the cephalic vein. This incision will expose the fibres of the pectoral muscle, which are now to be divided in the direction and extent of the external wound. The flap is then to be raised, by dividing the loose cellular tissue, which connects the pectoral muscle to the parts underneath it. The pectoralis minor will now be seen crossing the inferior part of the wound; and, by introducing his finger between the upper edge of this muscle and the clavicle, the surgeon may feel the pulsations of the axillary artery. Here one of the cervical nerves lies above, but in contact with, the artery; the other nerves are behind it. In the dead subject, the axillary vein is situated below it: but, in the living, the vein is distended, and conceals the artery. The cellular tissue, connecting these parts, is to be separated by careful dissection, or by lacerating it with a blunt instrument. A ligature having been drawn under the artery with an aneurism needle, the ends of the cord are to be raised, and a finger passed down, so as to compress the part surrounded by the ligature. If the artery be included, the pulsation in the aneurism will immediately cease. This precaution is highly necessary, lest one of the cervical nerves should be tied, instead of the artery. (See *Hodgson on Dis. of Arteries*, &c. p. 362.)

When an aneurism extends a certain way inwards, or towards the trachea, the operation below the clavicle becomes impracticable; and it is now requisite to make the incision above that bone, and take up the subclavian artery at the point, where it comes out from between the scaleni muscles, and lies on the flat surface of the first rib.

In the dead subject, without any tumour under the clavicle, this operation is easy enough; but in a living patient, and particularly in one whose neck is short, the difficulty is much increased, by a large axillary aneurism, for then the clavicle

is sometimes so much elevated, and the artery lies so deeply, that a ligature can hardly be carried under it, without a particular needle for the purpose. This was the case in an attempt which I once saw made by Mr. Ramsden to tie the artery, and in which one of the cervical nerves, affected by the pulsation of the artery, was mistaken for it, and tied, so that the aneurism soon afterwards burst, and a fatal hemorrhage arose. Hence, the advice given by my friend Mr. Hodgson, always to operate in this case while the tumour is small, cannot be too well remembered. The direction, given by Mr. Liston, is also important; indeed, it is given by Mr. Hodgson, in relation to the operation below the clavicle, and may be said to apply to all operations for the cure of aneurism. It is one which Dupuytren always particularly insisted upon; namely, "before tightening the ligature, try the effect of compression with the fingers on the pulsation, as by taking this precaution (says Mr. Liston) I saved myself and my patient the pain of tying the nerve, which I got hold of in my first operation, in place of the artery." (*Lancet*, No. 195. p. 234.) The chief difficulty in the operation is that of passing the ligature round the artery; but, it may be done either with an ingenious needle, which Mr. Ramsden has described, and which is exactly similar in principle to Desault's *aiguille à ressort*, or with the still preferable instrument constructed by Weiss. Another very ingenious contrivance for tying deep arteries has also been recently proposed by Dr. Prevost, of Geneva. (See *Edin. Med. and Surgical Journ.* No. 79.) The instruments used by Dr. Mott, when he took up the *arteria innominata*, will be presently noticed.

In order to avoid the inconveniences of the needles, ordinarily used for conveying ligatures under deep arteries, Desault (says Bichat) invented "une aiguille à ressort," composed of a silver tube, or sheath, which was straight at one end, and bent at the other in a semicircular form. This sheath enclosed an elastic wire, the projecting extremity of which was accurately fitted to the end of the sheath, and perforated with a transverse eye. The instrument was passed under the artery, and, as soon as it had reached the other side of the vessel, the sheath was kept fixed, while an assistant pushed the elastic wire, which, rising from the bottom of the wound, presented the aperture or eye to the surgeon, who now passed the ligature through this opening. The wire was next drawn back into its sheath again, and the whole instrument brought from beneath the artery, by which means the ligature was conveyed under the vessel. (See *Œuvres Chir. de Desault*, par Bichat, t. ii. p. 560.) Another very ingenious method of passing the ligature under the artery, is that practised by Mr. Key; but, as the comprehension of it is difficult without the plate, I shall here merely refer to that gentleman's description of it. (See *Med. Chir. Trans.* vol. xiii. p. 10.)

The invention of the foregoing instruments makes a material diminution in the difficulty of taking up the subclavian artery from above the clavicle; nor can it be wondered, that without such assistance, the operation should have baffled even so skilful a surgeon as Sir A. Cooper. (See *Lond. Med. Review*, vol. ii. p. 200.)

The following example is the first, in which the operation of applying a ligature to the subclavian

artery, from above the clavicle, was ever accomplished.

John Townly, a tailor, aged thirty-two, addicted to excessive intoxication, of an unhealthy and peculiarly anxious countenance, was admitted into St. Bartholomew's Hospital on Tuesday, the 2d of November, 1809, on account of an aneurism in the right axilla. The prominent part of the tumour in the axilla was about half as big as a large orange, and there was also much enlargement and distention underneath the pectoral muscle, so that the elbow could not be brought near the side of the body.

"The temperature of both arms," says Mr. Ramsden, "was alike, and the pulse in the radial artery of each of them was correspondent. After the patient had been put to bed, some blood taken from the left arm, and his bowels emptied, his pulse, which, on his admission, had been at 130, became less frequent; his countenance appeared more tranquil; and he experienced some remission of the distressing sensations in the affected arm: this relief, however, was of short duration."

The pulsation of the radial artery of the affected arm gradually became more obscure, and soon after either ceased, or was lost in the oedema of the forearm and hand. On the evening of the twelfth day, a dark spot appeared on the centre of the tumour, surrounded by inflammation, which threatened a more extensive destruction of the skin. A further postponement of the operation being deemed inadmissible, Mr. Ramsden performed it the next day in the following manner: a transverse incision was made through the skin and platysma myoides, along and upon the upper edge of the clavicle, about two inches and a half in length, beginning towards the outer border of the trapezius, and terminating about half an inch within the outward edge of the sterno-clavido-mastoideus muscle. "This incision divided a small superficial artery, which was directly secured. The skin, above the clavicle, being then pinched up, between my own thumb and finger, and those of an assistant, I divided it from within, outwards and upwards, in the line of the outward edge of the sterno-clavido-mastoideus muscle, to the extent of two inches.

"My object, in pinching up the skin for the second incision, was to expose at once the superficial veins, and, by dissecting them carefully from the cellular membrane, to place them out of my way, without wounding them. This provision proved to be useful, for it rendered the flow of blood during the operation very trifling, comparatively with what might otherwise have been expected; and thereby enabled me with the greatest facility to bring into view those parts, which were to direct me to the artery.

"My assistant having now lowered the shoulder, for the purpose of placing the first incision above the clavicle (which I had designedly made along and upon that bone), I continued the dissection with my scalpel, until I had distinctly brought into sight the edge of the anterior scalenus muscle, immediately below the angle, which is formed by the traversing belly of the omohyoides, and the edge of the sterno-clavido-mastoideus; and having placed my finger on the artery, at the point where it presents itself between the scaleni, I found no difficulty in tracing it without touching any of the nerves to the lower edge of the upper rib, at which part, I

detached it with my finger nail for the purpose of applying the ligature.

"Here, however, arose an embarrassment, which (although I was not unprepared for it) greatly exceeded my expectation. I had learned, from repeatedly performing this operation, many years since, on the dead subject, that to pass the ligature under the subclavian artery, with the needle commonly used in aneurisms, would be impracticable; I had, therefore, provided myself with instruments of various forms and curvatures to meet the difficulty, each of which most readily conveyed the ligature underneath the artery, but would serve me no farther; for, being made of solid materials, and fixed into handles, they would not allow of their points being brought up again at the very short curvature, which the narrowness of the space between the rib and the clavicle afforded, and which, in this particular case, was rendered of unusual depth, by the previous elevation of the shoulder by the tumour.

"After trying various means to overcome this difficulty, a probe of ductile metal was at length handed me, which I passed under the artery; and bringing up its point with a pair of small forceps, I succeeded in passing the ligature, and then tied the subclavian artery at the part, where I had previously detached it for that purpose. The drawing of the knot was unattended with pain, the wound was closed by the dry suture, and the patient was then returned to his bed." (See *Practical Obs. on the Sclerocèle, &c. to which are added four Cases of Operation for Aneurisms*, p. 276, &c.)

Immediately the artery was tied, the pulsation of the swelling ceased; the arm of the same side continued to be freely supplied with blood, and was even rather warmer than the opposite arm; the operation, which was severe from the length of time it took up, was followed by considerable indisposition; the patient died about five days after its performance; after the artery had been tied, the oedema of the arm and the aneurismal tumour partly subsided; and on examination after death, nothing but the vessel was found included in the ligature.

In Mr. Ramsden's publication are descriptions of instruments which will be of great service to any future performer of this operation. The chief one is a needle, resembling that, which was invented and used by Desault, and of which I have already endeavoured to give an idea. By means of this or other instruments already specified, I conceive, that the main difficulty of the operation will in future be avoided. Had Mr. Ramsden had its assistance, his patient would have been detained a very little time in the operating theatre, and the event of the case might have been completely successful. Having witnessed all the circumstances of the case the inference that I drew from them was, that, if the operation could have been done in a moderate time, which now seems practicable with the aid of some kind of aiguille à ressort, or even without it in most examples, the case in all probability would have ended well. The preceding case is particularly memorable, as being the first instance, in which the subclavian artery was scientifically tied, without any random thrust of a needle, and without the inclusion of any part besides the artery in the ligature. It furnished encouragement to repeat the experiment;

held out the hope, that axillary aneurisms might be cured as well as inguinal ones; and confirmed the competency of the anastomosing arteries to nourish the whole upper extremity, when the subclavian is tied where it emerges from behind the anterior scalenus muscle.

In the year 1811, the subclavian artery was tied in the London Hospital, in a case of axillary aneurism, by Sir W. Blizard, who found no difficulty in getting the ligature under the artery, with a common aneurism-needle. A single ligature was applied. At first, hopes of recovery were entertained; but the patient, who was old and debilitated, afterwards sunk, and died on the fourth day. (See *Hodgson's Treatise*, p. 375.)

In the year 1815, Mr. Thomas Blizard tied the subclavian artery in the same hospital. The case was an aneurism in the left axilla, and, like all the other examples of this kind upon record, was attended with great pain in the tumour and limb. There was no pulse in the left radial artery, though there was scarcely any difference in the temperature of both arms. "An incision, about three inches in length, was made through the integuments at the root of the neck, on the acromial side, and parallel with the external jugular vein. The platysma myoides being divided, the cellular membrane was separated with the finger, until the pulsation of the subclavian artery was felt where the vessel passes over the first rib. The finger being pressed upon this part of the artery, the cellular sheath investing it was carefully opened with the point of a knife. A ligature was then conveyed underneath the artery, by means of a common aneurism-needle, with the greatest facility." As soon as the ligature was tied, the pulsation in the tumour ceased. On the second day after the operation, the left arm began to have more feeling, and was as warm as the right. However, difficulty of breathing, twittings, delirium, &c. afterwards ensued, and the patient died on the evening of the eighth day, previously to which event the ring and middle fingers turned black. On opening the body, the pericardium exhibited the effects of a high degree of inflammation, and the heart was covered with flakes of lymph, its posterior surface being of a deep red colour. The inner membrane of the ascending aorta was of a bright scarlet hue, much diseased, and studded with white patches. A reddish appearance was also noticed in the lining of the right carotid, left subclavian, and even the abdominal aorta. The boundaries of the aneurismal tumour were in a state of sphacelation. These are all the circumstances which I wish here to notice; but more particulars may be perused in Mr. Hodgson's work, p. 602.

In some cases upon record, no difficulty was experienced in passing the ligature under the artery with a common aneurism-needle, a circumstance which must have depended upon the space between the clavicle and the first rib having been less deep in these instances, than the two which fell under my own observation, or in others which occurred in the practice of Dr. Colles, Sir Astley Cooper, and Mr. Liston. (See *Lond. Med. Review*, vol. ii. p. 200.; and *Edin. Med. and Surg. Journal*, January, 1815, No. 64.) In Mr. Key's case, "the depth of the angle in which the artery was enclosed, rendering it impossible to pass a ligature under it, about three quarters of an inch of the clavicular portion of the sterno-mastoid was

divided, which afforded sufficient room, and rendered the concluding part of the operation easy; the artery became readily exposed to view, and an aneurismal needle was passed with facility under it." (*Med. Chir. Trans.* vol. xiii. p. 5.) It is an observation made by Dupuytren, that in persons who have long necks, the subclavian artery is more superficial than in others whose necks are short. The size and situation of the tumour will also make a considerable difference; for if it be large, and placed a certain way towards the shoulder, it may raise the clavicle a good way from the first rib, and increase the difficulty of the operation.

In Dr. Colles's first case, the artery was tied before it reached the scaleni muscles, as the tumour, which was in the right subclavian artery, extended from the sternal origin of the sterno-mastoid muscle along the clavicle, a little beyond the arch of that bone, and rose nearly two inches above it, in a conical form, the apex of the cone being situated at the outer edge of the foregoing muscle. After a tedious dissection, it was found, that only a quarter of an inch of the artery was sound, and on this portion the ligature was placed. Great difficulty was encountered in passing it round the artery, and the pleura was supposed to have been slightly wounded. Before tightening the ligature, the breathing became laborious, and the patient complained of oppression about the heart. These symptoms, indeed, were so violent, that it was judged prudent not immediately to tighten the ligature. On the fourth day, however, the artery was constricted, when the pulse at the wrist ceased, the patient not seeming to suffer much from what had been done. The patient then went on pretty well till the ninth day, when he was seized with a sense of strangling, and pain about his heart; and becoming delirious, died in nine hours after the beginning of this attack. On dissection, the aorta was found diseased, and the disease extended into the subclavian artery.

In another instance, Dr. Colles tied this vessel at the point, where it emerges from between the scaleni muscles, without any particular difficulty. The operation, however, was soon followed by a train of severe symptoms, delirium, and mortification; the patient dying on the fifth day. (See *Edin. Med. and Surg. Journ.*, January, 1815.)

The first case in which complete success attended the operation of tying the subclavian artery, where it first comes from behind the anterior scalenus muscle, was that under the care of Dr. Post, of New York. The patient was a gentleman, with an aneurism in the left axilla. Dr. Post performed the operation on the 8th of September, 1817, in the following manner:—"An incision, commencing at the outer edge of the tendon of the mastoid muscle, was carried through the integuments about three inches in length, in a direction deviating a little from a parallel line with the clavicle. This divided the external jugular vein, the bleeding from which required a ligature for its suppression; and, in proceeding with the operation, three or four arterial branches were cut, which it was also necessary to secure. The subclavian artery was then sought immediately on the outside of the scaleni muscles, and was easily laid bare. Passing over the artery at this place, in contact with it, were three considerable branches of nerves, running downwards,

towards the chest, from the plexus above. These were separated, and a ligature passed under the artery, with great facility, by the instrument, well adapted to this purpose, invented by Drs. Parish, Harlshorn, and Hewson, of Philadelphia. On tying the ligature all pulsation ceased in the limb." In the afternoon, the temperature of the limb was observed to be rather higher than that of the other arm. On the 17th of September, the aneurismal tumour burst, and about three ounces of dark coagulated blood were discharged. On the 26th, the ligature came away from the subclavian artery. Oct. 11. the wound was entirely healed; and, on the 16th of the same month, the patient required no further attendance, his only complaints being now a little occasional pain in the fingers, and a superficial sinus at the part where the tumour burst. (*See Med. Chir. Trans. vol. ix. p. 185, &c.*)

In Europe, the first axillary aneurism cured by taking up the subclavian artery from above the clavicle, was that in which Mr. Liston was the operator, on the 3d of April, 1820. The particulars of the case prove the risk there always is of tying one of the axillary nerves, instead of the artery, unless great caution be employed; and, in fact, Mr. Liston himself first passed his ligature under a nerve, and would have tied it, had he not wisely tried what effect constricting the included part would have upon the pulsation of the tumour; a criterion that was never neglected by Dupuytren in operations for aneurism. As the subclavian artery seemed diseased at the point where it emerged from behind the anterior scalenus, Mr. Liston cautiously divided this muscle to about its middle, so as not to injure the phrenic nerve. At length, with the aid of an aneurism-needle, he passed a strong round silk ligature under the artery, and, having hold of the loop with a small hook, withdrew the needle. In consequence of the great depth of the artery, the knot could not be made with the fingers; but, with the assistance of a kind of forceps, each extremity of which had a little notch in it, the business was accomplished. (*See Edin. Med. and Surgical Journ. No. 64.*)

Several other successful operations of this kind have subsequently been done by English surgeons. One by Dr. Gibbs, in the General Naval Hospital of St. Petersburg (see *Med. Chir. Trans. vol. xii. p. 531.*); another by Mr. Bullen, in the Lyon Dispensary (see *London Med. Repository for Sept. 1823*); a third by Mr. Westart at Edinburgh (see *Edin. Med. and Surg. Journ. No. 78.*); a fourth by Mr. Key, in Guy's Hospital (see *Med. Chir. Trans. vol. xiii. p. 1.*); a fifth by Mr. B. Cooper, in the same establishment; and a sixth by Dr. Hobart, of Cork (see *Edin. Med. and Surgical Journ. No. 126. p. 48.*)

When the subclavian artery (says this gentleman) has emerged from behind the anterior scalenus muscle, it passes obliquely over the flat surface of the first rib, with which it is in immediate contact. The cervical nerves are situated above and a little behind the artery: the subclavian vein passes before it, and underneath the clavicle. If the finger be pushed down the acromial margin of the anterior scalenus muscle, the artery will be found in the angle, formed by the origin of that muscle from the first rib. The shoulder being drawn down as much as possible, the skin is

to be divided, immediately above the clavicle, from the external margin of the clavicular portion of the mastoid muscle, to the margin of the clavicular insertion of the trapezius. I think, with Mr. Hodgson, that no advantage whatever can be gained by cutting the clavicular attachment of the sterno-cleido-mastoideus. The exposed fibres of the platysma myoides are now to be carefully divided, without wounding the external jugular vein, which lies immediately under them, near the middle of the incision, and should be detached, and drawn towards the shoulder with a blunt hook. The cellular membrane, in the middle of the incision, is then to be cut, or separated with the finger, until the surgeon arrives at the acromial edge of the anterior scalenus. He passes his finger down the margin of this muscle, until he reaches the part where it arises from the first rib, and in the angle, formed by the origin of the muscle from the rib, he will feel the artery. The ligature is now to be conveyed under the vessel with an aneurism-needle, or that recommended by Desault. (*Hodgson on Diseases of Arteries, &c. p. 376, &c.*)

In 1819, Baron Dupuytren took up the left subclavian artery in the second part of its course, for the cure of an axillary aneurism, following a stab. This eminent surgeon used to consider this vessel as having three different portions; the first, extending from its origin from the aorta to the point where it passes between the scalenus; the second, from its entrance between the scalenus to the point of its quitting the interspace between them; the third, from the latter point to the upper surface of the first rib. This third portion of the course of the subclavian artery, which, in individuals whose necks are long and slender, and whose shoulders are low and thin, is not far beneath its skin, is, on the other hand, very deeply placed in persons whose necks are thick and short, and whose shoulders are covered with a good deal of flesh. In particular, this portion of the vessel is also deeply seated, when the clavicle is pushed up by a tumour in the axilla. Dupuytren's patient was in these latter circumstances; and besides the difficulty which they created to the ligature of this portion of the artery, Dupuytren reckoned that he should have had a good deal of trouble in separating the artery from the brachial plexus of nerves, which, however, in this situation, in reality lie above the vessel, the lowermost one alone lying close above it. Now, Dupuytren conceived that the second part of the course of the artery presented the advantage of the vessel passing alone between the scalenus, entirely separated from the subclavian vein, which ran in front of the anterior scalenus muscle, and also from the brachial plexus, the nerves of which lay backwards and outwards; consequently, by taking the anterior scalenus muscle as a guide, he judged that the artery might be tied, without risk of including any nerve in the ligature.

Governed by these reflections, Dupuytren made an incision on the left side, and at the lower part of the neck, from above downwards, and from within outwards. By this the skin, platysma, and subcutaneous cellular tissue were divided, together with three small vessels, which were immediately secured. In the continuation of the operation, the cellular tissue and absorbent glands contiguous to the artery and brachial plexus were arrived at.

The external border of the anterior scalenus was sought for, and this muscle completely cut through near its insertion, with the aid of a probe-bistoury. The artery was now exposed, and its pulsation readily stopped by the pressure of a finger passed to the bottom of the wound. A silver director, bent in the form of a quarter of a circle, was passed under the artery; and an eye-probe, armed with a ligature composed of three silk threads, conducted along the groove of the director, and withdrawn from the opposite side. Cure was now taken to ascertain that the ligature was really under the artery by pulling at each end of it, and at the same time placing the forefinger on the vessel above it. In this manner it was found that the pulsation of the artery was completely stopped. This proceeding, repeated several times, was observed not to give the least pain; a proof that no nerve was included in the ligature. The artery was now tied; the wound brought together; and the limb placed on a pillow, and covered with bags filled with warm sand. This case proved successful. By the sixty-eighth day the tumour was reduced to one fifth of its original size. The heat, sensibility, and muscular powers of the limb were entirely re-established. In it, as in all limbs, whose principal artery has been tied, the arteries did not pulsate, though blood circulated freely through them. This fluid in passing through numerous and minute anastomoses, from the upper to the lower portion of the limb, seemed to Dupuytren to be no longer within reach of the power of the heart. Between two and three years after the operation, an abscess formed in the axilla and burst. Dupuytren enlarged its opening, and a great deal of pus, blended with old coagula, was discharged. This was soon followed by a perfect cure. (See *Leçons Orales de Cliniq. Chir.* t. iv. p. 524—535.) The reasons assigned by Dupuytren for choosing this method of operating, appear to me not so good as one, which, I believe, is the only valid ground for taking up the subclavian in the second part of its course, viz. the extension of the tumour too far inwards to admit of the ligature being applied at the point, where the artery emerges from behind the anterior scalenus, close behind the tubercle of the first rib. This point can always be reached with facility, by tracing the outer edge of that muscle downwards, whatever may be the conformation of the neck or the height of the shoulder. The phrenic nerve, be it remembered, would also be considerably exposed to injury in Dupuytren's method, which therefore, seems to me eligible only under the circumstances already specified.

With respect to tying the subclavian artery on the tracheal side of the scalenus, I have stated, that it was performed by Dr. Colles, and the event fatal. Descriptions of the operation may be found in Mr. Hodgson's work, p. 382. When I consider the manner in which the subclavian artery, before it passes behind the anterior scalenus, is surrounded by parts of great importance, I can scarcely bring my mind to think, that the measures, requisite for taking up the vessel in this situation, will ever leave the patient much chance of recovery. "Between the aorta and scaleni muscles (says Mr. A. Burns), the subclavian arteries are connected with several important vessels and nerves. They are in the vicinity of the nervus vagus, of the recurrent laryngeal nerve, of the

sympathetic nerve, of the phrenic nerve, and the subclavian vein; and, on the left side, the subclavian artery is intimately connected with the termination of the thoracic duct. These parts are all grouped together in a very narrow space, and the perplexity of their dissection is further increased by the interlacement of the different nerves with one another. The natural connections of these parts are best shown by merely raising the external extremity of the sterno-mastoid muscle. If this be done, the nervus vagus will be brought into view, lying on the forepart of the subclavian artery, almost directly behind the sternal end of the clavicle; and, exactly opposite to the nervus vagus, but behind the artery, the lower cervical ganglion of the sympathetic nerve will be brought into view. The recurrent nerve, on the right side, hooks round the subclavian artery, and, in its course towards the larynx, ascends along the tracheal side of the sympathetic nerve. On the left side, it twines round the arch of the aorta, and, in mounting upward, is interposed between the subclavian artery and oesophagus. The subclavian vein lies anterior to the artery, and, in the collapsed state, sinks nearer to the thorax;" but, when distended in the living body, it overlaps the artery. The thoracic duct enters the subclavian vein, about the eighth of an inch nearer to the acromion than the point, where the internal jugular vein empties itself into the subclavian vein. The termination of the thoracic duct is situated between the sternal and clavicular portions of the sterno-mastoid muscle. (*A. Burns on the Surgical Anatomy of the Head and Neck*, p. 28.)

Axillary aneurisms are sometimes attended with fluctuation, in consequence of the blood becoming effused in the cellular tissue, and the pulsation in the deeper part of the swelling is then concealed. In such a case, Dupuytren once suspected the disease to be a chronic abscess, and made an exploratory puncture into the swelling; but a gush of blood made him promptly withdraw the knife and close the wound. The puncture healed up. Dupuytren wished to have tied the subclavian artery, but he was opposed by one of his colleagues; and, in the end, a point of the skin sloughed, hæmorrhage took place, and the patient died. (*Clin. Chir.* t. iv. p. 520.)

A case, in which an axillary aneurism, unattended with pulsation, was punctured, and the child bled to death, is recorded. (*See Med. Chir. Journ.* vol. iv. p. 78.)

For anatomical views of the parts concerned in the operation of taking up the subclavian artery, consult *Rosenmüller's Chir. Anat. Plates*, part ii. tab. 8 and 9; *Tiedeman's* and *Scarpa's* beautiful engravings; *Manec, Sur la Lig. des Artères*; and *Tabulæ Anat. Chir.* ed. Elias Bujalsky, Petropol. 1828, tab. vi. et vii.

Some valuable anatomical remarks, in relation to the operation, are given by Mr. A. Burns. (*Surgical Anatomy of the Head and Neck*, p. 28, &c.)

Mr. Guthrie observes, whenever an aneurismal tumour in the neck is accompanied by an alteration of the sterno-clavicular articulation, the case is clearly unfit for any operation, except that suggested by Brasdor, even if any operation at all be admissible. (*See Guthrie on the Arteries*, p. 397.) The same, he adds, may be said of any case of aneurismal swelling, either internal or external to

that articulation, in which the stethoscope, applied on the sternum in the course of the arteria innominata, or the arch of the aorta, indicates disease. A swelling at the root of the carotid is more likely to be an aneurism of the arch of the aorta or of the innominata, than of the carotid itself, and the stethoscope will remove all doubt. In one case of subclavian aneurism, where the tumour left no room for the application of a ligature on the tracheal side of it, and where there was great reason to suspect that the arteria innominata was itself enlarged, Baron Dupuytren took up the axillary artery on the 12th of June, 1829, in the Hôtel Dieu. The patient was placed in the recumbent posture, with the right arm raised from the side. An incision was begun near the inner end of the clavicle, two finger-breadths below it, and extended outwards nearly parallel to that bone for about three inches. The fibres of the great pectoral muscle, and then the upper third of the lesser pectoral, were divided. The axillary artery having been next separated from the vein and brachial plexus of nerves, a ligature was passed under it, with an eye-probe, and tightened, the doing of which occasioned no pain. In the course of the operation, which lasted thirty-five minutes, several arterial branches were cut and secured. Immediately after the axillary artery had been tied, the pulsations of the tumour became stronger and irregular, but soon returned to their former strength; simple dressings were applied to the wound, and a bladder of ice to the swelling. An anodyne draught was also exhibited ten hours after the operation; the pulse was strong, and under 90 in the minute. Some blood was now taken from a vein in the arm. On the 13th of June, the patient was feeble, and complained of restlessness and want of sleep. The pulsations in the tumour had not sensibly lessened, but the tension seemed diminished; and the limb retained its natural temperature. On the 16th, the pulse was only eighty, and the tumour and throbbing of it had manifestly diminished. Venesection was afterwards practised several times, and about six ounces of blood came away from the wound. The patient died on the 20th, and was supposed to have been too much lowered by the rigorous antiphlogistic treatment. The origin of several large arterial branches from the subclavian near the tumour, is regarded as a great cause of the little success which this method of operating promises, as applied to subclavian aneurisms; yet, it deserves notice, that in the case before us, the vertebral, internal mammary, and inferior thyroid branches were all found obliterated. This, according to Dupuytren, most frequently happens, when the aneurism has attained a certain size; and, therefore, he infers, that their presence should not deter a surgeon from applying a ligature between the tumour and the capillaries. No doubt, the diseased state of the right lung, and the morbid changes observed in the aorta, as observed after death, must have had a very unfavourable influence. (*Clin. Chir.* t. iv. p. 594.) Dupuytren publicly declared, that the preceding case would not deter him from repeating a similar operation in the same kind of case. (P. 611.)

LIGATURE OF THE ARTERIA INNOMINATA.

In certain cases of subclavian aneurism, it has been proposed to tie the arteria innominata. In the dead subject, Mr. Allan Burns applied two

ligatures to it; and after cutting through the vessel in the interspace, he injected the aorta, when the injection was found to pervade the anastomosing vessels of the right arm, and all those of the head. But notwithstanding this fact, and others noticed by Mr. Hodgson, tending to show the probability, that a ligature upon the arteria innominata would not prevent the arm and head from receiving an adequate supply of blood, other objections were made to the practice. The principal of these were founded upon the difficulty of the operation in the living body; the inflammation likely to be excited by it in neighbouring important organs; the danger of hemorrhage from the adhesion of the vessel being likely to be broken by the force of the circulation; and the equal practicableness, in most cases, of tying the subclavian artery on the tracheal side of the scalenus.

Dr. Mott, of New York, impressed with the value of Mr. Allan Burns' remarks upon this subject, has, ever since he became acquainted with them, maintained in his lectures the propriety of attempting to tie the arteria innominata, under particular circumstances of subclavian aneurism. At length, Dr. Mott put this new operation to the test of experience in the New York Hospital, on the 11th of June, 1818. The case was a subclavian aneurism on the right side; and the patient, a sailor, aged fifty-seven, to whom seventy drops of tinct. opii were first given. Dr. Mott began the first incision directly over the swelling above the clavicle, extending it along this bone, and ended it at the trachea, just above the upper portion of the sternum. Here he commenced the second incision of about the same length as the first, and reaching along the inner margin of the sternocleidomastoideus. Dr. Mott next detached the skin from the subjacent platysma myoides, cut through the latter, and cautiously divided the sternal portion of the mastoid muscle, in the direction of the first incision. The internal jugular vein now presented itself close to the swelling, and adherent to it; a circumstance that rendered the subsequent part of the operation very difficult. After detaching a portion of the latter vein from its connection, Dr. Mott cut through the sternohyoides and sternothyroides, and turned them back over the trachea. The carotid was now exposed a few lines above the sternum; and after he had separated the par vagum and internal jugular vein from it, they were drawn towards the outer side of the neck. Dr. Mott then laid bare the subclavian artery, which part of the operation he chiefly accomplished with the handle of the scalpel, as there was nothing to be separated but cellular membrane. The subclavian artery was found to be very much enlarged and diseased; and, as Dr. Mott recollected that this state of the vessel had seemingly hindered its successful closure, in the example operated upon by Dr. Colles, of Dublin, he decided to take up the arteria innominata itself. In detaching the cellular membrane from the lower surface of the subclavian artery, a small branch, situated about half an inch from the innominata, was injured, and the wound was six or eight times filled with blood from it. The hemorrhage was soon suppressed, however, by means of a little pressure. Had not the bleeding been so easily stopped, Dr. Mott would have concluded from the situation of the vessel, that it was the internal mammary; but, if it were not this branch, he con-

ceives it must have been an artery not regularly originating in this situation; perhaps the superior intercostal.

Dr. Mott continued the operation with a small, round-ended, sharp scalpel, until he came to the division of the *arteria innominata*, which great vessel he traced below the sternum; and after freeing it from all the cellular membrane with the handle of the scalpel, and drawing aside the recurrent and phrenic nerves, he tied it with a round silk ligature, about half an inch from its bifurcation.

On account of the difficulty of tying large arteries in a deep small wound, Dr. Mott recommends a set of instruments, invented for the purpose, in Philadelphia, by Drs. Parrish, Hartshorn, and Hewson; consisting, 1st, Of several blunt-pointed needles, of various sizes and curvatures, furnished with an eye at each end, and calculated at one end to screw into a strong handle. 2dly, Two strong instruments, with handles, having at one end an eye, or hole; they resemble those sometimes used for applying a ligature to the tonsils. 3dly, A small round-pointed scalpel. 4thly, A small hook fixed in a strong handle. (Parrish, in *Eclectic Rep.* vol. iii. p. 229.) After Dr. Mott had introduced the ligature into the eye of one of the above-described needles, and screwed the needle into a handle, he pressed with its convexity the cellular membrane and pleura carefully downwards, while he carried it from below upwards round the artery. As the point now appeared on the other side of the vessel, the above-mentioned hook was passed into its eye, and the handle unscrewed from the other end of it, when it was easily drawn out from under the artery, and the ligature left under the vessel. In this part of the operation, Dr. Mott urges the necessity of being particularly attentive to two important circumstances; one is, to convey the ligature round the artery from below upwards, as the only way to prevent injury of the pleura; and the other is, to fix the hook in the eye of the needle, before the handle is unscrewed from its other end, because, after this has been done, the needle loses all steadiness, and it is then difficult to get the hook into the eye.

With respect to the foregoing instruments, I may observe, that they are superseded by the needle constructed by Weiss.

Dr. Mott now made a noose, pressed it with the forefinger down to the artery, and tightened it very gradually, in order not to stop the flow of blood through the vessel all at once. A moderate constriction was kept up some seconds, so that the effect of the ligature upon the heart and lungs might be observed; and as no disturbance was produced in the functions of these organs, Dr. Mott tightened the ligature, and stopped the current of blood through the vessel. At this instant, the pulsation of the right, temporal and radial arteries ceased. The noose was tightened still more with the above-mentioned ligature irons, and then a second knot was made. Dr. Mott was greatly pleased at finding his patient's countenance remain perfectly unchanged, and no complaint made of pain in any other part. Immediately after the ligature had been applied, the aneurismal swelling lost one third of its size, and the clavicle could be felt through its whole extent. The divided muscles and detached skin were now brought into

their natural situation; the wound closed with three sutures and adhesive plaster, and a compress applied. In the operation, three small arteries were tied: the first lay under the sternum, and seemed to be a branch of the internal mammary; the second was a descending branch of the superior thyroideal; and the third a branch of the inferior thyroideal. From two to four ounces of blood were lost, most of which came from an injured small branch of the subclavian. The operation took up about an hour. The curved spatulæ, recommended by Dr. Colles, were found very useful for holding the carotid and par vagum aside, while, by their uniform pressure, they materially assisted in restraining the effusion of blood from small vessels, and, as taking up little room, were infinitely more convenient in a deep narrow wound, than the fingers of an assistant.

The day after the operation, the veins of the right forearm and hand had a turgid appearance. When the circulation in them was promoted by pressure, they became empty for some distance above the pressed part, but filled again immediately the pressure was removed; a circumstance that seemed to show, that the circulation in this arm, notwithstanding the ligature of the *arteria innominata*, still went on with great celerity, though no pulse could be felt in the brachial and radial arteries. On the contrary, the pulse was very plain in the front branch of the temporal artery, just above the outer angle of the orbit. The left external carotid beat with unusual force. In a few days, however, the pulse became perceptible again at the right wrist.

My limits will not allow me to enter into all the details of this interesting case; suffice it to mention, that the patient suffered considerable febrile disturbance at some periods after the operation, and it was necessary twice to have recourse to venesection. He was also afflicted with a severe cough. The discharge from the wound was copious and fetid. The main ligature separated on the fourteenth day. On the twentieth day, the patient was sufficiently recovered to walk in the garden. On the twenty-first day, the wound was almost closed; the patient could move his right arm with the same facility as his left, and he was gaining such strength, that no doubts were entertained about the successful result of the operation. On the twenty-third day, hemorrhage came on from the wound; it was stopped by the introduction of lint, and the employment of pressure. About twenty-four ounces of blood were lost, whereby the patient was so depressed, that the pulse was no longer distinguishable. On the twenty-fourth day, in the evening, he lost four ounces more blood; on account of his restlessness and the painful state of his arm, two grains of opium were administered to him. After one or more returns of bleeding, he died on the twenty-sixth day.

When the body was opened, no traces of inflammation or its consequences were found either in the arch of the aorta, the origin of the *innominata*, or the lungs. The aorta was now slit open longitudinally, and a probe then cautiously passed through it into the *innominata*, when the instrument went through the latter vessel into the cavity of the wound. The inner coat of the *innominata* was smooth and soft; but, about half an inch from the place where the ligature had cut through the vessel, marks of inflammation were noticed, and a

coagulum adhered to the sides of the artery with considerable firmness; so that nature had probably endeavoured, by means of adhesive inflammation, to close the vessel, but had been prevented from completing the salutary process by the destructive ulceration. One portion of the parietes of the innominata was thickened by inflammation, and an anomalous branch, as large as a crow's quill, arose from this artery.

The ulcer was twice as extensive inwardly as it was superficially, reaching laterally to the trachea and under the clavicle to the swelling. The tripod of great vessels, viz. the innominata, the subclavian, and the carotid, was destroyed by ulceration to the extent of about an inch, and the ends of both the last vessels opened into the wound. At this place, the pleura was considerably thickened by a layer of organized lymph.

The inner surface of the carotid was covered with a coagulum, and its coats so much thickened, that a probe could hardly be passed into it. The consolidation reached up to the division into the external and internal carotid. The subclavian was pervious as far as the situation of the disease. The diameter of the brachial and other arteries of the right arm was natural. The external mammary artery was enlarged, but not the internal. The clavicle was carious, and several lymphatic glands under it in a state of supuration.

Though the result of the operation was unsuccessful, it proves, as Dr. Mott correctly remarks, some interesting points; namely, that tying an artery of such magnitude, and so near the heart, may be done without occasioning any disturbance either in the functions of the brain, the heart, the lungs, or the right arm.

The suppuration, which continually extended itself more and more deeply, is set down by Dr. Mott as the cause of the patient's death; for, as no bleeding took place for several days after the detachment of the principal ligature, he believes that this must have fulfilled its duty, and that the artery had been closed. (See *New York Med. and Surgical Register*, 1818, vol. i.)

The arteria innominata was also tied by Græfe on the 5th of March, 1822, in the Clinical Hospital of the University of Berlin, on account of a subclavian aneurism. The carotid was exposed, and traced down to the innominata, to which a ligature was applied by means of a blunt tenaculum constructed for the purpose, the vessel being tied about an inch from the curvature of the aorta, and two inches from the heart. As soon as the ligature was tightened, the pulsation of the arteries of the right arm, right carotid, and right temporal artery, ceased; at the same instant, the throbbing of the aneurism stopped, and the tumour became flaccid. The constriction of the cord produced no disturbance of any function. The patient went on so well for several weeks afterwards, that no doubt was entertained of his recovery. However, when the wound was nearly healed, hemorrhage came on; and though it was suppressed, and hopes began to be again indulged, the bleeding recurred, and the patient died on the sixty-seventh day. Below the ligature the innominata was found closed with lymph. * Græfe has written an essay on the method in which the operation was done; the daily particulars of the case, and preparation from it, are placed in the Royal Anatomical Museum at Berlin. (See *Journ. de Chir-*

urgie von C. F. Græfe, und Ph. v. Walther, b. iii. p. 596, &c. b. iv. p. 587.) The ligature of the innominata is stated to have been lately done at Paris; but in this third example, the patient also died of hemorrhage. (See *Dupuytren, Leçons Orales*, &c. t. iv. p. 611.) Of Mr. Wardrop's practice of tying the subclavian artery in aneurism of the arteria innominata itself, we shall presently speak.

CAROTID ANEURISMS.

There is no part of the body where the diagnosis of aneurisms is more liable to mistake than in the neck. Here the disease is particularly apt to be confounded with tumours of another nature. I have already cited, in this article, examples in which aneurisms of the arch of the aorta so resembled those of the carotid, as to have deceived the surgeon who was consulted. A swelling of the lymphatic glands, or of the cellular substance which surrounds the carotid artery; an enlargement of the thyroid gland; and especially abscesses, may resemble an aneurism by the pulsations communicated to them from the neighbouring artery. On the other hand, aneurisms of long standing, which no longer throb, and the integuments over which are changed in colour, and likely to burst, may the more easily be mistaken by an inattentive practitioner for chronic abscesses, as the neck is remarkably often the seat of such diseases. (*Boyer, Maladies Chir.* t. ii. p. 185.)

Scarpa mentions one unfortunate patient, who was killed by a knife being plunged in a carotid aneurism, on the supposition that the case was an abscess. I need scarcely observe, that, by opening a carotid aneurism, a surgeon would expose himself to the disgrace and mortification of seeing the patient die under his hands, as happened in the example cited by Harderus. (*Apiar. Observationum*, Obs. lxxxvi.)

The possibility of tying the carotid artery, in cases of wounds and aneurisms, without any injurious effect on the functions of the brain, is now completely proved. Petit mentions, that the advocate Vieillard had an aneurism at the bifurcation of the right carotid, for the cure of which he was ordered a very spare diet, and directed to avoid all violent exercise. Three months afterwards, the tumour had evidently diminished; and, at last, it was converted into a small, hard, oblong knot, without any pulsation. The patient having died of apoplexy, seven years afterwards, the right carotid was found closed up and obliterated, from its bifurcation, as low down as the right subclavian artery. (*Acad. des Sciences de Paris*, an. 1765.) Haller dissected a woman, whose left carotid was impervious. (*Opuscula Pathol.* Obs. xix. tab. 1.) An example of the total closure of both carotids, in consequence of ossification, is stated by Koberein to be recorded by Jadelot. (*German Transl. of Mr. Hodgson's Work*, p. 293.) Hebenstreit (vol. iv. p. 266. ed. 3. of his *Translation of B. Bell's Surgery*) mentions a case, in which the carotid artery was wounded, in the extirpation of a scirrhus tumour. The hemorrhage would have been fatal, had not the surgeon immediately tied the trunk of the vessel. The patient lived many years afterwards. This is probably the earliest authentic instance, in which a ligature was applied to the carotid artery. Mr. Abernethy's case is perhaps the second; and that in which Mr.

Fleming, a naval surgeon, tied the common carotid in a sailor, who attempted suicide and who was saved by the operation, is still later, not having occurred till the year 1803. (See *Med. Chir. Journ.* vol. iii. p. 2.)

Dr. Baillie knew an instance, in which one carotid was entirely obstructed, and the diameter of the other considerably lessened, without any apparent ill effects on the brain. (See *Trans. for the Improvement of Med. and Chir. Knowledge*, vol. i. p. 121.) Sir Astley Cooper has also recorded an example, in which the left carotid was obstructed by the pressure of an aneurism of the aorta; and yet, during life, no paralysis, nor impairment of the intellects, had occurred. (See *Med. Chir. Trans.* vol. i. p. 223.) A similar case is related by Pelletan. (*Clin. Chir.* t. i. p. 68.)

Mr. Abernethy was under the necessity of tying the trunk of the carotid, in a case of extensive lacerated wound of the neck, where the internal carotid, and the chief branches of the external carotid, were wounded. The patient at first went on well; but, in the night, he became delirious and convulsed, and died about thirty hours after the ligature was applied. This case fell under my own notice; and the inference which I drew was, that the man died more from the great quantity of blood which he lost, and the severe mischief done to the parts in the neck, than from any effect of the ligature of the artery on the brain.

In another instance, in which the common carotid was tied, on account of a wound of the external carotid, by a musket-ball, complicated with fracture of the condyle and coracoid process of the lower jaw, every thing went on favourably until the seventh day after the operation. Neither the intellectual faculties, nor the functions of the organs of sense, had been at all disturbed. But, at that period, stupor, confusion of ideas, restlessness, a small unsteady pulse, discoloration of the face, and loss of strength came on, followed in the evening by a violent paroxysm of fever. On the eighth day, three copious hemorrhages took place from the whole surface of the wound; and, on the ninth, the man died. In this case, however, the affection of the brain, and the other unfavourable symptoms, would be ascribed by nobody to the effects of the ligature on the carotid, but every one would see the cause in the severe and extensive local mischief, produced partly by the musket-ball, and partly by the mode in which the operation was performed, the surgeon having extended his incisions from the parotid gland to within an inch of the clavicle! (See *Journ. Général de Méd. &c. par Sedillot.*)

That the carotid may be tied without injuring the functions of the brain, and that aneurisms of this artery admit of being cured by the operation, is now fully proved. The following is the second instance, in which I have been present at the operation of tying the carotid trunk on account of a wound.

A soldier of the 44th regiment was wounded in the neck, with a pike, at the battle of Waterloo, and was brought to Brussels. After he had been some little time in the hospital, the bleeding, which had stopped, recurred with great violence, both from the mouth and the external wound itself; and it was therefore judged necessary to tie the common carotid, which was done by my friend Mr. Collier. The operation was performed by

making an incision through the skin, superficial fascia, and platysma myoides, along the inner edge of the sterno-cleido-mastoideus, raising this muscle from the sheath including the artery, &c., and holding aside the jugular and lower thyroid veins, which swelled up every instant to a very large size, so as to overlap the artery. The deep cervical fascia and carotid sheath were then carefully opened; and the artery, having been exposed, a ligature was passed under from without inwards, so as to avoid injuring the vein, or including the nervus vagus in the ligature. Though the operation was done by candlelight, it was skillfully performed, and reflects great credit on Mr. Collier. A detail of the case may be found in a modern work. (*Med. Chir. Trans.* vol. vii. p. 107.)

Another example, in which the carotid artery was tied, and the patient saved, in a case where it was wounded with a penknife, was published by Dr. John Brown, surgeon to the County of Meath Infirmary. (See *Dublin Hospital Reports*, vol. i. p. 301, &c.) In this instance, the internal jugular vein "did not appear, nor was it a source of the slightest inconvenience during the operation." (P. 305.) A case, very analogous to the foregoing, is recorded by Mr. Hodgson, and the event equally successful. "The jugular vein afforded no trouble in the operation: it was not even seen." A gradual improvement of the power of deglutition marked the gradual subsidence of the tumour, which pressed against the pharynx. Nor was any change perceived in the state of the patient's mind after this operation, who remained as she had been previously, melancholy and dejected. (P. 332.)

Acrel mentions an example, in which the carotid artery was wounded by a gunshot, and the hemorrhage permanently stopped by compression. A similar case is related by Van Horne, in his annotations to the work of Botallus. (*De Vultu Sclopeticis.*) Baron Larrey has likewise related a case, in which the carotid was wounded by a musket-ball, and life saved by the instant application of pressure. (*Mém. de Chir. Mil.* t. i. p. 309.) However, considering the size of the vessel, and its unfavourable situation for being effectually and steadily compressed, some doubts may be entertained, whether the vessel wounded might not rather have been one of its branches.

Sir Astley Cooper has the honour of having been the first surgeon who ever tied the carotid for the cure of aneurism. The operation, referred to, was performed Nov. 1805, on Mary Edwards, aged forty-four, who had an aneurism of the right carotid artery: the tumour reached from the vicinity of the chin to beyond the angle of the jaw, and downward to within two inches and a half from the clavicle. The swelling had a strong pulsatory motion. The woman also complained of a particular tenderness of the scalp, on the same side of the head, and of such a throbbing in the brain as prevented her from sleeping.

An incision, two inches long, was made at the inner edge of the sterno-cleido-mastoideus muscle, from the lower part of the tumour to the clavicle. This wound exposed the omo-hyoideus and sterno-hyoideus muscles, which being drawn aside towards the trachea, the jugular vein presented itself to view. The motion of this vein produced the only difficulty in the operation, as, under the different states of breathing, the vessel sometimes

became tense and distended under the knife, and then suddenly collapsed. Sir Astley Cooper introduced his finger into the wound, to keep the vein out of the way of the knife; and, having exposed the carotid artery by another cut, he passed two ligatures under this vessel by means of a curved aneurism-needle. Care was taken to exclude the recurrent nerve on the one hand, and the par vagum on the other. The ligatures were then tied about half an inch asunder; but the intervening portion of the artery was left undivided. The pulsation of the swelling ceased immediately the vessel was tied, and, on the day after the operation, the throbbing in the brain had subsided, while no diminution of nervous energy in any part of the body could be observed.

The patient was occasionally afflicted with bad fits of coughing, but, upon the whole, went on at first pretty well. On the eighth day, however, a paralysis of the left leg and arm was noticed, attended with a great deal of constitutional irritation. November 8th, the patient could move her arm rather better; but became unable to swallow solids. November 12th, the palsy of her arm had now almost disappeared. The ligatures came away. November 14th, she was in every respect better; she swallowed with less difficulty; and the tumour was smaller, and quite free from pain. On the 17th, she became very ill; the tumour increased in size, and was sore when pressed. The wound was as large as immediately after the operation, and discharged a sanious serum. Great difficulty of swallowing, and a most distressing cough, were also experienced. The pulse was ninety-six, and the left arm again very weak. On the 21st, the patient died, the difficulty of swallowing having previously become still greater, attended with a further increase of the tumour, the skin over which had acquired a brownish red colour.

On opening the swelling after death, the aneurismal sac was found inflamed, and the clot of blood in it was surrounded with a considerable quantity of pus. The inflammation extended on the outside of the sac, along the par vagum, nearly to the basis of the skull. The glottis was almost closed, the lining of the trachea was inflamed and covered with coagulating lymph. The pharynx was so compressed by the tumour, which had been suddenly enlarged by the inflammation, that a bougie of the size of a goose-quill could hardly be introduced into the œsophagus. Sir Astley Cooper concludes with expressing his opinion that the causes of failure may, in future, be avoided by operating before the tumor is of such size as to make pressure on important parts; or, if the swelling should be large, by opening it, and letting out its contents, as soon as inflammation comes on. (See *Med. Chir. Trans.* vol. i.)

In one case, under the care of Mr. Connes, of Salisbury, the making of an opening, about a month after the operation, gave relief by discharging seven ounces of fetid blood and pus; but, three weeks afterwards, hæmorrhage came on from the sac, and the patient was carried off by repeated loss of blood. On dissection, an artery, capable of admitting a probe, was found to issue into the cavity of the sac. (See *Med. Chir. Trans.* vol. xi. p. 2.)

In June, 1806, Sir Astley Cooper operated, at Guy's Hospital, on a man aged 50, who had a

carotid aneurism, attended with pain on one side of the head, throbbing in the brain, hoarseness, cough, slight difficulty of breathing, nausea, giddiness, &c. The patient got quite well, and resumed his occupation as a porter. There was afterwards no perceptible pulsation in the facial and temporal arteries of the aneurismal side of the face. On the opposite side, the temporal artery became unusually large. The tumour was at last quite absorbed, though a pulsation existed in it till the beginning of September. The man's intellects remained perfect; his nervous system was unaffected; and the severe pain, which, before the operation, used to affect the aneurismal side of the head, never returned. The swelling, at the time of the operation, was about as large as a pullet's egg, and situated on the left side about the acute angle made by the bifurcation of the common carotid, just under the angle of the jaw.

Sir Astley Cooper began the incision opposite the middle of the thyroid cartilage, at the base of the tumour, and extended the wound to within an inch of the clavicle, on the inner side of the sterno-cleido-mastoideus muscle. On raising the margin of this muscle, the omo-hyoideus could be distinctly seen crossing the sheath of the vessels, and the nervus descendens noni was also brought into view. The sterno-cleido-mastoideus was now separated from the omo-hyoideus, when the jugular vein was seen. This vessel became so distended at every expiration as to cover the artery. When the vein was drawn to one side, the par vagum was manifest, lying between that vessel and the carotid artery, but a little to the outer side of the artery. The nerve was easily avoided. A double ligature was then conveyed under the artery with a blunt iron probe. The lower ligature was immediately tied, and the upper one was also drawn tight, as soon as about an inch of the artery had been separated from the surrounding parts above the first ligature, so as to allow the second to be tied at this height. A needle and thread were passed through the vessel below one ligature, and above the other. The artery was then divided. In a little more than nine weeks, the wound was quite healed, and the patient entirely recovered. (See *Med. Chir. Trans.* vol. i.)

Another successful instance, in which the carotid was tied for the cure of an aneurism, is related in a work, to which I always have the greatest pleasure in referring. (See *Hodgson's Treatise on the Diseases of Arteries*, p. 329.)

Mr. Travers tied the carotid artery in a woman, who had an aneurism by anastomosis in the left orbit. The disease had pushed the eye out of its socket. Two small ligatures were applied, which came away on the twenty-first and twenty-second days. No hæmorrhage, nor impairment of the function of the brain, took place, and the disease in the orbit was effectually cured. (See *Med. Chir. Trans.* vol. ii.) Another highly interesting example, in which an aneurism by anastomosis in the orbit was effectually cured by tying the carotid artery, is recorded by Mr. Dalrymple, surgeon at Norwich. This gentleman performed the operation on the 12th of November, 1812. The patient was a female, aged 44. The protrusion of the eye was relieved in proportion as the swelling diminished. The violent headaches also subsided; but the eyesight was irrecoverably lost. (See *Med. Chir. Trans.* vol. vi. p. 111.)

The carotid artery has sometimes been tied, with the view of enabling the surgeon to cut away swellings from the neck and side of the face, where, from particular circumstances in the cases, there was reason to fear a fatal hemorrhage without that preliminary measure. (See *Goodlad's and Arnaud's Cases*, in *Med. and Chir. Trans.* vols. vii. and xii.)

An interesting case, in which my friend Mr. Vincent tied the carotid trunk for an aneurism, is published in the 10th vol. of the latter work. (P. 212, &c.) In this example, the internal jugular vein did not appear to be at all in the way during the operation; some of the fibres of the omohyoides, however, could not be conveniently drawn aside, and were therefore divided. A single ligature was applied; the pulsation in the tumour did not entirely cease, at first, when the artery was tied, but it did so two days afterwards; and the swelling was rapidly diminishing. The ligature came away about three weeks after the operation, and there was every hope of a cure; but, between the fourth and fifth week, a considerable swelling occurred between the wound and the jaw, impeding deglutition, but not the breathing. This state was followed by febrile symptoms, increased difficulty of swallowing, an attack of coughing, and impeded respiration. In the hope of affording relief, an incision was made in the tumour, from which a small quantity of pus and coagulum issued; but, it was in vain, for the patient was dying. On dissection the carotid artery was found perfectly closed as far as the division of the *arteria innominata*. But, above the ligature, the vessel was open and inflamed, and pus was found in it. The most remarkable circumstance noticed was globules of air, adhering to the inner surface of the vorta, and other large arteries, and found also under the tunica arachnoidea. The bulk of the swelling in the neck depended upon effusion of serum in the cellular membrane.

The cure of carotid aneurisms by the operation has now been so often exemplified, that even to refer to every case upon record would demand more space than I can afford. A successful instance is reported by Macculay (*Edin. Med. Surg. Journ.* April, 1814); another by Dr. Post, who used two ligatures, and divided the artery in the space between them (*New England Journ. of Medicine and Surgery*, vol. iii. p. 205. Boston, 1814); another by Mr. Giles Lyford, proving the sufficiency of a single ligature (*Med. Chir. Trans.* vol. xi. p. 97, &c.) The case in which Mr. Goodlad tied the carotid, in order to prevent hemorrhage in the removal of a tumour involving the parotid gland, is contained in vol. vii. p. 112, &c. of the latter book. The example, in which the carotid was tied by Dr. Frick, in the hospital at Hamburgh, for the cure of a diseased parotid, is reported in the *Lancet*, No. 182. Some diminution of the swelling, and increased power of swallowing, followed; but suppuration took place, and the case ended fatally.

For the particulars of a carotid aneurism cured by the ligature of the artery by M. Dumont, see *Diss. sur l'Aneurisme de l'Artère carotide*, par P. J. Vanderhagen, Paris, 1815. Walther, of Landshut, in the year 1814, tied the carotid artery for the cure of an aneurism with complete success: he applied only a single ligature. (*Breschet, Fr. Transl. of Mr. Hodgson's Work*, t. ii. p. 83.) In

this translation are reported several instances, in which Dupuytren and other Continental surgeons applied a ligature to the carotid. Dr. Holscher, of Hanover, has also operated with success. (See *Lond. Med. Repository*, vol. xvi. No. 94.)

Of the plan of tying the carotid above the aneurism, when it is situated so low that the ligature cannot be applied below it, I have also spoken. The facts, by which the propriety of this practice has now been completely established, have also been noticed: they appear to me to reflect considerable credit on Mr. Wardrop, by whom this method of operating has been revived and tended. The practice of tying the carotid for the cure of aneurism of the *arteria innominata* will be noticed in the ensuing section.

On the subject of tying both carotids, I find some interesting observations made by my friend Mr. Crosse:—"Although (says he) some animals will bear a ligature to both carotids simultaneously, the human frame cannot sustain so great and so sudden an interruption to the supply of blood to the sensorium. Professor Mott has tested this question; and a case came under my own observation very recently, showing the fatal tendency of a ligature, if applied almost simultaneously to each of these arteries. An approximation has, however, been made towards ascertaining the shortest interval, at which the second carotid may be tied after a ligature to the first; and it has been safely done at an interval of thirty-eight, seventeen, and even twelve days. Amongst the most striking of these cases, is that related by Professor Kuhl of Leipzig, who, on account of a pulsating aneurismal tumour of the scalp, arising from a wound of the occiput, and extending over nearly the entire surface of the head, attended by frequent hemorrhages, first placed a ligature on the left common carotid. This proceeding only partially subduing the disease, and frequent hemorrhages from the affected portion of the scalp still occurring, and threatening life, a ligature was put upon the right common carotid after twenty-seven days. This was followed by convulsions; but, after a train of very troublesome symptoms, the patient recovered, and was cured of his disease. It is worthy to be noticed, that in this, and also in other like cases, some days after both carotids had been tied, heaviness and throbbing in the head have occurred, requiring free venesection. (*J. Green Crosse, in Provincial Med. Chir. Trans.* vol. v.)

For anatomical engravings of the parts, concerned in the operation of taking up the carotid artery, see those of Tiedemann (*Tabule Arteriarum*), of Rosenmüller (*Chirurg. Anatom. Abbildungen*, th. i. tab. 7, 8, 9.), and Elias Bujalsky, (*Tab. Anat. Chir. Petropol.* 1828, tab. 1, 2, et 3.) Also J. P. Mance, (*Sur la Lig. des Artères*, fol. Paris, 1832.)

NEW OPERATION FOR ANEURISM OF THE ARTERIA INNOMINATA.

It having been established, that aneurisms may be cured by simply lessening the impetus of the blood flowing through them, and that, although a circulation may yet continue in them for some time, the layers of coagulable lymph within the sac augment, and ultimately bring about a complete consolidation of the swelling, it occurred to Mr. Wardrop, that in aneurism of the *arteria*

innominate, the progress of the disease might be arrested by tying its two great branches, the carotid and subclavian. Although a certain portion of blood would still continue to pass along the innominate to those branches of the subclavian on the cardiac side of the ligature, the ligature being necessarily placed on the subclavian artery, after it emerges from between the scaleni muscles, Mr. Wardrop conceived that such would yet be the diminution of the impetus of the blood in the sac, that the future increase of the tumour would be prevented, and even a permanent obliteration of the aneurismal cavity would be accomplished. (*On Aneurism*, p. 58.) The knowledge of this principle, indeed, he thinks, may be useful in the cure of many aneurisms, which have hitherto been considered beyond the reach of art. In an aneurism of the innominate, Mr. Mackelcan found that nature had nearly completed a cure on this principle. The carotid artery was plugged up, and the large aneurismal swelling was filled with a coagulum, leaving only a comparatively small channel for the passage of the blood into the subclavian artery. (See *Appendix to Wardrop on Aneurism*.) However, Mr. Guthrie takes a different view of this case, and infers that a ligature on the carotid above the aneurism would have been of no use, so far as the obliteration of the arteries was concerned, unless it had been followed by inflammation of the sac and coagulation of its contents. (See *Guthrie on the Dis. of Arteries*, p. 296.) He makes this inference, because, though the artery was rendered impervious, by a natural process, the disease went on increasing, till it destroyed the patient. The coagulation of blood is all that the advocates of this plan have in view. Mr. Wardrop has seen instances, and several are on record, which illustrate the important pathological fact, and prove beyond a doubt, that blood may coagulate in an aneurism so as to strengthen the parietes of the sac, and ultimately fill its cavity, without the circulation in the sac being in the first instance either suddenly or entirely interrupted.

It was the knowledge of this fact, that led Mr. Wardrop to perform the operation which he has related. Nature, in the case alluded to, had already instituted a curative process by diminishing the circulation in the carotid artery; and, when he found this alone not sufficient to stop the enlargement of the aneurism, he determined to place a ligature on the subclavian. In doing this, he conceived that he was strictly imitating the process which nature herself had commenced. (P. 61.) The case of Mrs. Denmark, aged 45, in whom he tied the subclavian artery, and thus cured an aneurism of the arteria innominata, is highly interesting. The particulars may be read in his own publication, or in the *Lancet* for 1827. Suffice it here to state, that the operation had the effect of diminishing the size of the tumour, and causing it almost to disappear. The swelling afterwards enlarged, however, and the patient died. In the *post mortem* examination, the tumour was found occupying the central space between the sterno-mastoid muscles, and composed of three portions; one arising immediately above the sternum; another upwards, along the trachea; and a third was the original portion of the aneurism, consolidated by the effects of the operation. The swelling, which underwent no diminution after death, felt like a firm fleshy mass. On laying

it open longitudinally, it appeared nearly solid. The clavicular and tracheal portions of the sac were filled with firm coagulum, the cavity being chiefly limited to the division between the sternal and tracheal portions, and it was about the size of a walnut. The coats of the aorta were somewhat thickened; and it presented a few points of ossification. "On cutting into the innominate from the aorta, the aneurism was found to have originally extended from its origin to its bifurcation. The subclavian artery is divided at the place where the ligature had been applied; and both the cardiac and distal orifices are contracted, and the sides of the vessel coalesce, and adhere firmly together. The right carotid pervious, and quite healthy." I think with Mr. Guthrie, that the account of the dissection would have been improved by the statement, whether the branches of the subclavian, given off nearer the heart than the ligature, were pervious, or not. The following is the view taken by Mr. Guthrie of Mrs. Denmark's case: "It appears to me (he observes) that the operation gave rise to inflammation, and consequent coagulation in the sac, which led to a diminution of its size, without interfering with the channel by which the blood passed into the right carotid. The disease was therefore, for the time, arrested; but, as the artery was unhealthy, in the parts surrounding the aneurism, it again returned, and ultimately destroyed the patient. The same thing is clearly taking place in Mr. Evans's patient." (See *Guthrie on the Dis. of the Arteries*, p. 190.) In the advertisement prefixed to this work is a similar prognostication with reference to Dr. Mott's very interesting case. In the appendix to Mr. Wardrop's publication, and in the *Lancet* for November, 1828, is a case, in which Mr. Evans, of Belper, Derbyshire, treated an aneurism of the innominate and root of the carotid, by tying the latter vessel. Three months after the operation, the patient, a butcher and horse-dealer, thirty years of age, was well enough to attend regularly the markets and fairs of Derby, seven miles from his home. In the course of the case, three remarkable circumstances occurred: 1st, An obliteration of the principal arteries of the right arm. 2dly, A profuse salivation. 3dly, A disposition to paralysis of the right side; supposed, by Mr. Evans, to have arisen from a greater quantity of blood being sent to the left hemisphere of the brain than to the right. However, as such paralysis has not attended other operations, in which the carotid was tied, the truth of the explanation seems doubtful. The palsy afterwards nearly subsided. This case did not terminate, however, in a cure; for he led a very irregular life, and the tumour, which had been stationary, began to increase, and another tumour made its appearance on the other side of the sternum. "If I were to hazard an opinion (says Mr. Evans), I should be disposed to affirm, that the operation succeeded in arresting the disease for a time, and that, under more favourable circumstances, that time might have been prolonged; but, the patient's return to his usual irregular habits, and the fatigue and exercise his avocations necessarily led him into, excited the disease in the lower portion of the innominate, or, perhaps, in the aorta itself; for the original tumour is yet easily distinguished from the later enlargements." Of course, until the time for a *post mortem* examination arrives, this case must be attended

with obscurity. The following are some of the particulars of the case, in which Dr. Mott, of New York, tied the carotid artery for an aneurism of the innominata. The patient, Moses R. Gardner, aged 51, a farmer, of sound constitution, and good habits of life, about three years before he consulted this gentleman, while occupied in removing a building, was attacked with pain in the upper and back part of the neck. This afterwards extended to the right shoulder and arm, but, in time, partially subsided, and his voice became hoarse. About eighteen months before he consulted Mr. Mott, he discovered a small swelling at the upper part of the breast-bone, but did not at first remark any throbbing in it. Dr. Mott found, above the sternum, a pulsating tumour, about the size of a pigeon's egg; spreading some distance under the clavicular and sternal portions of the right sterno-mastoideus, in the course of the subclavian artery, and extending as low down as the second rib, compressing the bronchial tubes, and producing, on the least coughing or exercise, a wheezing, not unlike that of asthma. The patient shrunk from the least pressure upon it, complaining of impeded respiration, followed by pain; its pulsations were synchronous with those of the heart, and decidedly aneurismal.

After fully explaining to him the nature of his disease, and its probable fatal termination should it be left to itself, Dr. Mott advised him to return to his home, to avoid all exertion, to be occasionally bled, and to confine himself principally to a vegetable diet; but, should he observe the least increase, either in the tumour or any of his symptoms, to apply again. In a few months, he again came to New York. Dr. Mott now found that the tumour above the sternum had much increased, and, upon a careful application of the stethoscope, that it had evidently encroached more upon the chest. The *bruit de soufflet* could be heard; the thoracic viscera were sound, and the respiratory murmur distinct. In either speaking, walking, or coughing, respiration was very much impeded, and almost entirely suspended by the least pressure upon the tumour. The action of the right carotid was more feeble than that of the left, and no pulsation could be felt in its branches; the right subclavian, external to the scaleni muscles, was natural, while the axillary and brachial arteries could hardly be felt; and at the wrist no pulse could be distinguished; but the pulsations of the arteries of the left side were natural. The general health was good.

Dr. Mott was persuaded the aneurism was one of the arteria innominata, involving the subclavian and the root of the carotid, and he considered it a proper case for the operation proposed and successfully performed by Mr. Wardrop. From the evident interruption of the circulation in the right arm, and the apparent efforts of nature to effect a spontaneous cure, he determined to tie the carotid first, and afterwards the subclavian, should it be required.

"On the 20th Sept. the artery was taken up in the usual manner. 27th, 9 A.M. Slept well, and feels refreshed; thinks there is more room, as he expresses it, in breathing; complains of a little soreness of the tonsils; pulse 58, regular and tranquil; the skin natural; pulsation and size of the tumour evidently diminished. 9 P.M. Much more restless; pulse 68, and tense; in other respects the same as in the morning; being habituated to lau-

dum, was permitted to take a teaspoonful. 28th, 9 A.M. Slept well; breathes more easily: feels less of the pulsation in the tumour; pulse 63, and not so tense; skin natural; and cough less. Ordered a dose of magnesia and Epsom salts. 9 P.M. Has passed a comfortable day. His wife, who arrived from the country since the morning, expressed her surprise at the improvement in his voice and breathing, as well as at the difference in the beating. Pulse of the right radial artery very distinct, but intermitting from ten to fifteen beats; in the left arm 80, and stronger; coughs frequently, and expectorates freely; skin natural; tongue a little white; salts have not operated. Ordered the dose to be repeated; and if restless after its operation, to take his usual anodyne. 29th. Saluted Dr. Mott this morning with a full and fine voice, and said he was well enough to call on him. His cough and expectoration much less. Dr. Mott found him lying down, and breathing quietly; pulse 71, and regular. The radial artery of the right arm beating as last evening, with fewer intermissions, but of longer continuance; skin over the tumour more wrinkled; pulsation less and weaker. The ligature came away on the night of the 15th, and the tumour above the sternum, and pulsation, entirely had disappeared; the cough and breathing better; voice nearly natural; pulse 66, with now and then a very faint pulsation of the right radial artery; right hand a little swelled, and numbed. 22d. Wound has just healed; weakness of the arm considerable; fingers very thick and clumsy; whole arm swelled, and pits upon pressure; no pulse in the right radial artery; breathing easy; cough and expectoration much less; can sleep easy in any position, which he has not been able to do for many months. "26th. Left town for his residence in New Jersey." Of course, the profession will be anxious to hear the further history of this case; and I entertain a hope that Mr. Guthrie's prognostication may not be verified.

OF ANEURISMS OF THE AORTA, AND VALSALVA'S TREATMENT.

This afflicting and fatal disease is by no means unfrequent, and the arch of the aorta is its most common situation. Dr. Hunter was of opinion, that the latter circumstance depended on the forcible manner, in which the blood, propelled from the left ventricle of the heart, must be driven against the angle of the curvature of the vessel. Mr. A. Buras considered aneurism of the thoracic aorta more frequent, perhaps, than that of any other vessel in the body. "I have had (says he) an opportunity of examining fourteen who had died of this disease, but have not seen more than three instances of external aneurism." (*On Diseases of the Heart, &c.* p. 215.) These proportions, however, would not correspond to common observation, external aneurisms, taken collectively, being supposed to be about as numerous as those of the aorta alone, a calculation long ago made by Dr. A. Monro, primus.

It was the opinion of Dr. W. Hunter, that the aneurismal sac was composed of, the dilated coats of the artery, which parts nature thickened and studded with ossifications, after the origin of the disease, for the purpose of resisting its increase. Mr. Hodgson also declares his decided belief, and adduces facts to prove, that many aneurisms of

the aorta are formed by dilatation. Yet the celebrated Scarpa believed, that the generality of aneurisms of the aorta were the consequence of a rupture of the proper coats of this large vessel; and that its cellular sheath was distended into the aneurismal sac. While Dr. W. Hunter considered the ossifications of the sac as consequences of the disease, Haller looked upon the scales of calcareous matter in the aorta as the very cause of the affection, by rendering the artery inelastic, and incapable of yielding to each pulsation of the heart. On this point, Haller was right.

Aneurisms of the aorta are most common in persons who are advanced in life; and the aorta of every old subject, whether affected with aneurism or not, is very commonly marked in some place or another with ossifications, or, rather, with calcareous concretions. Such productions occasion a decay, or absorption, of the muscular and inner coats of the vessel, so that at length the force of the blood makes the artery give way; and this fluid, collecting on the outside of the laceration, or rupture, gradually distends the external sheath of the artery into the aneurismal sac.

"If any person, who is not prejudiced in favour of the common doctrine, with regard to the nature and proximate cause of this disease (says Scarpa), will examine, not hastily and superficially, but with care and by dissection, the intimate structure and texture of the aneurism of the aorta, unfolding with particular attention the proper and common coats of this artery, and, in succession, those which constitute the aneurismal sac, in order to ascertain distinctly the texture and limits of both, he will clearly see, that the aorta, properly speaking, contributes nothing to the formation of the aneurismal sac, and that, consequently, the sac is merely the cellular membrane, which, in the sound state, covered the artery, or that soft cellular sheath, which the artery received in common with the neighbouring parts. This cellular substance being raised and compressed by the blood, effused from the corroded or lacerated artery, assumes the form of a circumscribed tumour, covered externally, in common with the artery, by a smooth membrane, such as the pleura in the thorax, and the peritoneum in the abdomen." Scarpa then comments upon the differences of the mere dilatation of an artery from aneurism, a subject which has been already fully considered in the foregoing pages. (*Scarpa on the Anatomy, Pathology, and Surgical Treatment of Aneurism*, transl. by Wishart, p. 55, 56.)

As I have already explained, in the preceding columns, the views taken of this part of the subject by Scarpa, are not entertained by the generality of surgeons; or rather, his doctrine is not carried by others to the extent which he has insisted upon, and it would be useless repetition to bring again before the reader the facts, proving that his statements are liable to many exceptions. A case, however, recited by M. Roux, which I have met with since the foregoing pages were printed, merits notice; it was an instance, in which a popliteal aneurism, unattended, with pulsation, had been mistaken for an abscess and punctured, whereby the patient lost his life. On dissecting the limb, M. Roux says, "the three coats of the artery participated in the dilatation, and the case was one of the clearest specimens which I have ever seen of a true aneurism." (*Nouveaux Elémens de Méd. Opératoire*, t. i. p. 617.)

The best pathologists now admit six varieties of aneurismal disease of the aorta. 1. *A Dilatation*, involving the whole circumference of the artery. 2. *True aneurism*, or a sacculated dilatation of only a portion of its circumference. 3. *False aneurism*, formed by ulceration, or rupture of the internal and middle coats, and a dilatation of the external one into a sac. 4. *Mixed or sacculated aneurism*, where, after partial, or general dilatation of all the three coats, the internal and middle burst, and the external alone expands into another sac, engrafted as it were upon the original dilatation, or true aneurism. 5. The case, in which the inner coat protrudes through the outer ones. (*Dubois; Dupuytren; Laennec, De l'Auscult.* t. ii. p. 693.) A fine specimen of this is contained in Mr. Liston's collection. 6. A few very rare examples have been noticed, in which, after the rupture of the internal and middle coats of the aorta, the blood, instead of distending the external coat into a swelling, insinuates itself more or less extensively between this coat and the middle one. Thus Laennec saw a case, in which the internal and middle coats had a narrow fissure in them extending across two thirds of the circumference of the artery; and the blood had interposed itself between the external and middle coats, over more than half of the circumference of the aorta, from its arch to its bifurcation. (*Laennec, De l'Auscult.* t. ii. p. 700.) Two similar cases are reported by Mr. Guthrie. (*On Dis. of Arteries*, p. 40 and 43.) The late Mr. Sherketon met with a still more curious form of aortic aneurism, where the blood, after making its way through the internal and middle coats, had separated the external from the middle to the extent of four inches, and then passed again through the middle and internal coats into the canal of the artery; thus forming a new channel, and the old one being obliterated. (*Sherkelton, in Dubl. Hosp. Rep.* vol. iii.)

As Dr. Hope observes (*Cyclop. of Pract. Med.* art. *Aorta*), the foregoing are the only instances on record, where a fissure of the internal and middle coats has been followed by more than a circumscribed effusion of blood around it, occasioning a slight swelling of the external coat. Nichols found this in the body of George II. (*Phil. Trans.* vol. lii. p. 269.); and Hodgson once met with it. (*On Dis. of Arteries*, p. 63.)

Aneurisms, and the diseases of the coats of the arteries which precede their formation, are well known to be far more common in men, than women. (*Sir A. Cooper, Hodgson, Lisfranc, &c.*) Yet, women are perhaps quite as frequently afflicted with aortic aneurisms as men, though, with respect to external aneurisms, they may only exhibit the proportion of one case to fifteen or twelve in male subjects. (*See Hope, in Cyclop. of Pract. Med.* art. *Aorta*.) With respect to dilatation, affecting the whole circumference, I may observe, that the great arterial trunks, given off at right angles from the aorta, as the innominate and celiac axis, generally participate in it; but, as Laennec observes, the left subclavian commonly remains unaffected, on account of the acute angle, at which it leaves the arch of the aorta.

As for *true aneurisms*, almost all those of the ascending aorta and arch are originally of this description; but the false is sometimes engrafted upon them. The tumour, which mostly inclines to the right side of the chest, generally springs from the anterior or the lateral part of the vessel, while

the posterior is little, if at all, implicated. When it springs from the root of the aorta, and the middle and internal coats give way, the consequence is not a false aneurism, surmounting the true, as in other parts, but a fatal extravasation into the pericardium. The reason of this is, that the portion of the aorta referred to, is destitute of the cellular coat, and the pericardium, which supplies its place, not being equally extensible, bursts while the aneurism is but of small size. (See *Scarpa on Aneurism*, by Wishart, p. 80.; *Hope*, in *Cyclop. of Pract. Med.* art. *Aorta*; *Bertin*, *Bouilland*, &c.) It does not appear certain to me, that the preparation, No. 367. in the Hunterian collection at the College of Surgeons, proves, as Mr. Guthrie believes it does (*On Dis. of Arteries*, p. 70.), that this doctrine is incorrect, because, though it is true, that the aneurism in this instance is of unusual size, the inner membrane can be distinctly seen passing over the atheromatous patches. As Dr. Hope remarks, the preparation is then not one of false aneurism, as the middle coat is perfect, the internal one alone being removed, or diseased (it is doubtful which), at the base of the sac. Scarpa only maintains, that the pericardium becomes incapable of resisting a false extravasation after the inner coats have given way.

In the Museum of the London University, the preparation No. 616. exhibits three diminutive aneurismal sacs just above the valves of the aorta, one of which has burst into the pericardium. The preparation No. 617. in the same collection, is the heart of a patient who died of the rupture of a small aneurism within the pericardium. He had been operated upon for a popliteal aneurism only three months previously. The little tumour burst just above the pulmonary artery, and a bristle is passed through the opening from the inside of the aorta, where the sac is seen directly above the valves. We know that in one case, when Sir Astley Cooper had just commenced the operation for popliteal aneurism, the patient suddenly expired, owing to a small aneurism near the root of the aorta happening to burst into the pericardium at this moment of agitation and suffering.

In thin subjects, the throbbing of the abdominal aorta is sometimes unusually plain through the integuments and viscera, and this has occasionally given rise to the suspicion of an aneurism; a circumstance, which deserves to be remembered by every surgeon, desirous of not pronouncing a wrong opinion. The preternatural pulsations, however, which are liable to be mistaken for those of aortic aneurisms, are of various kinds, and form a subject, to which the attention of Dr. Albers of Bremen, the late Mr. A. Burns, and others, has been very usefully directed. (See *ABDOMEN*.)

While thoracic aneurisms of the aorta are not accompanied by external swelling, the symptoms are all equivocal, as very similar ones may depend on a disease of the heart, angina pectoris, phthisis pulmonalis, &c. However, some difference depends upon the volume, position, and nature of the aneurism. Simple dilatation, when in a moderate degree, hardly produces any effect, but the most inconsiderable false aneurisms may give rise to very serious disorder. The first and most common of these effects is, the compression of the heart and lungs. (See *Laennec on Diseases of the Chest*, by Forbes, p. 676. ed. 2.) Amongst its worst effects are those which it produces on the trachea and bronchi; for, though the pressure be

slight, it often suffices, in consequence of the great irritability of these parts, to produce considerable dyspnoea: It must not be imagined, however, that dilatation is an unimportant affection; for, when complicated with hypertrophy of the heart, it is one of the most formidable diseases of the organs of the circulation. (See *Hope*, in *Cyclop. of Pract. Med.* art. *Aorta*.)

The only unequivocal general sign of an aneurism of the thoracic aorta, is a tumour, presenting itself externally, and attended with an expansive heaving pulsation, synchronous with the action of the heart. Many of the other general signs are acknowledged to be like those of organic disease of the heart; viz. palpitation, dyspnoea, cough, tendency to syncope, terrific dreams, starting from sleep, hæmoptysis, livid complexion, cerebral or hepatic congestions, serous infiltration, &c. The identity of the general signs arises, as Dr. Hope explains, from an identity of cause; namely, an obstacle to the circulation, which depends either upon the aneurism alone, or conjointly upon it and a disease of the heart, to which, sooner or later, the aneurism almost invariably gives birth. When, however, the general signs coincide with those learned by auscultation, they lose their ambiguity. (See *Hope*, in *Cyclop. of Pract. Med.* art. *Aorta*.)

In aneurism of the aorta, forming a defined tumour, violent and irregular throbbings frequently occur between the fourth and fifth true ribs of the left side; the same irregularity of the pulse prevails as often proceeds from organic affections of the heart; sometimes a dissimilarity of the pulses in the two wrists, an effect depending upon obstruction, or obliteration of the arteria innominata or left subclavian; the respiration is exceedingly obstructed; the voice altered; and, in a more advanced period of the malady, the patient is at times almost suffocated, or actually perishes from this cause. The pressure of the internal swelling on the trachea, bronchi, and lungs, is sufficient to account for this difficulty of breathing. When the trachea, or primary bronchial divisions, are compressed by an aneurismal tumour, a harsh wheezing, or sibulous sound, characterizes respiration; and when the heart is simultaneously diseased, dyspnoea sometimes occurs in most severe paroxysms, threatening suffocation. (See *Hope*, *Op. cit.*) In many instances, the irritation and compression, produced by the tumour, occasion atrophy of the greater part of the lungs, and abscesses and induration throughout the portion which remains. The function of deglutition suffers interruption, in consequence of the pressure made on the œsophagus, which may even be in a state of ulceration. Thus, in one example, "the cavity of the windpipe was nearly obliterated from the pressure of the aneurism; and the extremities of four of its cartilages lay in the œsophagus, having entered that canal through an ulcer in its coats." (*Trans. for the Improvement of Med. and Chir. Knowledge*, vol. iii. p. 83.) After what has been stated, it cannot be surprising, that, ere the disease manifests itself externally, affection of the lungs, or strictures of the œsophagus, should often be suspected. (*Hodgson*, p. 91.; *Porter*, in *Dubl. Journ. of Med. Science*, vol. iv. p. 207.) On the supposition of a stricture in the œsophagus, probangs have frequently been used.

The greater weakness of one radial pulse than the other, or its total extinction, may proceed from a variety of causes, independent of aneurism of the

the contraction of the origin of either of the ~~clavicular~~ arteries from calcareous, cartilaginous, tumorous, or other depositions; obstructions in course of the artery produced by tumours, or, or subclavian aneurism, or from an ir-
subdivision of the radial brachial artery.
(*Cyclop. of Pract. Med.* art. *Aorta*.)
of the arteria innominata, not dis-
after the patient had died of suffocation,
eye free to great difficulty of drawing air into the
chest, without any other symptom, calculated to
throw light on the nature of the disease. The
pericardial swelling was situated behind the first
bone of the sternum, and pressed upon the trachea.
The front of this tube was pushed in by the tumour,
so as to present a convex prominence on the inner
surface, which, however, diminished its area in a
very slight degree. Mr. Lawrence adduces this
fact to prove, that spasm of the air-cells may be
the cause of great distress in breathing. "The
termination of this case (says he) is the more
remarkable, inasmuch as in another patient, an
aneurism rising out of the arch of the aorta, and
pressing on the corresponding part of the trachea,
so as to produce ulceration of the internal mem-
brane, under which there was a slight appearance
of coagulated blood, caused no affection of the
breath at all. The person died of a different com-
plaint, and the discovery of the aneurismal tumour,
which was very small, and filled with firm lami-
nated coagula, was quite accidental." (*Med. Chir.*
Trans. vol. vi. p. 227.) Thus, we find in thoracic
aneurisms, at least previously to their attainment
of a certain size, that no regularity prevails even
with regard to difficulty of breathing, the symptom,
which, *a priori*, one might suppose would invariably
be present.

One of the least equivocal signs of an aneurism
of the thoracic aorta, is a pulsation felt under the
sternum, or ribs, at the upper part of the chest.
But a positive opinion is not to be formed from
this symptom alone, which has been known to be
occasioned by some other kind of tumour behind the
sternum, by adhesion of the pericardium to the
heart, by fluid in the cavity of this membrane,
and by hypertrophy of the heart. (*Baillie's Mor-
bid Anat.*; and *Hope*, in *Cyclop. of Pract. Med.*
art. *Aorta*.) Then another symptom of aneurism
of the thoracic aorta, is pulsation above the sternum
or clavicles. But this may also proceed from
enlarged glands in the course of the subclavian
artery, and receiving its pulsation; by varix of the
jugular vein at its junction with the subclavian;
or by a subclavian aneurism. A gentleman, under
Mr. Maill, of Southampton, lately consulted me
for a considerable throbbing felt above the sternum
and clavicles, and which had been suspected to
denote on the left side a subclavian aneurism. The
radial pulse in the left arm was rather weaker than
in the right. But the carotids also pulsated with un-
usual force a good way up the neck; and every
little exertion brought on powerful beating of the
heart. In a consultation with Sir Astley Cooper,
these circumstances led us to set down the case as
one of dilatation of the great arteries at the source
of the circulation with an imperfect state of the
valves, and some degree of hypertrophy. A pul-
sation above the sternum may be occasioned by
coronary aneurism, which is liable to be confounded
with aneurism of the aorta, or of the subclavian
artery. Dr. Hope informs us, that in April, 1826,

he saw in Guy's Hospital a case, which led to
much deliberation, respecting the propriety of
taking up the carotid above a pulsating tumour,
supposed to be an aneurism of that artery. The
plan, however, was judiciously abandoned, for the
disease proved to be a dilatation of the aorta, and
innominata. (See *Hope* in *Cyclop. of Pract. Med.*
art. *Aorta*.)

Few diseases, according to Laennec, are so in-
sidious as aneurism of the thoracic aorta. He
affirms, "that it cannot be known with certainty
till it shows itself externally. It can hardly be
suspected, even when it compresses some important
organ, and greatly deranges its functions. When
it produces neither of these effects, the first indi-
cation of its existence is often the death of the
individual, as instantaneously as if by a pistol-
bullet." One case, recorded by Mr. Pattison,
confirms the same fact, for the patient had only
symptoms leading to a suspicion of rheumatism in
the neck, and died suddenly of apoplexy. (*Burns
on the Head and Neck*, ed. by Pattison.) Laennec
has known persons cut off in this manner, who
were believed to be in the most perfect health.
He admits, that percussion will sometimes enable
us to detect a tumour of large size, existing within
the mediastinum, or even in the back; but not to
discriminate the nature of the swelling. His ex-
perience had not been sufficient to let him pro-
nounce how far the difficulty of diagnosis was
likely to be removed by the stethoscope. Dr. Hope
has met with six or seven instances, in which large
aneurisms had existed, without awakening even a
suspicion of them. One, in particular, eluded the
penetration of a distinguished foreign auscultator,
though he explored the lungs with eminent suc-
cess. (*Hope*, in *Cyclop. of Pract. Med.* art. *Aorta*.)
Aneurisms of the abdominal aorta, Laennec ad-
mits, may be recognised with the utmost facility by
means of the stethoscope. In this case, we are
sensible of tremendous pulsations, which painfully
affect the ear, and the intensity of which is not at
all recognised by the hand, even when sufficiently
perceptible to the touch. As high up as the coeliac
artery, the contractions of the auricles are not
in the least distinguishable. The sound of the
pulsations is clear and loud. (*Laennec on Diseases
of the Chest*, p. 678, &c.)

Laennec believed, that thoracic aneurism might
sometimes be recognised by its *simple*, or rather *single*
pulsation, which is much stronger than the double
pulsation of the heart; but that, in most instances,
this criterion would fail, in consequence of the
sound of the heart and that of the aneurism being
confounded together. But, as the auricular sound
is not audible over the abdomen, Laennec had no
difficulty in recognising ventral aneurism by the
simple pulsation. The following are some of the
criteria, specified by Dr. Hope, for distinguishing
the pulsation of thoracic aneurisms from the beat-
ing of the heart; and, in some important points,
his observations have received confirmation from
the experience of Dr. Greene. (See *Researches
on the Symptoms, &c. of Aneurisms of the Thoracic
Aorta*, *Dubl. Journ. of Medicine*, vol. vii. p. 231.)
1. The first aneurismal sound, coinciding with the
pulse, is invariably louder than the healthy ven-
tricular sound, and generally than the most con-
siderable bellows-murmurs of the ventricles. 2.
On exploring the aneurismal sound from its source
towards the region of the heart, it is found to

decrease progressively, until it either becomes totally inaudible, or is lost in the predominance of the ventricular sound. If the sound emanated from the heart alone, instead of decreasing, it would increase, on ap

3. The secondly does sustain this progressive augmentation on advancing towards the heart. 4. The aneurismal pulsation is a deep, hoarse tone, of short duration, with an abrupt commencement and termination. It is compared to that of the rasping of a sounding board heard from a distance. But the sound, occasioned by valvular disease of the heart, has more analogy to the bellows-murmur, being somewhat soft and prolonged, with a gradual swell and fall. 5. In simple dilatation of the thoracic aorta, the *frémissement caillé*, or purring tremor, is more considerable than in sacculated aneurism, particularly if the former be accompanied with much asperity of the internal membrane. It is also very correctly noticed by Dr. Hope, that the sound of aneurisms is, in most instances, audible on the back; and when the tumour occupies the descending aorta, it is often louder behind than on the breast; and if it is of the abrupt rasping kind, it amounts almost to positive evidence. Pulsation, he observes, attends every species of enlargement of the aorta. In dilatation, it exists only above the sternal ends of the clavicles, and always on both sides of the neck simultaneously; though, when the enlargement is confined to the ascending aorta, it is stronger on the right than on the left side. When dilatation is in the form of a pouch, and of great magnitude, it may occasion pulsation under the sternum. Carotid and subclavian aneurisms produce impulse, sound, and tremor, on the affected side only; and by this circumstance, they may easily be discriminated from aortic enlargements. In sacculated aneurisms in the upper part of the chest, pulsation exists both above and below the clavicles; but Dr. Hope has generally found it stronger below. (*Hope, in Cyclop. of Pract. Med. art. Aorta.*) M. Bertin also believed, as Dr. Hope does, that Laennec underrated the power of the stethoscope to detect aneurism of the thoracic aorta. (*Mal. du Cœur, p. 143.*) Still, it is a fact, that, even with the assistance of this instrument, thoracic aneurism sometimes cannot be detected, and produces symptoms, leading to a suspicion of other affections, to which the treatment is directed accordingly. (See *Porter, in Dubl. Journ. vol. iv. p. 206, &c.*)

I have mentioned, that the symptoms of thoracic aneurisms, previously to the formation of any outward swelling, often resemble those of phthisis, and the latter is sometimes actually supposed to be the disease, under which the patient is labouring. But, there is one distinction between the cases, pointed out by Mr. Hodgson, which may be of use, in combination with other circumstances, in facilitating the diagnosis: 'In phthisis, the expectoration is either puriform, or thick, and clotted; but, in aneurisms which are not accompanied with disease in the lungs, as far as I have observed, it always consists of a thin frothy mucus. (*On Dis. of Arteries, &c. p. 93.*) According to Kreysig's experience, the cough comes on at irregular periods, is violent, and attended with great efforts, the expectorated matter being forced up with vehemence. He agrees with Mr. Hodgson, respecting the general quality of what is expectorated, where

thoracic aneurisms are in connection with diseased lungs; but, he says, that the matter coughed up also frequently contains a mass of lymph, blended with brick-red particles of blood, which masses, when thrown into water, seem as if they were composed of a ball of string substances. (*Gerin. transl. of the latter work, p. 137.*)

From a review of many cases of aortic aneurisms, Mr. A. Burns was inclined to think, that when the ascending aorta is aneurismal, the breathing is more affected, than when the arch of the vessel is enlarged; but, that in the latter case, the impediment to deglutition is greatest. (*On Dis. of the Heart, &c. p. 244.*)

False aneurisms are most common in the descending aorta; and true ones in the ascending portion of the vessel and its arch. Laennec never met with any species of false aneurism in the latter situation, but such as is consequent to the true, or simple dilatation of the artery. (*On the Dis. of the Chest, p. 676. ed. by Forbes.*)

The way, in which aneurisms of the thoracic aorta prove fatal, is subject to considerable variety. These swellings do not always destroy the patient by hemorrhage: in numerous instances, the functions of the lungs, bronchi, heart, and oesophagus, are so deranged by compression, that death is induced, and not a drop of blood is found internally effused. Frequently (to use the description of Mr. John Bell) before the awful and fatal hemorrhage has had time to occur, the patient perishes of sufferings too great for nature to bear. The aneurismal tumour so fills the chest, oppresses the lungs, compresses the trachea, and curbs the course of the descending blood, that the system, with a poor circulation of ill-oxygenated blood, is quite exhausted. And, thus, though the patient is saved from the most terrible scene of all, he suffers great miseries; he experiences in his chest severe pains, which he compares with the stabbing of knives; terrible palpitations; an awful sense of sinking within him; a sound within his breast, as if of the rushing of waters; a continual sense of his condition; sudden startings during the night; fearful dreams and dangers of suffocation; until, with sleepless nights, miserable thoughts by day, and the gradual decline of an ill-supported system, he grows weak, dropsical, and expires. (See *Anatomy of the Human Body, by John Bell, vol. ii. edit. iii. p. 234, 235.*) Cruveilhier relates the particulars of one very interesting case of aortic aneurism, where two swellings existed, one of which had pressed so strongly on the pneumo-gastric nerve, as entirely to have disorganised a portion of it. The patient suffered frequent syncope, and died from general derangement of the pulmonic and gastric functions, and not from the rupture of the aneurism, which, however, if the patient had lived a little while longer, would have burst into the trachea, the mucous membrane of which was ulcerated in more places than one. (See *Cruveilhier, Anat. Pathol.*) In this example, the left subclavian vein had been rendered impervious by the pressure of the swelling.

Mr. A. Burns saw two examples, in which the patients died instantaneously, though their aneurismal tumours were very small, and had not burst. Both these patients were in the early stage of pregnancy. (*On Diseases of the Heart, p. 236.*)

The situations in which aneurisms of the curvature of the aorta burst, are different in different

cases. Sometimes the swelling bursts into the cavity of the chest, or that of the pericardium, and the patient drops suddenly down. The left cavity of the pleura is by far the most frequent situation in which thoracic aneurisms of the aorta burst. (*Laennec on Dis. of the Chest*, p. 677.) They also frequently burst into the posterior mediastinum. They rarely open into the cavity of the right pleura. When the coats of the aorta give way within the pericardium, where they only receive a slight external membranous covering, this is apt to be also ruptured at the same time, so as to bring on copious effusion of blood, which oppresses the action of the heart, and produces immediate death. In other examples, the blood is effused into the trachea, or bronchi; and the patient, after violent coughing and ejections of blood from the mouth, expires. Sometimes, after the tumour has become closely adherent to the lungs, it bursts into the air-cells, through which the blood is widely diffused. An example of this termination of the disease was observed by Lacunec; who also saw another case, in which, if the patient had lived a little longer, the same occurrence in all probability would have happened. Ehrhardt is not aware, that this mode of rupture has been noticed by other writers. (*De Aneurysmate Aortæ*, p. 21. 4to. Lips. 1820.)

Amongst the most remarkable local effects of aneurisms of the aorta, are those on the vertebral column. They often destroy it to a very great depth. This is entirely the work of interstitial absorption, there never being any mark of supuration. On the side next the vertebra, the sac is completely destroyed, and the circulating blood is bounded by the naked bone. In certain cases, the swelling beats its way through the ribs; even the spinal marrow may be injured, and the patient suffer a species of death, somewhat less violent and sudden. In one case of an enormous aneurism of the abdominal aorta, reported in No. 259. of the *Lancet*, the left leg and thigh were much wasted, and quite paralytic. This seemed to arise, however, from the pressure on the nerves of the lower extremity, and not from injury of the medulla spinalis.

The preparation No. 623. in the Museum of the London University, is an aneurism of the aorta, which made its way through the ribs, destroying part of them and the lateral portion of the spine, so as to expose the medulla. The tumour presented itself below the scapula, and burst into the trachea by an ulcerated opening near its bifurcation. In the Hunterian Collection is a large aneurism of the commencement of the descending aorta, which caused the absorption of parts of several of the ribs, and of the bodies of the fourth and fifth dorsal vertebra, the aneurism forcing its way there into the spinal canal. (See *Guthrie on Dis. of Art.* p. 96.)

The effect of aneurism in producing absorption of the osseous texture, while the intervertebral substance remains little or not at all injured, is noticed in the previous part of this article.

But, although aneurisms in the chest do sometimes protrude at the back, a circumstance that depends on the particular situation of the disease (see *Palleson, Clinique Chir.* t. i. Obs. 7. p. 84.), they more commonly rise towards the upper part of the breast, where a throbbing tumour occurs, which has caused an absorption of the opposing parts of the ribs and sternum, and sometimes

dislocated the clavicle. Corvisart saw an instance, in which an aneurism of the aorta had dislocated the sternal extremity of the clavicle; and Duverney makes mention of a case, in which, besides the displacement and injury of the clavicle, the sternum and scapula were partially destroyed. I attended a case with Dr. Pinckard, where an aortic aneurism had produced considerable displacement of the scapula. Quattani speaks of an example, in which the clavicle was bent by a large aneurism, of which a portion, as large as a pigeon's egg, projected above the bone. (*Lauth*, p. 168.) And Morgagni has described a case, where the upper bone of the sternum, the sternal ends of the clavicles, and the adjoining ribs, were destroyed by the pressure of a large aneurism of the front of the curvature of the aorta, and the disease presented itself externally, somewhat in the form of a boil. (*Epist.* 26. art. 9.)

The swelling now pulsates in an alarming way. The blood is only retained by a thin covering of livid skin, which is daily becoming thinner and thinner. At length, a point of the tumour puts on a more conical, thin, and inflated appearance than the rest; a slough is formed, and, on this becoming loose, the patient is sometimes instantaneously carried off by a sudden gush of blood.

An extraordinary case of aneurism of the aorta is related by Dr. C. W. Wells. The disease, being unattended with any external swelling, it seems, was not comprehended during the patient's lifetime.

The following is an abstract of the case. Mr. A. B., a gentleman thirty-five years of age, and temperate in his habits, became affected in 1789 with symptoms, which were thought to denote the approach of pulmonary consumption. These, however, after some time entirely disappeared. In 1798, he was attacked with a slight hemiplegia, from which he also recovered, with the exception of an inconsiderable sense of coldness in the foot, which had been paralytic. In March, 1804, he complained of being frequently troubled with a noise in his ears, flatulence in his bowels, and pains in his hands and feet, sometimes attended with slight swellings in the same parts. From one, or more of these symptoms, he was never afterwards quite free; but, he did not complain of any unusual feelings in his chest.—August 11. 1807, he fatigued himself considerably with walking; ate rather a hearty dinner; and, having refreshed himself with some sleep afterwards, he played about with his children. While thus amusing himself, he was suddenly seized, between eight and nine o'clock, with great oppression in his chest. He soon afterwards became sick, and, in the matter thrown up, some streaks of blood were observed. He now went to bed; but, though the weather was warm, and he was covered with bed-clothes, his skin felt cold to the attendants. At midnight, he laboured under a constant cough, and expectorated mucus tinged with blood. His body was moistened with a cold sweat, and his pulse was extremely feeble; sometimes it was scarcely perceptible. About five in the morning, his pulse was feeble, and irregular; his breathing difficult, his skin pale, and cold, and covered with a clammy sweat. He frequently tossed and writhed his body, as if he was suffering great pain or uneasiness. The mental faculties, however, seemed unimpaired. Shortly

afterwards he expired, having complained, just before his death, of much heat in his chest, and thrown off the bed-clothes.

The most remarkable circumstance, found on opening the body, is thus recorded:—"The ascending aorta was distended to about the size of a large orange. The tumour adhered to the pulmonary artery, just before its division into the right and left branches. Within the circumference of this adhesion, there was a narrow hole, by means of which a communication was formed between the two arteries."

Dr. Wells concludes with observing, that, though such a disease might easily have been imagined, he had found no instance of it in books, and that it had not been observed by any of the surgeons or anatomists in London. He supposed, that the communication between the aorta and pulmonary artery, took place on the evening before the patient's death, when the oppression of the chest was first felt; and that, in consequence of the superior strength of the left side of the heart, a part of the blood which was thrown into the aorta must have been forced into the pulmonary artery, from which circumstance he conjectures most of the symptoms originated. (*Trans. of a Society for the Improvement of Med. and Chir. Knowledge*, vol. iii. p. 85.)

MM. Payen and Zeink met with another instance of the rupture of an aneurism of the aorta into the pulmonary artery. (*Bulletin de la Faculté de Méd.* 1819, No. 3.) And Dr. Hope informs us, that Professor Monro, tertius, showed him a preparation of an aneurismal pouch, springing from the aorta, directly against the pulmonary artery; so that, if the patient's life had been prolonged, the aneurism would probably have burst into the latter vessel. (*Hope, in Cyclop. of Pract. Med. art. Aorta.*) In the Hunterian Collection at the Royal College of Surgeons in London is a preparation, No. 366., exhibiting a sacculated aneurism of the ascending part of the aorta, and a communication formed between the nipple-like portion of the tumour and the pulmonary artery by ulceration, immediately above and between two of the sigmoid valves. (*Guthrie on Dis. of Art.* p. 60.)

Some additional examples of this nature are detailed by other writers. (*See Bulletin de la Faculté de Médecine*, No. 3., in which there are two cases; *Sue, in Journ. de Méd. continué*, t. xxiv. p. 124.; and *Bulletin de la Faculté*, &c. t. xvii. p. 16.)

Aneurisms of the arch of the aorta are stated to have adhered to, and burst into, the right auricle of the heart, and thus to have produced instant death. (*See Med. Chir. Journ.* vol. vi. p. 617.; *Bulletin de la Société de Médecine à Paris*, 1810, No. 3. p. 38.)

A case, in which an aortic aneurism projected into the ventricles of the heart, is described in a modern publication. (*See Dublin Journ. of Med. Science*, No. 27.)

The cases recorded, in which aneurisms of the thoracic aorta have burst into the œsophagus, are beginning to be more numerous than formerly. Bonetus and Morgagni relate no examples of it; nor are there any in the comprehensive treatises of Scarpa and Hodgson. Corvisart speaks of an instance, which had been seen by Dupuytren, of which, however, no description is given. Yet the possibility of the occurrence is not a matter of speculation, or doubt. A case of

this description is noticed by Matani (*De Aneurism. Præcordiorum Morbis*, p. 120.); another is alluded to by Ehrhardt, as being related by Copeland (*Comment. de Aneurismate Aorta*, p. 22.; *Cerutti Catal. Prop. Pathol.*); an instance is described by Bertin (*see Bulletin de la Faculté de Méd.* 1810, p. 14.); and a very interesting one, attended with disease of the spinal cord and paralysis, is given by Dr. Molison. (*See Edin. Med. Chir. Trans.* vol. iii. p. 173.)

I have recorded one example myself (*see Med. Chir. Trans.* vol. xvi.). This was remarkable for the length of time which the patient lived after the first rupture of it, and on account of the diminution of the external swelling and of the displacement of the scapula.

Sauvages is one of the writers who have adduced proofs of this mode of rupture: *Cadavere aperto, inveni ventriculū septem vel octo libris sanguinis distensum, aortam ad brachii magnitudinem, per spatium septem vel octo pollicum dilatatum, et orificium denarii magnitudine aortæ, et œsophago continuo commune, quod tamen quinque cristæ carnea, veluti valvulae ex ambitu orificii orunda et circumposita potuerunt obturare. Per hoc orificium, sanguis ex aorta fluxerat in œsophagum.* (*Nor. Method.* t. ii. p. 298.) A similar case was published by Bricheteau. (*See Bulletin de l'Athénée de Méd. de Paris*, Dec. 1816.) Laennec met with three examples of death from this cause. (*On Dis. of the Chest*, p. 677. ed. by Forbes.) The same distinguished professor met with an aneurism of the descending aorta, where the tumour had made such pressure on the thoracic duct, that this tube was partly destroyed, and all the lymphatic vessels were found uncommonly turgid. (*Journ. de Méd. par Corvisart*, t. ii. p. 15.) With the exception, perhaps, of one instance given on the authority of Lancisi (*Lauthii Collect.* p. 38.), no other example of this description is upon record.

An instance is reported by Corvisart, in which the pressure of an aneurism of the ascending aorta had nearly obliterated the termination of the lower vena cava, and a fatal attack of apoplexy was the consequence. (*Mal. du Cœur*, p. 342.) Other examples of this are reported by Corvisart, Bertin, and Dr. Hope.

Aneurisms of the arch of the aorta may occasion a tumour, so much like that of a subclavian aneurism, as to be in danger of being mistaken for the latter disease. An example of this kind is related by Mr. Allan Burns: "A case," says he, "on which several of the most distinguished practitioners of Edinburgh, and almost every surgeon in Glasgow, were consulted. The nature of the disease appeared to be so decided, and its situation in the subclavian artery so clear, that, on that subject, there was no difference of opinion. Some were, however, of opinion that an operation might be performed, while others were fully convinced that the case was hopeless. For myself, I must confess, that I was firmly persuaded, that, in the early stage of the disease, an operation might have been beneficial," &c. (*Surgical Anatomy of the Head and Neck*, p. 30.) After death, the vessel, which was supposed to have been most materially affected, was found perfectly healthy. (P. 39.)

After detailing all the particulars of this interesting case, Mr. A. Burns observes, that "it corroborates Sir Astley Cooper's remark, that aneurism—

of the aorta may assume the appearance of being seated in one of the arteries of the neck; an inference, drawn from the examination of a case, which came under his own observation, and of which he had the goodness to transmit a short history to me, along with a sketch, illustrative of the position of the tumour. In one case, the aneurism was attached to the right side of the aortic arch, and involved a part of the arteria innominata; in Sir A. Cooper's, the tumour arose from the effluve of the arch, from between the roots of the subclavian and carotid arteries. It formed a Florence-flask-like cyst, the bulbous end of which projected at the root of the neck from behind the sternum, and so nearly resembled aneurism of the root of the carotid artery, that the practitioner, who consulted Sir A. Cooper, actually mistook the disease for carotid aneurism." (*Allan Burns, Op. cit. p. 41.*)

The preceding statement has received full confirmation from the observations of an intelligent writer. "I have seen (says Mr. Hodgson) several cases of aneurism arising from the superior part of the arch of the aorta, which protruded above the sternum and clavicles, and, in one instance, the space between the tumour and the sternum was so considerable, that it was proposed to tie the carotid artery for an aneurism, which dissection proved to arise from the origin of the arteria innominata, and from the arch of the aorta." (*On the Dis. of Arteries and Veins, p. 90.*)

As I have already noticed, aneurisms of the aorta are most frequent at its curvature; but they are also met with on the other portion of this vessel in the thorax, and likewise on that part of it which is below the diaphragm. In subjects, predisposed to aneurisms, such swellings are frequently seen affecting various parts of the aorta at the same time.

When the disease occurs in the abdominal aorta, a preternatural pulsation generally becomes perceptible at some particular point. The pressure of the tumour disturbs the functions of the viscera. The functional derangements, however, produced by aneurisms of the abdominal aorta, are generally much less urgent, than those arising from aneurism in the thorax. The abdominal viscera bear compression, without evil consequences, much better than the thoracic ones; and the tumour, instead of being pent up in a rigid bony case, like the chest, are not prevented from expanding freely, in almost every direction, because the intestines and the abdominal parietes readily yield in the requisite degree. As Dr. Hope observes, here the pressure of the tumour on any particular organ, is in a great measure obviated by the want of counter-pressure. "Ventral aneurism, however, sometimes deranges the respiration, by preventing the due descent of the diaphragm; an effect, which may proceed either from the magnitude alone of the tumour, or, what is much more common, from its being seated near or in the substance of the muscle, and impeding its motions. Ventral aneurism is also occasionally characterized by involuntary evacuations of the urine and feces, by remarkable alternations of constipation and diarrhoea, and by deep-seated excruciating pains, resembling those of lumbar abscess. These symptoms arise from compression of the nerves, particularly the hypogastric plexus around the aorta." (*See Hope, in Cyclop. of Pract. Med. art. Aorta.*)

In the museum of the London University are several valuable preparations, illustrative of aneurism of the abdominal aorta. No. 619, is an aneurism of this vessel, implicating the mesenteric and renal arteries. No. 621, is an aneurism of the aorta at its bifurcation. No regular sac. Tumour extends down over the forepart of the sacrum. Vena cava obliterated at the point where it receives the two iliac veins. No. 622, is an aortic aneurism, consisting of two large sacs at the sides of the lumbar vertebrae, the texture of whose bodies is more or less destroyed, while the intervertebral substance is entire. During life, the disease was not suspected. The patient suffered excruciating pain in the lower part of the belly. A few days before death, a large tumour presented itself on the left side of the abdomen, with symptoms of internal hemorrhage. In the *post mortem* examination, blood was found between the abdominal muscles and the peritoneum, and the viscera were covered with coagula. The tumour had burst in two places on the right side. The shape of the kidneys was altered by the pressure of the tumour, which adhered to the spleen and pancreas. No. 623, is an aneurism of the aorta, where it passes between the crura of the diaphragm, and projecting into both sides of the chest; while a portion of it, on the right side, descends into the abdomen. The bodies of the vertebrae partly absorbed. Death from effusion of blood into the chest.

Aneurisms, within the thorax and abdomen, being entirely out of the reach of operative surgery, have been too commonly abandoned as unavoidably fatal, and when anything has been done in such cases, it has generally been only with a view to palliation. Moderating the force of the circulation by bleedings and low diet, avoiding every thing that has the least tendency to heat the body, or quicken the motion of the blood, keeping the bowels well open with laxative medicines, and lessening pain with opiates, have been the means usually employed. Of late years, also, digitalis, which has a peculiar power of diminishing the action of the sanguiferous system and impetus of the blood, has been commonly prescribed. In Germany, the superacetate of lead has been used for many years, for the same purpose; and Dupuytren, Iacnec, and Bertin have employed it frequently with advantage in France. The dose, at first, should be half a grain, combined with the same quantity of opium, and given thrice a day. The dose is gradually increased to a grain three or four times a day. Dr. Hope informs us, that he has always found any gastric irritation from it removed by a dose or two of castor oil, promptly administered, and mucilaginous diluents. (*See Cyclop. of Pract. Med. art. Aorta.*)

That the diminution of the force of the circulation will prevent the increase of an aneurism, Mr. Hodgson considers illustrated by the following circumstance: If two sacs exist in the course of the same artery, the obstruction, which is caused by the passage of blood into the upper, serves to remove the force of circulation from the lower, which becomes stationary, or its cavity is obliterated with coagulum. (*On Diseases of Arteries, &c. p. 149.*) Mr. Crose refers to a recent case, in which a popliteal aneurism was cured by another aneurismal swelling taking place in the thigh. The latter was afterwards cured by an operation. (*See Prov. Med. Surg. Trans. vol. v.*)

It was the opinion of the celebrated Valsalva, that the utility of a lowering plan of treatment might do more than merely retard the death of aneurismal patients. It was his belief, that the method might entirely cure such aneurisms as had not already made too much progress; and he put it into practice with such rigour and perseverance, that the treatment became considered as particularly his own. The plan alluded to is not described in his writings, but was published in the first volume of the Commentaries of the Academy of Bologna, by Albertini, one of his fellow students; and several persons, who had learned this method of Valsalva, afterwards imparted it to others. Thus, as Morgagni was passing through Bologna, in 1728, Stancazi is said to have informed him of Valsalva's practice. (See *Kreysig, Ueber die Herzkrankheiten*, b. ii. p. 728.)

After taking away a good deal of blood by venesection, Valsalva used next to diminish the quantity of food gradually, till the patient at length was allowed only half a pint of soup in the morning, and a quarter of a pint in the evening, and a very small quantity of water, medicated with mucilage of quinces, or with the lapis osteocolla. When the patient had been so reduced as to be incapable of getting out of his bed, Valsalva used to give him more nourishment, till this extreme debility was removed. Valsalva was sure that some aneurisms, thus treated, had got well, because every symptom disappeared; and his conviction was verified by an opportunity, which he had of dissecting the body of a person that had been cured of this disease, and afterwards died of another affection; for the artery, which had been dilated, was found contracted, and in some degenerated.

Morgagni states, that this method of treating aneurisms is somewhat like the plan, which Bernard Gengha tried with success, as well as Lancisi; and he refers us to the 24th chapter of the 2d vol. of the Anatomy of the one, and to lib. ii. cap. 4. of the Treatise on the Heart and Aneurisms of the other. But Sabatier tells us, that in consequence of this instruction, he examined both these works, without finding any thing on the subject. However this may be, we are informed by the latter, that he noticed the good effects of the practice in an officer, who had an alarming aneurism in front of the humeral extremity of the clavicle, in consequence of a sword-wound in the axilla. The patient, after having been bled several times, was confined to his bed, and kept to an extremely low diet. He was allowed, as drink, only a very acid kind of lemonade. He took pills containing alum, and the swelling was covered with a bag full of powder of oak bark, which was every now and then well wet with port wine. By perseverance in this treatment, the swelling was reduced to a smallish hard tubercle, having no pulsation, and a perfect cure ensued. (See *Sabatier, Médecine Opératoire*, tom. iii. p. 170—172.)

Guerin recommended the application of ice-water, or pounded ice, to aneurismal swellings; a plan, which he represents as being often of itself sufficient to effect a cure. This topical employment of cold applications may be rationally and conveniently adopted in conjunction with Valsalva's practice.

The most interesting facts, in proof of the efficacy of this mode of treatment, were published, some

years ago, by Pelletan. The following extract from a well-written critique on "*Pelletan's Clinique Chirurgicale*," will serve to convey to the reader some idea of the important information contained in the memoir on internal aneurisms:—"The intent in the treatment is to reduce the patient gradually to as extreme a degree of weakness as is possible, without immediately endangering life. It is done by absolute rest, a rigorous diet, and bleeding; to these means, M. Pelletan adds the external application of ice, or cold and astringent washes, &c. He has here detailed many cases from his own practice, of partial, or complete success, which cannot be too generally known, as they may be the means of creating in some, and of confirming in others, a good opinion of the only method of treatment, which has been found at all efficacious in a dreadful, and not an unfrequent, organic disease.

"Of the cases here recorded, some appear to have been cured; in others, the treatment had marked good effects. In extreme cases, at best, it afforded but partial and temporary relief. In one case, that of a robust man, an aneurism at the root of the aorta, with a pulsating tumour of the size of an egg, projecting between the ribs (the edges of which were already partly absorbed), was reduced, so as to recede within the ribs in the course of eight days. At the end of this time, the patient refused to submit any longer. The tumour did not appear again for nearly a year, although he returned to very drunken and irregular habits. He died in about two years and a half, with the tumour again appearing, and much increased in volume. The aneurismal sac communicated with the aorta, by a smooth and round opening, opposite to one of the sigmoid valves. There can be no doubt of the efficacy of the treatment in this case; and it is highly probable, that his health and his life might have been long preserved, but for his own indiscretion. In a case somewhat similar, but not so far advanced, the patient appears to have been cured. There was a swelling on the right side of the breast, about six inches in circumference, with a very strong beating. The pulsation was accompanied with a pain, which stretched towards the scapula and the occiput. It was evident that the disease was an aneurism of the great arch of the aorta. The patient was a crier, of a strong frame, who was accustomed to drink freely. In the four first days, he was bled eight times, drawing three basins, 'palettes,' in the morning, and two in the evening. On the fifth, the pains and the beating were much lessened, but the pulse was still full. He was again bled once. The pulse was in a favourable state, as to strength, till the seventh day, when it again rose, and the man was twice bled.

"During this time, the man was kept to a most rigorous diet. A cold poultice of linseed and vinegar was placed on the tumour, and renewed when it became warm. At the end of eight days, the good effects of this plan were very evident; the pain and the pulsation were gone. The patient, though weak, was in health, and tranquil. He was now allowed more food by degrees. At the end of four weeks from the commencement of the treatment, he left the Hôtel Dieu well. He afterwards led a sober life, and became fatter, without any vestige of disease, except a slight and deep pulsation at the part, in which the aorta may always be felt beating in its natural state. He died

two or three years afterwards, of another complaint. His death was not known, and the body was not examined." (See *London Med. Review*, vol. v. p. 123.)

Pelletan also cured by similar treatment a large axillary aneurism, which was deemed beyond the reach of operative surgery. On the thirteenth day, the patient was reduced to a degree of weakness which alarmed many of the observers. From that time, all pulsation in the tumour ceased. The contents were gradually absorbed; and the patient returned to his former laborious life with his arm as strong as ever. The pulse at the wrist was lost in consequence of the obliteration of the axillary artery, and the limb only receiving blood through the branches of the subclavian artery. "*Il y a beaucoup d'exemples d'aneurismes guéris spontanément et sans le secours de l'art* (says Pelletan); *mais on ne peut leur comparer le cas que nous venons de décrire: l'état extrême de la maladie, l'énergie des moyens employés, et l'effet immédiat et successif qui en est résulté prouvent assez que le succès a été dû tout entier à l'art.*" (*Clinique Chir.* tom. i. p. 80.)

In this work, we find not less than three cases, in which aneurism of the aorta is stated to have been effectually cured. One instance was greatly relieved; but the disease returned the next year in consequence of the patient's intemperate mode of life. In another example, an aneurism at the origin of the aorta was cured; but the disease recurred in another part of that vessel further from the heart. Even such cases as proved incurable, to the number of fourteen, all received various degrees of palliation from the treatment adopted.

In a modern work of great merit, several other instances are adduced, in which the utility and efficacy of a debilitating plan of treatment are illustrated. (See *Hodgson on the Diseases of Arteries*, p. 146, 147, &c. &c.) In the same publication, as I have previously explained, are various interesting facts, which tend to prove, that when aneurism of the aorta is lessened or cured, this great vessel itself may remain pervious. The progress of the disease is stopped by the blood coagulating in the sac, and closing the communication between the cavity of the aneurism, and that of the artery.

The diet should consist principally of fluids, and it should be gradually reduced. Pelletan sometimes allowed only two basins of broth in twenty-four hours, and lemonade as a common drink. Valsalva, by degrees, increased the food to half a pound of pudding in the morning, and a quarter of a pound in the evening, with a limited quantity of water. By gradual reduction, the solid food may be brought down to four ounces, and fluids to eight. Both the body and mind should be kept in the most perfect quietude; and if the plan is to be strictly enforced, the recumbent position must be constantly maintained. The frequent administration of purgatives, which weaken the action of the heart, is another part of this system of treatment.

It must be confessed, in regard to Valsalva's mode of treatment, that some experienced men do not place confidence in it. Boyer declares himself against it, as not being really efficacious; and he states, that some time ago, it was tried twice in the Hôtel Dieu of Paris. The first trial was made on a patient with an axillary aneurism, which could not be operated upon on account of

its situation; the second on a woman, who had an aneurism of the abdominal aorta. In both cases, the tumour was large, and its parietes reduced to the cellular coat, and the surrounding cellular substance. In these two aneurisms, the progress of the swelling was rapid, and its rupture happened precisely at the moment when the treatment had been pushed to the utmost, and there ought to have been the greatest hope. (*Traité des Maladies Chir.* t. ii. p. 121.)

Sir Astley Cooper declares, that he has seen but little benefit result from this treatment of the disease. According to his experience, only two measures are useful; viz. venesection when the pulse is hard and full; and the administration of the carbonate of soda in considerable doses, which, with entire rest, seem to prevent the increase of the swelling. But, he adds, that the soda is at length unavoidably given up, on account of its producing petechia. Sir Astley believes, that the irritability and quickened pulse, produced by antiphlogistic treatment, often do as much injury as the natural force of the circulation. (*Lectures*, &c. vol. ii. p. 48.)

Small occasional bleedings are safer than large ones. In an aneurism of the aorta, especially when combined with organic disease of the heart, bleeding should never be carried to syncope, as, in such cases, this is apt to be alarmingly protracted, and sometimes to terminate fatally. (*Sir Astley Cooper, Dr. Hope, &c.*) The blood should, therefore, be drawn slowly, and in the recumbent posture. Nor should venesection be performed during a paroxysm of palpitation, as the exhaustion consequent on it, superadded to that occasioned by the loss of blood, might depress the patient beyond the possibility of restoration. (See *Hope, in Cyclop. of Pract. Med.* art. *Aorta*.)

M. Roux expresses his entire disbelief in the possibility of an aneurism of the aorta being ever completely cured by Valsalva's mode of treatment, because he imagines, that such change could not happen without the tube of that great vessel becoming impervious, and of the lower parts of the body then perishing from stoppage of the circulation. But he bears witness to the utility of such treatment, and recites a case which he attended himself, where an aneurism made a considerable projection on the left side of the sternum, where the cartilages of the third and fourth ribs were raised, the throbbings very forcible, and the sense of suffocation such, that the patient was obliged to keep himself constantly quiet; yet, says M. Roux, though the disease now exists, it forms no prominence on the chest; the pulsations can only be obscurely felt between the ribs; the respiration is but slightly oppressed; and the patient is capable of attending to his business. (*Nouveaux Elém. de Méd. Opér.* t. i. p. 510. 8vo. Paris, 1813.) If any one doubt the possibility of retarding the progress of an aortic aneurism by bleeding, I would refer him to a case, which was laid by me before the profession not long ago. The aneurism burst by a small ulcerated opening into the œsophagus; and after the loss of a vast quantity of blood, not only did the hemorrhage cease for a considerable time, but the external swelling subsided, and the base of the scapula, which had been pushed forwards and backwards by it, returned into its natural position again. (See *Med. Chir. Trans.* vol. xvi. p. 320.)

ANEURISMAL VARIX; VARICOSE, OR VENOUS ANEURISM; ANEURISM BY TRANSFUSION.

By these terms, surgeons mean a tumour, arising from a preternatural communication, formed between a large vein and a subjacent artery. Thus, in venesection, performed immediately over the artery, at the bend of the elbow, if the lancet be carried too deeply, it may transfix the vein, and wound the artery; in which event, the arterial blood, in consequence of the proximity of the two vessels, instead of being effused in the cellular substance, will pass directly into the cavity of the vein, which will become dilated in the form of a varix by the jet of arterial blood into it.

Although Sennertus probably referred to an instance of this disease (*Op. t. v. l. v. cap. 43.*), Dr. W. Hunter is undoubtedly the first, who gave an accurate description of it. Scarpa is disposed to claim a share of the merit for his countryman Guattani; but, as Mr. Hodgson has remarked, Dr. Hunter's observations on this disease were published in the years 1757 and 1764; whereas, Guattani did not see his first patient until the year 1769, and his book was not published until the year 1772.

"Does it ever happen in surgery," says Dr. Hunter, "that when an artery is opened through a vein, a communication, or anastomosis, is afterwards kept up between these two vessels? It is easy to conceive this case; and it is not long since I was consulted about one, that had all the symptoms that might be expected, supposing such a thing to have actually happened, and such symptoms as otherwise must be allowed to be very unaccountable. It arose from bleeding; and was of some years' standing when I saw it, about two years ago, and I understand very little alteration has happened to it since that time. The veins, at the bending of the arm, and especially the basilic, which was the vein that had been opened, were there prodigiously enlarged, and came gradually to their natural size, at about two inches above, and as much below the elbow. When emptied by pressure, they filled again almost instantaneously; and this happened, even when a ligature was applied tight round the forearm, immediately below the affected part. Both when the ligature was made tight, and when it was removed, they shrank, and remained of a small size, while the finger was kept tight upon the artery, at the part where the vein had been opened in bleeding. There was a general swelling in the place, and in the direction of the artery, which seemed larger, and beat stronger than what is natural; and there was a tremulous jarring motion in the vein, which was strongest at the part which had been punctured, and became insensible at some distance both upwards and downwards." (*Med. Obs. and Inq. vol. i.*)

In the second vol. of the same work, Dr. Hunter adds some further remarks:—"In the operation of bleeding, the lancet is plunged into the artery through both sides of the vein; and there will be three wounds made in these vessels, viz. two in the vein and one in the artery, and these will be nearly opposite to one another, and to the wound in the skin. This is what all surgeons know has often happened in bleeding, and the injury done the artery is commonly known by the jerking impetuosity of the stream whilst it flows from the vein,

and by the difficulty of stopping it when a sufficient quantity is drawn.

"In the next place, we must suppose, that the wound of the skin, and of the adjacent, or upper side of the vein, heal up as usual; but, that the wound of the artery, and of the adjacent, or under side of the vein, remain open (as the wound of the artery does in the spurious aneurism), and, by that means, the blood is thrown from the trunk of the artery, directly into the trunk of the vein. Extraordinary as this supposition may appear, in reality it differs from the common spurious aneurisms in one circumstance only; viz. the wound remaining open in the side of the vein, as well as in the side of the artery. But this one circumstance will occasion a great deal of difference in the symptoms, in the tendency of the complaint, and in the proper method of treating it: upon which account, the knowledge of such a case will be of importance in surgery. It will differ in its symptoms from the common spurious aneurism, principally thus:—The vein will be dilated, or become varicose, and it will have a pulsating jarring motion, on account of the stream from the artery. It will make a hissing noise, which will be found to correspond with the pulse for the same reason. The blood of the tumour will be altogether, or almost entirely fluid, because kept in constant motion. The artery, I apprehend, will become larger in the arm, and smaller at the wrist, than it was in the natural state; which will be found out by comparing the size, and the pulse, of the artery, in both arms, at these different places, the reason of which I will speak of hereafter; and the effects of ligatures, and of pressure upon the vessels above the elbow and below it, will be what every person may readily conceive, who understands any thing of the nature of arteries and veins in the living body.

"The natural tendency of such a complaint will be very different from that of the spurious aneurism. The one is growing worse every hour, because of the resistance to the arterial blood, and, if not remedied by surgery, must at last burst. The other, in a short time, comes to a nearly permanent state; and, if not disturbed, produces no mischief, because there is no considerable resistance to the blood that is forced out of the artery.

"The proper treatment must, therefore, be very different in these two cases; the spurious aneurism requiring surgical assistance, as much, perhaps, as any disease, whatever; whereas, in the other case, I presume it will be best to do nothing.

"If such cases do happen, they will no doubt be found to differ among themselves, in many little circumstances, and particularly in the shape, &c. of the tumefied parts. Thus the dilatation of the veins may be in one only, or in several, and may extend lower or higher in one case than in another, &c. according to the manner of branching, and to the state of the valves in different arms. And the dilatation of the veins may also vary, on account of the size of the artery that is wounded, and of the size of the orifice in the artery and in the vein.

"Another difference in such cases will arise from the different manner, in which the orifice of the artery may be united, or continued with the orifice of the vein. In one case, the trunk of the vein may keep close to the trunk of the ar-

tery, and the very thin stratum of cellular membrane between them may, by means of a little inflammation and coagulation of the blood among its filaments, as it were solder the two orifices of these vessels together, so that there shall be nothing like a canal going from one to the other; and then the whole tumefaction will be more regular, and more evidently a dilatation of the veins only. In other instances, the blood that rushes from the wounded artery, meeting with some difficulty of admission and passage through the vein, may dilate the cellular membrane between the artery and vein into a bag, as in a common spurious aneurism, and so make a sort of canal between these two vessels. The trunk of the vein will then be removed to some distance from the trunk of the artery, and the bag will be situated chiefly upon the underside of the vein. The bag may take on an irregular form, from the cellular membrane being more loose and yielding, at one place, than at another, and from being unequally bound down by the fascia of the biceps muscle. And if the bag be very large, especially if it be of an irregular figure, no doubt, coagulations of blood may be formed, as in the common spurious aneurism.

A concurrence of two circumstances is requisite for the production of an aneurismal varix: 1. the puncture in the vein, and that in the artery, must be exactly in the same direction; 2. the solution of continuity in the integuments and upper side of the vein must heal, while the wound in the deeper side of that vessel, and the puncture in the upper surface of the artery, remain open, and communicate so readily, that the arterial blood finds greater facility in entering from the artery into the vein, than in being effused from the artery into the surrounding cellular substance.

If one of these two circumstances be wanting, either because the wounding instrument has entered the artery a little obliquely from the vein, or because the vein has not been sufficiently near to the artery, on account of the cellular substance between them, the arterial blood most frequently does not produce the aneurismal varix; or, if it does, the disease is always complicated with effusion of arterial blood into the cellular substance, or with an aneurism and aneurismal varix at the same time. In this case, the small aneurismal sac serves as a short canal of communication between the artery and the vein (*Med. Facts and Obs.* vol. iv. p. 115.); two distinct diseases, in fact, being formed from the same cause, and placed one over the other, viz. an aneurism, and an aneurismal varix. (*Scarpa*, p. 421. ed. 2.) The following marks of distinction between aneurism and aneurismal varix, are pointed out by the same author: the aneurismal varix always forms a circumscribed tumour; aneurism does not always do so. The cellular substance, which constitutes the sac of the aneurism, does not always resist so strongly the impetus of the arterial blood, as the coats of the vein do. Not unfrequently, therefore, aneurism, from being circumscribed at first, becomes diffused; extends along the course of the wounded artery; compresses strongly the surrounding parts; occasions acute pain and inflammation; and the parts are threatened with gangrene. On the contrary, the aneurismal varix is always circumscribed, increases very slowly, does not produce much pain, and, as it augments, it always extends,

more or less, above or below the place where venesection has been done; and this extension is in proportion to the greater or less force with which the arterial blood is thrown from the artery into the vein, and the greater or less resistance made by the valves situated in the vein below the puncture; and according to the greater or less number of veins communicating with the aneurismal varix. The seat of the disease is generally the basilic or median vein, which appears dilated in an unusual manner, forming an oblong tumour, of the size of a walnut, if the disease is recent. In the centre of the swelling is the cicatrix left by the lancet. The vein is less dilated, the further it is from this scar; and, in general, at the distance of two inches and a half above and below this point, the vessel resumes its natural size. The small tumour, as has been explained, pulsates like an artery, with a tremulous motion and hissing noise, which is sometimes so great, that the patient cannot sleep, if he is lying with his head low, and resting on the injured arm. The trunk of the brachial artery, from the axilla down to the place where it has been wounded with the lancet, vibrates with extraordinary force. There is no change of colour, nor inflammation of the skin; and the pain is inconsiderable. The swelling is compressible and yielding; but it returns as soon as the pressure is removed from it. When the arm is kept for some time raised up towards the head, the tumour diminishes; and the same thing happens when pressure is made on the communication between the artery and vein, or when a tight tourniquet is applied near the axilla. If the disease be complicated with aneurism, a second pulsating tumour will be found lying under the aneurismal varix. (*Scarpa*, p. 424. ed. 2.)

A simple aneurismal varix is gradual in its formation, never attaining a considerable size, and never exposing the patient's life to danger by the rapidity of its increase, or a tendency to burst; but, if it be a less serious disease in these respects than a consecutive false aneurism, it does not, like the latter, present any chance of a spontaneous cure, and its duration is perpetual. However, after it has acquired some size, and the veins have become exceedingly varicose, the patient complains of numbness and weakness of the limb, diminution of its temperature; and there is a bluish, or somewhat purple, discolouration of it, which Breschet ascribes to the passage of some of the venous blood into the artery, and to there being a smaller quantity of scarlet blood conveyed by the artery into all parts beyond the tumour. (*Mém. Chir. sur Différentes Espèces d'Aneur.* p. 102.)

It is generally believed that only the blood of the artery leaves its proper vessel; but, according to the investigations of M. Breschet, at the same time that arterial blood passes into the veins, the artery itself receives a certain quantity of venous blood. The symptoms, he observes, demonstrate this during life, as well as the examination of the parts after an operation on the tumour: it is also proved by the appearances of the vessels in *post mortem* examinations. (*Breschet, Mém. sur Différentes Espèces d'Aneurysmes*, p. 100.)

After relating two cases, illustrative of the nature of aneurismal varix, Dr. W. Hunter proceeds to inquire, "Why is the pulse at the wrist so much weaker in the diseased arm than in the other?—surely the reason is obvious and clear. If the

blood can easily escape from the trunk of the artery directly into the trunk of the vein, it is natural to think that it will be driven along the extreme branches with less force, and in less quantity.

"Whence is it that the artery is enlarged all the way down the arm? I am of opinion, that it is the consequence of the blood passing so readily from the artery into the vein, and is such an extension as happens to all arteries, in growing bodies, and to the arteries of particular parts when the parts themselves increase in their bulk, and at the same time retain a vascular structure." (See *Med. Obs. and Inq.* vol. ii.) This explanation is not deemed by Breschet altogether correct. M. Breschet has endeavoured to give a more particular and precise explanation of the changes which the vessels and adjacent textures undergo, and the effects of the communication between the arteries and veins. In consequence of the artery receiving venous blood, the flow of this fluid through it becomes slower, and the pulse weaker. The artery itself dilates throughout its whole extent, a fact long ago noticed by Morand; its tunics grow thinner, and become nearly as soft and flaccid as those of a vein. The artery becomes likewise tortuous, and gradually assumes the characters, first, of a vein, and then of a dilated vein. All this happens, however, only below the communication between the two vessels. (*Breschet, Mém. Chir. sur Différentes Espèces d'Aneur.* p. 103.) If it were not for the passage of some of the blood of the vein into the artery, Breschet conceives, that it would be impossible to account for the diminished rate of the circulation in the latter vessel, the reduction of sensibility and temperature of the limb, and especially the enlargement of the artery beyond the tumour, its assuming the characters of a vein, and the deeper colour of the blood in it. The vein, likewise, becomes altered around the wound (below, and particularly above it), its coats assuming greater solidity and firmness; and, though the vessel is enlarged, the suppleness of its parietes is diminished. (See *Breschet, Op. cit.* p. 104.)

No doubt M. Breschet has extended his criticisms of Dr. Wm. Hunter's account too far, inasmuch as the atrophy and loss of temperature in the extreme part of the limb are certainly, in some measure, owing to a part of the arterial blood flowing directly and prematurely into the venous system. Dr. Wm. Hunter has chiefly erred in overlooking the effect of the entrance of venous blood into the artery. If, as Hunter states, a greater quantity of blood arrives by the artery above the wound, how does it happen, inquires M. Breschet, that the artery should diminish in diameter below the puncture, as Dr. Wm. Hunter affirms that he had ascertained to be the case at the wrist? "For (observes M. Breschet), by the more considerable afflux of red blood, the lower continuation of the artery must be indemnified for the quantity of this fluid which passes into the vein. A new channel, opened for the arterial blood, cannot (says he) bring on a dilatation of the vascular trunk above the aperture of the new channel. This effect would be more likely to arise from some impediment to the circulation, and is actually what does happen in old consecutive false aneurisms." (See *Mém. sur les Différentes Espèces d'Aneur.* p. 105.) M. Breschet, further on, expresses a suspicion, that Dr. Wm. Hunter perhaps confounded the weakness and softness of the pulse at the wrist

with a diminution of the artery. I am of opinion that little foundation exists for this suspicion, because it is certain, that, in some cases of aneurismal varix, the arteries below it, so far from being enlarged, are diminished; and, therefore correspond to Dr. Wm. Hunter's description. In proof of this fact, I may refer M. Breschet to the evidence of his distinguished countryman M. Jules Cloquet, who has given the particulars of the dissection of an aneurismal varix illustrated by a diagram (pl. 1. fig. 13.), where the brachial artery below the tumour was not larger, than the middle portion of the radial artery. (See *Jules Cloquet, Pathol. Chir.* p. 85. 4to. Paris, 1831.) According to M. Breschet, in old varicose aneurisms of the limbs, and especially of the lower extremities, the principal artery, as well as its branches, are manifestly dilated, and their coats resemble those of veins. "If the same quantity of red blood passed through a vessel of this description, its pulsations would not have the same character as those of the artery of the opposite limb. We think, then, that this change in the pulsations of the artery in old aneurisms, depends both upon the dilatation of the vessel, demonstrated in the dead subject, and upon the passage of venous blood into the artery; for how could dilatation and alteration of the parietes of the vessel be accounted for in any other way?"

In the foregoing passage, the statement that a new channel for the blood, arising from an arterial trunk, will not be followed by an enlargement of that trunk above such channel, seems to me incorrect; for if there be a new channel, blood will be required for it: an increased quantity will therefore pass through the trunk above the new channel, and such trunk of course increase in size, agreeably to a well-established law of the animal economy. The case of an old false aneurism, referred to by M. Breschet seems to me rather to invalidate, than strengthen, his conclusion, respecting the cause of the enlargement of the arterial trunk above the disease. This change is not ascribable to impediment of the circulation, but to the blood having new channels to supply; viz. the sac, and the enlarged collateral anastomosing vessels.

An interesting circumstance, pointed out by M. Breschet, is, that the dilatation of the artery beyond the injury, is not exemplified in all varicose aneurisms. Their situation has considerable influence in producing it; for it can only take place in vascular trunks of large calibre; and it is requisite, also, that venous blood pass into the artery, and that the circulation of this fluid be favoured by the laws of hydraulics and the power of gravitation. Hence, this dilatation of the injured artery, regarded by M. Breschet as the consequence of the admission of a certain quantity of venous blood into it, is principally noticed in varicose aneurisms of the limbs, and not in those of the neck, or subclavian region. The wound in the artery must likewise have a certain extent, be constantly gaping, and in direct communication with the vein. (See *Breschet, in Mém. sur Différentes Espèces d'Aneur.* p. 107.) In the remarkable case of spontaneous varicose aneurism of the thigh, recorded by Mr. Perry, the posterior tibial artery, and the other arteries in the neighbourhood of the aneurism, were apparently sound. (See *Lond. Med. Gaz.*, Nov. 1835.)

In thin subjects, the median basilic vein is so close to the brachial artery, the track of which it

crosses at a very acute angle, that it is almost impossible to open it at this point, without risk of wounding the artery at the same time. Although the bend of the arm is the situation, in which the aneurismal varix and venous aneurism are usually noticed, it is easy to conceive, that they may happen wherever an artery of a certain diameter lies immediately under a large vein. Thus, Lassus saw an aneurismal varix in the ham, the consequence of a wound with a sword, which had transfixed the popliteal vein and artery. (*Méd. Opér.* t. ii. p. 442.) Breschet records instances of it at the upper and inner part of the arm; in the thigh; and in the neck, from a communication formed between the common carotid and the internal jugular vein, by a wound. He likewise gives the particulars of several occasioned by venesection at the bend of the arm, the ordinary situation of the disease. Larrey records examples of it in the subclavian vessels, the external iliac, the popliteal, and between the carotid artery and internal jugular vein. (*Mém. de Chir. Clin.* t. iii.)

The frequency with which Dupuytren met with these arterio-venous aneurisms, as he terms them, was considerable; for, during fifteen years, not a single year passed without his being consulted for at least two cases. For the prevention of them, he recommends the following rules:—1. That venesection should never be practised, until the pulsation of this artery is felt. 2. That the vein immediately over the artery should never be punctured. 3. That some other vein should be selected. He admits, however, that other veins sometimes cannot be readily found, and that they do not always yield the requisite quantity of blood; still he deems these inconveniences slight, in comparison with that of exposing the patient to a wound of the artery. (*Dupuytren, Clinique Chir.* t. i. p. 262.) While I fully coincide with this eminent surgeon, in recommending a vein to be generally preferred, which does not lie directly over the artery, I do not agree with him, that the practitioner should not open the median basilic vein, if another could not be easily found, which would furnish the proper quantity of blood. I frequently bleed in the median basilic vein; and as there is the fascia between it and the artery, believe, that the latter vessel can only be wounded by a very-careless or unskilful hand. Indeed, when Dupuytren, in censuring the custom of letting perfect novices in the profession attempt venesection (p. 261.), he is adverting to the chief cause of the accident. The last case which I saw, was in a woman who had been bled by a farrier.

Baron Larrey, surgeon to the hospital at Val-de-Grâce, saw a case of aneurismal varix, which had been occasioned by a wound of the popliteal vein and artery; and a history of the disease, accompanied with the pathological preparation, was sent to the former Royal Academy of Surgery at Paris. "The varicose swelling, which was as large as two fists, occupied the whole of the ham in a middle-aged man, who some years previously had been wounded with a sword in that part of the limb. At a consultation, amputation was deemed necessary, and was performed with success. At the bottom of the wound, the communication between the popliteal vein and artery was observed. The sac itself was evidently composed of the vein, the parts of which, adjacent to the varicose swelling, were dilated, especially the lower continuation of the

vessel. The popliteal nerve was rendered flat, like a piece of tape, and adherent to the outside of the cyst." (See *Mém. de Chir. Mil.* t. iv. p. 340.; *Boyer, Traité des Mal. Chir. &c.* t. ii. p. 177.)—Two cases are likewise recorded by Mr. Hodgson. In one, the disease was caused in the thigh, about four inches below Poupert's ligament, by the point of a heated iron rod, which had passed through the femoral artery and vein. In the other example, the aneurismal varix was situated in the ham, and was the consequence of a wound in that part with a pistol-ball. (*On the Diseases of Arteries*, p. 498.) Larrey records one example of aneurismal varix, situated under the clavicle.

P. Cadriéux was wounded with a sabre in a duel, on the 20th of November, 1811: part of the attachment of the sterno-mastoid muscle was divided, the anterior scalenus, the subclavian artery and vein at a very deep point, and probably also a portion of the brachial plexus. A most violent hemorrhage took place, followed by syncope. Pressure was applied to the wound, and the patient conveyed to the hospital at Gros Caillou. The external wound, which was small, did not bleed at all the following morning; but the clavicle was quite concealed by a large tumour, which throbbed with the arteries, particularly at its lower part. A peculiar noise, like that of the passage of a fluid through tortuous metallic tubes, could also be felt more deeply, in the direction of the axillary vein. The arm was quite cold, insensible, motionless, and without any pulse even in the axillary artery itself. On the 22d, the tumour was not larger, but its throbbings were stronger; the jugular vein on the same side was considerably dilated; and the pulsation of the carotid, and of the arteries of the opposite arm, had augmented. A vein in the right arm was opened, and compresses dipped in camphorated vinegar, muriate of ammonia, and ice, applied to the swelling. It would be superfluous here to detail the diet, bleedings, and other parts of the treatment. On the 8th day, the outer wound was quite healed. On the 10th, the veins of the limb were observed to be swelled, and sensibility and warmth were returning in it; though no pulse could yet be felt. The tumour was much smaller, and restricted to a circumscribed place behind the great pectoral muscle; but the hissing sound was still plainer. By degrees, the muscles of the arm and forearm regained their power of motion. The hand, however, continued useless, and affected with pricking pains. On the 20th day, the tumour was quite gone, but the hissing sound was unaltered, and the throbbings were still evident in the veins of the neck and arm. The arm was not at all emaciated. On the 55th day, a pulse at the wrist could be slightly felt: the hissing sound had become less distinct; the veins were less turgid, and their throbbing had diminished. A second instance of aneurismal varix, or rather, perhaps, of a varix of all the veins of the arm, caused by a sword-wound of the axilla, is recorded by Larrey. In the most prominent of the large vessels, there was a pulsation. (*Mém. de Chir. Mil.* t. iv. p. 341, &c.)

Dr. Dorsey, of Philadelphia, published a case of aneurismal varix, which is in several respects interesting. A patient was wounded in the leg with buck-shot; and after the cure of the injury, an aneurismal varix was noticed just below the

knee; and, in a little time, the superficial veins of the limb became dilated, and the hissing noise, characterizing this species of aneurism, could be plainly distinguished. The patient was seen by Dr. Dorsey, twelve years after the accident; the veins were then considerably distended from the toes up to the groin, all about which latter part pain was constantly experienced, and some ulcers situated on the foot and ankle could not be healed by any of the remedies which were tried. The patient was under the care of Drs. Physick and Wistar. The enormous distention of the vessels of the leg, and the uncertainty of finding out the communication between the artery and vein, led these gentlemen to tie the first of these vessels in the middle of the thigh. Gangrene soon ensued, and in this state the patient was further weakened by an unexpected hemorrhage from one of the distended veins; and though the vessel was secured with a ligature, the bleeding recurred, the patient became more and more enfeebled, and at length expired. When the limb was examined after death, the whole of the trunk of the femoral artery was found preternaturally dilated, while all the veins of the limb were considerably distended; a bougie could readily be passed from the popliteal into the posterior tibial artery which participated in the dilatation, and from this last artery, the instrument could be passed into the vein, through a cyst, situated on the inside of the leg below the knee. (See *Dorsey's Elements of Surgery*, vol. ii. p. 210. Philadelphia, 1813.)

In November, 1835, Mr. Perry, surgeon to the Marylebone Infirmary, communicated to the Royal Medical and Chirurgical Society of London, the history of a remarkable case of varicose aneurism. It was a case in which death ensued six days after an operation for aneurism of the femoral artery, in consequence of the sac having communicated with the accompanying vein. I believe this patient was shown to me some months before the operation, when, from the peculiar thrilling sensation and hissings then perceptible, I intimated my expectation, that a communication existed between the femoral vein and the artery. This is not the only instance on record, where a similar condition was spontaneously established between a great vein and a neighbouring artery; for Mr. Syme, of Edinburgh, has published the particulars of a case, in which a free communication was found between the descending vena cava and the aorta, close to their bifurcations, attended with a considerable swelling of the latter vessel. (See *Edin. Med. and Surgical Journ.* No. 108.)

Professor Scarpa, Dr. Hunter, B. Bell, Pott, and Guattani, mention cases of aneurismal varix, which remained stationary for fourteen, twenty, and thirty-five years. Several cases are related by Brambilla, Guattani, and Monteggia, of a cure having been obtained by means of compression. But, as this method of cure, if it does not succeed, exposes the patient to the danger of a complication of the disease with an aneurism, it ought not to be employed, except in recent cases, where the tumour is small, and in slender patients. Sir Astley Cooper mentions in his Lectures, that he once cured the aneurismal varix in a young lady, by compression with an instrument; and, in the Museum of the London University is a preparation, given to that institution by Mr. Oldknow, illustrating the power of pressure

to effect a cure, even when the disease consists of a varix and a false aneurism together. In this preparation, the communication between the vein and the subjacent aneurism, and that between the aneurism and the artery, are obliterated; while the remains of a small sac are discernible between the artery and vein. The case was treated by Mr. Oldknow. I have seen one example cured by compression; the case was recent, and in a woman, about forty, who had imprudently suffered herself to be bled by a farrier.

Two cases are recorded, in which it was necessary to operate in consequence of the disease being joined with aneurism of the artery, and even bursting. The sacs were opened, and a ligature applied both above and below the aperture in the artery. (See *Park, in Medical Facts and Obs.* vii. iv. p. 111.; and *Physick, in Medical Museum*, vol. i. p. 65.) The latter form of the disease, which is particularly noticed by Dr. Hunter, and also by my friend Mr. Hodgson, is readily understood by recollecting, that the artery and vein, when punctured together, do not always unite in such a manner as to let the arterial blood have a direct passage into the vein; but they may be separated for some distance from each other, so that the blood passes from the artery into the adjacent cellular membrane, where a sac is formed, into which the blood poured previously to its entrance into the vein. (See *Gibson's Institutes of Surgery*, vol. ii. p. 158. Philadelphia, 1825.)

In the winter of 1819, I heard a case read to the Medical and Chirurgical Society of London, from Mr. Atkinson, of York, who had found it necessary to take up the brachial artery on account of the large and increasing size of an aneurismal varix; mortification of the limb ensued. In the Museum of the London University is a preparation, taken from a person on whom Sir Charles Bell operated for a venous aneurism, and who died of gangrene of the limb. In this case, there was a high bifurcation of the brachial artery, and the radial division had been punctured in bleeding. The preparation exhibits a double aneurism; one being under the fascia, and communicating with the dilated portion of the vein through an opening in that texture. An anastomosing branch, between the radial and ulnar, is seen equal in size to either of them. I believe that the records of surgery prove, that operations for the cure of venous aneurisms have more frequently been followed by mortification, than operations for other aneurisms; and when it is considered, that the extreme part of the limb, even previously to the ligature of the artery, is deprived of a great quantity of the arterial blood, which ought to be distributed to it, that venous blood gets into the artery, and that it has a difficulty in maintaining its proper temperature, the fact seems accounted for. These considerations, joined with the recollection that the disease, after attaining a certain size, generally remains stationary through life, ought to make surgeons decline an operation, except when the increase of the false aneurism, or an unusual degree of annoyance from the swelling, justifies the opposite line of conduct. Here the artery, then, has a ligature applied to it under very disadvantageous circumstances. When an arterial trunk is tied, soon after the wound of an artery, as M. Breschet observes, hopes may be entertained of the member preserving its vitality, because its several textures are in a favourable

state for receiving blood from the vessels of small calibre. The anastomoses between the trunk of the vessel, above and below the ligature, possess the advantage of having the lower portion of the artery sound, and fitted for carrying on the circulation. But, when a ligature is applied to an artery for venous aneurism of long standing, the part of the artery, situated below the disease, is dilated; its coats are weakened; they no longer possess the contractility requisite to carry on the circulation; and the vitality of the tissues being thus reduced, the fluids stagnate in them, and the parts are soon seized with gangrene or paralysis. (See *Mém. Chir. sur Différentes Espèces d'Aneurysmes*, p. 109.) If the limb be not seriously affected with atrophy, and a diminution of its temperature, sensibility, and power of action, the wisest plan is to let the disease alone, or, at most, only to make gentle equable pressure on the limb, and on the point corresponding to the wound of the artery. In the opposite circumstances, says M. Breschet, a surgical operation is indicated, which should not consist in the simple ligature of the artery between the heart and the wound, because the return of the blood through the lower portion of the artery would reproduce the disease, especially if the wound were not recent. Neither, says he, should it consist in merely tying the artery beyond the injury, or in the separate ligature of the vein above it, because these proceedings would expose the patient to the risk of various inflammatory accidents, or to a false aneurism, either circumscribed or diffused. But, it is better and safer to place the injury of the vessels between two ligatures. By acting in this manner, not only do we hinder the blood from returning through the lower end of the artery, and reproducing the disease, but we prevent the venous blood from passing into the artery, and thereby avert the stupor which the passage of this black blood into the tissues always creates; a stupor the more considerable, and the more readily followed by gangrene, inasmuch as the red blood enters the organized textures in less quantity, and with increased difficulty. (See *Breschet, in Mém. sur Différentes Espèces d'Aneurysmes*, p. 153.) If the artery be tied both above and below the communication with the vein, the exchange of blood between the two vessels will be effectually stopped: the proposal once made by Dupuytren, to include the vein in the ligatures along with the artery, must therefore be unnecessary; and, as likely to cause phlebitis, it should not be adopted. Indeed, Dupuytren himself never tried the plan on the living subject. (See *Malgaigne, Manuel*, &c. p. 195.) As for the mode of operating, different writers give different advice. Thus, according to Scarpa, when the aneurism is joined with an aneurismal varix, and circumscribed, but the circumstances such as to require the brachial artery to be tied, this vessel should be exposed, and tied above the swelling with a single ligature. It is only when the aneurism is diffused, that opening the swelling and applying a ligature both above and below the aperture in the artery, are deemed by him necessary. On the other hand, Mr. Guthrie directs "an incision at the part, and the application of two ligatures to the artery; for, although in some cases one has been found sufficient, in others, the blood has returned into the sac by the anastomosing branches, and a second operation has been required to effect

a cure." (See *Guthrie on Dis. of Arteries*, p. 334.) M. Lisfranc prefers opening the sac, and applying two ligatures. "Perhaps," says he, "in examples where a sac intervenes between the dilatation of the vein and the injury of the artery, it might be prudent to open the aneurismal pouch, without meddling with the vein; a method that would create less risk of phlebitis, which sometimes arises as a complication of the operation." (*De l'Obstruction des Artères dans les Aneurysmes*, p. 114, 8vo. Paris, 1834.) In three subjects, in whom the brachial artery was tied, the tumour reappeared (*Dupuytren, Breschet*); and, in two others, in whom the femoral artery was tied, death ensued from sloughing and hemorrhages. M. Jules Cloquet relates a case where the ligature of the artery, above the communication with the vein, was followed by a return of the pulsation in the tumour, atrophy of the limb, a livid discoloration of the fingers, and detachment of the nails, and amputation was performed. (*Pathol. Chir.* p. 85, 4to. Paris, 1831.) Hence Dupuytren, Breschet, and Malgaigne are of opinion, that the Hunterian method, with a single ligature above the tumour, should be abandoned. (See *Manuel de Méd. Opér.* p. 195, 12mo. Paris, 1834; *W. Hunter, in Med. Obs. and Inq.* vol. v.; *Scarpa on Aneurism*, p. 433, ed. 2.; also *Guattani, De Cubiti flexura aneurysmatibus*, in *Laurel's Coll. Scriptorum*, &c.; *P. Adelman, Tract. Anat. Chir. de Aneurismate spurio varicoso*, Wirceb. 1824; *Dupuytren, Répert. Gén. d'Anat. et de Physiologie*, &c. t. viii. p. 104, 1829, and *Clin. t. i.* p. 275, &c.; *Larrey, in Mém. de Chir. Mil. t. v.*, and in *Clin. Chir. t. iii.*; *G. Breschet, De l'Aneurysme par Transfusion*, in *Mém. Chir. sur Différentes Espèces d'Aneurysmes*, 4to. Paris, 1834.)

ANEURISM BY ANASTOMOSIS

Is the term which Mr. John Bell applied to a species of aneurism, resembling some of the bloody tumours (*nævi materni*) which appear in newborn children, grow to a large size, and ultimately bursting, emit a considerable quantity of blood. Imperfect descriptions of this disease may be traced in writers; though, before the publication of Mr. John Bell's *Principles of Surgery*, it was not classed with aneurisms. Thus, Desault has recorded a case of this affection, for the express purpose of proving, that pulsation is an uncertain sign of the existence of an aneurism. (See *Parisian Chir. Journal*, vol. ii. p. 73.)

Aneurism by anastomosis often increases from an appearance like that of a mere speck, or mother's mark, to a formidable disease. The tumour is a congeries of active vessels, and, according to Mr. John Bell, the cellular substance, through which these vessels are expanded, resembles the gills of a turkey-cock, or the substance of the placenta, spleen, or womb. The irritated and incessant action of the arteries fills the cells with blood, and from these cells it is reabsorbed by the veins. The size of the swelling is increased by exercise, drinking, emotions of the mind, and by all causes which accelerate the circulation.

Aneurism by anastomosis is compared by Dupuytren to certain erectile tissues, which naturally appertain to the organization of the animal body. In this point, there is an agreement between him and John Bell. "A texture of this kind," says Baron Dupuytren, "is met with in the genital

organs of many animals of both sexes, and particularly in the urethra, the corpora cavernosa, and the glans penis; on the heads and necks of many birds; on the buttocks of several species of ape; and on parts of the bodies of many other animals. This erectile tissue was regarded by Dupuytren as the model and type of several accidental tissues, which, in consequence of defects of organization, either original or acquired, may be developed in almost any part of the human body, where they produce tumours, which frequently attain a considerable size. Such growths all exhibit the same vascularity and organization, the same investment, and the same fibrous interlacement, as the natural erectile tissues do; but their investment is weaker, and the quantity of nerves in them is less. The skin and subcutaneous cellular tissue are particularly often the seats of tumours of this character, which, however, are sometimes met with in almost every part. In particular, they present themselves on the face and the integuments of the cranium; and they form the basis of those congenital marks and swellings, which receive the name of *navi*. Sometimes they invade the whole of an organ. Thus, Dupuytren had a case, in which the whole of the external ear, and a portion of the contiguous parts, were converted into a true erectile mass. In other examples, the new growth leads to the formation of tumours of various size, placed in the very substance, or in the interstices of organs. Under some circumstances, the accidental erectile tissue seemed to Dupuytren to be the product of a degeneration of some natural texture, and of the dilatation of its capillary network; while, on other occasions, it appeared to him to be in reality a new organ developed amongst the parts. In the first case, it is confounded on every side with the healthy textures; in the second, it separates these textures from one another, compresses them, and at the same time remains divided from them by a dense cellular investment, by which it is circumscribed.

The accidental erectile tissues of Dupuytren, corresponding to the aneurism by anastomosis of John Bell, the tetangiectasia of Graefe, the cylindrical aneurism of the small arteries of M. Breschet, and the *navi* of many writers, are generally of a reddish or brownish colour, often granular on their surface, and situated in the skin, the subcutaneous cellular tissue, or between the muscles. From the investigations of M. Breschet and Scarpa, it appears that the small vessels of the bones, as well as the soft parts, are occasionally the seat of aneurism by anastomosis. (See Breschet, in *Répert. d'Anat. &c.* t. i. année 1826; Scarpa, *Annali Univ. di Med.* 1830.) Tumours of this character are either flaccid or prominent. Sometimes the skin, under which they lie, is scarcely altered. A kind of motion is perceptible in them, synchronous with the arterial pulse. Pressure reduces them to a very small size. Though usually soft, any irritation or excitement renders them remarkably tense and turgid; and if they happen to be wounded, the hemorrhage from them is profuse, and often very difficult to stop. The blood, though of a vermilion colour, and manifestly arterial, does not flow out *per saltum*; but trickles away, just like what happens in cases of fungus hæmatodes. (Dupuytren, *Clin. Chir.* t. iv. p. 8.) Tumours of this description do not spontaneously disappear, but, on the contrary, have a tendency to increase in

magnitude. In a few instances, however, they have been known to disperse in consequence of an accidental attack of inflammation; and Professor Gibson, of the United States, gives an instance of this, which occurred during a fever. (*Pract. and Inst. of Surgery*.) Like the natural erectile tissues, these tumours undergo, at the same epochs, and from the same causes, a marked development, and alternations of tension and relaxation, which are in relation to the healthy or unhealthy state, the strength or weakness, of the individual. (See Dupuytren, *Clinique Chir.* t. iv. p. 3—5.)

I have mentioned the observation of Dupuytren, that the accidental erectile tissue forms the basis of those congenital marks and substances, which go under the name of *navi materni*. As Mr. Guthrie remarks, however, "it is only when these spots, or marks, are subcutaneous, that their nature approaches to that of aneurism by anastomosis. The milder kinds of subcutaneous disease, to which the name of *navi* is often applied, differ much both in appearance and size; sometimes remaining stationary through life, and, in others, even disappearing altogether, or becoming small solid prominences. A *navus* is usually of a red colour, with a bluish cast, shining through the skin, which appears to be exceedingly thin. It has also a tolerably defined and terminating edge; and the disease of the vessels seems to be confined to the part discoloured, or extends to a very short distance around it. The tumour, or *navus*, although large and elevated in size, does not pulsate. An aneurism by anastomosis, in its most formidable shape, is a swelling of a more or less elevated form. The skin is in general thickened, and its colour is sometimes but little altered, although it more frequently has a bluish cast, which may even tend to red. The pulsatory nature of the tumour is distinct, and the vessels, both arteries and veins, leading to or from it, are enlarged for some distance. The tortuous forms, which the veins particularly assume, give to this disease a distinct character, which cannot be mistaken." (See Guthrie on *Dis. of Arteries*, p. 341.; also Breschet, *Mém. Chir.* p. 28.)

Several writers describe an essential difference between simple *navi* and aneurism by anastomosis to be this: in the former, the veins are chiefly affected; in the latter, the arteries. To this view Mr. Guthrie inclines, for he says, "When the arteries partake most of the disease, the indistinct throbbing attendant on it is soon perceptible, and becomes in a short time a marked pulsation; but, in cases which more frequently occur in children, and are congenital, and the disease seems more to affect the veins, the swelling will be considerable, the veins greatly dilated, and the part have a varicose appearance, without any pulsatory motion." (See Guthrie on *Dis. of Arteries*, p. 344.) The cylindrical aneurism in the vessels of the smallest diameter, for instance, in the capillaries, says M. Breschet, is named *aneurism by arterial anastomosis*, and *aneurism by venous anastomosis*. In the first of these tumours, there are pulsations synchronous with the pulse, and alternate rises and falls corresponding to the diastole and systole of the arteries, circumstances not remarked in aneurisms of the second kind; which, however, in certain states of the circulation, exhibit a sort of erection or turgescence, produced by the influx of a greater quantity of venous blood. (See Breschet,

in *Mém. Chir. des Différentes Espèces d'Aneurysmes*.)

It is observed by Mr. Syme, that most surgeons have followed John Bell in believing aneurism by anastomosis to consist of a morbid cellular structure, through which the blood passes in its course from the arteries into the veins. However, he has long been one of those who maintain, that the apparent cells are really sections of enlarged vessels. (See *Ed. Med. Journ.* No. 98. p. 72.)

In the dissection of a pulsating tumour of the scalp in a patient who had died after the operation of tying the carotid artery, Dr. MacLachlan found the branches of this vessel on the head "degenerated into dilated tubes of extreme thinness and transparency; which, apparently yielding to the impetus of the blood, had become elongated, contorted, and ultimately convoluted on themselves, so as to form, by this species of doubling, the tumours, which constituted this singular disease." They felt like placenta, and the larger portion, immediately over the ear, looked precisely like a bundle of earthworms coiled together. (See *Glasgow Medical Journ.* vol. i. p. 85.) Two cases are given by Pelletan, fully confirming the view, taken of the nature of the disease by Dr. MacLachlan and Mr. Syme. (See *Clinique Chir.* t. ii.) Boyer, who saw one of these cases, describes all the arteries of the swelling as being dilated, tortuous, knotty; and though very large in some places, in others contracted. (*Traité des Mal. Chir.* t. ii. p. 295.) In the tumour, described by Dr. MacLachlan, none of the cells, spoken of by Mr. John Bell, were found; no parenchyma, as in the spleen; the bulk of the tumour was formed almost entirely by convoluted dilated arterial trunks, the veins being but little changed from their healthy state. He adds, that these arteries did not appear to communicate more freely than by their ordinary inoculations. Some of these conclusions appear to me to require corroboration by a careful anatomical injection of the vessels.

Why, however, should there not be varieties in this disease? The observations of Baron Dupuytren make allusion to modifications of it; and, according to Mr. Guthrie, dissection has shown, that, in some instances, the tumour has been formed by contortions and reflections of the vessels alone; whilst, in others, the spongelike appearance has been more distinct. (*On Dis. of Arteries*, p. 343.) He adds, that in navi of large size, and marked characters, as well as in aneurism by anastomosis, the disease essentially consists of vessels, with the interposition of very little cellular structure. However this may be, I believe Dupuytren correct in describing aneurism by anastomosis as essentially a new growth, consisting of an adventitious erectile cellular tissue, pervaded by a congeries of blood vessels. Thus, in giving the particulars of a case of aneurism by anastomosis of the ear and side of the head, Dupuytren states, that two very different elements were distinguishable in the mass, both by the finger and the eye. The first presented itself in the form of wide, sinuous, irregular knotty tubes, full and compressible, winding over the temple and ear, to which they communicated a knobby appearance. These tubes arose one from another, in the manner of arteries; and the trunk of them, which was equal in size to the little finger, gradually diminished, still retaining, however, in its smallest branches, the diameter of a crow-quill;

and these could be traced even into the skin. The origin, the situation, the direction, and the divisions of these tubes, and especially their pulsations, synchronous with those of the heart, and the force of which seemed to threaten every instant a rupture of the tumour, and a perilous hemorrhage, were a sufficient proof that they were formed by the arterial system of the ear, temple, and occipital region, extraordinarily dilated in its trunk, branches, and cutaneous ramifications. All that did not immediately belong to the dilatation of the arterial trunks, was formed of accidental erectile tissue, which filled up the interstices of the network of vessels, and gave to the parts their purple colour, their higher temperature, and their double movement of expansion and subsidence. The tumour shrivelled and became pale under slight compression; but soon resumed its usual colour, size, and tension. (See *Dupuytren, Clin. Chir.* t. iv. p. 13.)

In the female subject, the hemorrhage from the aneurism by anastomosis is sometimes a substitute for menstruation, as the following example illustrates:—Ann Vachot, of St. Maury, in Bresse, was born with a tumour on her chin, of the size and shape of a small strawberry, without pain, heat, or discolouration of the skin. As it produced no uneasiness, nor inconvenience whatever, it excited little attention, particularly as it did not seem to increase with the growth of the child. For the first fifteen years, there was but little alteration; but, about the menstrual period, it increased suddenly to double the size, and became more elongated in its form. A quantity of red blood was observed to issue from its extremity. This flux became, in some measure, periodical, and sometimes was sufficiently abundant to produce an alarming degree of weakness. Each period of its return was preceded by a violent pain in the head, and numbness. Before and after the appearance of these symptoms, there was no alteration in the size of the tumour; the only difference was a small enlargement of the cutaneous veins, with an increase of heat in the part, occasioning some degree of tenderness. The menses at length took place, but in small quantity, and at irregular periods, without influencing the blood discharged from the tumour, or the frequency of the evacuation. The breasts were not enlarged till a late period, nor did the approach of puberty seem to have its accustomed influence on those glands, &c. (See *Parisian Chir. Journ.* vol. ii. p. 73, 74.)

In the article *Nævus*, I shall explain the modes of treatment applicable to the superficial kinds, and at present consider what should be done for the cure or relief of the subcutaneous and deeper forms of the disease, to which the term aneurism by anastomosis more particularly refers.

The first plan, which I shall notice, is that of removing the disease with a knife. This should only be attempted where the morbid tissue does not extend too deeply, and where there is a fair prospect of being able to take every particle of it away, without endangering life by hemorrhage. As Mr. John Bell inculcates, the rule in this operation is, not to cut into the diseased part, but to cut it out (see *Principles of Surgery*, Disc. ix.); a piece of advice repeated by Mr. Wardrop, when he says, the surgeon should avoid cutting into the tumour; for, unless this caution be attended to, the hemorrhage is violent; whereas, by making the incisions beyond the diseased structure, the flow of blood is much

more moderate. (*Med. Chir. Trans.* vol. ix. p. 212.) If the incisions be carried into the morbid tissue, the hemorrhage will be great, because the enlarged and diseased vessels have lost their power of contracting, and there will also be a probability of the return of the disease. "If the nœvus be large, round, or of a figure which does not admit of its being removed by two elliptical incisions, so as to give a reasonable hope of union, or if the cicatrix is likely to be large and unseemly, the operation by ligature is to be preferred." (See *Guthrie on Dis. of Arteries*, p. 346.) I find that extirpation with the knife answers remarkably well when the disease is on the lip, or part of the ear, care being taken to cut in the sound part. I have removed many swellings of this kind from the lips of young children, and always found the hemorrhage cease directly the edges of the wound were brought together with the twisted suture.

The following case, recorded by Mr. Wardrop, affords a valuable illustration of the nature and structure of one form of this disease. A child was born with a subcutaneous nœvus on the back part of the neck, of the form and size of half an ordinary orange. The tumour had been daily increasing; and when Mr. Wardrop saw it, ten days after birth, the skin had given way, and a profuse hemorrhage had taken place. The swelling was so soft and compressible, that, when squeezed in the hand, it yielded like a sponge, and was reducible to one third of its original size. On removing the pressure, however, the tumour rapidly filled again, and the skin resumed its purple colour. "Conceiving the immediate extirpation of the tumour the only chance of saving the infant (says Mr. Wardrop), I removed it as expeditiously as possible, and made the incision of the integuments beyond the boundary of the tumour; aware of the danger of hemorrhage, where such tumours are cut into. So profuse, however, was the bleeding, that, though the whole mass was easily removed by a few incisions, the child expired.

"The tumour having been injected, by throwing coloured size into a few of the larger vessels, its intimate structure could be accurately examined. Several of the vessels, which, from the thinness of their coats, appeared to be veins, were of a large size, and there was one sufficiently big to admit a full-sized bougie." This vessel was quite as large as the carotid artery of an infant. The boundaries of the tumour appeared distinct, some healthy cellular membrane, traversed by the blood vessels, surrounding it. On tracing these vessels to the diseased mass, they penetrated into a spongy structure, composed of numerous cells and canals, of a variety of forms and sizes, all of which were filled with the injection, and communicated directly with the ramifications of the vessels. These cells and canals had a smooth and polished surface, and, in some parts, resembled very much the cavities of the heart, fibres crossing them in various directions, like the chordæ tendinæ. The opening in the skin, through which the blood had escaped during life, communicated directly with one of the large cells, into which the largest vessel also passed. (*Wardrop, in Med. Chir. Trans.* vol. ix. p. 203.)

This case furnishes an instructive warning to us not to attempt to cut out an aneurism by anastomosis, where the size of it, and the age or weakness of the individual, render it probable that he

will not bear the loss of blood. I lately saw a child with Messrs. Gilchrist, of Sunbury, aged about two years, with a tumour over the base of the scapula, the nature of which seemed obscure. I made an exploratory puncture in it, meaning to remove it at once, if composed of fat. But the profuse gush of blood which followed the lancet, and the pulsations felt in the swelling during the child's agitation, left no doubt about the case being an aneurism by anastomosis. As the tumour was as large as half an orange, and the child so young, I refrained from the attempt to cut it away, fearful that the bleeding might be more profuse than the little patient would bear. Mr. Lawrence, who has since been consulted, does not recommend the operation.

In the Section on Carotid Aneurisms, I have mentioned the cases, in which Mr. Travers and Mr. Dalrymple cured aneurisms by anastomosis in the orbit, by tying the common carotid artery; a practice which has been repeated with success very lately by Mr. Rusk, surgeon to the Dreadnought hospital ship at Deptford. (See *Lond. Med. Gaz.*, Feb. 27. 1836.) Professor Pattison cured an immense anastomosing aneurism of the cheek and side of the face by taking up the carotid artery. (See *Med. and Phys. Journ.* vol. xlviii. July, 1822.) These facts prove, that aneurism by anastomosis, like many other diseases, sometimes admits of being cured, on the principle of cutting off, or lessening, the supply of blood to the part affected.

However, surgeons must not be too confident of being always able to cure the disease, by tying the main artery, from which the swelling receives its supply of blood; and the great cause of failure is the impossibility of preventing in some situations the transmission of a considerable quantity of blood into the tumour, through the anastomosing vessels. A case is recorded by Maunoir, in which he applied a ligature for three days to the carotid artery, and obliterated it; yet the benefit effected seemed to be only temporary, as, in a short time, the tumour was as large as before. (See *Med. and Phys. Journ.* vol. xlviii.) In fact, every vessel, artery, and vein, around the disease, seems to be enlarged and turgid; and the inosculation is so infinite, that no point of the circumference of the swelling can be imagined which is free from them. Etienne Dumas was born with two small red marks on the antihelix of the right ear. Until the age of twelve years, the chief inconveniences were a sensation of itching about the part, occasional bleeding from it, and the greater size of this than of the other ear. The disease now extended itself over the whole antihelix, and to the helix and concha; and the upper part of the ear became twice as large as natural. Slight alternate dilatations and contractions began to be perceptible in the tumour, which was of a violet colour, and covered by very thin skin. Soon afterwards any accidental motion of the patient's hat was sufficient to excite copious hemorrhages, which were difficult to suppress, and, at the same time that they produced great weakness, caused a temporary diminution of the tumour and its pulsations. At length the disease began to raise up the scalp for the distance of an inch around the meatus auditorius, and the hemorrhages to be more frequent and alarming. Pressure was next applied to the temporal, auricular, and occipital arteries; but, as the patient

could not endure it, the first two of these vessels were tied, the only benefit from which was a slight diminution in the pulsation and bulk of the swelling. This treatment did not prevent the return of hemorrhage, and, therefore, forty-three days after the first operation, a ligature was applied to the occipital artery. As the disease still continued to make progress, the patient entered the Hôtel Dieu, where, on the 8th of April, 1818, Dupuytren tried what effect tying the trunk of the carotid artery would produce on the swelling. As soon as the ligature had been applied, the throbbings ceased, and the tumour underwent a considerable diminution. On the 18th day, slight expansions and contractions of the diseased part of the ear were again perceptible, though the swelling had diminished one third, and no throbbing could be distinguished in the neighbouring arteries. The ear was now kept compressed between two masses of charpie. On the 46th day, Dupuytren tried what benefit would result from pressing the blood out of the tumour, and then covering it with plaster of Paris. This, however, soon cracked in various places, and could not be kept on the part. An instrument was then contrived for the reception and compression of the ear. This had the effect of restraining the enlargement of the ear, but was found inadequate to destroy the erectile tissue, which still continued, notwithstanding the pulsation of the arteries had ceased. To have got rid of this portion of the disease, observes Dupuytren, it would have been necessary either to remove the tissue composing it, or to change its organization. The first plan, on account of the extent of the disease, he did not consider safe; nor could he alter the nature of the disease.

The history of the foregoing case, resumed fifteen years after the operation, proves, that though tying the carotid artery is less efficacious in curing a tumour composed of erectile tissue, than a common aneurism, yet it checks its progress, and diminishes its danger. After the carotid artery had been tied in the preceding case, the tumour made little or no progress; the size of the ear remained stationary; and no return of hemorrhages took place. But whatever may be the degree of benefit resulting from the plan of tying the principal artery leading to the disease, Dupuytren gives it as his decided opinion, that it ought to be resorted to when an erectile tumour has invaded a part, where compression, cauterisation, and extirpation with the knife, are all impracticable. If there be no carcinomatous tissue blended with the erectile, the progress of the disease will, at all events, be retarded by the operation. (See Dupuytren, *Clinique Chir.* t. iv. p. 5—26.; and Breschet's *Transl. of Hodgson's Treatise*, t. ii. p. 296.) The experiment has been made of tying both carotids, where the ligature of one proved insufficient to prevent the return of pulsation in the arteries immediately supplying the tumour. Dr. Mussey, of New Hampshire, in America, was consulted in September, 1829, by J. Pattee, aged 20, for a large pulsating purple tumour, situated upon the vertex of the head, with a base of about five inches in diameter, and rising about two inches above the cranium. The tumour, which had existed from infancy, had greatly increased during the three years anterior to the above date. Upon its apex was an ulcer, from which hemorrhages had occasionally taken place; and once to the amount of two quarts.

"The left temporal artery and vein in front of the ear, seemed through the integuments five eighths of an inch in diameter, and the pulsations of the artery were visible at the distance of fifteen feet. A vein, passing from the tumour down the forehead, was half an inch in diameter; and when the head had been shaved, more than twenty pulsating arteries were seen running to the tumour, none of which were under the size of a goose-quill. Dr. Mussey, on the 20th of September, tied the left common carotid; and finding this effectual, he applied a ligature to the right one, twelve days after the first operation. The tumour was covered with a compress moistened with alum-water, and gentle pressure maintained with a bandage. In about three weeks from the period of the second operation, the swelling was not above one third of its original size. Five or six days later, it began very slightly to enlarge again; its colour became deeper; and a feeble thrill was sometimes perceptible in the left temporal artery. As Dr. Mussey found that the ligature of the carotid promised no further benefit, he determined to encircle the tumour by incisions, and to dissect it away rapidly from the pericranium. More than an hour was occupied in carrying the knife around the base of the tumour; for only an inch and a half of the scalp was cut at a time, and as soon as this was done, firm compression was made upon each lip of the incision, while the vessels were secured with ligatures, more than forty of which were applied in proceeding round the tumour. Notwithstanding these precautions, nearly two quarts of blood were lost. The patient was faint, and continued very feeble for several hours. The naked pericranium, in extent about twenty-five square inches, granulated favourably, and the part healed up. (See *American Journ. of Med. Sciences* for Feb. 1830.)

This case is instructive, as proving still more convincingly than perhaps any other case on record, that tying the carotid artery will not completely cure an aneurism by anastomosis on the head, though the plan has generally succeeded for swellings of this description in the orbit. The ligature even of both carotids, in Dr. Mussey's case, did not prevent the return of pulsation in the temporal artery; and this unpromising circumstance led him to adopt, without delay, the plan of encircling this disease by a succession of short incisions, in the way practised by Dr. Gibson. Time was not afforded to see whether the growth of the tumour would have been permanently checked, and the return of hemorrhages prevented by the ligature of both carotids, as happened in Dupuytren's case from the ligature of one of them. An interesting question here is, whether the ligature of the carotids made the final excision of the tumour safer, with respect to hemorrhage? Without this preliminary measure, Dr. Gibson, we find, accomplished what Dr. Mussey did with it.

Some aneurisms by anastomosis, on or near the surface of the body, may be extirpated with a ligature. A needle, armed with a double ligature, is passed under the erectile tissue. As it is of importance that the ligature go more deeply than the deepest part of the swelling, the assistant ought to raise up the tumour from the subjacent parts, while the needle is pushed under its base. The needle having been cut off, one portion of the ligature is firmly tied over one half of the circumference of the swelling, and the remaining part of it over the

other half. Thus the supply of blood to the swelling is completely cut off. After a few days, the diseased mass and the ligatures are detached by an ulcerative process; and, as Mr. Guthrie observes, if the disease has been completely removed, the ulcer heals without difficulty, and the scar is often less, than if the operation had been done with the knife. If the disease should not be completely removed, a second ligature may be applied, or, as I have sometimes preferred, the remains of the disease may be extirpated with caustic and pressure. We are informed that this method has been followed, for many years, by the surgeons of the Westminster Hospital. Mr. Keate, has made an improvement in it, which consists in employing pins, which, by being passed across, but underneath the tumour, admit of compression being made around a larger surface than could otherwise be included in the ligature. (See *Guthrie on Dis. of Art.* p. 346.) In one case, thus treated by Sir Benjamin Brodie, where the size of the swelling, which was on the forehead, was too extensive to be embraced with a needle and double ligature in the common way, he used straight pins, like those for the hare-lip, which, being pushed under the disease at right angles, enabled him to pass a ligature around the base of it. In this instance it became necessary to employ a second set of pins and a second ligature; but the cure was ultimately complete. (See *Brodie, in Med. Chir. Trans.* vol. xv. p. 177.)

An infant, six weeks old, was brought to Mr. Wardrop, on account of an aneurism by anastomosis (a subcutaneous nævus) of a very unusual size, situated on the left cheek. The base of the tumour extended from the temple to beyond the angle of the jaw, completely enveloping the cartilage of the ear. At its upper part, there was an ulcer, about three inches in diameter, presenting a sloughing appearance. The tumour was soft and doughy; its size could be much diminished by pressure; there was a throbbing in it, and a strong pulsation in the adjacent vessels. The disease was daily increasing, and several profuse hemorrhages had taken place from the ulcerated part. Mr. Wardrop knowing, from the case to which I have already adverted, the danger of attempting to extirpate so large a tumour of this nature, was led to try what benefit might be obtained by tying the carotid artery. A few hours after this operation, the tumour became soft and pliable; its purple colour disappeared, and the tortuous veins collapsed. On the second day, the skin had resumed its natural pale colour, and the ulceration continued to extend. On the third, the tumour still diminished. On the fourth, the swelling had considerably increased again; the integuments covering it had become livid, and the veins turgid. The inosculating branches of the temporal and occipital arteries had become greatly enlarged. A small quantity of blood had oozed from the ulcer. After remaining without much alteration, the tumour on the seventh day had again evidently diminished. On the ninth, the ulceration was extending itself slowly, and the tumour was lessened fully one half. On the twelfth, the child's health was materially improving. The auricular portion of the swelling had now so much diminished, that the cartilage of the ear had fallen into its natural situation. After a poultice had been applied for two days, the central por-

tion of the swelling, which appeared like a mass of hardened blood, was softened, and Mr. Wardrop removed considerable portions of it. On the thirteenth, the child became very ill, and died the following day, exhausted by the irritation of an ulcer, which had involved the whole surface of an enormous tumour. Mr. Wardrop thinks the advantages likely to occur from the plan of tying the main arteries supplying tumours of this nature with blood are, the diminution of the size of the disease; the lessening of the danger of hemorrhage, if the ulcerative process has commenced; and the rendering it practicable to remove the swelling with the knife, though the operation may previously have been dangerous, or impracticable. (See *Méd. Chir. Trans.* vol. ix. p. 206—214, &c.)

In the foregoing part of this article, I mentioned the trial of the method of securing the principal branches of the external carotid distributed to the tumour. This plan has generally failed, and it did so in the example under Dupuytren, who, therefore, decided to take up the common carotid itself. Dr. Gibson, in his *Institutes of Surgery*, however, relates a case, in which the practice succeeded. The patient, a woman, had a large pulsating tumour, which covered almost the whole of the right side of the head, and often bled profusely. Dr. Gibson began with cutting off the supply of blood to the tumour through the occipital and temporal arteries. The swelling now lessened, and its pulsations became weaker; but, as this amendment was only temporary, he proceeded to divide the parts situated between the former incisions, and to tie the vessels. The first cut was two inches in length, and a great deal of blood was lost before all the vessels were secured. The second cut was three inches in extent; but so much blood was now lost, that it became necessary to postpone the completion of the operation. After twelve days, the incisions were extended again; and, at the end of the fortnight, the circumvection of the wound was completed, and the tumour removed; the periosteum being left, from which granulations soon arose, and, in a few weeks, the wound was healed.

Aneurism by anastomosis, when situated on the fingers, may render amputation of them indispensable, provided the whole of the disease cannot be got rid of by other means. I once saw, with Mr. Lawrence, an aneurism by anastomosis, situated on the ring finger of the right hand, in a young woman, about twenty years of age. The disease was attended with painful sensations, extending to various parts of the limb and the breast, and the arm was disqualified for any kind of exertion. In January, 1815, Mr. Hodgson had taken up the radial and ulnar arteries, and the first consequences of the operation were an entire cessation of beating, collapse of the swelling, and relief from pain; but these symptoms all recurred in a few days. Finding compression unavailing, and the sufferings of the patient increasing, Mr. Lawrence proposed amputation of the finger at the metacarpal joint; but, as this suggestion was not approved of, he recommended the patient to try the effects of a division of all the soft parts, by a circular incision close to the palm, so as to cut off the supply of blood. This operation Mr. Lawrence performed, in the presence of Mr. George Young and myself, in as complete a manner as can possibly be conceived.

All the soft parts, excepting the flexor tendons, with their thecæ and the extensor tendon, were divided. The digital artery, which had pulsed so evidently in the palm of the hand, was fully equal in size to the radial, or ulnar of an adult, and was the principal nutrient vessel of the disease. After tying this and the opposite one, we were surprised at finding so strong a jet of arterial blood from the other orifices of these two vessels, as to render ligatures necessary. I can here only add, that the whole finger beyond the cut swelled very considerably; the incision healed slowly; the swelling subsided, but did not entirely disappear; the integuments recovered their natural colour; the pulsation and pain were removed; and the patient so far recovered the use of her arm, that she could work at her needle for an hour together, and use the arm for most purposes. (See *Wardrop's Obs. on one Species of Nevus*, in *Med. Chir. Trans.* vol. ix. p. 216.)

Mr. Russell, an army surgeon, has lately published some interesting particulars of an aneurism by anastomosis of the hand. The patient (a laundress), aged 41, had two tumours, each about the size of a walnut; one at the extremity of the ring finger, the other on that of the little finger of the left hand. They extended along each finger to the middle of it, and were of a violet colour, spongy feel, and of a structure resembling placenta. They shrunk under pressure, but recovered their size on its being removed; throbbed strongly, as did all the vessels of the arm; were excessively painful, and attended with irritability of the whole frame. The radial and ulnar arteries were enlarged, the latter tortuous; and the basilic vein had a varicous appearance. The disease had existed five years, and bled freely and frequently. Mr. Russell recommended the removal of the two fingers at the metacarpal joints, which the woman objected to. In about two months, however, she returned, willing to undergo any operation which Mr. Russell deemed necessary. The disease had now extended itself, so as to form one aneurismal tumour at the commissure of the two fingers. The placenta-like appearance reached to the wrist; the arm was of an erythematous hue to the elbow; the tumours had ulcerated and sloughed; and the carious phalanges protruded from the gangrenous fingers, which were enlarged, and dreadfully painful. The increased pulsation and magnitude of the arteries extended to the axilla. Mr. Russell first tied the ulnar artery, and then amputated the ring and middle fingers, with their metacarpal bones, at the carpus. The stump healed well; and a valuable portion of the hand was saved. Three years after the operation, the vessels of the arm had resumed their natural appearance, and the woman was able to follow the business of a laundress. This case Mr. Russell believes unusual, as having occurred in a person of advanced life; and he considers, that it exemplifies the truth of Mr. Wardrop's observation, that a ligature on the artery, leading to the disease, may render the excision of it practicable, when this proceeding would otherwise be unsafe. However, Mr. Russell took up the ulnar artery, he says, for a different purpose; namely, that of enabling him to cut close to the disease. The case proves also, that the secondary effects on the surrounding parts, and, especially, the extensive enlargement of the blood-vessels, will subside after the excision of the erectile

tumour. (See *J. Russell*, in *Lond. Med. Gaz.* for April, 1836.)

Most of those aneurisms by anastomosis which admit of being extirpated with a ligature, may also be destroyed with strong caustic, like pure potassa, the liquid nitrate of mercury, &c. This plan, which was particularly recommended by Mr. Wardrop, and is an old practice, was sometimes adopted by Dupuytren. I have followed it in some instances, and found it answer, though the necessity of repeating the application several times makes it a more tedious method of cure than the ligature. I lately attended a child with Mr. Jephson, of Hampton, for a large thick nevus on the forearm: in this instance, the caustic answered exceedingly well, but it was indispensable to apply it several times. It seems to act partly by converting portions of the tumour into sloughs, and partly by exciting an ulcerative process in the remainder. In the North London Hospital, there was a lad about a twelvemonth ago for a large erectile tumour on the side of the head. Mr. Liston attacked parts of it with caustic in succession, but the patient left the hospital before the plan had been carried to the extent intended. Dupuytren regarded the actual cautery as a still surer means of extirpating erectile tumours than caustic, though rarely employed, on account of the terror which it excites. (*Clin. Chir.* t. iv. p. 33.) The acid nitrate of mercury was the caustic which he was in the habit of using. (*Op. cit.* p. 28.)

Whatever will change the texture by exciting a general and severe inflammation of an erectile tumour, and an obliteration or annihilation of its vessels, will effect a cure. The treatment on this principle is sometimes practicable. Thus, swellings, composed of erectile tissue, have occasionally been cured by compression; a plan, which Abernethy wrote in favour of, and which both he and Dupuytren tried in several instances with success. The latter sometimes applied this method to the lips, the diseased portion of which was placed between a compressing instrument.

On the principle of changing the organization of the erectile tissue, and converting it into the fibrous, M. Lallemand has treated certain tumours of this description very successfully by exciting inflammation in them by the introduction of pins through them. One of his most interesting cases is that of an infant three months old, which had an erectile tumour over the scapula, three inches in length and two in diameter, with a red granular surface. Compression had been tried in vain. M. Lallemand first introduced a dozen fine pins through the inferior portion of the tumour, and covered the spaces between them with waxed thread variously twisted. Three days afterwards, a similar operation was repeated on the opposite side. The pins were left in their places seven or eight days, till they had excited sufficient inflammation. The rest of the tumour was afterwards attacked, and in the course of two months and a half, after 120 pins had been introduced at successive periods, a cure was effected, without the loss of a spoonful of blood, a uniform glossy cicatrix being left. Long fine pins, such as are used for transfixing insects, are preferable to common sewing needles. (See *Lallemand*, in *Archives Gen. de Méd.* t. viii. sér. 2.) On the same principle of exciting inflammation, and changing the texture of erectile tumours, cures have occasionally been accomplished by passing a

couching needle into them, and breaking up their structure. Stimulating injections have likewise been thrown into their substance with the same view. (*Lloyd, in Med. Gaz. for 1836-37.*) Most of these latter methods seem to me only eligible when the tumour is of limited size, and its base not too deep.

Erectile tumours are more frequently noticed on the lips than any other part of the body, a circumstance ascribed by Dupuytren to their spongy vascular structure (*Clin. Chir. t. iv. p. 51.*). But, they have been met with in the arm, forearm, hand, fingers, thigh, instep, scalp, ear, cheek, labia pudendi, substance of the skin, muscles, peristomum, bones, kidney, liver, &c. In the work last cited, reference is made to an example where the skin, muscles, and bones of the upper extremity, all became affected from the fingers to the shoulder (*t. iv. p. 52.*)

Besides the varieties of aneurism particularly treated of in the foregoing columns, there is another rarer form of the disease, named by Breschet *cirsoid aneurism* (from *κίρσος*, a varicous vein, and *σῆξ*, like); and by Dupuytren, *arterial varix*, in consequence of its resemblance to a varicous vein. It consists in the dilatation of an artery in the greater or lesser portion of its extent, and frequently through the whole of an arterial trunk and its branches. In addition to the transverse dilatation, the artery is elongated and tortuous, so as to describe bendings and windings in various degrees. Independently of these dilatations of the whole arterial tube, nodosities, or small circumscribed aneurismal tumours, present themselves, which are true saciform aneurisms, and occasionally mixed ones. Most commonly, the coats of the vessel are thinned and softened, and, when divided, collapse like those of varicous veins. As Breschet observes, an artery affected in this manner, may easily be mistaken for a varicous vein. The disease has been noticed in the iliac, carotid, brachial, femoral, and tibial arteries, and also in some of less size; such as the occipital, the auricular, radial, ulnar, palmar, plantar, and ophthalmic. This kind of arterial disease, according to Breschet, accompanies an aneurismal varix of long standing. The arterial varix, like the venous aneurismal varix, has been suspected to be attended with some communication between the two orders of vessels, and the passage of a certain quantity of venous blood into the dilated varicous artery. But pathologists have not yet been acquainted with the disease long enough to know its nature perfectly. Some interesting examples of it, illustrated by engravings, are recorded by Breschet. (*See Mém. Chir. &c.*)

BIBL. AND REFER.—*G. Arnaud* on Aneurisms, 8vo. S. C. *Lucas*, De Ossescentia Arteriarum Senili, 4to. Marburgi, 1817. *A. F. Waller*, Programma de Aneurysma, Argent. 1738. (*Haller*, Disp. Chir. v. 189.) *A. de Haller*, De Aortæ Venosæ Cavæ gravioribus quibusdam Morbis Obs. 4to. Gott. 1749. *Laurei*, Scriptorum Latinorum de Aneurysmatibus Collectio, 4to. Argent. 1785, which work contains *Aman's* Diss. de Aneurismate, 1773; *Gualtani*, De Externis Aneurismatibus, 4to. Romæ, 1772; *Lucas*, De Aneurysmatibus, Argent. 1785; *Matani*, De Aneurysmaticis Præcordiorum Morbis Animadversiones, 1785; *Verbrugge*, Dissertatio Anatomico-Chirurgica de Aneurysmate, 1773. *Penchiceni*, Recherches Anat. Pathol. sur les Aneurysmes des Artères de l'Épaule et du Bras; des Artères crurales et poplitæes; in Mém. de l'Acad. des Sciences de Turin, 1784. *Paletta*, Ueber die Schlagadergeschwulst; in *Kuhn's* and *Weigel's* Ital. Med. Chir. Bibl. bd. 4. *Murray*, Obs. in Aneurysmate Femoris, 1781. *Trew*, Aneurysmatis Spurii post Venæ Basilicæ Sectionem Orti, Historia et Curatio. See also an Account of Mr. Hunter's Method of performing the

Operation for the Cure of the Popliteal Aneurism, by *Sir E. Home*, in *Trans. of a Society for the Improvement of Med. and Chir. Knowledge*, vol. i. p. 138., and vol. ii. p. 235. Most of the volumes of the *London Medico-Chir. Trans.* *J. F. L. Deschamps*, Obs. et Réflexions sur la Ligature des principales Artères blessées, et particulièrement sur l'Aneurisme de l'Artère poplitée, 8vo. Paris, 1797. *P. Letan*, Clinique Chir. t. i. et ii. *A. Burns's* Surgical Anatomy of the Head and Neck, 8vo. Edin. 1811; and Obs. on Diseases of the Heart, &c. 8vo. Edin. 1809. *Ramaden's* Practical Obs. on the Sclerocœle, with Four Cases of Operations for Aneurism, 8vo. Lond. 1811. *Œuvres Chir. de Desault*, par *Richot*, t. ii. p. 553. *Wells*, in *Trans. of a Soc. for the Improvement of Med. and Chir. Knowledge*, vol. iii. p. 81—85, &c. *Corvisart*, Essai sur les Maladies et les Lésions Organiques du Cœur et des Gros Vaisseaux, edit. 2. y or *Transl.* by C. H. *Hubb*, 8vo. Lond. 1813. *John Bell's* Principles of Surgery, vol. i. A. *F. Ayer*, Ueber die Pulsadergeschwulst und ihre Chir. Behandlung, Gött. 1800. *Abernethy's* Surgical Works, vol. i. *Morgan's* Obs. in the Edin. Med. Essays. Various productions in the Med. Observ. and Inquiries. *J. P. Manoir*, Mémoires Physiologiques et Pratiques sur l'Aneurisme et la Ligature, 8vo. Genève, 1802. *Frey's* Observations on Aneurism, 4to. Lond. 1807; and a Treatise on the Anatomy, Pathology, and Surgical Treatment of Aneurism, by *A. Scarpa*, translated by *J. Wishart*, 1808: the original Italian published 1802. *Ant. Scarpa*, Memoria sulla Legatura delle Principali Arterie delle Arti, con una Appendice all'Opera sull'Aneurisma, 101. Pavia, 1817. This tract, and a great deal of valuable additional matter, are contained in the 3d edition of *Scarpa's* work on Aneurism, by *Mr. Wishart*, 8vo. Edin. 1819. *Buyer*, Traité des Maladies Chir. t. n. p. 84. &c. *A. C. Hutchinson*, Letter on Popliteal Aneurism, 8vo. Lond. 1811. *Joseph Hodgson*, on the Diseases of Arteries and Veins, Lond. 1815, a work of great merit. *Transl.* into German by *Dr. Koberwein*, with additions by this gentleman, and *Dr. Kreyzig*, 8vo. Hanov. 1817; and into French, with valuable Annotations by *Beschet*, 2 t. 8vo. Paris, 1819. *G. A. Spangenberg*, Erfahrungen über die Pulsadergeschwulst, in *Horn's* Archiv. 1815. *C. H. Ehrmann*, La Structure des Artères, &c. et leurs Altérations Organiques, Straßb. 1822. *Roux*, Nouveaux Elémens de Médecine Opératoire, t. i. Also, *Roux*, Voyage fait à Londres en 1814, ou Parallèle de la Chirurgie Anglaise avec la Chirurgie Française, p. 248, &c. 1815. *D. Fried. Lud. Kreyzig*, Die Krankheiten des Herzens, 4 bände, 8vo. Berlin, 1814—17. *C. D. Kühn*, De Aneurysmate Externo, 4to. Jenæ, 1816. *A. J. Eschschauer*, Mém sur la Ligature et l'Appâtissement de l'Artère, dans l'Opération de l'Aneurisme Poplitée, 8vo. A. *V. Berlinghieri*, Memoria sopra l'Alcalcarata dell'Artère, 8vo. Pisa, 1819. *T. F. Baitz*, De Ophthalmia Cataractali Bellica, &c. præmittitur *F. C. Nægelii* Epistola, quod Illustoria et Descriptio Aneurysmatica, quod in Aorta abdominali observavit, 4to. Mendelberg, 1816. *J. Cole*, Exposé du Traitement d'un Aneurisme Inguinal par la Ligature de l'Artère Iliaque Externe, 8vo. Cambrai, 1817. *Lawson's* Military Surgery, p. 183—185. 383, &c. 2. Edin. 1820. *Manuale di Chirurgia del Cav. A. Asslini*, Milano, 1812: the author's main object is to recommend his compressor. *Todd's* Cases in Dublin Hospital Reports, vol. iii.: he is an advocate for trying compression previously to the operation, with the view of making the collateral vessels enlarge, and removing the risk of gangrene from insufficient circulation, after the ligature is applied. *C. T. Gräfe*, Angiectasie, ein Beitrag zur rationellen Cur und Erkenntnis der Gefäss-ausdehnungen. *Valentine Mott*, in New York Medical and Surgical Register, vol. i. 1818: the first example of the arteria innominata being tied. *C. F. Gräfe*, in Journ. der Chirurgie, b. ii. 1822, and b. iv. 1823: the second instance of it. *Waller*, Ueber Verhartung, Bluthschwamm, Teleangiectasie und Aneurysma per Anastomosis, in Journ. für Chir. b. v. *John Syng Dorsey*, Elem. of Surgery, Philadelphia, 1823, pl. 23. p. 270. *Dr. MacLachlan*, on a Pulsating Tumour of the Scalp, in Glasgow Med. Journ. vol. i. p. 81. *J. Syme*, Case of Aneurismal Condition of the Posterior Auricular and Temporal Arteries, Edin. Med. Journ. No. 98. *Gibson's* Institutes and Practice of Surgery, vol. ii. p. 101, &c. 8vo. Philadelphia, 1825. *Corvisart*, Des Mal. du Cœur. *J. L. Bégin*, in Dict. de Med. et de Chir. Pratiques, t. ii. 8vo. Paris, 1829. *Laennec* on Diseases of the Chest, transl. by *Forbes*, ed. 2. 1827. *Sir A. Cooper's* Lectures on the Principles and Practice of Surgery, ed. by *Tyrrrell*, vol. i. 8vo. Lond. 1825. *Thomas Turner*, on the Arterial System, intended to illustrate the importance of studying the Anastomosis in reference to the Rationale of the New Operations for Aneurisms, and the Surgical Treatment of Hemorrhage, Lond. 1826. *M. J. Chelius*, Handb. der Chir. bd. i. Heidelb. and Leipz. 1826. *J. Wardrop*, on Aneurism, 1828. *J. G. Guthrie*, on the Diseases and Injuries of Arteries, 8vo. Lond. 1830. *Berlin*, Traite des Maladies du Cœur et des Gros Vaisseaux, Paris, 1824. *J. Liqurang*, Des Diverses Méthodes, et des Différens Procédés pour l'Obturation des

Artères dans le Traitement des Aneurismes, 8vo. Paris, 1834. G. Brouchet, Mém. Chir. sur Différentes Espèces d'Aneurismes, avec six Planches, 4to. Paris, 1834. G. Antral, Précis d'Anatomie Pathologique, t. ii. p. 360. 8vo. Paris, 1829. J. Cruveilhier, Anatomie Pathologique du Corps Humain, t. i. fol. Paris, 1829—35. M. Le Baron Dupuytren, Leçons Orales de Clinique Chir. 4 tomes, 8vo. Paris, 1832—34. P. J. Macez, Traité Théorique, et Pratique de la Ligature des Artères, fol. Paris, 1832. Dr. Hope, in Cyclop. of Pract. Med. art. "Aorta, Aneurism of." Geo. Busk, in Lond. Med. Gaz. for Feb. 1836, p. 851. Lallemand, Archiv. Gén. de Méd. t. viii. série 2 : this vol. contains an account of several modes of operation for erectile tumours. Robert Harrison, Surgical Anatomy of the Arteries, 2 vols. 12mo. Dublin, 1834—25. A. L. M. Velpeau, Traité de l'Anatomie Chir. Paris, 1825. L. J. Von Bierkowski, Anat. Chir. Abbildungen nebst Beschreibung der Chir. Operationen, Berlin, 1826. Elias Bujalski, Tabulæ Anatomico-Chir. Petropol. 1828.

ANTHRAX (ἀνθράξ, a burning coal). See CARBUNCLE.

ANTIMONY. Antimonial medicines are prescribed in a great number of surgical cases, and I may say very commonly in all, where it is desirable to promote the secretions in general, and those of the skin and bowels in particular. Hence, in the treatment of phlegmonous and erysipelatous inflammation, antimony, especially the tartrate of it, or tartarised antimony, is a valuable medicine. In this work, there is no occasion to notice the usefulness of tartarised antimony as an emetic.* In inflammations of the brain and its membranes, the eye, the testicles, and the synovial tissues, surgeons frequently prescribe it with great advantage to the patient. Rasori, an Italian physician, used to order it in very large doses, as a means of keeping down inflammation of important organs; and the success of this treatment, as compared with that resulting from the free employment of the lancet, has excited a great deal of attention. The disturbance of the stomach, which was at first severe, afterwards generally subsided, and that organ seemed to bear the medicine well. In this country, the tartrate of antimony is sometimes employed in cases of dislocation, where the muscles make powerful resistance to the reduction: here it is prescribed in small doses, repeated every five or ten minutes, until a good deal of nausea is excited, or the patient actually vomits. In this state the patient becomes exceedingly faint, and the muscles no longer oppose the efforts of the surgeon to reduce the dislocated bone. (See DISLOCATION.) With this view, half a grain, dissolved in distilled water, or in the form of the vinum antim. tart., may be given every five minutes, till the desired effect takes place. In doses of one sixth or one fourth of a grain, joined with calomel and opium, the tartrate of antimony operates as a diaphoretic, and this combination is useful in various cases of inflammation, which are within the province of surgery. Tartarised antimony, in the proportion of 3j to ʒj of lard, makes what is termed the antimonial ointment, which, where it is desirable to keep up counter-irritation on the surface of the body, is rubbed upon the part in the quantity of about a drachm, and for a few minutes at a time. The effect is to bring out pustules, and even ulceration, the degrees of which, and their influence on the complaint, are to determine how often and long the antimonial frictions are to be continued. In some cases, these excite pustules and ulceration in distant parts; a fact deserving to be particularly remembered.

Instead of the pulvis antimonialis (L. P.) the best practitioners now usually prescribe either tartarised antimony, or James's powder. In fact,

doubts are entertained about the efficacy of the common antimonial powder. Dr. Elliotson prescribed it in a dose of more than 100 grains, and it seemed to have no effect. This inertness of the preparation was believed by Mr. R. Phillips to depend upon its being a peroxide. (See *Annals of Philosophy* for Oct. 1822; and *Pharmacol. by Dr. Paris*, p. 357. vol. ii. ed. 5. 1822.) In general, says Dr. A. T. Thomson, it displays no influence whatever on the system. Its occasional activity may be ascribed to the oxide being accidentally in the state of a protoxide. (See *Thomson's Elem. of Mat. Med.* p. 923. ed. 2.) Hence, when antimonials are indicated in surgery, for the purpose of promoting the secretions generally, and of the skin in particular, it is best to prescribe either tartarised antimony or James's powder. The dose of the latter is from four to ten grains; and it may be combined with calomel, or opium, or both, according to the indications of the case.

The precipitated sulphuret of antimony is only prescribed as an ingredient in the compound calomel pill.

The muriate of antimony, termed butter of antimony, from its consistence, is a powerful caustic, more frequently employed by foreign than British surgeons, who, in consequence of its deliquescent character, consider it an inconvenient application.

ANTRUM, *Diseases of*. The diseases to which the antrum, or maxillary sinus, is liable, commence either in its mucous lining, the bony laminae of which it is composed, or the fangs of the teeth, which form projections at the lower part of it. Sometimes the mucous membrane inflames, and, becoming thickened, closes the natural opening, by which the antrum communicates with the nasal fossæ, and the consequence is an accumulation of mucus or limpid fluid in it. On other occasions a purulent fluid is secreted; or a fluid is formed, which concretes into small masses, and has the characters of adipocire. The antrum may also be the seat of polypi, sarcomatous tumours of various descriptions, erectile tumours, or aneurism by anastomosis, and scirrhus swellings. Then its bony parietes may be softened, more or less absorbed, or carious, or affected with necrosis or exostosis. (See *General, Sur Quelques Maladies, Graves du Sinus Maxillaire*, &c. p. 2. 8vo. Paris, 1833.) Sometimes extraneous bodies, detached portions of bone, a bullet, and even insects, may lodge in the antrum, and cause, for many years, very afflicting pains.

COLLECTION OF MUCUS.

In general, this disease, which is not very common, takes place unpreceded by any causes which are at all manifest. It is alleged mostly to happen in young subjects: of three patients seen by Boyer, the eldest was not more than twenty. (*Traité des Mal. Chir.* t. vi. p. 139.) Sir Benjamin Brodie has seen only two cases, one patient was a lady, whose age is not specified; the other, a boy. A collection of transparent fluid in the antrum is undoubtedly a much rarer occurrence than one of pus. (See *Brodie*, in *London Med. Gaz.* for Dec. 1834.) As Mr. Hunter has noticed, whether the obliteration of the duct, leading to the nose, be a cause or only an effect of the disease, is not easily determined; but from some of the symptoms, there is great reason to suppose it as attendant. "If it be a cause, we may suppose that

the natural mucus of this cavity, accumulating, irritates, and produces inflammation for its own exit, in the same manner as an obstruction to the passage of the tears through the ductus ad nasum produces an abscess of the lachrymal sac." (See *Hunter's Natural Hist. of the Teeth*, p. 174. ed. 3.) A most interesting example of the effects of the lodgment of mucus in the antrum, is that recorded by Dubois: a boy, between seven and eight years of age, was observed to have at the base of the ascending process of the upper jaw-bone, on the left side, a small, very hard tumour, of the size of a nut. As it gave no pain, and did not increase, his parents gave themselves no concern about it. When he was about sixteen, however, the swelling began to increase, and to be somewhat painful. Before he was eighteen, its augmentation was so considerable, that the floor of the orbit was raised up by it; the eye thrust upwards, and nearly closed; the arch of the palate pushed down in the form of a tumour; and the nostril almost effaced. Below the orbit, the cheek made a considerable prominence; while the nose was thrown towards the opposite side of the face, and the skin at the upper part of the tumour, below the lower eyelid, was of a purple red colour, and threatening to burst. The upper lip was drawn upwards, and behind it; all the gums on the left side were observed to project much further than those on the opposite side of the face; and, at this point alone, the thinness of the bony parietes of the antrum was perceptible. The patient spoke and breathed with great difficulty; he slept uneasily, and his mastication was painful. The case was at first supposed by Dubois, Sabatier, Pelletan, and Boyer, to be a fungus of the antrum, and an operation was considered advisable. In proceeding to this measure, the first thing, which attracted the notice of Dubois, was a sort of fluctuation in the situation of the gum, behind the upper lip; a circumstance which led him to give up the idea of the case being a fungus, though he expected that, on making an opening, merely a small quantity of ichorous matter would escape, affording no kind of information. In this place, however, he determined to make an incision along the alveolar process, whereby a large quantity of a glutinous substance, like lymph, or what is found in cases of ranula, was discharged. A probe was now introduced, with which Dubois could feel a cavity equal in extent to the forepart of the tumour; and in moving the instrument about, with the view of learning whether any fungus was present, it struck against a hard substance, which felt like one of the incisor teeth, near the opening that had been made. Five days after this first operation, Dubois extracted two incisors and one grinder, and then removed the corresponding part of the alveolar process. As the hemorrhage was profuse, the wound was now filled with dressings, which in two days came away, and enabled Dubois to see with facility all the interior of the cavity. At its upper part, he perceived a white speck, which he supposed was pus; but on touching it with a probe, it turned out to be a tooth, which was then extracted, in doing which some force was requisite. The rest of the treatment merely consisted in injecting lotions into the cavity, and applying common dressings. In about six weeks all the hollow disappeared; but the swell-

ing of the cheek and palate, and the displacement of the nose, still continued. In the course of another year and a half, however, every vestige of deformity was entirely removed. (*Dubois, Bulletin de la Faculté de Méd. an 13. No. 8.*)

In the case of the lady attended by Sir Benjamin Brodie, there was no distinct fluctuation; but a kind of crackling sensation communicated to the fingers, like what would be felt in pressing upon very thin horn, or parchment. (*Med. Gaz. loc. cit.*)

With respect to the treatment of collections of mucus, or transparent albuminous fluid, in the antrum, by means of injections, thrown into that cavity through the natural opening in it, while the head is inclined to the opposite side, for the purpose of facilitating the escape of the collected fluid, as proposed by Jourdain in 1765 (*Mém. de l'Acad. de Chir. t. iv. p. 357.*), I fully agree with Deschamps and Boyer that the method is a bad one; because long before the disease forms an outward swelling, we may presume that the natural communication between the antrum and the nostril is closed, and will not readily admit of a tube being introduced into it. Some plan, more fraught with promptitude and efficiency, is here demanded. Hence, the practice of opening the tumour in an eligible place, and to an extent sufficient for the discharge of the mucus, and the prevention of another accumulation, is what all surgeons of the present day recommend. (*Deschamps, Traité des Maladies des Fosses Nasales, et de lev. Sinus*, p. 231. 8vo. Paris, 1804; *Boyer, Traité des Mal. Chir. t. vi. p. 145. 8vo. Paris, 1818.*) Indeed, that Jourdain's proposal was attended with too much difficulty for common practice, was the sentence long ago pronounced upon it by a committee of the Royal Academy of Surgery in France. If the case has not destroyed, or softened the front or lower portion of the bony texture of the antrum, and any bad tooth is situated under it, this should be extracted, and a perforation made into the antrum through the bottom of the socket. This aperture may be preserved as long as necessary, by the introduction of a piece of elastic gum catheter, which is to be fastened to the adjacent teeth, and through which the secretion in the antrum may escape, and lotions be injected. (*See Deschamps, Traité des Mal. des Fosses Nasales, &c. p. 234.*) However, as Hunter remarks, if the forepart of the bone has been destroyed, even though the case be merely a collection of mucus, or pus, an opening may be made on the inside of the lip; but, from a fear that there would be difficulty in maintaining such an aperture, he still inclines to the practice of drawing one of the teeth. (*Natural History of the Teeth*, p. 176. ed. 3.)

In general, I believe that the extraction of one of the molar teeth will not prove very applicable to the present case; first, because the thick albuminous fluid requires a larger opening than can be thus obtained; and secondly, because when the surgeon is called upon to perform an operation, the bony texture of the antrum is already very thin, much softened, or even partially absorbed above or behind the alveoli; consequently, as soon as the surgeon has made an incision, above the gum, or in the part of the swelling presenting itself on the roof of the mouth, he finds that a probe will immediately enter the antrum. All that he has to do, therefore, is to enlarge this opening with a

small pair of bone-pliers, or a strong knife. Mr. Hunter's apprehension about the difficulty of maintaining the opening, and of the likelihood of a return of the accumulation, does not appear to be confirmed by what happened in the cases under Dubois and Sir Benjamin Brodie. The latter informs us, that "after dissecting the membrane of the cheek from the jaw, I took a curved scalpel, bent laterally, with a strong sharp point, and introduced the point into what seemed the thin bony parietes, or boundary of the tumour. Immediately there escaped a large quantity of transparent fluid, like very thin mucus, something like what we find in cases of ranula. I then introduced a probe into the cavity of the antrum, and found that it might be passed in any direction. There was neither tumour nor dead bone in it; and the cavity seemed to be in a natural state, except that it was enormously dilated. I next enlarged the opening, cutting out a circular portion of thin bony shell, formed by the expanded parietes of the antrum. After the operation the tumour subsided, and, in a few weeks, the cheek was not larger than the other. The aperture made by the scalpel has continued pervious to this day, though it is ten years since I performed the operation. The lady wears a plug, which she takes out night and morning, and with her own hand introduces the point of a syringe, and washes out the antrum." (*See Lond. Med. Gaz. for Dec. 1834.*)

ABSCESSSES OF THE ANTRUM.

Abscesses are far more common than collections of mucus. Violent blows on the cheek, inflammatory affections of the adjacent parts, and especially of the pituitary membrane lining the nostrils, exposure to cold and damp, and, above all things, bad teeth, may bring on suppuration within the antrum. The first symptom is pain, often imagined to be toothach, particularly if there should be a carious tooth in this part of the jaw. Such pain, however, extends more into the nose, than that usually does which arises from a decayed tooth; and affects the eye, orbit, and frontal sinuses. (*See Hunter on the Teeth, p. 175, ed. 3.*) But these symptoms are insufficient to characterise the disease, the nature of which is not unequivocally evinced till a much later period. Sir Benjamin Brodie adverts to inflammation of the antrum, independent of local causes; a case more obscure than when some manifest local cause of irritation is present. In one such example, he was led to make a perforation above the second molaris, but no pus escaped. The patient was relieved by taking two grains of calomel and half a grain of extract of opium three times a day till the gums had become rather sore. (*Brodie, in Lond. Med. Gaz. for Dec. 1834.*) An inflammation of the antrum, tending to suppuration, is generally of longer duration than one entirely dependent on a caries of a tooth. There is a constant dull pain in the cheek, with frequent paroxysms of agonising torture, and a great deal more sympathy with febrile disturbance than attends toothach; and the violence of the suffering increases more and more, until, at last, a hard tumour is perceptible below the cheek-bone. By degrees the swelling extends over the whole cheek; but it afterwards rises to a point, and forms a circumscribed hardness, visible above the back

grinders. This symptom is accompanied with oedema, redness, and sometimes with suppuration of the external parts. In some instances, when there is an outward abscess, the matter has made its way into that situation through the bone, and there is consequently a communication between both collections of matter.

The circumscribed elevation of the tumour, above the molares, does not, however, occur in all cases; for sometimes the matter makes its way towards the palate, causing the bones of this part to swell, and, at length, bringing them into the state of caries, or necrosis, unless timely assistance be given. In some other cases, the matter escapes between the fangs and sockets of the teeth, and causes a soft prominent swelling in the gums. Lastly, there are certain examples, in which the matter passes into the nostril of the same side, when the patient is lying with his head on the opposite one. If this mode of evacuation should be frequently repeated, it affords relief, and prevents the tumour both from pointing externally, and bursting, as it would do if the purulent matter could find no other outlet. But this evacuation of pus from the nostril is not so common as might be expected; for, according to Mr. Hunter, the opening between the antrum and cavity of the nose is generally stopped up. He even seems inclined to think, as I have already observed, that the disease may sometimes be occasioned by the impervious state of this opening, in consequence of which the natural mucus of the antrum collects in such quantity, as to irritate and inflame the membrane with which it is in contact, just as an obstruction in the ductus nasalis hinders the passage of the tears into the nose, and causes an abscess in the lachrymal sac. This is a point, however, on which even Mr. Hunter would not venture to speak with certainty; for it is by no means impossible, that the impervious state of the opening is rather an effect, than the cause, of the disease, since inflammation in the antrum is often manifestly produced by causes of a different kind, and the opening in question is not invariably closed.

Sir Benjamin Brodie concurs with other surgeons in believing that inflammation of the antrum is mostly dependent on local causes, and more commonly upon the irritation of a bad tooth than any other circumstance. This gives rise to inflammation at the bottom of the alveolus. Here matter forms; and not always being able to escape between the fang and the socket, destroys the periosteum lining the latter part, causes absorption of the bone, and the inflammation is propagated to the lining of the antrum. In many instances, the case becomes complicated with dead as well as carious bone. (*See Brodie, in Lond. Med. Gaz. for Dec. 1834.*)

In the early stage of these cases, leeches, fomentations, calomel, opium, and saline purgatives may be employed for the purpose of reducing the inflammation, and preventing its advance to suppuration. But, when an abscess has formed, and the matter is confined in the antrum, the indications dictate other treatment. The matter should be discharged, and any source of local irritation, which is discoverable, removed.

Abscesses in the antrum require a free outlet; and, if the surgeon neglects to procure it, nature herself ultimately does what is requisite; but, not till the patient's agony has been greatly prolonged, and

the disease has extended further than it ought to have, been allowed. At length, however, the pus makes its appearance, either towards the orbit, the alveoli, the palate, or, as is mostly the case, towards the cheek. The matter having thus made its escape from the antrum, bursts through the soft parts, and the disease now becomes fistulous.

In all cases, whether the pus be simply confined in the antrum, or whether the case be conjoined with a necrosis, or caries, the principal indication is to discharge the matter.

The ancients seem to have known very little about the treatment of diseases of the antrum. Drake, an English anatomist, is reputed to be the first proposer of a plan for curing abscesses of this cavity. (*Anthropologia Novæ*. Londini, 1727.) However, Meibomius was much earlier in proposing, with the same intention, the extraction of one or more of the teeth, in order that the purulent matter might escape through the sockets.

Drake, and, perhaps, before him, Cowper, aware that the fangs of the teeth did not reach completely into the antrum, proposed making a perforation through the socket into that cavity, for the purpose of letting out the matter, and injecting such fluids as were judged proper.

In the treatment of abscesses of the antrum, the extraction of one or more teeth, and the perforation of the alveoli, being generally essential steps, the first question is, what tooth ought to be taken out. In general, caries, or even a mere continual aching of any particular tooth, ought to decide the choice. But, if all the teeth should be sound, which is not often the case, writers direct us to tap each of them gently, and to extract that which gives most pain on this being done. When no information can be thus obtained, other circumstances ought to guide us. All the grinding teeth, except the first, correspond with the antrum. They even sometimes extend into this cavity, the fangs being then only covered by the pituitary membrane; and the bony lamella, which separates the antrum from the alveoli, is always very thin towards the back part of the upper jaw. Hence, when the choice is in our power, it is best to extract the third or fourth grinder, as, in this situation, the alveoli can be more easily perforated. Though, in general, the first grinder and canine tooth do not communicate with the antrum, their fangs approach the side of it, and from their socket an opening may readily be extended into that cavity.

When one or more teeth are carious, they should be removed, because they are both useless and painful. The matter frequently makes its escape, as soon as a tooth is extracted, in consequence of the fang having extended into the antrum, or rather in consequence of its bringing away with it a piece of the thin partition between it and the sinus; or the discharge may follow from the partition itself being carious. If the opening, thus produced, be sufficiently large to allow the matter to escape, the operation is already completed. But, as it can easily be enlarged, it ought always to be so when there is the least suspicion of its being too small. However, when no pus makes its appearance after a tooth is extracted, the antrum must be opened by introducing a pointed instrument in the direction of the alveoli. For this purpose a trocar, an awl, or a gimlet, may be employed.

Sir Benjamin Brodie prefers an instrument, formed like a common hydrocele trocar, but a little larger, and of course without a cannula. "It should not be made of the best steel; for (says he) I once used a common trocar, made of steel, and it broke while I was performing the operation. In this case, I extracted the broken portion very easily; but such an accident might occur, and great difficulty be experienced in extracting the point of the instrument. When the bottom of the alveolus is broken down, the matter will readily escape from the antrum, and you may introduce a probe, and explore the cavity, so as to ascertain whether there be in it any dead bone, or not. Sometimes there is a piece of dead bone at the bottom of the alveolus, and then you have only to wait patiently till an opportunity occurs for its removal. At other times, you will feel the dead bone, after the probe has entered the antrum, and the opening already made may not be sufficient for its extraction. Under these last circumstances, the opening must either be enlarged, or another made in a different place." (*Brodie*, in *Lond. Med. Gaz.* for Dec. 1834.)

The patient should sit on the ground, in a strong light, resting his head on the surgeon's knee, who is to sit behind him. Immediately the instrument has reached the cavity, it is to be withdrawn. Its entrance into the antrum is easily known by the cessation of resistance. After the matter is discharged, surgeons advise the opening to be closed with a wooden stopper, in order to prevent the entrance of extraneous substances.

The stopper is to be taken out, two or three times a day, to allow the pus to escape. If there be no dead bone present, this plan soon disposes the parts affected to discontinue the suppuration, and resume their natural state. The cure may often be accelerated by employing injections of weak brandy and water, lime-water, or a solution of the sulphate of zinc. Two or three days after an opening has been made into the antrum, Sir Benjamin Brodie begins to wash out the cavity, once or twice daily, with tepid water, injected by means of a syringe with a slightly curved pipe. The water injected will now generally pass into the nostril, and the cavity can be very completely washed out. If the water does not pass out of the nose, it shows that the natural opening between the two turbinated bones is blocked up. (*Brodie*, *Op. cit.*)

Some surgeons prefer a piece of bougie, or of elastic gum catheter, instead of the wooden stopper. The examples on record, where the extraction of a tooth, and the perforation of the bottom of the antrum, were the means of curing abscesses of that cavity, are very numerous. (See *Farmer's Select Cases*, No. ix.; *Gooch's Cases*, p. 63., new ed.; *Palfyn, Anatomie*, &c.; *Brodie*, *Op. cit.*)

When the bones are diseased, the simple perforation will not accomplish a cure. A probe will generally detect caries or necrosis. The fetid smell, and ichorous appearance of the discharge, will also leave little doubt that the bones are diseased.

When there are loose pieces of dead bone, or other foreign bodies, to be extracted, it may be requisite to make a larger opening in the antrum than can be obtained through the socket of a tooth. Instances also occur where patients have lost all the grinding teeth, and the sockets are quite obliterated, so that a perforation from below cannot be

effected. Some practitioners object to sacrificing a sound tooth. In these circumstances, a perforation in the antrum may be made above the alveolar processes; as first suggested by Larmorier. It consists in making a transverse incision, below the malar process, and above the root of the third grinder. Thus the gum and periosteum are divided, and the bone exposed. A perforating instrument is to be conveyed into the middle of this incision, and the opening in the antrum made of the requisite size with the small pair of cutting pliers, or other convenient instrument. In this way an opening can be more conveniently made than with a trephine. The following way of making the opening is recommended by Sir B. Brodie: "Raise up the cheek, so as to expose the membrane covering the gum on the side of the face, and, with a scalpel, make a transverse incision down to the bone. In one case (says he), I did otherwise, thinking the division of the membrane, as a separate part of the operation, was unnecessary; but, the consequence was, that the blood escaped into the cellular membrane underneath, and there was an immense ecchymosis, rendering the rest of the operation very difficult. Then perforate the thick plate of bone, as nearly as possible to what you suppose to have been the original seat of the disease." The best instrument for this purpose, according to Sir Benjamin Brodie, is a pair of sharp-pointed strong scissors. "Apply them to the bone in their closed state, using them as a chisel, and they will easily penetrate it, and go into the antrum. With these the bone may be broken away to the requisite extent." (See *Mém. de l'Acad. de Chir.* liv. p. 351; *Gooch's Obs.*, Append. p. 138.) Some examples occur, where it is absolutely necessary to expose a great part of the surface of the bone, and to cut away the dead pieces which are wedged, as it were, in the living ones. In general, however, it is prudent to wait till the dead bone is loose; and, in the meanwhile, to restrict our interference to preventing the lodgment of matter, and maintaining cleanliness.

TUMOURS OF THE ANTRUM.

Ruysch, Bordenave, Desault, Abernethy, Weinhold, Gensoul, Liston, Regnoli, Guthrie, and others, have recorded examples of various kinds of tumours affecting the antrum. Surgical writers describe polypi of the antrum; and as growths of this kind have their origin from parts invested by mucous membranes, it is natural to expect that the antrum would occasionally be the situation of them. Yet, the disease must here be very rare; and Sir Benjamin Brodie even regards the history and treatment of polypi of the antrum as altogether hypothetical; and he adds, "No polypus, I believe, ever existed in the antrum, around which a surgeon could put a ligature, and I never heard of the operation being performed." (See *Lond. Med. Gaz.* for Dec. 1834, p. 850.) In no hospital, either civil or military, have I had an opportunity of seeing a polypus of the antrum; neither has any case presented itself to me out of an hospital. I join Sir Benjamin Brodie, therefore, in believing the disease to be exceedingly rare. There are, however, some good authorities in confirmation of the fact that polypi do sometimes grow in the antrum. (*Eichhorn, Chelius, &c.*) Certain other tumours, originating within the antrum, are far more common; some of which are of a fibrous,

sarcomatous, or osteo-sarcomatous character, free from malignancy; while the others are of a malignant cancerous kind, partaking of the nature of medullary tumours, or of carcinoma, and sometimes of both these formidable diseases together. Malignant tumours are attached to the mucous membrane, and fill up the cavity. At first the patient has but little pain, and the existence of the disease is scarcely indicated by any particular symptoms. But, as the disease advances, things are different. The tumour, growing larger, presses upon the inner surface of the antrum, and causes its bony parietes to become dilated. By degrees, it forms a projection in the cheek. After a time, there is another projection in the bony palate. Then another projection occurs at the inferior part of the orbit; and there is still another blocking up the nostril. From the pressure of the tumour, the osseous texture of the antrum is absorbed; the alveoli are destroyed; and the teeth are loosened, or drop out. At length, the morbid growth either makes its way into the orbit, disarranging the eye, and then passes through the orbital plate of the frontal bone into the skull, and proves fatal; or else it protrudes through the front, or lower part of the antrum: in either of which last situations it presents a large fetid, bleeding mass, bringing the patient to his doom with equal certainty. In the Museum of London University College, are three specimens of malignant disease of the antrum; in two, the swelling made its way from the antrum to the brain; in the third, which was taken from an elderly woman, a patient of mine, who died in the North London Hospital, the medullary and scirrhus mass, after entering the orbit, and displacing the eye, caused ulceration and sloughing of the cheek, and a protrusion of some of the tumour in this direction. The woman, who had suffered indescribable agony from the pressure of the tumour, as it continued to enlarge, was at length worn out by the discharge, irritation, and repeated bleedings from the disease. I remember a boy in St. Bartholomew's Hospital many years ago, in whom a medullary tumour, beginning in the antrum, made its way through the orbital plate of the frontal bone and cribriform plate of the ethmoid into the cranium. He was only comatose about forty-eight hours before he died, though the portion of the swelling projecting into the cranium, and causing a corresponding depression in the anterior lobes of the brain, was equal in size to a small orange.

The indolence of any ordinary fleshy tumour in the antrum, while in an incipient state, certainly tends to conceal its existence; but such a disease rarely exists a long while without being accompanied with some affection of the neighbouring parts; and hence its presence may generally be ascertained before it has attained such a size as to have altered in a serious degree the natural shape of the antrum. This information may be acquired, by examining whether any of the teeth have become loose, or have spontaneously fallen out; whether the alveolar processes are sound, and whether there are any fungous excrescences making their appearance at the sockets; whether there is any habitual bleeding from one side of the nose, any sarcomatous tumour at the side of the nostril, or towards the great angle of the eye. When the swelling, however, has attained a certain size, the bony parietes of the antrum are dilated, and

an extraordinary swelling of the cheek takes place.

A swelling of the parietes of the antrum, in consequence of an abscess, or a sarcomatous tumour in its cavity, may lead us to suppose the case an enlargement of the bones, or an exostosis. The symptoms of the two first affections have been already detailed. One sign of an exostosis, besides the absence of the symptoms characterizing an abscess or a tumour in the antrum, is the thickened parietes of this cavity forming a solid resistance; whereas, in cases of mere expansion, the dimensions of the surface of the bone being increased, while its substance is rendered proportionally thinner, the tumour is softer and more yielding.

When such an exostosis depends upon a particular constitutional cause, and especially upon one of a venereal nature, it must be attacked by remedies suited to this affection. But when the disease resists internal remedies, and its magnitude is likely to produce an aggravation of the case, a portion of the bone may be removed with a trephine, or other cutting instrument.

Mr. B. Bell has described, as a kind of exostosis of the upper jaw, a swelling which, from its history, I presume was really a medullary tumour. In fact, it was attended with such suppleness and elasticity of the bone, that it yielded to the pressure of the fingers, and immediately resumed its former plumpness when the pressure was discontinued. When the bone was cut, it was found to be as soft as cartilage, and, in an advanced stage of the disease, its consistence was almost gelatinous. The swelling increased gradually, and extended equally over the whole cheek, without becoming prominent at any particular point, or only so in the latter periods of the malady, when the soft parts inflamed, and became affected. The complaint is described as totally incurable. Cutting and trephining the tumour, as recommended in other cases of exostosis, only aggravate the patient's unhappy condition. I have no doubt that the case here depicted was not an exostosis, but a medullary tumour.

Mr. Abernethy published an account of a very singular disease of the antrum. The patient, who was thirty-four years of age when the account was written, perceived, when about ten years old, a small tumour on his left cheek, which gradually attained the size of a walnut, and then remained for some time stationary. About a year afterwards, the tumour having again enlarged, a caustic was applied to the integuments, so as to expose the bone. The actual cautery was next applied, and an opening thus made into the antrum. After the exfoliation, the antrum became filled with a fungus, which rose out upon the cheek, and could not be restrained by any applications. Part of the fungus also made its way into the mouth, through the socket of the second tricuspid tooth, the other teeth remaining natural. The disease continued in this state nine years, occasionally bleeding in an alarming way. When the patient was in his twentieth year, the whole fungus sloughed away during a fever, and never returned. After this, the sides of the aperture in the bone began to grow outwards, forming an exostosis, which rapidly attained a great magnitude. A small exostosis took place in the mouth, but became no larger than a horsebean. The exostosis of the maxillary bone was of an irregular figure,

and projected from the whole circumference of the aperture a great way directly forward. Mr. Abernethy compared its appearance, when he was writing, with that of a large tea-cup fastened upon the face, the bottom of which may be supposed to communicate with the antrum. The diameter of the cup, formed by the circular edge of the bone, was three inches and a half; the depth two inches and seven eighths. The general height of the sides of the exostosis, from the basis of the face, was two inches; its walls were not thick, and terminated in a thin circular edge. The integuments, as they approached this edge, became thinner, and they extended over it into the cavity. The exostosis now reached to the nose in front, and to the masseter muscle behind; above it included the very ridge of the orbit, and below it grew from the edge of the alveolar process. A line, that would have separated the diseased from the sound bone, would have included the orbit and nose, and indeed one half of the face. Mr. Abernethy saw no means of affording the man relief. (*Trans. of a Society for the Improvement of Med. and Chir. Knowledge*, vol. ii.) See also a case related by Harrison. (*New Lond. Med. Journ.* vol. i. p. 1.)

In a case of fungus, which had distended the antrum, hindered the tears from passing down into the nose, raised the lower part of the orbit, caused a protrusion of the eye, made two of the grinding teeth fall out, and occasioned a carious opening in the front of the antrum, through which opening a piece of the fungus projected, Desault operated as follows:—The cheek was first detached from the os maxillare, by dividing the internal membrane of the mouth at the place where it is reflected over this bone. Thus the outer surface of the bone was denuded of all the soft parts. A sharp perforating instrument was applied to the middle of this surface, and an opening made more forward than the one already existing. The plate of bone situated between the two apertures was removed with a little falci-form knife, which, being directed from behind forward, made the division without difficulty. The opening thus obtained being insufficient, Desault endeavoured to enlarge it below, by sacrificing the alveolar process. This he endeavoured to accomplish with the same instrument; but finding the resistance too great, he had recourse to a gouge and mallet. A considerable piece of the alveolar arch was thus detached, without any previous extraction of the corresponding teeth, three of which were removed by the same stroke. In this manner an opening was procured in the external and inferior part of the antrum, large enough to admit a walnut. Through this aperture a considerable part of the tumour was cut away with a knife, curved sideways, and fixed in its handle. A most profuse hemorrhage took place, but Desault, unalarmed, held a compress in the antrum for a short time; this being removed, the actual cautery was repeatedly applied to the rest of the fungus, and the cavity was filled with charpie dipped in powdered colophony.

On the eighteenth day, the swelling was evidently diminished, the eye less prominent, and the epiphora less visible. But, at this period, a portion of fungus made its appearance again. This was almost entirely destroyed by two applications of the actual cautery. It appeared again, however, on the twenty-fifth day, and required a third and last recourse to the cautery. From this time,

the progress of the cure went on rapidly. Instead of fungous excrescences, healthy granulations were now formed in the bottom of the sinus. The parietes of the antrum gradually approaching each other, the large opening, made in the operation, was reduced to a small aperture, hardly capable of admitting a probe. Even this little opening closed in the fourth month, at which time no vestiges of the disease remained, except the loss of teeth, and a very obvious depression just where they were situated. (*Euvres Chir. de Desault, par Bichat, t. ii.; and Parisian Chir. Journ. vols. i. and ii.*) See other cases recorded by Acoluthus (*Act. Cur. Natur.*); Garengot (*Mém. de l'Acad. de Chir.*); Dupuytren (*Bulletin de la Faculté de Méd.*); Gensoul (*Sur quelques Mal. du Sinus Maxil. p. 9.*); Bécлар (*Gensoul, Op. cit. p. 11.*); Georgi (*Gensoul, Op. cit. p. 14.*); Velpeau (*Ib. p. 14.*); Anderson (*Glasg. Med. Journ. vol. ii. p. 74.*); Canolles (*Recueil Périodique de la Soc. de Méd. t. ii. No. 9.*); Eichorn (*Diss. de Polypis in Antro Highmori, Goett. 1814.*); Sandifort (*Museum Anat. vol. ii. tab. 30.*); Leveillé (*Recueil de la Soc., &c., t. i. p. 24.*); Weinhold (*Von den Krankheiten der Gesichtsknochen, p. 27. 4to. Halle, 1818.*)

In some of these examples a cure is stated to have been accomplished; in others, the disease returned, and proved fatal. The question then arises, whether all the tumours were malignant, or only a part of them? Those which were permanently cured might have been of a different nature, not partaking of the character of medullary sarcoma nor of that of carcinoma.

With respect to Desault's operation, and any other performed for a medullary, or cancerous tumour of the antrum, it would have been desirable to know what was the state of the patient some considerable time after the removal of the swelling; for, as Sir Benjamin Brodie correctly observes, a malignant disease may appear to be cured for a twelvemonth, and yet return. The circumstance of Desault's patient seeming to be well four months after an operation of this kind, by no means proves that it produced a permanent cure. (*See Lond. Med. Gaz. for Dec. 1834, p. 351.*) Dr. Anderson, of Glasgow, has furnished information respecting the case, in which he extirpated a fungous tumour from the antrum after it had produced complete absorption of the bone. "This patient died of pectoral inflammation, five years and a half afterwards, when she had just recovered from the operation of removing nearly the whole of the lower jaw. On a minute examination of the antrum, the former disease was found to have been permanently cured by the operation." (*Anderson, in Lond. Med. Gaz. for Feb. 1835.*) Hence, Dr. Anderson disapproves of leaving a patient, even with such a tumour, to his fate.

Sir Benjamin Brodie formerly attempted to destroy a malignant tumour of the antrum in its early stage. The bone being absorbed, he cut out a large portion of the membrane, which now constituted the only boundary of the antrum. He now came to a considerable tumour, growing from a broad surface. "The outer part of the tumour, which was of soft consistence, I broke down with my fingers, and I then turned the tumour out, so that the antrum appeared to be perfectly empty. But this was not done without an enormous, and, indeed, frightful hemorrhage." Notwithstanding the free use of caustic and the actual cautery, the

disease returned, and grew faster than it could be destroyed, and proved fatal. Mr. Liston's observations are to the same purpose. The malignant form of the disease, even in a very early stage, is pronounced by him to be unmanageable. "The tumours, if removed, are speedily reproduced, and the fatal termination may be accelerated by interference. I have removed tumours from the antrum maxillare, and from the frontal sinus; but the parts soon became occupied by morbid growths of a more formidable character than the preceding; the membrane and bone appear to assume a disposition to generate such disease; and the fungous protrusions cannot be kept down with escharotics, nor with the actual cautery. The antrum, when filled with such tumours, is easily laid open. The cheek is divided perpendicularly from over the inferior orbitar foramen to the mouth, and the soft parts are dissected from off the bone. The cavity may then be exposed by means of a small trephine; but this instrument is scarcely ever required, the parietes being so softened as to yield easily to the knife; though pliers, or cutting forceps, may be useful in enlarging the aperture. By the guidance of the finger, the attachments of the morbid growth are separated with a blunt-pointed bistoury; and a scoop is used to turn out the diseased mass. The root of the tumour is then touched with a red-hot iron; and by this implement, or by dossils of lint, the hemorrhage is easily arrested. But such operations, considering the result of those which have been practised, are scarcely justifiable." (*See Liston's Elem. part ii. p. 158.*)

Mr. Liston delivers the same judgment on the operation of removing a malignant tumour of the antrum, along with its investment, and every part of the bone to which it is connected. "The disease," says he, "is seldom, if ever, seen by the surgeon early enough to admit of any operation being practised with the least chance of ultimate success. At a sufficiently early period, the removal of the bone of the parietes of the cavity containing, and from which the tumour has grown, must, without doubt, afford a better chance, and is, in every point of view, to be preferred to the old operation of what was called trephining the antrum." The view which I now entertain of this subject, in relation to malignant tumours of the antrum, completely agrees with that taken by Sir Benjamin Brodie and Mr. Liston. If a case were needed to confirm the accuracy of their opinions, I would refer to that in which Mr. Guthrie lately operated in the Westminster Hospital, and who has honestly laid the true result of it before the public, as every other surgeon ought to do who ventures to try the practice. (*See Guthrie, in Lond. Med. Gaz. for January 16. 1836.*) The example in which M. Georgi operated, it seems, was followed by a lasting cure; but, as M. Gensoul remarks, there was a double piece of good luck in this instance; viz. that of a necrosis of the bone taking place to a sufficient depth to prevent the return of the disease, and the not less fortunate circumstance of such necrosis being restricted precisely to the half of the face. (*See Gensoul, Sur quelques Mal. graves du Sinus Maxil. p. 19.*) The case recorded in the *Bulletin de la Faculté de Méd.*, where Baron Dupuytren removed about one third of the alveolar arch and the bony palate, in order to extirpate an

osteosarcoma, proved successful; but some forms of this disease are not regarded by British pathologists as partaking of the same degree of malignancy, the same unfavourable state of the constitution, and the same disposition to return, as attend medullary sarcoma and a truly cancerous swelling. The operations performed by Acoluthus, of Breslaw, and M. Garengnot, of Paris, are reported to have terminated in cures.

M. Gensoul, lately principal surgeon of the Hôtel Dieu at Lyons, instead of merely opening the antrum, cutting away as much of the tumour as possible, and attacking the rest with caustic, or the cautery, proposed and practised another operation, founded on the same principles as are recognised by the best surgeons as applicable to every operation for the removal of a cancerous breast. "Here," says he, "all writers agree in advising amputation to be performed at the base of the disease, so as to make all the incisions in the sound parts; and this is exactly what I recommend to be done in diseases of the maxillary sinus." (*Sur Quelques Maladies Graves du Sinus Maxillaire*, p. 4.) Gensoul's first operation was executed on the 26th of May, 1827. (*Op. cit.* p. 18.) The precise date of Mr. Lizars' earliest operation I am not at the present moment acquainted with; but I suspect that this gentleman removed the whole antrum some time before a similar operation was practised by M. Gensoul: as, however, the particulars of Mr. Lizars' case are upon record, the question on this point may be settled without difficulty. This subject I shall have occasion to return to in another place, where a description of the operation of removing the antrum will be given. (See BONES, EXCISION OF.)

As it appears from the foregoing observations that, whatever operation is done, the patient has a fairer prospect of being cured by it when the disease does not partake of a medullary or cancerous nature, and as, likewise, the chances of recovery are so bad in the latter cases that many of the best surgeons pronounce any operation for them unjustifiable; it would be very desirable if the character of the disease could always be determined before the tumour has made its way beyond the limits of the antrum. I remember that Sir Benjamin Brodie once mentioned to me a case, in which he was able to ascertain the medullary consistence of the tumour by the introduction of one of his exploratory grooved needles. The plan seems to me one deserving of recollection. In the case here referred to, the antrum was removed by another surgeon, but the disease returned. In a case which was in the North London Hospital under my care, the disease, which was malignant, had caused ulceration of the cheek, and thrown out a firm fungous bleeding mass in that direction; so that the nature of the case was but too manifest. But if there had been no such protrusion of the disease through the cheek, the projecting part of the tumour in the roof of the mouth admitted of manual examination; and its consistence could be felt to be in some places elastic; in others, firm, like scirrhus, or mammary sarcoma. In fact, the preparation taken from the patient, an aged female, after her death, exemplifies a combination of these two structures; and is placed in the museum of the London University. Mr. Mayo, in noticing the importance of discriminating osteosarcoma from medullary sarcoma of the an-

trum, remarks,—"The only criterion that I am acquainted with for determining the nature of the swelling is to plunge a lancet into it; when, if the disease is osteosarcoma, the peculiar crisp sensation of cutting that texture will be perceived." (See *Mayo's Outlines of Pathology*, p. 278.)

A few years ago, Mr. Pattison suggested the expedient of tying the carotid artery, as likely to bring about the dispersion of fungous diseases of the antrum, without the necessity of meddling with the tumour itself. He adverts to three cases, the results of which, according to his account, were favourable to the practice. (See *Burns on Anat. of the Head*, &c. ed. by Pattison.) However, the ligation of an arterial trunk has been tried by Sir Astley Cooper, to stop the progress of medullary tumours in other situations, but without success (see *Surg. Essays*); and Mr. Liston declares, that the statement of a malignant tumour in the antrum having been arrested by ligation of the common carotid, is not borne out by facts. (*Elem. of Surgery*, part ii. p. 161.) In M. Magendie's *Journ. de Physiologie* is a case, in which this eminent physician tried in vain to stop the progress of a tumour of the antrum by tying the common carotid artery.

INSECTS IN THE ANTRUM.

It is said, that insects in this cavity may sometimes make it necessary for the surgeon to open it. This case, however, must be exceedingly rare; and even what we find in authors (*Pallas, De Insectis Viventibus intra viventia*) appears so little authentic, that I should hardly have mentioned the subject if there were not, in a modern work of repute (*Med. Comm.* vol. i.), a fact which appears entitled to attention. Mr. Heysham, a medical practitioner at Carlisle, relates, that a strong woman, aged sixty, in the habit of taking a great deal of snuff, was subject, for several years, to acute pains in the antrum, extending over one side of the head. These pains never entirely ceased, but were more severe in winter than summer, and were always subject to frequent periodical exacerbations. The patient had taken several anodyne medicines, and others, without benefit; and had twice undergone a course of mercury, by which her complaints had been increased. All her teeth on the affected side had been drawn. At length, it was determined to open the antrum with a large trochar, though there were no symptoms of an abscess, nor of any other disease in this cavity. For four days no benefit resulted from the operation, Bark injections, and the elixir of aloes, were introduced into the sinus. On the fifth day, a dead insect was extracted, by means of a pair of forceps, from the mouth of the cavity. It was more than an inch long, and thicker than a common quill. The patient now experienced relief for several hours: but the pains afterwards recurred with their former severity; oil was next injected into the antrum, and two other insects, similar to the former, were extracted. No others appeared, and the wound closed. The pains were not completely removed, but considerably diminished for several months, at the end of which time they became worse than ever, particularly affecting the situation of the frontal sinus.

Bordenave has published, in the twelfth and thirteenth volumes of the *Mém. de l'Acad. de Chir.* edit. 12mo., two excellent papers on diseases of

the antrum. In the thirteenth volume he relates a case, in which several small whitish worms, together with a piece of fetid fungus, were discharged from the antrum, after an opening had been made on account of an abscess of this cavity, attended with caries. (P. 381.) But, in this instance, the worms had probably been generated after the opening had been made in the cavity; for when they made their appearance, the opening had existed nine months. Deschamps refers to another case, in which M. Fortassin, his colleague at La Charité, found in the antrum of a soldier, whom he was dissecting, a worm of the ascaris lumbricus kind, four inches in length. (*Traité des Mal. des Fosses Nasales*, &c. p. 107.) Such an example is also recorded in one of the volumes of the *Journal de Méd.* Were a case of this description to present itself in a living subject, it would be advisable to inject oil into the cavity of the antrum, and then endeavour to wash out the extraneous substances, by throwing into the sinus warm water, by means of a syringe.

BIBL. AND REFER.—Précis d'Observations sur les Maladies du Sinus Maxillaire, par M. Bordenave, in *Mém. de l'Acad. Royale de Chir.* t. xii. edit. in 12mo. Also, Suite d'Observations on the same subject, by M. Bordenave, t. xiii. of the said work; L. H. Rung, De Morbis Præcipuis Sinuum Ossi Frontis et Maxillæ Superioris, &c. Binstel, 1750; Haller, *Disp. Chir.* l. 205. Jourd'au, in *Mém. de l'Acad. de Chir.* t. iv. p. 337; also *Traité des Dépôts dans le Sinus Maxillaire*, &c. 12mo. Paris, 1760; *Traité des Mal. de la Bouche*, t. ii. Paris, 1778; and *Journ. de Méd.* t. xxi. p. 57. et t. xxvii. p. 52—157. This author, who, in 1765, suggested to the Royal Academy of Surgery the method of injecting fluid into the antrum, through the natural opening, is said to have been anticipated in the practice by Allouel, who first conceived the plan in 1737, and tried it with success in 1739. See *Boyer*, *Traité des Mal. Chir.* t. vi. p. 143. *Becher*, *Diss. de Insolito Maxillæ Superioris tumore altissimo ejusdem morbis*, Wircob. 1776. *Remarques et Observations sur les Maladies du Sinus Maxillaire*, in *Œuvres Chir. de Desault*, par *Féchet*, t. ii. p. 158. *Desault's* *Parisian Chir. Journal*, vols. I. and II. *Medical Communications*, vol. i. *Trans. of a Soc. for the Improvement of Med. and Chir. Knowledge*, vol. ii. *Natural History of the Human Teeth*, by *John Hunter*, p. 174, 175. edit. 3. *Gooncke's Chir. Works*, vol. ii. p. 64, and vol. iii. p. 161. edit. 1792. *Callicæ's Systema Chirurgiæ Hodiernæ*, t. i. p. 346, &c. *Dubois*, in *Bulletin de la Faculté de Médecine*, No. 8. J. I. *Deschamps*, *Traité des Maladies des Fosses Nasales*, et de leur Sinus, 8vo. Paris, 1804. *Eichorn*, *Diss. de Polypis in Auro Highmori*, Gött. 1804. *Liston*, *Edin. Med. Journ.* No. 18. P. F. *Leinicker*, *De Sinu Maxillari*, ejusdem *Morbi*, &c. Wircob. 1809. C. A. *Weinhold*, *Ideen über die abnormen Metamorphosen der Highmorschle*, Leipz. 1810. C. A. *Weinhold*, *Von den Krankheiten der Gesichtsknochen und ihrer Schleimhäute, der Ausrottung eines grossen Polypen in der linken Oberkieferhöhle, dem Verhuten der Einsinkens der Gichtischen und Venetischen Nase, und der Einsetzung Künstlicher Choanen*, 4to. Halle, 1818. Account of a malignant Tumour removed from the Antrum, by T. *Irvine*, in *Edin. Med. Journ.* Nos. 83. and 84. J. *Gesaoul*, *Lettre Chir. sur Quelques Maladies Graves du Sinus Maxillaire, et de l'Os Maxillaire Inférieur*, 8vo. Paris, 1833, avec huit Planches, in folio. *Sir Benjamin C. Brodie*, *Lond.* in *Lond. Med. Gaz.* Dec. 1834. G. J. *Guthrie*, in *Bart. Med. Gaz.* *Edin.* in *Elem. of Surgery*, part ii.; and *Med. Chir. Trans.* vol. xx. *Scott*, in *Lancet* for 1831.

ANUS. The lower termination of the intestine, named the rectum, is so called, and its office is to form an outlet for the feces. It is furnished with muscles, which are peculiar to it; viz, the sphincter, which keeps it habitually closed, and the levator ani, which serves to draw it up into its natural situation, after the expulsion of the feces. It is also surrounded, as well as the whole of the neighbouring intestine, with muscular fibres, and a very loose sort of cellular substance. As Cruveilhier observes, it is liable to a greater number of diseases than all the other natural openings together. In order that the least possible section of a continual

and involuntary discharge of the feces may not occur, the anus has for its base and support the sphincter, a voluntary muscle, which, as I have stated, keeps this opening habitually shut, and is antagonized when the necessity for emptying the rectum occurs, not only by the levator ani, its proper dilating muscle, but also by the diaphragm and muscles forming the anterior parietes of the abdomen. The want of something corresponding to a sphincter, is a main source of the annoyance resulting from an artificial anus. The external sphincter, as Cruveilhier further explains, is covered by skin, which is abundantly furnished with sebaceous follicles; hairs grow upon it, and it is folded up itself to assume the character of a mucous tissue. At the place of its duplicature, it is thrown into many diverging wrinkles, which become effaced whenever the anus is dilated. In the situation where the skin is reflected, there is a great development of erectile tissue. The common cuticle terminates a little above the reflexion, where, according to Cruveilhier, it is replaced by the kind of epidermis belonging to mucous textures. In the mucous membrane, are distributed the terminal ramifications of the hemorrhoidal arteries; while, from the erectile tissue, originate a multitude of tortuous plexiform veins, constituting the lowermost radicles of the vena portæ. The anus receives a large supply of nerves from the hypogastric plexus; and numerous mucous cryptæ lie under the mucous membrane, which their secretion serves at once to lubricate and to protect. (See *Cruveilhier*, in *Dict. de Méd. et de Chir. Pratiques*, t. iii. p. 113.)

IMPERFECT ANUS.

As it is of the utmost consequence that this and other malformations should not remain long unknown, one of the earliest duties of an accoucheur, after delivery, is the examination of all the natural outlets of new-born infants.

The place in which the extremity of the rectum, or the anus, ought to be, may be entirely, or partly, shut up by a membrane, or fleshy adhesion. In other instances, no vestige of the intestine can be found, as the skin retains its natural colour over the whole space between the parts of generation and the os coccygis, without being more elevated in one place than another. In these cases, the intestine sometimes terminates in one or two cul-de-sac, about an inch upward from the ordinary situation of the anus. (See *Baillie's Engravings*, fasc. iv. tab. v.) Sometimes it does not descend lower than the upper part of the sacrum; sometimes it opens into the bladder, or vagina. Dr. Palmer dissected a case, where the colon, after reaching the vicinity of the left kidney, began, as it descended, to form a sigmoid flexure; but, previously to its arrival at the concavity of the left ilium, made a sudden turn to the right, and, crossing the psoas muscle, reached the projection of the sacrum, where it terminated, without entering the pelvis at all. With this malformation was combined an imperforate meatus urinarius, and other considerable deviations of the genital organs from their natural structure. (See *Medico-Chir. Journ.* vol. i. 8vo. Lond. 1816.)

Sometimes the colon terminates in a sac, and the rectum is entirely deficient. (See *Beauregard*, in *Journ. de Méd.* i. 66.) Instances are also upon record, where the rectum opened into the urethra,

(*Bresl. Samml.* 1718, p. 702.; *Hist. de l'Acad. Royale des Sciences*, 1752, p. 113.; *Hochstetter*, in *Med. Wochenblatt*, 1780, No. 18.; 1783, No. 19.; *Kretschmar*, in *Horn's Archiv*, b. i. p. 350.)

Crucvillier saw an infant, in which the rectum opened under the glans penis, through a canal formed in the substance of the raphe of the scrotum. (*Anat. Pathol.* pl. vi. lre livr.)

In cases of imperforate anus, if a speedy opening be not made for the feces, the infants soon perish, with symptoms similar to those of a strangulated hernia. *Mr. A. C. Hutchison* thinks it advantageous, however, not to operate till the expiration of from twenty-four to sixty hours after birth, as he conceives that, within this period, no great inconvenience will arise, and the distention of the rectum with meconium will be a guidance to the surgeon in making the incisions. (See *Obs. in Surgery*, ed. 2.) After ascertaining the complaint, which is an easy matter, the surgeon should endeavour to learn, whether the anus is merely shut by portions of skin, a membrane, or a fleshy adhesion, or whether the anus is altogether wanting, in consequence of the lower portion of the cavity of the gut being obliterated, or the rectum not extending sufficiently far down.

When merely a thin production of the skin closes the opening of the rectum, the part producing the obstruction is somewhat different in colour from the neighbouring integuments, being usually of a bluish or livid hue, in consequence of the accumulation of the meconium under it. The meconium, propelled downward by the viscera above, forms a small roundish prominence, which yields like dough to the pressure of the fingers, but immediately projects again when the pressure is removed. When a fleshy adhesion closes the intestine, the circumstance is obvious to the eye, if the part protrude, as is generally the case; greater hardness and resistance are felt, than when there is merely a membrane; and the livid colour of the meconium cannot be seen through the obstructing substance.

These last circumstances are of themselves enough to convince the surgeon of the necessity of an operation; but they do not clearly show, whether the intestine descends as far as it ought, in order to form a proper kind of anus. Complete information on this point can only be acquired after the obstructing substance has been divided, or else after the child's death, when the operation has proved ineffectual. Though there be no mark to denote where the anus ought to be situated, and no degree of prominence, yielding, like soft dough, to the pressure of the fingers, and rising again when such pressure is removed; yet the rectum may still exist, and have a cavity, as far as the membrane, or adhesion, closing it.

When the anus is simply covered with skin, and its place indicated by a prominence, arising from the contents of the rectum, we have only to make an opening with a knife, sufficient to let out the meconium. Another cut may then be made across the first, and the four angles removed. About two years ago, I performed this operation on a child in a family near Bedford Square, attended by *Mr. Wright*, and the little patient was saved. A piece of bougie, or, what is better, a portion of elastic gum catheter, is afterwards to be introduced, in order to keep the opening from closing. If the anus be only partly closed by a

membrane, the opening may be dilated with tents or bougies; but, if the aperture be small, it is preferable to use the bistoury for its enlargement.

When no external appearance denotes where the situation of the anus ought to be, the case is more serious and embarrassing; and this, whether the intestine be stopped up by a fleshy adhesion, or the coalescence of its sides, or whether a part of the gut be wanting.

However, it is the surgeon's duty to do every thing in his power to afford relief. For this purpose, an incision an inch long, or rather more, is to be made in the situation where the anus ought to be, and the wound is to be carried more and more deeply in the natural direction of the rectum. The cuts are not to be made directly upwards, nor in the axis of the pelvis; for the vagina, or bladder, might thus be wounded. On the contrary, the operator should cut backward, along the centre of the concavity of the os coccygis, where there is no danger of wounding any part of importance. In all cases of this kind, the surgeon's finger is the best director. The operator, guided by the index finger of his left hand, introduced within the os coccygis, is to dissect in the direction above recommended, until he reaches the feces, or has cut as far as he can safely reach with his finger. If he should fail in finding the meconium, as death must unavoidably follow, one more attempt ought to be made, by introducing, upon the finger, a middle-sized trocar, in the direction best calculated to reach the rectum, without danger to other parts, viz. upwards and backwards in the median line. The cannula may be left in the puncture, and secured there with tapes, so as to afford an outlet for the feces. In some observations on this subject, addressed to the Medical and Chirurgical Society by *Mr. A. Copland Hutchison*, he recommends an elastic gum catheter to be substituted for the cannula, after a week; and, when the tube can be dispensed with, a sponge tent, or piece of bougie, to be worn twelve out of the twenty-four hours. (See *Obs. in Surgery*, ed. 2. 1826.)

In an interesting case, recorded in *Langenbeck's new Surgical Bibliotheca*, the imperforate state of the anus was not discovered till the evening of the 12th day from the child's birth, when hiccough and convulsions had come on. *M. Wolff* found the abdomen protuberant, hard, and painful when handled, and the child was suffering from nausea, vomiting, and great depression of strength. Next day, he introduced a lancet a few lines in front of the os coccygis, to the depth of an inch, without finding the rectum. The puncture was then carried to the depth of two inches, but without effect. With a pharyngotomus, however, he now succeeded in piercing the rectum; and a glyster was administered, which brought away some meconium. Under the use of glysters and tents, the child soon recovered.

By such proceedings, many infants have been preserved, which would otherwise have been devoted to certain death. *Hildanus*, *La Motte*, *Roonhuysen*, *Mr. A. Copland Hutchison*, and others, have successfully adopted the practice. *Mr. B. Bell* met with two cases, in which the intestine was very distant from the integuments, yet he succeeded in forming an anus, which fulfilled its office tolerably well for several years; though he found it difficult to keep it pervious. As soon as he removed the drosses of lint, and other

kinds of tents, used for maintaining the necessary dilatation, such a degree of contraction speedily followed, that the evacuation of the intestinal matter became difficult. He employed, at different times, tents made of sponge, gentian root, substances, which swell on being moistened. But they always produced such pain and irritation, that it was impossible to persevere in their use. Tents of soft lint dipped in oil, or rolls of bougie-plaster, were found to cause less irritation, than those composed of any other materials.

Though keeping the opening dilated may seem simple and easy to such men as have had no opportunities of seeing cases of this description, it is far otherwise in practice. Mr. B. Bell assures us, that he never met with any disease, that gave him so much trouble and embarrassment, as he experienced in the two cases of this sort, which occurred in his practice. Although, in both instances, he made the openings at first sufficiently large, it was only by very assiduous attention, for eight or ten months, that the necessity for another operation, and even repeated operations, was prevented. When only the skin has been divided, the rest of the treatment is, doubtless, more simple; for, then, nothing more is requisite, than keeping a piece of lint, for a few days, in the opening made with the knife. But, when the extremity of the rectum is at a certain distance, though we may generally hope to effect a cure, after having succeeded in giving vent to the intestinal matter; yet the treatment, after the operation, will always demand, for a long while, a great deal of attention and care on the part of the surgeon. In a highly interesting example, recorded by Mr. Miller, of Methven, such was the tendency to closure of the new opening, that he was obliged to repeat the operation ten times before the child was eight months old. (See *Edin. Med. Journ.* No. 98. p. 62.) Notwithstanding all these operations, and another one of two hours and three quarters' duration, performed several years afterwards for the extraction of an alvine concretion, equal in size to a turkey's egg, the power of the sphincter was perfect. The difficulty of success may be considered as, in some measure, proportioned to the depth of the necessary incision. An infant was brought to the North London Hospital with an imperforate anus; Mr. Liston, after carrying the incisions to the depth of three inches, made a small opening into the intestinal canal, as indicated by the discharge of fetid gas, and a small quantity of meconium. A piece of bougie was introduced to maintain the opening; but the child died in a very short time, and there was no opportunity of ascertaining the state of the parts. In a case like that recorded by Dr. Palmer, to which I have above adverted, the inutilty of any attempt to discharge the feces by an operation, in the usual site of the anus, must be sufficiently obvious. (*Medico-Chir. Journ.* vol. i. p. 181.)

Sometimes, while the anus appears pervious and well formed, the infant suffers the same symptoms as if there were no anus at all. The reason of this depends upon the intestine being occasionally closed by a membranous partition, situated more or less upward, above the aperture of the anus. (*Courtial, Nouvelles Obs. sur les Os*, p. 147.; *John Wraye*, in *Edin. Med. and Surgical Journ.* April, 1821; and *Cases in*

Hutchison's Obs. in Surgery, ed. 2.); and sometimes the symptoms are owing not simply to an interruption of the cavity of the intestine, but even of its parietes; and thus the colon may be separated entirely from the rectum. (*Andral, Précis, d'Anat. Pathol.* t. ii. p. 143.) Such erroneous formations may be suspected, when an inf whose anus is externally open, does not void any excrement for two or three days after its birth, and especially when urgent symptoms arise, such as swelling of the belly, vomiting, &c. We are now to endeavour to ascertain, whether the rectum is impervious above the anus, by attempting to inject glysters, or introducing a probe. If the gut be shut up, there is nothing to be done but having recourse to the method described above, and forming a communication by means of a bistoury guided on the finger, or else with a pharyngotomus. If the obstacle should only consist of a transverse membrane, the operation will be easy, and its success highly probable; but if there should be an internal strangulation, or obstruction of the intestinal canal, from total deficiency of some part of its parietes, the case is infinitely more serious.

In the case recorded by Mr. Wraye, the membranous septum was felt by the finger, about an inch from the verge of the anus. It was pierced with a pointed probe, which was followed by a hydrocele trocar, and afterwards by a bougie of larger dimensions. On withdrawing the latter, much meconium, mixed with feces, escaped, and continued to be frequently discharged. In a week, however, the opening closed, and a fresh puncture was made, which was maintained by the frequent introduction of bougies. The child proceeded tolerably well until the end of another week, when the passage was again much contracted, and the abdomen proportionally distended. On the 20th day from birth, a full-sized trocar was used for restoring the opening, which, however, again had a tendency to close, but was afterwards dilated by introducing twice a day bougies, which were increased in size, until a rectum bougie of middling size could be passed. The boy now rapidly improved, and every hope of a perfect recovery was entertained, but disease of the os coccygis ensued; and, at the end of six months, the little patient died hectic. (See *Edin. Med. and Surg. Journ.* vol. xvii.)

When the anus is imperforate, the intestine sometimes opens into the vagina, or bladder, or urethra; there being, as Andral expresses himself, a tendency in the terminal orifices of the digestive, urinary, and genital organs to be confounded together, and to form a common cavity more or less analogous to the cloacæ of birds. (*Précis d'Anat. Pathol.* t. ii. p. 144.; *Dumas*, in *Recueil Périodique de la Soc. de Méd.* t. iii. No. 13.; *L'Eveillé, Rapport des Travaux de la Soc. Philom.* vol. i. p. 145.; *Murray, Diss. Atresi Ani vesicalis*, Ups. 1794; *Act. Nat. Cur.* vol. viii. Obs. 24.; vol. ix. Obs. 11.; *Roestel*, in *Mursinna's Journ. für die Chir.* b. i. p. 547.; *Obs. Med. Decad.* ii. No. 2.; *Velpeau, Nouv. Elem.* t. iii. p. 977.) The first case is the least dangerous of such malformations. The intestine may also terminate at two places at the same time, viz. at the usual place, so as to form a proper anus, more or less perfect; and also in the vagina. If the rectum were to terminate at the lower and posterior part of the vulva of which, M. Brachet has lately published an example, the making of a

new anus in the proper situation would be unattended with difficulty. A director should be passed into the rectum through the opening already existing, and an incision made, under the guidance of this instrument, from the perineum towards the coccyx, through all the textures, keeping up the displacement of the end of the rectum. A cannula is then to be fixed in the bowel at the posterior part of the wound, by which means the front of the incision would have an opportunity of healing, and the feces take their right course. This operation was recommended by Vicq. d'Azyr. M. Velpeau sees no occasion for the suture, advised by M. Martin for the union of the anterior part of the wound, and suggests, that sometimes it may be advantageous not to divide the recto-vaginal septum at all, but to pass a blunt curved instrument from the vaginal fistula to the lower end of the bowel, and then make a puncture into the latter through the skin. (*See Velpeau, Nouv. Elém. de Méd. Opér. t. iii. p. 979.*)

When the two openings are exceedingly small, and the feces cannot readily pass out, even with the aid of glysters, the opening of the anus ought to be enlarged with a knife, and kept dilated with a cannula. The communication with the vagina will then gradually close.

For the most part, the intestine has but one opening in the vagina. In this circumstance, the surgeon should make an incision in the place which the anus ought to occupy. The natural course of the feces being thus opened, less excrement will pass out of the vagina; and by the introduction of a tube into the new anus, the communication between the rectum and vagina will be obliterated, and a perfect cure accomplished; an instance of which is recorded by M. Lépine. (*See Dict. de Méd. et de Chir. Prat. t. iii. p. 121.*) The opening between the intestine and vagina is sometimes too small for the due evacuation of the feces, and the infant is then exposed to the same sort of dangerous symptoms as if the rectum had no opening at all.

In male infants, the rectum sometimes opens into the bladder; and, in this circumstance, there is generally no anus. The case is easily known, by the meconium being blended with the urine, which acquires a thick greenish appearance, and is voided almost continually, though in small quantities. Only the most fluid part of the meconium is thus discharged. The thicker part, not getting from the rectum into the bladder, nor from the bladder into the urethra, greatly distends the intestines and irritates the bladder, producing in the end fatal symptoms. For a few days, however, the meconium may be diluted, and voided with the urine. An infant, whose meconium came away through the urethra, seen by M. Velpeau, lived nearly a week. (*Nouv. Elém. de Méd. Opér. t. iii. p. 977.*) In all such cases one thing is certain, viz. that without the speedy interference of art to form an anus, capable of serving as an outlet to the feces, with which the urinary organs cannot remain obstructed, the infant will inevitably die. This case must, therefore, be treated on the same principles, which apply to the foregoing examples. Though we can hardly hope to prevent altogether the inconveniences resulting from the rectum opening into the bladder, since even a new passage will not completely hinder the feces from following the other course; yet we shall thus afford the child

the only chance of preservation which its situation will allow.

In cases, in which an outlet for the feces cannot be procured by any of the methods pointed out above, Littré proposed, in 1720, to make an opening in the sigmoid flexure of the colon, above the left groin, and thus form an artificial anus. In 1788, Dumas tried the plan on an infant, which died on the tenth day. In 1793, it was practised with complete success by M. Duret, of Brest; and M. Pilore, of Rouen, had an equally fortunate case. But the infant, on whom Desault operated in 1794, lived but four days afterwards. M. Ouvrard, of Anger, and M. Roux, of Paris, lost also the two children on whom they made the experiment. (*See Velpeau, Nouv. Elém. de Méd. Opér. t. iii. p. 983.*) M. Duret cut into the abdomen at the lower part of the left iliac region; and, having opened the sigmoid flexure of the colon, he fixed it near the wound. The child was saved by the formation of an artificial anus; but at the age of twenty-five months, it continued to be troubled with a prolapsus of the lining of the bowel. (*See Recueil Périodique de la Soc. de Méd. t. iv. No. 19; and Sabatier, Méd. Opératoire, t. iii. p. 336. edit. 2.*)

An instance was published by Mr. Pring, in which he made an opening in the colon, near its sigmoid flexure, in a lady, who, in consequence of a scirrhus disease of the rectum, was afflicted with an obstinate and perilous obstruction of the intestinal canal. The patient survived the operation nearly sixteen months, at the end of which time she fell a victim to the disease of the rectum. (*See London Med. and Physical Journal, vols. xlv. and xlvii.*) Every permanent closure or obliteration of a part of the intestinal canal being fatal if left to itself, M. Velpeau sees nothing blameable in forming, in such a case, an artificial anus. The difficulty, says he, would first be to acquire a certainty of the existence of the obliteration or permanent closure, and then to ascertain that it was situated in the rectum, or lower part of the sigmoid flexure of the colon, so that the artificial anus above Poupart's ligament would be above the obstruction. These points, however, according to M. Velpeau, are often made out. "Braillet had no doubt about them in the case which he has recorded. Neither was M. Solon mistaken in the example quoted by M. Paris. The same things were equally manifest in the course of Talma's disease. I may apply a similar remark to the case of a woman, whose body I examined in 1825. No modification of the operation would be requisite, except that, instead of being always performed on the left side, it might be indispensable to cut into the right iliac fossa, if the stricture were in the transverse or ascending colon. After all (observes M. Velpeau), this operation is not merely a theoretical speculation: practitioners have had the courage to perform it on the living subject. Martland, who first did this in 1814, saved his patient's life." (*See Nouv. Elém. de Méd. Opér. t. iii. p. 985.*) I should be reluctant to offer any remarks encouraging the repetition of this practice, against which various considerations present themselves, particularly in cases where, besides a mere difficulty of emptying the bowels, another disease exists, which is itself likely to destroy the patient, and is of a nature not capable of receiving any effectual benefit from the operation.

The operation consists in making an incision a

little above Poupart's ligament, about two inches in length, and on the outer side of the course of the epigastric artery: the skin, superficial fascia, aponeurosis of the external oblique muscle, the lower fibres of the integral oblique and transverse muscles, the fascia transversalis, and the peritoneum, are to be divided in succession. As soon as the peritoneum has had a small puncture cautiously made in it, a director is to be introduced into the opening, which is to be enlarged with a probe-pointed bistoury. The distended bowel, of a livid or greenish colour, presents itself in the wound; and, being opened in the same direction as the wound, a tent, or a piece of full-sized elastic gum catheter, should be placed in the new passage. The introduction of a ligature through the mesentery is sometimes advised; but as my observations only refer to opening the sigmoid flexure of the colon, such expedient is out of the question.

Callisen conceived, that the descending colon might be most safely got at by making an incision in the left lumbar region, along the edge of the quadratus lumborum muscle, and opening that intestine between the two layers of peritoneum, which fix it in its situation. Thus he calculated that all necessity for cutting into the cavity of the peritoneum itself would be obviated. (*Syst. Chir. Hodiernæ*, t. ii. p. 688, 689. ed. 1800.) The operation was tried in one case by M. Roux, but in two hours the infant perished. (See *Velpeau, Nouv. Elém. de Méd. Opér.* t. iii. p. 984.) I fully agree with the latter surgeon, that this method, which is far more difficult than the plan of M. Littré, must be fully as dangerous.

I shall conclude this subject with briefly mentioning a scheme, attributed to M. Dubois, which was, to introduce some exploratory instrument into the intestinal canal, through the wound above Poupart's ligament, for the purpose of ascertaining whether it is practicable to push it on to the peritoneum, and, with its assistance, to form an anus in the natural place. This, as M. Velpeau informs us, has hitherto only been attempted on the dead body.

See *Sabatier, Médecine Opératoire*, t. iii. p. 530. *Papendorff, De Ano infantum Imperforato*. Leips. 1763. *Remarque sur Différens Vices de Conformation que les Enfants apportent en naissant*, par M. Petit, in *Mém. de l'Acad. Royale de Chir.* t. ii. p. 435. edit. in 12mo. *II. A. Vicesque*, *De præternaturali et raro Intestini Recti cum vesica urinaria uniti et independente Ani defectu*, 4to. Gött. 1779. *Ford*, in *Med. Facts and Obs.* vol. i. No. 10. *Chamberlaine*, in *Memoirs of the Med. Soc. of Lond.* vol. v. No. 23. *Richcrand*, *Nosographie Chir.* t. iii. p. 437. &c. edit. 4. *G. Weyle*, in *Edin. Med. Journ.* vol. xvii. *Lancet*, vol. i. p. 431. *A. C. Hutchison*, in *Pract. Obs. in Surgery*, ed. 2. 1824. *Miller*, in *Edin. Med. Journ.* No. 98. p. 61. *Jolinet*, in *Journ. de Méd.* par Leroux, t. xxxii. p. 272. *Alf. L. M. Velpeau*, *Nouv. Elém. de Méd. Opér.* t. iii. p. 977. 8vo. Paris, 1832.

ABSCESSSES OF THE ANUS.—FISTULA IN ANO.

The custom of giving the appellation of *fistula* to every collection of matter formed near the anus, has frequently, by conveying a false notion of them, been productive of such methods of treatment, as are diametrically opposite to those which ought to be pursued. It is well observed by *Pott*, that a small orifice or outlet from a large or deep cavity, discharging a thin gleet or sanies, made a considerable part of the idea, which our ancestors had of a fistulous sore, wherever seated. With the term fistulous, they always connected a notion of callosity; and, therefore, whenever they found such a kind of

opening yielding such sort of discharge, and attended with any degree of induration, they called the complaint a *fistula*. Imagining this callosity to be a diseased alteration made in the very structure of the parts, they had no conception, that it could be cured by any means but by removal, with a cutting instrument, or by destruction with escharotics; and, therefore, they immediately attacked it with knife or caustic, in order to accomplish one of these ends.

Collections of matter from inflammation (wherever formed), if they be not opened in time, and in a proper manner, do often burst. The hole, through which the matter finds vent, is generally small, and not often situated in the most convenient or most dependent part of the tumour: it therefore is unfit for the discharge of all the contents of the abscess; and, instead of closing, contracts itself to a smaller size, and, becoming hard at its edges, continues to drain off what is furnished by the sides of the cavity.

When an abscess near the anus bursts, the smallness of the accidental orifice; the hardness of its edges; its being found to be the outlet from a deep cavity; the daily discharge of a thin, gleety, discoloured kind of matter; and the induration of the parts round about, have all contributed to raze and confirm the idea of a true fistula.

Abscesses about the anus present themselves in different forms.

Sometimes the attack is made with symptoms of high inflammation; with pain, fever, rigor, &c. and the fever ends as soon as the abscess is formed. In this case a part of the buttock, near the anus, is considerably swollen, and has a large circumscribed hardness. In a short time, the middle of this hardness becomes red and inflamed, and in the centre of it matter is formed.

The pain is sometimes great, the fever high, the tumour large, and exquisitely tender; but however disagreeable the appearances may have been, or however high the symptoms may have risen, before suppuration, yet, when that end is fairly and fully accomplished, the patient generally becomes easy and cool; and the matter formed under such circumstances, though it may be plentiful, is good.

On the other hand, the external parts, after much pain, attended with fever, sickness, &c. are sometimes attacked with considerable inflammation, but without any of that circumscribed hardness which characterizes the preceding tumour; instead of which the inflammation is extended largely; and the skin wears an erysipelatous kind of appearance. In this the disease is more superficial, the quantity of matter small, and the cellular membrane sloughy to a considerable extent.

Sometimes, instead of either of the preceding appearances, a gangrenous suppuration takes place, and the cellular tissue is affected in the same manner as it is in a carbuncle.

In this case, the skin is of a dusky red or purple kind of colour; and, although harder than in a natural state, it has, by no means, that degree of tension or resistance, which it has either in phlegmon, or in erysipelas. The patient has generally, at first, a hard, full, jarring pulse, with great thirst and restlessness. If the progress of the disease be not stopped, or the patient relieved by medicine, the pulse soon changes into an unequal,

low, faltering one; and the strength and the spirits sink in such manner, as to imply great and immediately impending mischief. The matter formed under the skin, so altered, is small in quantity, and bad in quality, and the adipose membrane is gangrenous and sloughy throughout the extent of the discoloration.

Sometimes the disease makes its first appearance in the induration of the skin, near to the verge of the anus, but without pain or alteration of colour; which hardness gradually softens and suppurates. The matter, when let out in this case, is small in quantity, good in quality; and the sore is superficial, clean, and well-conditioned. On the contrary, it now and then happens, that although the pain is but little, and the inflammation apparently slight, yet the matter is large in quantity, bad in quality, extremely offensive, and proceeds from a deep crude hollow. (*Pott.*)

Sir Benjamin Brodie remembers a gentleman, in whom an abscess formed by the side of the rectum, and who was not conscious of any local symptoms; "but he had been for some time subject to headach, was languid, forced to go home, and lie down in the middle of the day. One day, as he was walking in the streets, the abscess burst; and that was the first thing which gave him any notice of its existence." (*See Lond. Med. Gaz. for 1835, 1836, p. 26.*)

The place where the abscess points, and where the matter, if let alone, would burst its way out, is various and uncertain. Sometimes, it is in the buttock, at a distance from the anus; at other times near its verge, or in the perineum; and this discharge is made sometimes from one orifice only, sometimes from several. In some cases, there is not only an opening through the skin, externally, but another through the intestine into its cavity; in others, there is only one orifice, and that either external or internal.

Sometimes the matter is formed at a considerable distance from the rectum, which is not even laid bare by it; at others, it is laid bare also, and not perforated: it is also sometimes not only denuded, but pierced; and that in more places than one.

All consideration of preventing suppuration is generally out of the question: and our business, if called at the beginning, must be to moderate the symptoms; to forward the suppuration; when the matter is formed, to let it out; and to treat the sore in such manner as shall be most likely to produce a speedy and lasting cure.

When no symptoms require particular attention, and all that we have to do is to assist the maturation of the tumour, a soft poultice is the best application. When the disease was of the phlegmonous kind, Mr. Pott preferred letting the skin become very thin before an opening was made in it; but, at the present day, abscesses near the anus and rectum are commonly opened directly the matter has formed. This kind of tumour is generally found in people of full sanguine habits; and who, therefore, if the pain be great, and the fever high, will bear evacuation, both by phlebotomy and gentle cathartics.

When the inflammation is erysipelatous, the quantity of matter formed is small, compared with the size and extent of the tumour; the disease is rather a sloughy, putrid state of the cellular membrane, than a single abscess, and, therefore, the

sooner it is opened the better: if we wait for the matter to make a point, we shall wait for what will not happen; at least not till after a considerable length of time, during which the disease will extend itself.

When, instead of either of the preceding appearances, the skin wears a dusky purplish-red colour; has a doughy, unresisting kind of feel, and very little sensibility: when these circumstances are joined with an unequal faltering kind of pulse, irregular shiverings, a great failure of strength and spirits, and inclination to dose, the case is formidable, and the event generally fatal.

The habit, in these circumstances, is always bad; sometimes from nature, but much more frequently from gluttony and intemperance. What assistance art can lend, must be administered speedily; every minute is of consequence; and if the disease be not stopped, the patient will sink. Here (says Pott) is no need for evacuation of any kind: recourse must be immediately had to medical assistance; the part affected should be frequently fomented; a large and deep incision should be made into the diseased part, and the applications made to it should be of the warmest, most antiseptic kind.

Strangury, dysury, and even total retention of urine, are no very uncommon attendants upon abscesses in the neighbourhood of the rectum and bladder: more especially if the seat of them be near the neck of the latter organ. They sometimes continue from the first attack of the inflammation until the matter is formed, and has made its way outward, and sometimes last a few hours only.

The two former most commonly are easily relieved by the loss of blood, and the use of gum arabic, with nitre, &c. But in the total retention, they who have not often seen this case generally have immediate recourse to the catheter; but this practice was condemned by Pott, who observes that the retention here is spasmodic, and arises from irritation, notwithstanding the participation of the neck of the bladder in some degree in the inflammation.

The following is the practice advised by Pott:—Loss of blood is necessary, the quantity to be determined by the strength and state of the patient; a gentle cathartic: but the most effectual means of relief seemed to him to be the warm bath, or semicupium; the application of bladders with hot water to the pubes and perineum; and, above all other remedies, the injection of a glyster, consisting of warm water, oil, and opium.

A painful tenesmus is no uncommon attendant upon an inflammation of the parts about the rectum. If a dose of rhubarb, joined with the confect. opii, does not remove it, the injection of thin starch and opium, or tinct. thebaic., is almost infallible.

The bearing down in females, as it proceeds, in this case, from the same kind of cause (*viz.* irritation), admits of relief from the same means as the tenesmus.

In some habits, an obstinate costiveness attends this kind of inflammation, accompanied, not unfrequently, with a painful distention and enlargement of the hemorrhoidal vessels, both internally and externally. While a large quantity of hard feces is detained within the large intestines, the whole habit must be disordered; and the symptomatic fever, which necessarily accompanies the

formation of matter, must be considerably heightened. And while the vessels surrounding the rectum (which are large and numerous) are distended, all the ills proceeding from pressure, inflammation, and irritation, must be increased. Here we must agree with Pott, that phlebotomy, laxative glysters, and a low cool regimen must be the remedies: while a soft cataplasm, applied externally, will serve to relax and mollify the swollen indurated piles, at the same time that it hastens the suppuration.

When abscesses have formed, and are fit to be opened, or when they have already burst, they may be reduced to two general heads,—viz.

1. Those, in which the intestine is not at all interested: and,
2. Those, in which it is either laid bare, or perforated.

In making the opening, the knife or lancet should be passed in deep enough to reach the fluid; and when it is in, the incision should be continued upward and downward, in such manner as to divide all the skin covering the matter. By these means, the contents of the abscess will be discharged at once; future lodgment of matter will be prevented, and convenient room will be made for the dressings.

Notwithstanding all these collections of matter are generally called *fistulae*, and are all supposed to affect the rectum, the abscess is sometimes really at a distance from the gut, and none of these cases either are or can be originally *fistulae*. (Pott.)

Abscesses near the rectum happen with particular frequency in persons who are habitually constive, and, according to Sir Benjamin Brodie, in those also who have been troubled with piles. His observations confirm the truth of some cases on record, where abscesses of the rectum are stated to have been produced by foreign bodies penetrating through the mucous membrane of the bowel and sphincter muscle, into the cellular tissue. "I was sent for (he informs us) to a gentleman, who had a very uneasy feeling in the rectum. I thought he laboured under internal piles, and prescribed for him something, which, however, did not relieve him. The next day, as he was no better, I examined the rectum, and found a hard substance sticking in the mucous membrane: with some difficulty I extracted it, and found it to be part of the core of an apple, which the patient had eaten." If this had not been extracted, no doubt an abscess might have been produced by the side of the gut. Sir Benjamin Brodie was sent for to another patient, who had an abscess near the rectum; and, after he had opened it, he detected a long fish-bone sticking across it, which was extracted. The bone had evidently penetrated the mucous membrane of the bowel; and, in all probability, some feculent matter had passed by the side of it, so as to account for the remarkable putridity of the matter. (See *Lond. Med. Gaz.* for 1835, 1836, p. 27.) The experience of Sir Benjamin Brodie likewise agrees with the remarks made by the greater number of writers on this subject, respecting the occasional formation of abscesses near the rectum in persons otherwise healthy, though they take place far more commonly in unhealthy individuals.

A few years ago, some interesting remarks on *fistulae* in and were published in France by M.

Ribes, deduced from the dissection of not less than seventy-five persons, who had died with fistulae. No man, who has seen much of this part of surgery, can doubt that the most frequent form of the disease is that, in which the abscess has only an external opening, and does not perforate the rectum at all, from which, indeed, the matter is sometimes more or less distant. Nor can any experienced surgeon question the truth of Mr. Pott's account, respecting the diversity of the nature of the cases of fistulae, some being phlegmonous, some erysipelatous, and others more like the carbuncle in their origin, progress, and consequences. But, besides these circumstances, another one worthy of notice is, that the presence of fistula in and by no means always implies the previous or present existence of piles. However, notwithstanding these considerations, the doctrine started by M. Ribes is, that a fistula is formed by the bursting of an internal pile into the rectum, and the consequent passage of a portion of the contents of the bowel into the orifice. Now this is not the common mode in which an abscess near the anus is occasioned; yet it sometimes appears, as an exception to the common course of things. Sir Benjamin Brodie speaks of two kinds of abscesses as happening in connection with piles. First, an abscess may form in an external pile, and burst externally. Sometimes, says he, it will heal, and not form again; at other times, it will heal and then form again. Secondly, an abscess may form in internal piles, which burst into the cavity of the rectum; and this sometimes heals spontaneously and sometimes not. (Brodie, in *Lond. Med. Gaz.* for Oct. 1835, p. 26.) According to M. Ribes, the orifice is always within five or six lines above the junction of the internal membrane of the bowel with the external skin, and may usually be seen, if the patient forces the gut gently down, as in going to stool. This account of the common situation of the internal opening, when the abscess communicates with the bowel, agrees with the observations of Subatier, Larrey, and Chelius. (See *Récherches sur la Situation de l'Orifice interne de la Fistule de l'Anus*, &c. *Quarterly Journ. of Foreign Med.* No. 8. Oct. 1820; *Larrey*, in *Mém. de Chir. Mil.* t. iii. p. 415; *Chelius*, *Handb. der Chir.* b. i. p. 577. 8vo. Heidelberg. 1826.)

If a large and convenient opening has been made by a simple incision, the contents of the abscess have been discharged, and a cavity left, which is to be filled up, the dressings ought to be so small in quantity as to permit nature to bring the sides of the cavity towards each other, and they ought not by their quality either to irritate or destroy.

In this, as in most other cases, where there are large sores or considerable cavities, a great deal will depend on the patient's habit, and the care that is taken of it; if that be good, or if it be properly corrected, the surgeon will have very little trouble in his choice of dressings; only to take care that they do not offend either in quantity, or quality: but if the habit be bad, or injudiciously treated, he may (according to Pott's expression) use the whole farrago of externals, and only waste his own and his patient's time.

By light easy treatment, large abscesses formed in the neighbourhood of the rectum will sometimes be cured, without any necessity for meddling

with the bowel. But more frequently the intestine, although it may not have been pierced by the matter, has yet been so denuded that no consolidation of the sinus can be obtained but by a division; that is, by laying the two cavities, viz. that of the abscess, and that of the intestine, into one.

Sir Benjamin Brodie admits, with Pott, that abscesses near the rectum, after discharging themselves, sometimes heal up like others. This, however, he considers as an exception to a general rule. In the majority of examples, if nothing be done, the opening will continue, sometimes discharging little and sometimes much; or it will alternately close and break. Sir Benjamin Brodie has seen several cases (and most other surgeons of experience must have seen the same thing) where a neglected fistula has continued in this state for years. This, however, is what ought not to be allowed; for, sooner or later, the case may assume a formidable character. The following case is related by this eminent surgeon:—A gentleman had had an abscess by the side of the rectum for twenty years, sometimes discharging a little matter, then stopping, and afterwards discharging again. Three or four months before Sir Benjamin Brodie was consulted the orifice closed, and did not open again as usual; after this the patient soon began to suffer a great deal of pain, and became exceedingly ill. Sir Benjamin Brodie examined the rectum, and satisfied himself of the existence of a very large deep abscess; a lancet was introduced by the side of the gut, and it went in quite up to the handle before the matter was reached. When a little matter had escaped, a director was introduced, and the opening freely dilated with a probe-pointed bistoury; a pint or more of very putrid matter immediately flowed out. Afterwards another enlargement of the wound became necessary, and the patient recovered from a dangerous state, produced entirely by the neglect of a trifling case. (*Op. et vol. cit. p. 28.*) The reason of abscesses near the rectum less frequently healing up than others, is referred by Sir Benjamin Brodie to the sinus, or passage for the matter, running through the sphincter muscle. "The sphincter muscle is constantly in motion, contracting and dilating, and consequently there is not the repose which is necessary for the cure of the abscess." (*Op. et vol. cit. p. 27.*) Sir Benjamin Brodie acknowledges, that an abscess sometimes forms high up by the side of the rectum, above the sphincter; but this he regards as an occurrence comparatively rare. "These abscesses (he observes) attain a very large size before the patient suffers much pain or inconvenience. There is at first merely a sense of bearing down of the rectum, occasioned by the pressure of the abscess on it; but as the abscess increases in size, the patient has violent painful spasms, and a constant feeling as if he wanted to pass a motion, while there are no feces in the bowel. His sufferings are now excessive. You examine the external parts, and you see nothing; you introduce your finger into the rectum, and there you perceive the abscess pressing on one side of the gut, and very much diminishing its diameter. Having thus ascertained the position of the abscess, if you examine the external parts again, although you could discover nothing in the first instance, you will probably be able to detect it, deep seated as it is, at the side of the anus. More resistance will

be offered to the pressure of the finger here than elsewhere; and if you introduce two fingers of the left hand into the rectum, and press on the abscess from within, you will make it actually bulge a little externally." Sir Benjamin Brodie then proceeds to explain, that abscesses, formed high up by the side of the rectum, if left to themselves, generally burst into it.

When the intestine is found to be separated from the surrounding parts by the matter, the operation of dividing it should be performed at the time the abscess is first opened, and not be deferred. For, if it be done properly, it will add so little to the pain which the patient must feel by opening the abscess, that he will seldom be able to distinguish the one from the other, either with regard to time or sensation; whereas, if it be deferred, he must either be in continual expectation of a second cutting, or feel one at a time when he does not expect it.

The intention in this operation is to divide the intestine, from the verge of the anus, up as high as the top of the hollow in which the matter was formed; thereby to lay the two cavities of the gut and abscess into one, and by means of an open wound, instead of a hollow or sinuous sore, which serves for the lodgment of matter, to obtain a firm and lasting cure. The operation, however, is effectual partly on another principle, first particularly explained by Sir Benjamin Brodie. The division of the sphincter muscle had indeed been insisted upon by others (see *Chelius, Handb. der Chir. b. i.*); but the principle of its utility had not been duly pointed out. "When the abscess is laid open, the fibres between it and the bowel must be divided; and the sphincter muscle being thus set at liberty, not only is there a free and ready escape for the matter, but the action of the muscle, which prevents the healing of the abscess, is put an end to. This then is the mode of curing the abscess: lay it open into the bowel, dividing at the same time the fibres of the sphincter muscle, which lie over it." (*Brodie.*)

For this purpose, the curved probe-pointed knife, with a narrow blade, is the most useful and handy instrument of any. This, introduced into the sinus, while the surgeon's forefinger is in the intestine, will enable him to divide all that can ever require division; and that with less pain to the patient, with more facility to the operator, as well as with more certainty and expedition, than any other instrument whatever. If there be no opening in the intestine, the smallest degree of force will thrust the point of the knife through, and thereby make one; if there be one already, the same point will pass through it. In either case, it will be received by the finger in ano; will thereby be prevented from deviating; and being brought out by the same finger, must necessarily divide all that is between the edge of the knife and the verge of the anus. (*Pott.*)

Besides the operation with the probe-pointed bistoury, as described by Pott, surgeons often practise another with a silver director and sharp-pointed bistoury. The director is introduced into the sinus, and then into the rectum, either through the internal opening, if one already exists, or by making it gradually penetrate through the coats of the bowel if no internal opening can be discovered. Then the director is to be bent, so as to make one extremity of it project through the

anus; and the soft parts which lie over it divided, by the sharp-pointed bistoury along its groove. See Brodie, in *Lond. Med. Gaz.* for 1835, 1836, p. 184.) When there are several sinuses, and any of them are left undivided, the operation will probably not bring about a cure; hence the common maxim, that every sinus must be laid open.

Sir Benjamin Brodie usually divides the sphincter from within outwards with a probe-pointed bistoury, the cutting edge of which is slightly convex. The forefinger is passed into the rectum, quite above the sphincter, as a guide to the bistoury. The sphincter is then cut across, and the incision extended fairly into the surrounding fat; two or three strokes of the knife are generally required. In females, the incision should never be made towards the vagina, for it will never heal properly in this situation, and the sphincter will not become perfect again; so that the patient will be left with an incontinence of feces. In neither sex should the incision be directed towards the coccyx; because in this way only the inner fibres of the sphincter can be divided, and the contractile power of the muscle remains, and interferes with the cicatrization of the wound. (Brodie, *Op.* et vol. cit. p. 187.) The following remarks by Sir Benjamin Brodie deserve to be well remembered:—"The advantage of the division of the sphincter is not merely theoretical. There are few cases, in which it will not greatly facilitate the ultimate cure, preventing the burrowing of matter, and the formation of fresh sinuses, and rendering the subsequent dressings more easy to the surgeon, and less painful to the patient. It is, however, to the more complicated cases of fistula that the division of the sphincter is especially applicable; as, for example, where the sinus is of unusual extent, or where there are several sinuses, or where you are not certain that you have been able to detect the whole of them, or where the neighbouring parts are extensively indurated. It is quite a mistake to suppose, that there is any well-founded objection to even the most free division of the sphincter; even in the first instance it scarcely interferes with the retention of the feces, except they are actually liquid; and the muscle never fails to become perfectly united, and afterwards perform its functions as well as ever. Nor have I ever known any hemorrhage arise, which was not readily commanded by a dossil of lint introduced into the wound, and the pressure of the finger continued for a short space of time. If there be any considerable bleeding vessel, it is not difficult to secure it with the tænuaculum and ligature; but this is seldom necessary." (*Op.* et vol. cit. p. 184.)

Immediately after the operation, a soft dossil of fine lint should be introduced (from the rectum) between the divided lips of the incision; as well to repress any slight hemorrhage, as to prevent the immediate reunion of the said lips; and the rest of the sore should be lightly dressed with the same. Cramping the sinuses with lint, besides causing great pain, would prevent the free escape of purulent matter, and promote the formation of new sinuses. Sometimes it is advantageous to give a few drops of laudanum after the operation, on the principle specified by Sir Benjamin Brodie; namely, not with the view of relieving pain, but of occasioning constipation, which will allow the

dressings to remain undisturbed for two or three days. After this, a gentle aperient may be administered, which will prevent the ill effects of too long-continued constipation, and, at the same time, bring away the first dressings. Instead of immediately applying dressings again, Sir Benjamin Brodie prefers a poultice for three or four days, until the first inflammation consequent on the operation has subsided. After this, he dresses the sinuses daily, either with dry lint, or with lint spread with some stimulating ointment, or soaked in a stimulating lotion; always observing the rule to dress lightly. This first dressing should be permitted to continue until suppuration renders it loose enough to come away easily; and all the future ones should be as light, soft, and easy as possible. (*Pott.*)

When the matter is fairly formed,—when it points, and is fit to be let out, the opening should be made where such point is; that is, where the skin is most thin, and the fluctuation most palpable.

When a discharge of the matter by incision is too long delayed or neglected, the abscess makes its own way out, by bursting somewhere near to the fundament, or through the intestine into its cavity; or sometimes in both directions. In either case, the discharge is made sometimes by one orifice only, and sometimes by more. Those in which the matter has made its escape by one or more openings through the skin only, are called *blind external fistulae*; those in which the discharge has been made into the cavity of the intestine, without any orifice in the skin, are named *blind internal*; and those which have an opening both through the skin, and into the gut, are called *complete fistula*.

The most frequent of all are what are called the *blind external*; and the *complete*. The method whereby each of these states may be known is, by introducing a probe into the sinus by the orifice in the skin, while the forefinger is within the rectum.

Whether the case be what is called a complete fistula or not, that is, whether there be an opening in the skin only, or one there and another in the intestine, the appearance to the eye is much the same. Upon discharge of the matter, the external swelling subsides, and the inflamed colour of the skin disappears; the orifice, which at first was sloughy and foul, after a day or two are past becomes clean, and contracts in size; but the discharge, by fretting the parts about, renders the patient still uneasy.

As this kind of opening seldom proves sufficient for a cure (though it sometimes does), the induration, in some degree, remains; and if the orifice happens not to be a depending one, some part of the matter lodges, and is discharged by intervals, or may be pressed out by the fingers of an examiner. The disease, in this state, is not very painful; but it is troublesome, nasty, and offensive: the continual discharge of a thin kind of fluid from it creates heat, and causes excoriation in the parts above; it daubs the linen of the patient, and is at times very fetid: the orifice also sometimes contracts so as not to be sufficient for the discharge; and the lodgment of the matter then occasions fresh disturbance, an illustration of which is afforded in the case which I have quoted from Sir Benjamin Brodie.

The means of cure proposed and practised by

our ancestors were three; viz. caustic, ligature, and incision.

The intention in each of these is the same, viz. to form one cavity of the sinus and intestine, by laying the former into the latter. The two first are now completely, and most properly, exploded.

Hitherto we have considered the disease either as an abscess, from which the matter has been let out by an incision made by a surgeon, or from which the contents have been discharged by one single orifice, formed by the bursting of the skin somewhere about the fundament. When, instead of one such opening there are several, the quantity of matter has been large, the inflammation of considerable extent, the cellular membrane sloughy, and the skin very thin before it burst, it was formerly believed that each of these orifices was an outlet from a distinct sinus, or hollow; but commonly these openings are only so many distinct burstings of the skin covering the matter; and do all, be they few or many, lead and open immediately into the one single abscess. Hence, as Pott argues, the treatment of this case ought to be very little, if at all, different from that of the preceding; and each of the orifices should be divided in such manner as to make one cavity of the whole. This the probe-knife will easily and expeditiously do.

When a considerable quantity of matter has been recently let out, and the internal parts have not yet had time to approach each other, the inside of such cavity will appear large; and if a probe be pushed with any degree of force, it will pass in more than one direction into the cellular membrane by the side of the rectum. But, as Pott justly remarks, let not the unexperienced practitioner be alarmed at this, and immediately fancy that there are so many distinct sinuses; neither let him, if he be of a more hardy disposition, go to work immediately with his director, knife, or scissors; let him enlarge the external wound by making his incision freely; let him lay all the separate orifices open into that cavity; let him divide the intestine and sphincter lengthwise by means of his finger in ano; let him dress lightly and easily; let him pay proper attention to the habit of the patient; and wait, and see what a few days, under such conduct, will produce. By this, he will frequently find that the large cavity of the abscess will become small and clean; that the induration round about will gradually lessen; that the probe will not pass in that manner into the cellular membrane; and, consequently, that his fears of a multiplicity of sinuses were groundless. On the contrary, if the sore be crammed or dressed with irritating or escharotic medicines, the hardness will increase; the lips of the wound will be inverted; the cavity of the sore will remain large, crude, and foul; the discharge will be thin, gleety, and discoloured; the patient will be uneasy and feverish; and, if no new cavities are formed by the irritation of parts, and confinement of matter, yet the original one will have no opportunity of contracting itself, and may become truly fistulous.

Sometimes the matter of an abscess, formed near the anus, instead of making its way out through the skin, externally near the verge of the anus, or in the buttock, pierces through the intestine only. This is what is called a *blind internal fistula*. In this case, after the discharge has been made, the greater part of the tumefaction subsides,

and the patient becomes easier. If this does not produce a cure, which sometimes, though very seldom, happens, some small degree of induration generally remains in the place where the original tumour was; upon pressure on this hardness, a small discharge of matter is frequently made per anum; and sometimes the expulsion of air from the cavity of the abscess into that of the intestine may very palpably be felt, and clearly heard; the stools, particularly if hard, and requiring force to be expelled, are sometimes smeared with matter; and although the patient, by the bursting of the abscess, is relieved from the acute pain which the collection occasioned, yet he is seldom perfectly free from a dull kind of uneasiness, especially if he sits for any considerable length of time in one posture. The real difference between this kind of case and that in which there is an external opening (with regard to method of cure), is very immaterial; for an external opening must be made, and then all difference ceases. In this, as in the former, no cure can reasonably be expected, until the cavity of the abscess, and that of the rectum, are made one; and the only difference is, that in the one case we have an orifice at or near the verge of the anus, by which we are immediately enabled to perform that necessary operation; in the other, we must make one.

Abscesses near the rectum frequently occur in patients who are labouring under tubercles and abscesses of the lungs. Hence, Sir Benjamin Brodie very properly recommends surgeons, before they operate on a patient for fistula, to ascertain whether the lungs are sound. "Persons, with diseased liver, and other visceral diseases (he observes), are also liable to the formation of these abscesses. The distinction of these cases from others, which occur in otherwise healthy subjects, is very important, inasmuch as the practice, which is proper in the one case, is quite improper in the other." (See *Lond. Med. Gaz.* vol. cit. p. 28.) He adds, if the patient labour under visceral disease, it is seldom that the abscess will heal; but if it should, the visceral disease will make increased progress, and the patient die sooner if the operation be performed than if it were let alone. (P. 29.) Every well-informed surgeon will likewise coincide in the prudence of not operating for a fistula, if stricture, or carcinoma of the rectum exist; for, under these circumstances, the sinus will not heal, even if be laid open.

The surgery, required in these cases, consists in laying open and dividing the sinus, or sinuses, in such manner, that there may be no possible lodgment for matter, and that such cavities may be fairly opened lengthwise into that of the rectum. The dressings should be soft, easy, and light; and the whole intent of them to produce such suppuration as may soften the parts, and bring them into a state fit for healing.

If a loose fungous kind of flesh has taken possession of the inside of the sinus, a slight touch of the lunar caustic will reduce it sooner, and with better effect on the sore, than any other escharotic whatever.

Modern writers also speak of a smooth adventitious membrane, which is found to line old fistulae, and frequently to hinder the success of the operation (see *Quarterly Journ. of Foreign Medicine*, &c. No. 8.); a complication, which would undoubtedly justify the recourse to mea-

tures for the extirpation of such membrane. But, my own belief is, that a case, hindered from getting well by this cause, is very rare in comparison with others, in which the cure is prevented by the matter being still more or less confined, and not having as free an outlet as circumstances demand.

* If the bad state of the sore arises merely from its having been crammed and irritated, the method of obtaining relief is obvious. A patient who has been so treated, has generally some degree of fever; has a pulse which is too hard, and too quick; is thirsty, and does not get his due quantity of natural rest. A sore which has been so dressed, has generally a considerable degree of inflammatory hardness round about; the lips and edges of it are found full, inflamed, and sometimes inverted; the whole verge of the anus is swollen; the hemorrhoidal vessels are loaded; the discharge from the sore is large, thin, and discoloured; and all the lower part of the rectum participates in the inflammatory irritation, producing pain, bearing down, tenesmus, &c. All escharotics must be thrown out and disused; and, in lieu of them, a soft digestive should be substituted, in such manner as not to cause any distention, or to give any uneasiness from quantity; over which a poultice should be applied, and the patient should be enjoined absolute rest. At the same time, attention should be paid to the general disturbance, which the former treatment may have created. Blood should be drawn off from the sanguine; the feverish heat should be calmed by proper medicines; the languid and low should be assisted with bark and cordials; and ease in the part be obtained by the injection of ano-lyne clysters of starch and opium.

Abscesses are frequently formed about the lumbar vertebra, under the psoas muscle, and near the sacrum; in which cases, the bones are sometimes carious, and sinuses may run down by the side of the rectum, and burst near the fundament. The treatment of such sores and sinuses can have little influence on the remote situation, where the collection of matter is originally formed. (See LUMBAR ABSCESS.)

Sometimes, in attempting to cure what seems to be a common fistula, we find that it does not get well; and, in the end, a copious abscess is discovered higher up, which prevents the closing of the smaller sinus below. (See Brodie, in *Lond. Med. Gaz.* vol. for 1835, 1836, p. 28.) I have had opportunities of seeing several cases corresponding to this accurate description. In another place, Sir Benjamin Brodie, in adverting to a few cases which are met with, and kept from healing by some undetected sinus, relates the particulars of one instance, in which a lady had several sinuses near the rectum. Sir Benjamin Brodie laid open all he could find; but she continued uncured a considerable time, during all which she complained of uneasy sensations, which could not be accounted for. After repeated examinations, a sinus was detected high up, not more than an inch in length, and seemingly involving the levator ani. This having been laid open, a cure soon followed. (See *Lond. Med. Gaz.* for 1835, 1836, p. 185.)

Fistulous sores, sinuses, and indurations about the anus, which are consequences of diseases of the neck of the bladder, and urethra, called fistula in perineo, require separate and particular consideration. (See FISTULA IN PERINEO.)

Some years ago, M. Roux published a critique

The plan is preface
in the use of a kind of director, called a gorget, which is usually made of ebony or box-wood, and intended to be introduced within the rectum, with its concavity turned towards the fistula. A steel director, slightly pointed, and without a cul-de-sac, is then passed through the fistula till the point comes into contact with the wooden gorget. A long, narrow, sharp-pointed, straight bistoury is now introduced along the groove of the steel director, till its point meets the groove of the ebony gorget, by cutting upon which all the parts are divided, which lie between the internal opening of the fistula and the anus. It may be objected to this method, that it is not always easy to make a director pass at once through the fistula into the rectum. This is acknowledged by Richerand, who adds, that, in this circumstance, the point of the director may be forced into the rectum, without lessening the chance of the success of the operation. (*Nosogr. Chir.* t. iii. p. 463, 464. ed. 4.) A flexible silver director will be more likely to follow the track of the fistula completely into the rectum, than a steel one; and the finger of the surgeon will always do the office of the wooden gorget with greater convenience. The only purpose which such a contrivance answers, seems to Sir Benjamin Brodie to be that of saving the surgeon's forefinger; but, in using it, an advantage is lost, that of the sense of touch; "and (-says he), in my own practice, I have found that I could complete the operation better with my fore-finger than the wooden gorget." (*Op.* et vol. cit. p. 184.) M. Roux censures us for not cramming the wound with charpie; for he is not content with merely introducing into it a dossil of lint. (See *Parallèle de la Chir. Anglaise*, &c. p. 296. &c.) His countryman, Pouteau, however, long ago expressed his decided conviction of the inutility of cramming the wound with dressings to its very bottom after the third day, when superficial dressings, and the renewal of them as often as cleanliness requires, will be fully sufficient. This agrees with the remark of Sir Benjamin Brodie, "that it is chiefly in consequence of the use of too much lint in dressing, that further operations frequently wanted before the cure is completed. The daily dressing should be repeated until the cut surfaces are cicatrized, but no longer. The cicatrization of the bottom of the sinus will be completed better without the dressing than with it." (*Op.* et vol. cit. p. 185.) After the sinuses are healed, there is always a sort of fissure or chink left by the side of the anus. If the sinus has been deep, this chink will be deep in proportion; and then an inconvenience will follow, which may lead the patient to fear he is not cured, though he is so in reality. "The efflux of the rectum, sometimes stained with the feces, will flow through it and stain the linen. But (as Sir Benjamin Brodie adds), this is only temporary; the chink, however deep, will gradually close, and the mucus will ultimately be retained as well as ever."

Operations for fistulae in ano may be followed by very troublesome hemorrhage; but this happens, I believe, chiefly in patients, whose hemorrhoidal vessels are enlarged, or where the surgeon deviates from the prudent advice delivered by

Sir Benjamin Brodie, with reference to such abscesses as are formed high up by the side of the rectum, and above the sphincter. In such cases, he directs the lancet to be carried through the skin by the side of the anus, until the matter flows. Then a probe-pointed bistoury is to be introduced, and the rectum divided at the lower part of the abscess, and the incision carried through the sphincter. It is quite unnecessary to lay the whole abscess open into the rectum, and it might give rise to a dangerous hemorrhage from vessels beyond the reach of the finger. (*Brodie, Op. et vol. cit. p. 186.*) Like all other mechanical injuries, operations for fistula may give rise to erysipelas, and, in some rare examples, to traumatic tetanus. With respect to erysipelas, Sir Benjamin Brodie notices its occasional extension in a few instances up the mucous membrane of the rectum into other parts of the intestinal canal; a formidable disease, the symptoms of which are peculiar, but not described by any other writer. "The pulse (says Sir Benjamin Brodie) becomes very rapid, and, at the same time, weak; then it is irregular and intermitting. The abdomen is tympanitic, in consequence of the intestines being distended with air; hicough takes place; there is a great prostration of strength, and the patient often dies in the course of three or four days, sometimes sooner." On one lady, whom Sir Benjamin Brodie attended, the attack began when the wound of the operation was nearly healed up, and she died in less than forty-eight hours. He considers that, in consequence of the great prostration attendant on it, the disease demands the free exhibition of cordials and stimulants. (*See Lond. Med. Gaz. for 1835, 1836, p. 185.*)

*Le Dran's Operations; Sharp's Operations; La Faye's Notes on Dionis. H. Bass, De Fistula Ani feliciter curanda, in Halleri Disp. Chir. 4. 453. J. L. Petit, Traité des Mal. Chir. t. i. and ii. p. 115. Kirkland's Medical Surgery, vol. ii. Some of the best practical remarks ever published are contained in Pott's Treatise on the Fistula in Ano, in which he has offered also an excellent critique on the opinions of Le Dran, de la Faye, and Cheselden. Sabatier, Méd. Opératoire, t. ii. *J. Housharp, Practical Obs. on the Diseases of the Lower Intestines, &c. chap. 6 ed. 3. Lond. 1824. T. Whately, Cases of Polypi, &c.; with an appendix, describing an improved instrument for the fistula in ano, 8vo. Lond. 1805. J. T. Dietzmann, De Fistula Ani, 4to. Jenæ, 1812. Roux, Voyage fait à Londres en 1814, ou Parallèle de la Chirurgie Anglaise avec la Chirurgie Française, p. 296. 8vo. Paris, 1815. Schreger, Chirurgische Versuche b. i. Ueber die Unterbindung der Mastdarmfisteln, p. 1. 131 8vo. Nürnberg, 1818. Kothe, Darstellung, &c. der Afterfisteln, in Rust's Mag. b. i. s. 259. T. Ribes, Recherches sur la Situation de l'Orifice interne de la Fistule de l'Anus, et sur les parties dans l'épaisseur desquelles ces ulcères ont leur siège, in Revue Méd. Hist. et Phil. Paris, 1820, livr. i. p. 174. Fr. Reisinger, Darstellung eines neuen Verfahrens die Mastdarmfisteln zu unterbinden, &c. 8vo. Augsburg, 1816. Sir Benjamin C. Brodie, in Lond. Med. Gaz. for 1835 and 1836.**

ANUS, PROLAPSUS OF.

Prolapsus ani, technically called also *exania*, or *archoptosis*, but, more correctly, *prolapsus recti*, is commonly described as presenting itself under three forms; in one, the protrusion of the rectum involves both its mucous and muscular tunics; in a second, its mucous coat alone; in a third, the upper portion of the bowel descends into the lower, and the displacement is truly what is termed a *volvulus*, or *intussusception*. In this account, Sir Benjamin Brodie believes that there is a mistake, and that prolapsus of the rectum is frequently confounded with internal piles. But the difference between internal piles and real prolapsus of

the rectum, seems to him to be this: In the protrusion of the former, the mucous membrane covering them descends, and may be seen below the anus; but it is only the mucous membrane: whereas in a true prolapsus ani, the muscular tunic protrudes, as well as the mucous membrane. If one portion of bowel, inclusive of both these tunics, can slip down into another portion, why (inquires this distinguished surgeon) should not the rectum slip out at the anus? (*See Lond. Med. Gaz. for 1834 and 1835, p. 845.*) However, as I have already explained, the latter form of displacement is universally admitted; and the question which is raised refers to the point whether prolapsus ani ever really consists in a relaxation and protrusion of the mucous membrane of the rectum alone, without being essentially combined with internal piles. The inner coat of the rectum being connected to the muscular by a very loose elastic cellular tissue, naturally forms several folds, the use of which is to let the bowel dilate sufficiently for the retention of the excrement. This structure has appeared to some pathologists to account for the occasional protrusion of the mucous membrane, without being accompanied by the muscular coat. In one page, Baron Dupuytren speaks of "*la procidence de membrane muqueuse du rectum*," in common with other surgical writers; but, in the next, he describes the displacement as consisting in a descent of the upper portion of the rectum into the lower, down to the anus, and even beyond it, so as to constitute a protrusion from two to six inches in length. (*Clin. Chir. t. i. p. 157, 158.*) His view then seems to me to agree with that of Sir Benjamin Brodie. The swelling occasioned by the protrusion of the inner coat of the rectum, or of this, together with the muscular, is subject to considerable variety in respect to length and thickness; when small, resembling a mere ring; when large, and reaching far downwards, having an oblong globular form. The tumour sometimes admits of reduction with ease; sometimes it cannot be returned without difficulty. The disease is now and then met with in persons of all ages; but it is most common in infants and elderly subjects. When it exists in young adults, which is only seldom, Sir Benjamin Brodie has found that it has generally begun in early life. Children whose bowels are habitually confined, whose bellies are large and tumid, and in whom the contents of the abdomen seem too large for it, are more frequently, than others, afflicted with prolapsus ani. Sir Benjamin Brodie refers to an anatomical reason for the frequency of the complaint in children:—"It is because the prostate gland, urethra, and vesiculæ seminales, are not so much developed as in the adult. The attachment of the rectum to the surrounding parts does not extend so high in children as in persons of mature age; while the reflection of the peritoneum takes place lower down; and hence the rectum is more liable to be pushed out." (*Brodie, in Lond. Med. Gaz. vol. cit. p. 845.*) Such examples as are combined with thickening and relaxation of the inner coat of the rectum, internal hemorrhoids, or other tumours, are often attended with copious discharge of a thin mucous fluid, mixed with blood. The disease may originate from various causes:—

1. From circumstances tending to relax and weaken the parts, which retain the rectum, or its inner membrane, in its situation.

2. From various kinds of irritation and pressure on the bowel itself, having the effect of increasing the powers by which it is liable to be forced outward.

3. From any disease or irritation in the adjacent parts, and affecting the rectum sympathetically.

Hence, a prolapsus ani may be caused by long habitual crying, and great exertions of the voice; violent coughing; sitting long at stool; hard dry feces, and much straining to void them; obstinate diarrhoea, in infants, kept up by dentition; dysentery; chronic tenesmus; various diseases of the rectum itself; the abuse of aloetic medicines and emollient clysters; hemorrhoids; excrescences and thickenings of the inner membrane of the rectum; difficulty of making water; the efforts of parturition; a calculus in the bladder; paralysis of the sphincter and levator ani; and prolapsus vaginæ.

In general, the prolapsus takes place whenever the patients go to the water-closet, and, in some persons, it occurs whenever they are in the erect position. Dupuytren correctly notices, that this disposition of the rectum is often connected with a debilitated, relaxed constitution, and hemorrhoidal complaints. (*Clin. Chir. t. i. p. 158.*)

The inconveniences vary in different cases. — Sometimes the bowel falls down only when the patient is costive, and he is expelling some hardened feces; and when pushed up, it remains in its place till some accidental circumstance brings it down again. In some cases it may be returned; but the moment the patient begins to walk about, it descends again. In others, of long standing, the bowel becomes so fixed in its unnatural position that it cannot be returned. Then it is apt to become inflamed from friction, exceedingly painful, and sometimes ulcerated. (See *Brodie, Op. et vol. cit. p. 845.*)

Considering the degree of the disease, and the constriction by the sphincter, the symptoms are sometimes mild, the rectum generally bearing pressure, exposure to the air, and other kinds of irritation, better than any other bowel. Indeed, when the protrusion has continued a long while, the mucous membrane of the bowel becomes covered with a kind of cuticle. But the urgency and danger of a prolapsus ani are greater, when the swelling is large, recent, and conjoined with violent pain, inflammation, and febrile symptoms. When complicated with strangulation, the consequences may be a stoppage of the feces, severe pain, swelling, inflammation, and even gangrene. In short, all the evils may arise which attend **strangulated hernia**. The prognosis, therefore, varies according to the different degree, species, cause, and complication of the disease. The recent small moveable prolapsus ani, the cause of which admits of being at once removed, may be effectually cured. It should always be recollected, however, that when once the rectum has been affected with prolapsus, a tendency to protrusion from any slight occasional cause generally remains. The habitual prolapsus, which has existed for years, and comes on whenever the patient goes to stool, is the case most difficult of relief.

The treatment of prolapsus ani embraces three indications: —

1. Speedy reduction of the prolapsed part.
2. The retention of the reduced bowel.

3. The removal and avoidance of the causes, by which the disease has been induced.

In general, when the case is recent, and the tumour not of immoderate size, the reduction may be accomplished with tolerable ease, by putting the patient in a suitable posture, with the buttocks raised, and the thorax depressed, and by making gentle and skilful pressure, either with the palm of the hand or fingers. When difficulty is experienced, the patient, if young or robust, may be bled, and the part fomented. The large intestines may be emptied by means of a mild unirritating clyster, and half an ounce of the oleum ricini should be exhibited. In the habitual prolapsus ani, the patient himself is generally accustomed to reduce the part, or it goes up of itself when he lies down. When, however, the inflammation and swelling are urgent, there is a difference of opinion about the treatment, many writers stating, that the part ought on no account to be irritated by repeated attempts at reduction, and advising recourse to the antiphlogistic plan, especially leeches, fomentations, or, cold washes, and the exhibition of the oleum ricini, and not attempting reduction until the swelling has been lessened. When the reduction is prevented by a spasmodic resistance, the use of an anodyne poultice, or fomentations, a clyster of the same quality, the warm bath, and the internal use of opium, are recommended. Should the complaint not give way to the preceding remedies, nor admit of reduction, and the symptoms become more and more pressing, perhaps the constriction should be obviated by dividing the sphincter with a bistoury, an operation sanctioned by *Chelius*. (*Handb. der Chir. b. i. p. 775.*) Cases are recorded, in which the protruded part, either in the state of gangrene or of chronic hardness, thickening, and elongation, was removed with a knife or ligature. (See *Cheselden's Anatomy, &c. 1741; Kerstens, Historia Sedis prociidatæ, resectione feliciter sanata, Kilon. 1779; Whately, in Med. Trans. and Observ. vol. viii. No. 16.*) However, I should apprehend, that, in the circumstance of gangrene, the measures best calculated for stopping its course, detaching the sloughs, and keeping up the patient's strength, must always be more prudent than such an operation.

On the other hand, we have high authority for not insisting the plans above specified; and for trying to accomplish the reduction with less delay. The examples attended with difficulty of reduction, and hazard of gangrene, are noticed by Dupuytren. "Sometimes (he observes) the swelling of the parts is so great, and the sphincter so much inverted, that it strangulates the bowel, and aid is urgently required. The displaced organ is then of twice or thrice its proper size; assumes a red purplish colour, with an appearance of ecchymoses, and is sometimes in danger of sloughing to a greater or lesser extent. Under such circumstances, the reduction should be immediately performed in the following way: — The patient should lie on his belly, with the pelvis raised up by one or two pillows under it, so that the anus may be the highest part of the trunk. The tumour having been every where covered with wet cloths, and a compress laid over the centre of its outer end, gentle pressure is to be made on its base, in order to lessen its size; and then it is to be very gradually pushed towards the interior. Thus, the

reduction commences with the part last protruded." (*Dupuytren, Clin. Chir. t. i. p. 159.*) Scarifications and leeches he thinks objectionable. Undoubtedly, the removal of the part from its constricted state, by a prompt reduction of it, seems here as manifestly called for, as in a case of hernia; and, at all events, it is only when this is not immediately practicable, that other expedients are indicated.

The reduction having been effected, the forefinger should be passed up the rectum to ascertain that no intussusception exists above the sphincter. The bowel is then to be kept in its place by quietude and the recumbent posture; and, if there be a great tendency to relapse, it will be proper to apply to the fundament a piece of soft sponge, wetted with cold water, and supported with the T bandage. But if such means should not answer, and an habitual prolapsus ani recur, which is not unfrequent when the disease has been neglected, or its causes have long remained unremoved, some other apparatus like that described by Mr. Gooch, may be needed. (*Chir. Works, vol. ii. p. 150. ed. 1792.*) Trusses for prolapsus of the rectum may be procured. Others have used perforated balls of ivory. Callisen found the introduction of a piece of sponge within the rectum, fastened to a silver probe, give effectual support. In France, and also in other countries, instruments made of elastic gum, have sometimes been employed. (*Richerand, Nosogr. Chir. t. iii. p. 444. ed. 4.*) On account of the elasticity, and unirritating quality of this substance, I conceive it is better calculated than any other material for the construction of such instruments. It cannot be denied, however, that all foreign bodies in the rectum create serious annoyance. In the female sex, a vaginal pessary, rather prominent behind, will usually hinder the recurrence of the prolapsus. The horizontal posture should be observed as much as possible, and when the patient has a motion a bed-pan should be placed under him. Astringent injections are to be employed daily. Sir Benjamin Brodie speaks also in favour of a course of Ward's paste. (*See Lond. Med. Gaz. for 1834, 1835, p. 846.*) Of the latter practice I cannot speak from experience, never having had confidence enough in it to give it a trial, which may not, I confess, be a fair way of deciding.

After the reduction of a prolapsus ani, the disposition which gave rise to the protrusion generally still continues; and therefore, as Dupuytren observes, the reduction is only to be regarded as a palliative, and, in some cases, as a means of preventing dangerous consequences; but never as a mode of accomplishing a permanent cure. Cold bathing and cold washes have been tried for the latter purpose, on the principle of strengthening the sphincters, so that the descent of the bowel may be opposed. But this method requires long perseverance, and is so disagreeable to some patients that it is soon given up. Astringent lotions and compression with a sponge and T bandage, suppositories which, Dupuytren admits, do occasionally succeed in children, after a certain time, frequently fail, and especially in adults and old persons. (*Clinique Chir. t. i. p. 160.*) In such cases, recourse must be had to the operation first practised by Hey, or the modification of it adopted by Dupuytren.

The late Mr. Hey published some highly interesting remarks on the cure of the procidentia

ani in adults. In one gentleman, the disease took place whenever he had a stool, and continued for some hours, the gut gradually retiring, and at last disappearing, until he had occasion to go to the privy again. After each stool, he used to place himself in a chair, and obtain a little relief by making pressure on the prolapsed part; and he then was in the habit of going to bed, where the intestine by degrees regained its natural situation. While the bowel was down, there was a copious discharge from it of a thin mucous fluid, blended with blood. When the part was up, the anus was constantly surrounded by a thin, pendulous flap of integuments, generally hanging down to the extent of three fourths of an inch. Around the anus there were also several soft tubercles of a bluish colour, situated at the basis, and at the inner part of the pendulous flap. These were evidently formed by the extremity of the rectum. The patient, previously to the establishment of these habitual attacks of prolapsus ani, had been afflicted for several years with pain after each stool, protuberances at the extremity of the rectum, and discharge of blood and mucus. For these complaints he applied to Mr. Sharp, who gave him an ointment to be applied after each stool, some soapy pills to be taken, and recommended the use of a clyster a little before the time of going to stool. The latter remedy, however, could not be adopted, and no material benefit was derived from the others. Some years afterwards, when Mr. Hey was consulted, the foregoing symptoms continued; in addition to which there was the grievance of the prolapsus, which came on at every time of going to stool, and lasted for several hours. This judicious surgeon at first advised the patient to wash the prolapsed part with a lotion, composed of an infusion of oak-bark, lime-water, and spirit of wine, and keeping on the tumour compresses, wet with this fluid, and supported by the T bandage. The disease, however, was too obstinate to be cured by this treatment. Nor could Mr. Hey succeed in reducing the bowel when it came down. "Although (says he) the prolapsed part of the intestine consisted of the whole inferior extremity of the rectum, and was of considerable bulk, yet the impediment to reduction did not arise from the stricture of the sphincter ani, for I could introduce my finger with ease during the procidentia; but it seemed to arise from the relaxed state of the lowest part of the intestine, and of the cellular membrane which connects it with the surrounding parts. My attempt proved vain, as to its immediate object, yet it suggested an idea which led to a perfect cure of this obstinate disorder. The relaxed state of the part, which came down at every evacuation, and the want of sufficient stricture in the sphincter ani, satisfied me that it was impossible to afford any effectual relief to my patient, unless I could bring about a more firm adhesion to the surrounding cellular membrane, and increase the proper action of the sphincter. Nothing seemed so likely to effect these purposes, as the removal of the pendulous flap, and the other protuberances, which surrounded the anus." This operation was performed on the 13th of November. On the 15th the gut protruded, and did not gradually retire as it used to do. Mr. Hey attempted to procure ease by means of opiates and fomentations, and avoided immediately trying to reduce the

lapsed part. However, the prolapsus continued so long, that the appearance of the part began to alter, and, therefore, on the 16th he made an attempt at reduction, and succeeded with great ease. However, as a good deal of pain in the hypogastrium was still complained of, the patient was bled in the evening, and gently purged with the oleum ricini. These means gave relief; but, as some pain in the belly yet continued, an opiate was given. A low diet, linseed tea, lac amygdalæ, &c. were ordered, and a little of the oleum ricini every morning, or every other morning, with an opiate after a stool had been procured. "By proceeding in this manner for some days, regular stools were procured, without any permanent inconvenience. My patient recovered very well, and was freed from this distressing complaint, which had afflicted him so many years." (See *Hey's Pract. Obs.* p. 483. &c. ed. 2.)

This, and some other cases, which this gentleman has related, convincingly exemplify the necessity of paying attention to the removal of redundant skin, excrescences, hemorrhoids, and other tumours, situated about the lower part of the rectum, in cases of prolapsus ani; for, unless this object be accomplished, the disease may resist every other treatment. Mr. Howship prefers the ligature for the extirpation of the protuberances; but heartily commends the principle of the treatment proposed by Mr. Hey. (*Pract. Obs. on Diseases of the Lower Intestines*, p. 163. ed. 3.) An elderly gentleman, whom I know, was troubled for many years with a prolapsus ani, which used to come on several times a week, sometimes at the privy, and sometimes on other occasions. Several of the first surgeons were consulted, who failed in affording permanent benefit, because they omitted to extirpate some hemorrhoidal excrescences, situated at the lower part of the rectum; for, when these were afterwards removed, the prolapsus ani entirely disappeared.

Dupuytren finding, as Hey did, that the excision of piles, which so often accompany prolapsus ani, commonly prevented the return of the latter complaint, was led to cut off more or less considerable portions of the internal membrane of the rectum. However, as in one case a profuse hemorrhage took place, and, in another, a tedious suppuration, he subsequently adopted the plan of removing a certain number of the projecting folds, which may be seen converging from the circumference to the margin of the anus. The skin at the margin of the anus is thinner, and of a different colour from that of other parts; and contains numerous mucous cryptæ, which secrete an oily matter of a peculiar smell. It forms also prominent folds separated by fissures, which converge from the circumference of the margin to the centre of the anus. These folds extend up within the anus, and are the more numerous and prominent the closer the latter opening is; being effaced, when it is dilated. Their use is to facilitate such dilatation, and promote the evacuation of the feces. Beyond the skin is a stratum of fibro-cellular tissue, erectile tissue, as Cruveilhier calls it; higher up, the external sphincter; and still further up, the internal sphincter. (See *Dupuytren, Clinique Chir.* t. i. p. 161.) The method, practised by this distinguished surgeon, consisted in taking hold of some of these converging folds of skin, one after another, with a pair of broad-bladed dissecting forceps, and

cutting them away in succession with a pair of scissors curved laterally. The excision was extended quite up to the anus, and even a few lines within it, if the relaxation were considerable, by the degree of which the number of folds to be removed is also determined; two or three being taken away on each side in moderate cases, and a larger number where the relaxation is very great. (See *Dupuytren, in Clinique Chir.* t. i. p. 162.) I have practised this operation very successfully in several cases. The principle, on which it answers, is precisely what Hey and Dupuytren have explained; the anus being immoderately dilatable, the surgeon cuts away a portion of one of its textures, and the rest becoming more consolidated, the tendency to too much dilatation is obviated. The contraction of the cicatrices, and the adhesion of the textures together, induced by inflammation, have the principal share in bringing about this desirable change.

Dupuytren, in his first method, used to cut away the mucous membrane itself; in the last, only the folds of skin at the margin of the anus are removed. A woman had had a constant prolapsus ani for ten years; when she was in the upright posture, the swelling was ten inches in one diameter, and seven in the other; it hindered her from walking, and continually discharged a mixture of blood and mucus. Dupuytren removed five or six of the projecting folds from without inwards. The patient, who used to have more than twenty stools a day, now went six days without one; on the seventh, however, an abundant evacuation took place, and the prolapsus never returned. Only simple dressings, as lint wetted with cold water, and a T bandage, are needed. (See *Journ. Universel des Sciences Méd.* No. 81. Sept. 1822.)

Although Dupuytren's operation bears some resemblance to Hey's, and is founded on the same principle, the French do not admit that what the latter did, will in any way affect the claim of the former to the merit of first suggesting a valuable improvement. They erroneously observe, that Hey's practice only related to prolapsus ani, as a consequence of piles; whereas that of Dupuytren is particularly adapted to examples, in which there are no piles. (See *Clinique Chir.* t. i. p. 166.)

The last indication in the treatment is the removal, and avoidance, of all such causes as are known to have a tendency to bring on the complaint. In infants, a fresh protrusion of the rectum may sometimes be prevented by making them sit on a high night-stool, with their feet hanging freely down. Every thing tending to cause either diarrhœa, or costiveness, should be avoided. In the generality of cases, however, there is an inclination to costiveness, which must be obviated by the mildest means. For this purpose, Mr. Hey used to prescribe half an ounce of the oleum ricini, which is to be taken every morning, or every other morning, as circumstances may require. The same practitioner sometimes employed, in addition to this medicine, a clyster composed of a pint of water-gruel, and a large spoonful of treacle. The tone of the relaxed intestine is to be restored by the continued use of cold clysters, made with the decoction of oak-bark, alum, and vinegar. In one obstinate case, under the care of Mr. Hey, he recommended the following lotion for washing the part during the state of prolapsus; and he also advised its application to

the anus in the intervals, by means of a thick compress, supported by the T bandage. R. Aquæ calcis simplicis lbij. Cort. quercus contus. ℥iv. f. infus. per hebdomadam, et colaturæ adde sp. vini rect. ℥iv. ft. lotio. (See *Hey's Pract. Obs.* p. 442. ed. 2.)

In the treatment of a child, Sir Benjamin Brodie recommends occasional purging with calomel and rhubarb; the avoidance of much vegetable food, which tends to fill up the intestines, while it affords but little nourishment; and an injection, every morning of two, or three ounces of a lotion, compound 3j. of tinct. ferri muratis, and a pint of water. The child is to retain the injection as long as possible. Sir Benjamin Brodie has never seen a prolapsus of the rectum in a child, which was not cured in this manner.

Intussusception of the higher part of the bowel, especially of the colon, or cæcum, causing a protrusion at the anus, is always incurable, as it is not in the power of art to rectify the displacement. Some extraordinary cases prove, however, that large portions of the intestinal canal, thus inverted, may slough and be voided, and the patients recover. (See INTUSSUSCEPTION.)

According to Mr. Travers, when an artificial anus is complicated with prolapsus, the case rarely admits of cure. (See *Inquiry into the Process of Nature in repairing Injuries of the Intestines*, p. 374.)

Surgical writers have been too much in the habit of confounding together prolapsus ani and intussusception. In the latter disease, they have even fallen into the error of supposing, that the whole of the rectum becomes everted, in consequence of the relaxation of the sphincter and levator ani, and that it then draws after it other portions of the intestinal canal. But, they ought to have been undeceived by the strangulation, which sometimes occurs under such circumstances, and which not only throws a great obstacle in the way of the reduction of the displaced part, but even sometimes brings on mortification. Besides, the connections of the rectum with the neighbouring parts, by means of cellular substance, which surrounds it, and the attachment of this intestine to the posterior surface of the urinary bladder, render the above origin of the complaint impossible. Such an explanation could only be admitted with regard to those protrusions of the rectum, which come on in a very slow manner. It could not apply to certain cases, in which the everted intestine presents itself in the form of an enormous tumour. Fabricius ab Aquapendente met with cases of prolapsus of the rectum, where the tumour was as long as the forearm, and as large as the fist. In the *Mélanges des Curieux de la Nature*, is the description of a tumour of this sort, which was two feet long, and occurred in a woman from parturition. Nor is a more satisfactory reason assigned for these cases, by supposing that they originate from a relaxation of the mucous coat of the rectum, and its separation from the muscular one. We are not authorized to imagine, that such a separation can take place to a considerable extent, nor so suddenly, as to give rise to the phenomena sometimes remarked in this disease.

Accurate observations long ago removed all doubt upon this subject. In the *Mémoires de l'Académie de Chirurgie*, t. xi. ed. in 12mo., is an account of a pretended prolapsus of the rectum,

which, after death, was discovered to be an eversion of the cæcum, the greater part of the colon being found at the lower end of this intestine, and most of the rectum at its upper part. This eversion began at the distance of more than eleven inches from the anus, and terminated about five or six from this opening, the tumour, formed by the disease, having been reduced some time before the child's death. It was impossible to draw back the everted part, in consequence of the adhesions which it had contracted. Another dissection evinced the same fact. A child, having suffered very acute pain in the abdomen, after receiving a blow, had a prolapsus of intestine through the anus, about six or seven inches long. This was taken for a prolapsus of the rectum. After death, the termination of the protruded bowel was found to be the cæcum, which had passed through the colon and rectum. (See INTUSSUSCEPTION.)

Schacher, De Morbis a Situ Intestinatorum Preternaturali, 1721. Luther, De Procidencia Ani, Erf. 1732. Heister, Recti Prolapsus Anatome, Helmst. 1734. Gooch's Chir. Works, vol. ii. p. 150. 1792. Recherches Historiques sur la Gastroïomie, ou l'Ouverture du bas Ventre, dans le cas du Volvulus, &c. par M. Ilévin, in Mém. de l'Acad. Royale de Chir. t. xi. p. 315. ed. in 12mo. Monteggia, Fasc. Pathologici, p. 91. Tur. 1793. Jordan, De Prolap-u ex Ano, Goett. 1793. J. Howship, Obs. on the Diseases of the Lower Intestines, &c. ed. 3. Lond. 1824, chap. 4. Richter's Anfangs. der Wundarzn. b. vi. p. 403. ed. 1802. Callisen's Syst. Chirurgiæ Hodiernæ, t. ii. p. 521. ed. 1800. Hey's Practical Obs. in Surgery, p. 438, &c. 8vo. ed. 2. 1810. Journ. Univ. des Sciences Méd. No. 19. Sept. 1822. M. J. Chevalier, Handb. der Chir. b. i. 773. Heidelb. 1826. Dupuytren, in Leçons Orales de Clinique Chirurgicale, t. i. p. 157. &c. 8vo. Paris, 1832. Sir Benjamin C. Brodie, in Lond. Med. Gaz. for 1834, 1835, p. 842.

ANUS, ARTIFICIAL.

This signifies an accidental opening in the parietes of the abdomen, to which opening some part of the intestinal canal tends, and through which a variable quantity, or even the whole of the intestinal matters, or of the feces, is involuntarily discharged. Of all the infirmities which assail the human race, none is more annoying and disgusting than an artificial anus; and, as a modern writer exclaims, what a wretched spectacle does a person exhibit, from whom the bilious alimentary matter and excrement are every instant involuntarily discharged! In vain is the aid of pouches, reservoirs, and boxes, for the palliation of his dreadful affliction: to him society is lost; and he is for ever doomed to lead a solitary and miserable life. Such, at all events, was the sentence pronounced by science, until the genius of Dupuytren came to reform, and restore to the world the unfortunate individuals, who seemed to be for ever banished from it. (*Leçons Orales de Clinique Chir.* t. iii. p. 193.)

An artificial anus is always preceded by an injury of the intestinal canal, either by a penetrating wound, or by ulceration of the bowel, and the bursting of an abscess externally; or by an operation, in which the preternatural opening is purposely made, with the view of saving life, in particular cases of imperforate anus; or by an accidental wound of the gut in the operation for hernia; or, lastly, and most commonly, by mortification of the bowel, the effect of the violence and long continuance of the strangulation of the part.

Foreign bodies, swallowed by mistake, have sometimes irritated the bowel, and caused it to become adherent to the peritoneum lining the parietes

of the abdomen; then ulcerative inflammation ensued, followed by fecal abscess, and a fistulous opening, or true artificial anus. In a few uncommon instances worms, of the lumbrici kind, have excited the same consequences. As already stated, an artificial anus is sometimes the result of surgical operations, practised to prevent the fatal consequences of certain intestinal injuries or diseases; as when the bowel is cut completely across, and the surgeon deems it safer for the patient to establish an artificial anus, than to stitch the bowel; or where an imperforate anus, attended with an obliteration of the rectum, leaves the child the only chance of living by the formation of an artificial anus in the left iliac region. Lastly, the same thing has been suggested for cases, where an incurable obstruction of the intestinal canal, the rectum for instance, exists as the effect of some organic affection; or where the small intestines suffer internal strangulation. Dupuytren mentions these opportunities of making an artificial anus, with more confidence, however, than I am inclined to do. (See *Clin. Chir.* t. ii. p. 219.) All these cases are further divisible into such as are attended with a destruction of a portion of the intestinal tube; and into those which are not accompanied with any such loss of substance.

When once an artificial anus has been formed, it is a solution of continuity produced in the bowel and parietes of the abdomen, which are completely adherent to one another. The opening, in whatever way occasioned, is almost always roundish, but sometimes of an irregular shape. Its diameter varies from a few lines to an inch or more. In the majority of persons, its edges are thick, depressed, adherent to the subjacent parts, inclined towards the abdominal cavity, and immediately contiguous with the mucous membrane of the bowel. A reddish spot denotes the place of their junction. The neighbouring integuments have radiating furrows in them, *en cul de poule*, analogous to what is observed near cicatrices in general; and notwithstanding the most minute attention to cleanliness, the matter evacuated irritates the skin, bringing on an erysipelatous redness, or excoriations of variable depth. (*Dupuytren, Clin. Chir.* t. ii. p. 196.)

Whatever may be the kind of injury which the bowel has sustained, one thing here invariably happens, viz, the adhesion of the two divided portions of the intestine to the edge of the opening in the parietes of the abdomen. This occurrence, which has the most salutary effect in preventing extravasation of the contents of the bowel in the cavity of the abdomen, is produced by the inflammation, which precedes gangrene, and follows wounds. (See *Œuvres Chir. de Desault*, t. ii. p. 352—354.) In hernia, the adhesions precede the destruction of the parts; in wounds, they follow the division of the bowel; and hence, in these last cases, the solution of continuity frequently brings on a fatal effusion. The adhesions never ascend far along the extremities of the bowel, which being only contiguous, and covered by a smooth membrane, as in other parts of them, leave between them a sort of *cul de sac*, the entrance of which is towards the belly, while the fundus is directed towards the skin. It is into this *cul de sac* that, in certain individuals, the abdominal viscera protrude, so as to occasion hernia; which push the

artificial anus outwards, compress, displace, and otherwise complicate it. (See *Dupuytren, Clinique Chir.* t. ii. p. 198.)

When, in strangulated hernia, the case is not relieved by the usual means, or when the necessary operation has not been practised in time, the protruded bowel sloughs; the adjoining part of it adheres to the neck of the hernial sac; and the gangrenous mischief spreads from within outwards. If the patient live long enough, and an incision in the tumour be not now practised, one or more openings soon form in the integuments, and, through these apertures, the feces are discharged until the separation of the sloughs gives a freer vent to the excrement. But when an incision is made, the feces are more readily discharged; and, as Mr. Travers has related, this is sometimes the best mode of relief. "In the ordinary situation of hernia, the portions of intestine, embraced by the stricture, occupy a position nearly parallel. Their contiguous sides mutually adhere; in the remainder of their circumference they adhere to the peritoneum, lining or forming the stricture. The existing adhesion of the contiguous sides, strengthened by the adhesion of the parts in contact, ensures a partial continuity upon the separation of the sphacelated part. The line of separation is the line of stricture. It commences on that side of the gut which is in direct contact with the stricture. As the separation advances, the opposite adhering sides may perhaps recede somewhat, and a little enlarge the angle of union. But, it is ever afterwards an angle; and, where the peritoneum is deficient, the canal is simply covered in by granulations from the cellular membrane of the parietes, coalescing with those of the external, or cellular surface of the peritoneum." (*On the Process of Nature in repairing Injuries of the Intestines*, p. 360.) It must be confessed, that few surgeons have entertained sufficiently accurate ideas of the changes which happen around the wounded or mortified portion of intestine, when an artificial anus is produced; and though Desault's account was excellent, so far as it went, it was not until the year 1809, when Scarpa published his valuable work on *Hernia*, that the whole process of nature on such occasions was completely elucidated. The hernial sac (says he) does not always partake of gangrene with the viscera contained in a hernia; and even when it does slough, since the separation of the dead parts happens on the outside of the abdominal ring, there almost always remains in this situation a portion of the neck of the hernial sac perfectly sound. It may be said, therefore, that, in all cases, immediately after the detachment of the mortified intestine, whether it happen within, or on the outside of the ring, the two orifices of the gut are enveloped in the neck of the hernial sac, which soon becoming adherent to them by the effect of inflammation, serves for a certain time to direct the feces towards the external wound, and to prevent their effusion in the abdomen. In proportion as the outer wound diminishes, the external portion of the neck of the hernial sac also contracts; but that part, which embraces the orifices of the intestine, gradually becomes larger, and at length forms a kind of membranous, funnel-shaped, intermediate cavity, which makes the communication between the two parts of the bowel. However, according to Scarpa's inves-

tigations, this adhesion of the neck of the hernial sac round the two orifices of the gut, does not hinder the latter from gradually quitting the ring, and becoming more and more deeply placed in the cavity of the abdomen. The base of the above-described funnel-shaped membranous cavity corresponds to the bowel, and its apex tends towards the wound, or fistula.

But, in relation to this part of the subject, there are some other circumstances which every surgeon should well understand, and his ignorance of them would not be excusable, on the ground of their not having been, like the funnel-shaped membranous cavity, forming the communication between the two orifices of the bowel, only a discovery of recent date; for they were fully explained many years ago. I here allude to the exact position of the two portions of the bowel, with respect to each other, the direction of their orifices, the angle or ridge between them, and the difference in their diameters. The first of these circumstances, viz. the position of the two parts of the bowel, was correctly described by Saviard, Morand, and Desault; and, as we have seen, is pointed out by Mr. Travers, who represents them as occupying a position nearly parallel, and cites an interesting observation recorded by Pipelet. The patient was a woman fifty-six years old; the loop of spoiled gut was from five to six inches long; the contents of the bowel were discharged through the wound for a considerable time, and an artificial anus was established. Some accidental obstruction occurred; a purgative was given, which operated in the natural way, and in fifteen days the wound was healed. She lived in perfect health to the age of eighty-two, when she died of a disease not connected with this malady. Pipelet examined the body, and has given a figure representing the union. The line of the intestine formed an acute angle, where it adhered to the peritoneum, opposite to the crural arch. The cylinder is evidently much contracted. Pipelet particularly dwells upon the angular position, and constriction of the tube at the point of union. The lower continuation of the intestinal tube was also remarked to be more contracted than the upper portion; a circumstance correctly referred, by Mr. Travers, to the undilated state of the bowels, situated between the artificial and the natural anus. (See *Mém de l'Acad. de Chir.* t. iv. p. 164.; and *Travers on Injuries of the Intestines*, p. 364.) The two ends of the bowel, as Scarpa has observed, are found lying in a more or less parallel manner by the side of each other; the upper with its orifice open, and directed towards the external wound by the feces, which issue from it; while the lower, which gives passage to nothing, becomes less capacious, and is retracted further into the abdomen; or, as Dupuytren observes, the two terminating portions of bowel pass into the abdomen, sometimes crossing, sometimes coiling over one another; in other instances, running parallel; but most frequently diverging at a more or less acute angle. Lastly, they terminate in bending more and more, to become lost in the convolution of the intestinal canal. (See *Dupuytren, Clinique Chir.* t. ii. p. 202.) According to Scarpa, the breach in the intestinal canal is never repaired by the orifices of the upper and lower portions of the bowels reuniting, coalescing, and running, as it were, into each other.

Indeed, they meet at a very acute angle; the axis of one does not correspond to that of the other; and their orifices never lie exactly opposite each other. It is, in short, by means of the funnel-shaped cavity, formed by the remains of the hernial sac, that the two parts of the bowel communicate; and the feces, in order to get from the upper into the lower continuation of the intestine, must first pass in a semicircular track through that funnel-shaped cavity, there being between the orifices of the bowel, directly opposite to the communication between the cavity of the intestine and that of the funnel-shaped membrane, a considerable projection, or jutting angle, forming a material additional obstacle to the direct passage of the feces from the upper into the lower portion of the intestinal tube. (*Scarpa sull' Ernia Memorie, Nat. Chirurgiche*, Milano, 1809.)

This éperon, as it is named by the French, is mentioned both by Saviard and Morand. It consists, in fact, of the part of the bowel which has been spared by gangrene, or a wound in the direction towards the mesentery; and it advances more or less towards the skin, in proportion as the bowel has experienced a greater or lesser loss of substance, or a greater or lesser change of direction. When the bowel has only been wounded, or the seat of a small slough, and it pursues its natural course, the projection is trivial and concealed; but very large, reaching the level of the skin, when the whole circumference of the bowel has been destroyed, and in consequence of the loss of substance its two ends meet at an acute angle or run parallel to one another. In the first case, there is between the two orifices of the bowel a cylindrical channel, more or less deep, which may still convey matters from the upper to the lower end. This case is most easy of cure. In the other, no trace of such a channel is discoverable; and the jutting angle, the éperon, between the two orifices of the intestine, forms a barrier which the intestinal matter cannot pass. Thus the difficulties are greater, and the resources of surgery less certain. (See *Dupuytren, Clin. Chir.* t. ii. p. 203.) Whatever may have been the original state of this projecting angle, after a certain time it does not divide the bottom of the funnel-shaped tube, where the orifices of the intestine are, into two equal parts; because it is propelled towards the lower portion of the bowel, by the pressure of the matters passing through the orifice of the upper end. By degrees the orifice of the lower end becomes indeed covered by it as by a valve, and is detected with difficulty.

Towards the interior of the bowel, Dupuytren found that the éperon had constantly the shape of a crescent, while towards the cavity of the abdomen the two equal halves of it diverged from one another to receive the mesentery in the interspace. The éperon, therefore, is composed of a single wall only at its sharp edge, and every where else it consists of two parietes, leaving between them a triangular interval, which becomes greater as the two portions of the bowel recede from one another in their course into the abdomen. From this latter disposition, says Dupuytren, a fact of the highest importance arises; viz. that the cavities of the two ends of the intestine are separated from one another by a double septum, the surfaces of which, on the side towards the belly, are smooth, and free from all adhesion together. To get,

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therefore, from one of these cavities into the other, through their parietes, the cavity of the peritoneum must of necessity be pervaded: hence the difficulty and danger in trying to form a communication between the two ends of the bowel by attacking the septum between them. (See Dupuytren, *Clinique Chir.* t. ii. p. 204.)

Another interesting circumstance, explained by Dupuytren, is, that the jutting angle, and double septum, the continuation of it, are not invariably so fixed as to be totally incapable of advancing or receding; but, being connected with the mesentery, they are, in a certain degree, obliged to follow the movements communicated by it to them. Sometimes, when hernia is combined with adhesions, the mesentery, which becomes elongated, and forms a cord between the spine and the displaced bowel, keeps the trunk immutably bent forwards. In cases of artificial anus, the end of this cord, corresponding to the intestine, is attached to the bottom of its angle on the side towards the belly, precisely at the base of the éperon interposed between the two orifices. Hence the éperon, and the bowel terminating at it, must be continually drawn towards the cavity of the abdomen by the mesentery; and thus we may discern how the motion and posture of the trunk backward should have a favourable influence in promoting a spontaneous cure. Sometimes, however, the tension of the mesenteric cord ruptures the adhesions of the ends of the bowel to the parietes of the abdomen, and causes a fatal effusion of intestinal matter within the peritoneum. Long after the spontaneous cure of an artificial anus, the effect of this action of the mesentery may be to separate the bowel completely from the parietes of the abdomen, and restore it to its free and floating condition again. Dupuytren ascertained this fact by *post mortem* examinations; a fact, which he would have had difficulty in crediting, if he had not been perfectly certain of the identity of the individuals, and had not detected in each of them a fibrous cord extending from the point of the parietes of the abdomen, corresponding to the former artificial anus, to the bowel. (See *Clinique Chir.* t. ii. p. 206.)

It is then in the deeper part of the funnel-shaped tube, which, as we have seen, lies between the opening in the skin and the bottom of the artificial anus, that the most remarkable and important dispositions of an artificial anus are placed. Here are situated the orifices of the two ends of the intestinal canal, and the septum between them. Of these two orifices, one belongs to the upper part of the bowel; and, being always pervaded by alimentary matter, or feces, is the freer and larger: the other is continuous with the lower portion of the bowel; and since it transmits no alimentary nor fecal matter, or only trivial quantities, it is usually narrow, contracted, and not readily detected. Next to these orifices are the extremities of the bowel, constituting their termination.

Desault, after noticing the efficiency of the adhesions, between the injured part of the bowel and the edge of the opening in the parietes of the abdomen, in preventing extravasation, remarks, that if such adhesions were entire, the abdominal parietes would form a substitute for the portion of the canal which has been destroyed, and the contents of the bowel would continue to pass, as usual, towards the anus, were it not that the portion of the intestine, separated and adherent to the

neighbouring parts, form such an acute angle as obstructs the passage of the intestinal matter. The more acute this angle is, the greater is the obstruction; when the two parts of the bowel lie nearly parallel, the entrance into the lower portion of the canal is completely prevented; but if they meet at a right angle, then more or less of the contents of the upper portion may be transmitted into the lower. The first disposition chiefly happens when a considerable part of the intestinal canal has been destroyed, or when the tube has been completely divided; while the second posture is principally remarked in all cases where the injury has been less extensive. And it is plain that the possibility of a cure depends materially on the kind of angle, at which the two portions of bowel meet, and that the projection of the internal frænum, or jutting membranous ridge between the two orifices, is always a greater or lesser obstacle to the cure.

With respect to the diminution which occurs in the diameter of the part of the intestinal canal, between the artificial opening and the natural anus, Desault admits the correctness of the observation, but entirely dissents from such authors as have spoken of the change as sometimes proceeding so far that an obliteration of that portion of the intestinal tube is the consequence. The mucus secreted within it suffices for preventing this obliteration; a secretion which, in these cases, is copious, and is partly voided from the rectum in the form of white flakes. And, if any further proof were needed that the bowels between the artificial and natural anus remain pervious, it is furnished by the fact, that, in cases of artificial anus, the lower continuation of the tube frequently becomes inverted, and protrudes. On the other hand, the kind of obliteration above spoken of has never been demonstrated by dissection: it was not observed by Leent, in the examination of the body of a person, who died twelve years after the entire cessation of the passage of feces *per anum*; nor was it found to exist by Desault, when he opened a patient who died of marasmus in the Hôtel Dieu, in consequence of an artificial anus, which communicated with the ileum, and had lasted two years. (*Eurr. de Desault*, t. ii. p. 354—356.)

It is true, then, that the lower portion of the intestinal canal undergoes a kind of atrophy, but, perhaps, is never obliterated or rendered quite impervious. Such atrophy, according to Dupuytren, extends to the corresponding part of the mesentery and mesenteric gland: and after some years, such is the difference between the upper and lower parts of the intestinal tube, that while the former seems to be that of an adult, the other looks as if it belonged to a new-born infant. (*Clinique Chir.* t. ii. p. 210.)

I believe the only case, forming an exception to the assertion of Desault, that the lower portion of the intestinal canal is never obliterated, is that met with by M. Bégin in the *Val de Grace*. It was that of a man, eighty years of age, who, for forty years before he died, had been afflicted with artificial anus, communicating with the transverse arch of the colon. The intestine below the artificial anus was transformed into a solid cord, not larger than a quill, until it approached the anus, when its diameter increased, and its solidity lessened. Here it contained also a whitish mucus; and in other parts was only capable of admitting

a small probe, except for the space of six or eight inches towards the artificial anus, where its cavity was totally obliterated. (See *Dict. de Méd. et de Chir. Pratiques*, t. iii. p. 133.)

However proper the formation of an artificial anus may be in many cases, in which the patient's life depends upon the event, it must be confessed that the consequence is a most afflicting and disgusting infirmity. This truth cannot be denied, though the feces which are discharged, from not having been so long retained in the bowels, may not be so fetid as those which are evacuated in the ordinary way. As the opening, which gives vent to the excrement, is not endowed with the same organization as the lower end of the rectum, and as, in particular, it is not furnished with any sphincter capable of contracting and relaxing itself, as occasion requires, the feces are continually escaping without any knowledge of the circumstance on the part of the patient. Hence the uncleanly state of the parts around the external opening, and their frequently excoriated fungous state. Some persons in this state, among the number of those whose histories are on record, made use of a metal box, in which their excrement was received. Schenckius relates the case of an officer who was wounded in the belly, and who allowed his feces to escape into a vessel made for the purpose. Dionis mentions a similar case.

Moscatti also communicated to the Academy of Surgery, the history of a wounded man, in whom an artificial anus took place, in consequence of a wound in the abdomen below the right hypochondrium. His excrement used to be received in a tin box, fastened to him with a belt. The wound received a leaden cannula, to which the tin box was accommodated.

Uncleanliness is not the only inconvenience of an artificial anus. Persons have been known to be quite debilitated by the affliction, and even ultimately to die in consequence of it. This is liable to happen, whenever the intestinal canal is opened very high up, so that the aliment escapes before chyli-fication is completed, and the nutritious part of the food has been taken up by the lacteals. In this circumstance, the patient becomes emaciated, and sometimes perishes, as Desault had an opportunity of observing; and examples of which are also recorded by Hoin and Le Blanc. In cases of this description, the matter voided has little fetor, and is frequently sourish. In all instances, the matter is evacuated involuntarily, because there is nothing like a sphincter. But when the opening only communicates with the lower convolutions of the ileum, or, what is more frequent, with the large intestines, the danger is less serious, and patients in this state are often noticed performing all their functions very well; and, with the exception of colic, to which they are subject, enjoying as good health as they did previously to their having the present disease. In such examples, the matter voided is more fetid, its discharge does not follow so quickly its introduction into the stomach, and it is retained for a longer time.

On this part of the subject, the investigations of Dupuytren led to some interesting information, which was, that the upper or stomachic portion of the intestinal canal not only preserves its calibre, motion, and natural appearance, but, in consequence of having an increased duty to perform, it acquires an increase of capacity, and becomes

the seat of a more energetic circulation, as well as of more active secretion and absorption. This excess of life, says he, is propagated even to the mesentery and its glands.

In cases of artificial anus, the regular convolutions of the bowels, so favourable for the advance of their contents, are immediately affected at some point or another. A noose of intestine is elongated, and drawn towards the breach in the parietes of the abdomen; it assumes the form of a triangle, the base of which is the mesentery, while one side is the stomachic portion, the other the anal continuation of the intestine. In every simple hernia, we see the difficulty occasioned to the free course of the intestinal matter, by the deviation of the bowel from its regular and uniform curve, and its assuming an angular direction. Besides, as Dupuytren has admirably explained, the bowel being, in cases of artificial anus, fixed by adhesions to the parietes of the abdomen, this state not only resists the motions of the digestive tube, but it makes the adherent portion of the bowel a fixed point, towards which all the efforts of the intestinal canal are concentrated, and towards which its contents are incessantly directed: whence a true acceleration of them from the stomach to the artificial anus. A still more serious inconvenience is the shortening of the track which they have to pass. Their lodgment in the intestinal canal being abridged, their digestion remains incomplete, and the absorption of their nutritive principles is performed with less precision. Then nutrition is impaired, and the exhaustion threatens to render the continuance of all the organic functions impossible. (See *Dupuytren, Clinique Chir.* t. ii. p. 213.)

Many patients, afflicted with an artificial anus, void no feces at all from the rectum; but, occasionally, a thick whitish substance, which is the mucous secretion of the portion of the large intestines nearest to the anus. Under certain circumstances, the quantity of this mucus discharged is more copious. (*Desault*, vol. cit. p. 359.)

One disagreeable occurrence, to which persons with an artificial anus are exposed, is a prolapsus of the bowel, similar to what sometimes happens through the anus, with respect to the rectum. The descent of the bowel is sometimes simple, only affecting a portion of the intestinal canal just above, or below, the opening. On other occasions, the complaint is double, the bowel both above and below the opening being prolapsed. This descent of the intestine forms a tumour, the dimensions of which vary considerably in different subjects. Instances have been known of its attaining the length of sixteen or eighteen inches, or even two feet. (*Dupuytren, Clinique Chir.* t. ii. p. 200.) The surface of the prolapsus is reddish, like that of the inside of the intestine, though discoloured by the irritation of exposure to the air. When it has been of long continuance, the mucous membrane becomes dense and solid, covered with a thin dry cuticle, and assumes the characters of cutaneous texture. (See *Dupuytren*, vol. cit.) When the protrusion is caused by the upper part of the intestinal canal, the feces are voided at the extremity of the tumour; and, when the swelling consists of the lower portion of the bowel, the excrement is evacuated at the base of the prolapsed part. By observing this evacuation, when the tumour is double, it is easy to know to which end of the intestinal canal each protruded portion

belongs. This consequence of an artificial anus is very serious, because it greatly increases the inconvenience which the patient suffers. Sometimes the tumour is exquisitely sensible; and, occasionally, when the eversion of the intestine is considerable, a strangulation is produced, which puts the patient's life in danger.

An artificial anus, particularly that formed by the destruction of the whole calibre of the bowel, rarely continues a simple fistulous opening, but, almost always, becomes complicated with a prolapsus of the intestine, the interior of which becomes everted, as well as protruded. This happens with greater facility, in proportion as the intestine is less fixed in the cavity of the abdomen. The protrusion is more considerable, in proportion as the efforts of the patient at stool are greater; and it is the more afflicting, the older the artificial anus is. The prolapsus, or protrusion of the lower end of the bowel, is less common than that of the upper; not so voluminous; and seems to be occasioned by the antiperistaltic movements which propel the mucous secretion of the lower part of the intestinal canal towards the artificial anus. (See Dupuytren, *Clinique Chir.* t. ii. p. 199.) These tumours are usually of an elongated conical shape, with the apex in the integuments, and a depressed aperture in the base, whence is discharged stercoraceous matter, if the prolapsus be connected with the upper portion of the bowel; and mucus, or even the fluid of clysters, if connected with the lower.

I apprehend no well-informed surgeon of the present day can doubt, that formerly the frequency of artificial ani after hernia was seriously increased by the absurd measures sometimes adopted for the express purpose of preventing them; and, as Mr. Travers has rightly observed, the cases reported by the old surgeons, if they prove any thing, prove this: "that the canal has been very generally restored, when the artificial anus was reckoned upon as inevitable; and that where an officious solicitude had been at work to prevent it, showing itself in an active interference with the arrangements of nature, the case has terminated in artificial anus; so that the event, either way, has been a matter of surprise to the surgeon. The fear of doing too little, or too much, applies only to the pernicious customs of dilating the stricture, displacing, amputating, and sewing the intestine; the general adoption of which practice fully accounts to my mind for the number of artificial ani, which are the sequelæ of hernia." (*Op. cit.* p. 367.)

With respect to the prognosis, it is universally agreed, that, *ceteris paribus*, an artificial anus is more dangerous the nearer it is to the stomach, for reasons already explained. An opening produced by injuries of the cæcum, colon, or rectum, has scarcely any effect on that part of the digestive function termed assimilation. The risk is also in some measure greater, in proportion as the quantity of intestinal matter voided from it is more considerable. The prognosis is more favourable, when the two orifices of the bowel are readily found at the bottom of the artificial anus, than when only the orifice of the upper end is discoverable. Lastly, the more free an artificial anus is from complications and accidental ill consequences, the less is the patient the subject of annoyance and danger. (See Dupuytren, *Clin. Chir.* t. ii. p. 223.)

The treatment of an artificial anus, is either palliative or radical. The first consists in ob-

viating the habitual uncleanness produced by the involuntary discharge of the intestinal matter, and in relieving any unpleasant symptoms present.

The first indication is fulfilled by the employment of silver, or tin machines, which are either kept applied to the external opening by means of a spring, or form receptacles placed more or less off the artificial anus, from which the intestinal matter is transmitted through a tube, kept constantly in the opening. In general, says Desault, as elastic gum is supple, light, and capable of taking any shape, it is the best material for the construction of such instruments, which, however, rarely answer their purpose completely.

Richter, with the view of hindering the too quick escape of the intestinal matter, and the death of the patient from this cause, proposed covering the opening for a certain time with a piece of sponge, supported by an elastic bandage, or truss. But Loeffler found this method objectionable, as it was apt to bring on colic, constipation, and an inflamed excoeriated state of the skin.

When the outer opening is disposed to contract too much, and inconveniences arise from this change, Sabatier is an advocate for preventing such closure by means of a tent, or skein of silk, introduced into the aperture, and changed very often for the sake of cleanliness; while others prefer a ring of ivory for the purpose. But the irritation, produced by the matter imbibed by this sort of tent, and in particular the liability of the bowel to protrude, and be strangulated in the opening of the ivory ring, are found strong objections to these practices; and, according to Desault, who preferred a linen tent, compress, and bandage, the sponge, employed by Richter, also occasions a great deal of excretion by the irritation of the fluid lodged in it.

The investigations of Scarpa and Dupuytren fully prove, that the causes of the discharge of the intestinal matters through an artificial anus, and the obstacles to their resuming their natural course, and to a radical cure, depend,—1st, Upon the adhesion, angular direction, and fixed condition of the bowel. 2d, Upon the loss of substance which it has sustained, and the consequent contraction of it. 3d, Upon the jutting angle (*éperon*), and the double septum between its two ends. These obstacles, great as they may be, are sometimes overcome by nature and art. Loss of substance is indeed irreparable; but amends for it may be made in certain cases by a dilatation of the calibre of the bowel. Its adhesion to the parietes of the abdomen may also become less close, or even so loosened as to let the bowel assume a position and direction more favourable for the re-establishment of the course of its contents. The projection, formed by the *éperon* and double septum, may also be lessened by being continually dragged by the mesentery, and subjected to the effort of the intestinal matter to get from the upper into the lower portion of the bowel. A rich full diet is recommended by M. Louis, for the purpose of gradually enlarging the communication between the two portions of bowel: purgatives, administered with the view of forcing the obstacles to a free communication; the introduction of tents, the size of which is gradually increased, in order to dilate the contraction between the two parts of the intestine; the motions and position of the

trunk backward, advised by Dupuytren to render the mesentery tense, and to efface the projecting angle and the septum continued from it; compression of the external opening, practised from time immemorial, to hinder the intestinal contents from escaping outwards, and obliging them to pass by the natural way,—are all, as Dupuytren observes, so many resources, which, employed singly or unitedly, have accomplished many cures. (See *Clinique Chir.* t. ii. p. 225.)

But, every body must agree with this distinguished practitioner, that, previously to attempting to cure the principal disease, all accidental complications should be removed; as an indurated or inflamed state of the skin, extensive sinuses, or a prolapsus of the intestine. The latter, according to Dupuytren, is easily obviated by keeping the patient a few days on his back, and having recourse to the taxis with gentleness, and moderate steady compression. Almost all artificial ani, attended with a simple perforation of some point of the circumference of the bowel, are set down by Dupuytren as curable. These cases are in reality but stercoraceous fistule, behind which the intestinal canal is almost entire, without loss of substance, or any manifest contraction, or material change of direction. Here nature is disposed to close the accidental opening, and her efforts, assisted by moderate compression, are mostly successful. But, Dupuytren explains that this simple treatment will not answer, when the artificial anus has been produced by the destruction of a third or a half of the circumference of the bowel, for an extent varying from a few lines to an inch. Yet, here the loss of substance, the changed direction of the intestine, and the jutting angle between the two portions of it, are not so considerable as to prevent the restoration of the natural passage for the intestinal matter from being brought about by suitable treatment. Nay, he adds, that cases are not absolutely incurable by the plans above adverted to, even when the artificial anus was the consequence of a loss of substance, involving two thirds or three quarters of the circumference of the bowel, with a proportionate length of it. But, when the loss of substance amounts to four-fifths, or the whole of the circumference, with or without the inclusion of a piece of the mesentery, such methods will not avail. Here the diminished calibre of the bowel, its altered direction, the jutting angle, and the double septum, present themselves in the strongest manner as invincible impediments to the re-establishment of the natural course of the alimentary matter; and, as Dupuytren further remarks, pressure, which, when made with precision, is the most effectual means of closing the outlet, immediately brings on colic, nausea, hicough, vomiting, and all the symptoms of strangulated hernia.

From a calculation made by Dupuytren, it appears that artificial ani, capable of spontaneous cure, or of one produced by the means already specified, are, in comparison with the examples which obstinately resist such treatment, as three to one. (See *Clin. Chir.* t. ii. p. 223. 229.) It was for this obstinate fourth of cases of artificial ani, that Dupuytren devised a method of cure, which reflected upon him the highest credit.

The business of the surgeon is to prevent, if possible, the formation of an artificial anus; but, when the event has occurred, and, particularly,

when the whole, or the greater part, of the stools is discharged in this way, no attempt must be made to stop up the opening, without a great deal of consideration; for any effort of this kind, made under circumstances which do not justify it, may be the means of exposing the patient's life, to the most alarming danger. Sometimes, indeed, without any interference of the surgeon, the outward opening contracts, and, the issue of the intestinal matter being obstructed, pain and tenesmus are excited: and the same consequences may be produced by any swelling and enlargement of the projecting ridge, situated between the two portions of the bowel. In two cases, Puy found this swelling take place in such a degree, that the patients fell victims to the complete stoppage of the intestinal contents. The symptoms, which arise, are then similar to those which happen in strangulated hernia. Hoin, Le Blanc, and Sabatier, also cite instances, in which the patients lost their lives by gangrene, brought on by this species of strangulation. (*Desault*, vol. cit. p. 360.)

There is a period (says Mr. Travers); at which the function of the lower portion of the canal, with a little assistance, may be restored. The natural order of events, connected with this recovery, has been mistaken and inverted. Practitioners have closed the wound, instead of conducting the matter by purgatives and clysters into the large intestines. Now, the wound will never fail to heal, when the matter recovers its accustomed route; but this condition cannot be reversed. The restoration is safest, when most gradual; when there is evidence of an existing sympathy between the repair of structure, and the return of function. According to the same gentleman, there is reason to believe that the well-timed exhibition of a single purgative might often prove effectual. "If the food is rapid, and little changed in its passage, it should be pulqueous and nutritive, and given in moderate quantity at short intervals; while injections of the same kind should be administered at least twice in twenty-four hours, and retained as long as possible." He states, that by such means patients may be nourished for many weeks. If the discharge is sparing, and does not readily escape, he recommends an occasional purgative in less than ordinary quantity. He disapproves of other medicines, especially stimulants, and all such food as is difficult of digestion, giving a general preference to animal food in a gelatinous form. He bestows just praise on strict attention to cleanliness; and, in opposition to Desault and Sabatier, condemns the employment of tents and sponges. (*Op.* cit. p. 371. 373.)

Numerous cases on record furnish abundance of proof that the feces, after being voided for several months from the wound, produced by the operation for hernia, frequently resume their natural course. Facts of this kind, which, in general, may be said to be common when the intestine is without loss of substance, are not very rare even when more or less of the bowel has been destroyed by gangrene; and many illustrations of this remark may be found in the writings of De la Peyronne, Louis, Petit, Pott, Le Dran, &c. Several such cases have fallen under my own observation. The greater number of these instances of success, as already stated, were the result of the most simple unobtrusive treatment, or rather of the undisturbed and very little assisted efforts of nature.

According to Desault, the most frequent impediment to the restoration of the natural course of the intestinal contents, is the angle formed by the two portions of the intestine; and, says he, it must be enlarged, and rendered less acute, in order that the feces may continue their route. This desirable change he recommends to be effected by introducing long dossils of charpie into the two ends of the bowel, and gradually altering their direction so as to bring it into a straight line. When the dilatation is sufficient, and the inner angle, or ridge, is effaced, the long dossils need not be continued. The linen tent, with the precaution of not introducing it too deeply, lest it obstruct the course of the feces itself, will then suffice. When this plan is skillfully managed, Desault says, there will be a great chance of its succeeding, and its beneficial effect will be denoted by a rumbling in the bowels, and frequently by slight colics. At first, wind is discharged from the rectum, and, soon afterwards, the feces begin to come away. On the contrary, if they should not pass with facility, the colic be violent, and an accumulation happen in the upper portion of the intestinal canal, the tent must be withdrawn, and the other cause of obstruction be considered, and, if possible, removed. (Vol. cit. p. 365, &c.)

In the preceding columns, I have given a full explanation of the impediment made to the passage of the feces into the lower orifice of the intestinal canal, by the projecting septum, or ridge between the two parts of the bowel, and the matter having sometimes to traverse the funnel-shaped membranous cavity in quite a semicircular track. A representation of this septum may be seen in Scarpa's work, tab. 9. fig. 1.; and also in the sixth plate of Mr. Travers's Inquiry. In one example in which this septum was plainly visible in the wound, Dupuytren introduced into the orifice of the upper part of the bowel a curved needle; and, passing it through the projecting septum, brought it out again through the orifice of the lower portion of the gut. Thus, he included a considerable part of the septum in a ligature, which was daily made thicker, with a view of first exciting inflammation in the two layers of this septum, and thus ensuring their adhesion together; and his next plan consisted in making a division through the part embraced by the ligature, whereby the passage for the feces into the lower portion of the bowel was made quite free. But, as the section made by the ligature was too superficial, Dupuytren completed the division of the septum with a knife; but peritonitis and the death of the patient ensued. According to Dr. Breschet, the ligature also proved ineffectual; because its operation was so slow, that adhesions and cicatrization took place behind it as fast as it made its way through the rest of the septum. Hence, the expectation that the feces would sufficiently pass through the aperture made by the ligature was not realised; and, in one case quoted by Breschet, though some amendment followed the operation, still the cure was far from being accomplished, as only some of the feces passed out of the natural anus, while the remaining and greater part of them still came through the fistula. (See *Graefe's Journ.* b. ii. p. 306.; also *Clinique Chir.* t. ii. p. 233.) In another case, Dupuytren tried to render the layers

of the septum adherent by compressing them between the blades of a pair of forceps of particular construction; and afterwards he effected the division of the part by augmenting the compression, by means of a screw, traversing the handles of the instrument. In a case which followed the operation for bubonocoele, attended with mortification of the bowel, Dupuytren began with dilating the outer opening with a bistoury; and, after ascertaining the position of the septum, between the two orifices of the bowel, he introduced one of the blades of the forceps into each portion of the gut, and closed the instrument with the screw. The part of the instrument, situated externally to the ridge, or septum, he covered with charpie and a compress. The constriction was soon followed by colic pains, and tendency to vomit, complaints which were quickly removed by fomenting the belly. They recurred, however; the instrument became loose, and some discharge ensued. On examination, the septum was found to be partially divided. After the breadth of the instrument had been lessened, it was applied again; but, when the screw was turned, the patient began so suffer such violent pain over the whole of the abdomen, that it was necessary to diminish the pressure; and, as the instrument was afterwards separated from the parts in a fit of vomiting, it was withdrawn. A trial was now made to determine the feces towards the rectum by pressure on the external opening; but the plan could not be endured, and the hindrance to the egress of the intestinal matter was so oppressive, that it was discontinued. As the forceps, used on the foregoing occasion, did not take sufficient hold of the septum, nor divide it properly, the instrument was somewhat altered. A particular description of its improved make has been inserted by Breschet in *Graefe's Journal*, b. ii. p. 302.; and likewise in t. ii. of *Dupuytren's Clinique Chir.* p. 248., where it is termed *Enterotome*. Dr. Reisinger published three cases, in which it was successfully employed by Dupuytren. In the first of these examples, when the instrument had been applied, it embraced the septum so well, that it could not be displaced from it. The colic attacks, vomiting, thirst, turned tongue, and loss of appetite, which ensued, soon gave way after the belly had been fomented; the constriction was then increased, and found to produce less and less indisposition. On the 29th, very little of the feces came out of the artificial anus; and, after a short time, five natural evacuations took place. The blades of the instrument were now completely closed, and, on taking it out, a slough of membrane was found between the blades; a proof that the septum was destroyed. On the 30th, the patient's health was undisturbed. Clysters were now administered, with the view of promoting evacuations in the natural manner; and, the next day, the patient had a proper motion, without any assistance, and a very small quantity of the feces passed out of the fistulous opening. This aperture was now merely covered with charpie; but, as some high granulations were rising, the powder of colophonum was sprinkled upon them, and compresses and a bandage were applied. The use of clysters was also daily continued, though the patient voided his feces in the natural way. On discontinuing the external pressure, the quantity of discharge from the fistulous opening increased;

and, therefore, on the 1st of October, the compresses were again applied, and kept on the part with a spring truss. The treatment ended in a perfect cure.

In another case, Dupuytren enlarged the lower angle of the outer opening with a bistoury; and, after feeling with his finger, that both orifices of the bowel were close to that opening, he applied the forceps. In the evening, the constriction was increased, which was followed by severe colic pains over the whole abdomen. They subsided, however, the following day. From the outer opening, a great deal of slimy excrement was discharged. The constriction was not augmented. On the 5th day, the patient was attacked in the night with pain and vomiting. The following night he was also very restless. Though the belly was not tense, it could not bear to be touched. On the 11th and 12th days, the patient was nearly free from pain; and by means of clysters, two natural motions were procured; and on the 13th, as the patient was easy, Dupuytren began to make pressure on the fistulous opening. On the 26th, the edges of the aperture were touched with lunar caustic; and on the 28th, a compress supported by a spring truss was applied. The patient was kept constantly in the horizontal posture; the feces began to be voided the natural way regularly, and the opening contracted in the most favourable manner.

I think the generality of surgeons will agree with Dr. Reisinger, that the foregoing treatment cannot be indiscriminately adopted, in all descriptions of patients, without danger. It should never be tried too soon after the formation of an artificial anus; but time should be allowed for the irritability and sensibility of the gut, and especially of the septum, to be lessened by the effect of the air and the pressure of the feces. Nor should the trial ever be made ere it has been fully ascertained that nature cannot herself bring about the cure. Breschet mentions an example, in which the foregoing method could not have been practised, in consequence of the mouth of the lower portion of the bowel having been obliterated by the pressure of a large tent, three inches long, which had been worn by the patient two years, and the projecting ridge could not be detected. (See *Graaf's Journ. der Chir.* b. ii. p. 298.) Many other interesting observations on this new proposal may be perused in the memoir by Dr. Breschet, in Dr. Reisinger's tract, the title of which is given in the list of works at the end of the present article, and in Dupuytren's *Leçons Orales*, &c. t. i. In order not to incur the risk of extravasation of the feces in the abdomen, the constriction of the septum should never be increased with imprudent haste, before the adhesive inflammation has had time to be produced between the two layers, of which that part is composed.

In cases of artificial anus, the appearance of the mucous coat of the bowel undergoes some change, in consequence of exposure to the air and the contact of extraneous bodies; it becomes redder and less villous, but does not cease to secrete a great quantity of mucus: this is one of the principal reasons why it is so difficult to close the fistulous opening, even when the passage for the feces has been restored. The skin, around an artificial anus, is also generally very irritable, and rendered exceedingly painful by the contact

of the excrement. (*Breschet, in Graaf's Journ.* b. ii. p. 303.)

The following general directions were given by Dupuytren for the application of his *enterotome*:—

1. The two ends of the bowel must be detected.
2. The septum between them divided.
3. The external opening healed up.

The lower end of the intestine he frequently found very difficult to make out. In old cases, very often neither the angle (*éperon*), nor the lower portion of the bowel, can be discovered; and it seems as if there was only one passage leading to the fistula. The other partly obliterated, and retracted within the belly, has an orifice so concealed, that, unless accidentally entered by a probe, its detection is almost impossible. Then the relation of the two portions of intestines to one another, Dupuytren found remarkably inconstant. The stomachic portion, according to the kind of case, may be superior or inferior, external or internal. When the artificial anus communicates with the great intestine, he considers clysters amongst the best means of discovering the orifice of the lower continuation of the intestinal canal. In very difficult cases, he sanctions the use of a plug, purgative clysters, and a very full diet. (See *Clinique Chir.* t. ii. p. 265.)

The two ends of the bowel being ascertained, the operation must not be performed if the mucous coat of the bowels, the peritoneum, or other organs, be the seat of acute or chronic inflammation. The patient is to be prepared by a suitable, mild, antiphlogistic plan.

In the operation the patient is to lie upon his back. The surgeon takes one of the branches of the *enterotome* in the right hand, and guides it, if requisite, with the left forefinger, to one of the orifices of the bowel to the depth of one, two, three, or four inches, according to circumstances. An assistant then takes charge of this first part of the instrument. The other branch is then introduced into the other end of the bowel in the same manner. Both branches are then brought together, and joined like a pair of forceps. The blades are then made to grasp the bowel by pressing the handles together. The pressure is next regulated and maintained by means of a screw. Before the expiration of the first day, the pressure is to be increased sufficiently to kill the portion of intestinal tunics embraced by the instrument; and the pressure is to be again augmented every second day, to render their destruction still more certain. In the cases under Dupuytren, the instrument was detached between the seventh and tenth day, bringing away with it the destroyed jutting angle and septum, which prevented the upper portion of bowel from communicating with the lower. Frequently the first signs of the re-establishment of the natural passage precede the detachment of the *enterotome*. In all cases, slight colic occurs, the evacuations are at first white and albuminous from the lower bowels, and these are followed by stercoraceous matter from the upper ones. At first they are numerous and liquid, and attended with gripings; but they soon become of proper quality, and all uneasiness subsides. (See Dupuytren, in *Clin. Chir.* t. ii. p. 264, &c.)

If, after the destruction of the septum, and the re-establishment of a free communication between the two portions of the bowel, the external fistula were not to admit of being healed by pressure and

other ordinary means, no doubt could be entertained of the propriety of resorting to the plan of attempting to cure it by paring off the edges and bringing them together with sutures, as was sometimes done by Dupuytren; or on the Taliacotian principles, as successfully exemplified by Mr. G. F. Collier. (See *Med. and Physical Journ.* for June, 1820.) Dupuytren, for the purpose of making the sides of the fistula remain in contact, or making them approach each other, occasionally applied an ingenious little instrument, consisting of two pads, which, by means of a screw, can be made to embrace the part. An engraving of it may be seen in *Graefe's Journ.* b. iii. taf. 3. fig. 9. For the closure of the fistula, Dupuytren also sometimes had recourse to a truss, and now then to the actual cautery.

If after the contraction, or perfect closure of the external opening, the patient should be attacked with colic, nausea, vomiting, and other symptoms of retention of the intestinal matter, and these complaints were not to yield to diluent drinks, aperient injections, and fomentations, Dupuytren recommends making a prompt incision through the cicatrix, and forming a free outlet for the matter accumulated above it. (See *Clinique Chir.* t. ii. p. 272.)

I shall conclude with the relation of an interesting case of artificial anus, complicated with prolapsus, as recorded by my friend Mr. Lawrence.

"If the complaint (a mortified hernia) terminated in the formation of an artificial anus, we must endeavour to alleviate those distressing inconveniences, which arise from the involuntary discharge of wind and feces through the new opening, by supplying the patient with an apparatus, in which these may be received as they pass off. An instrument of this kind, the construction of which appears very perfect, is described by Richter (*Anfangsgr. der Wundarzn.* vol. v.), from the *Traité des Bandages* of Juville. The patient will be best enabled to adapt any contrivance of this sort to the particular circumstances of his own case. It has been found, in some instances, that a common elastic truss, with a compress of lint under the pad, has been more serviceable than any complicated instrument (*Parisian Journ.* vol. i. p. 193.) in preventing the continual flow of feculent matter from the artificial opening." (*Treatise on Hernia*, p. 206.)

"I know," says Mr. Lawrence, "a patient with an artificial anus, in whom the gut often protrudes to the length of eight or ten inches, at the same time bleeding from its surface. This is attended with pain, and compels him to lie down; in which position the intestine recedes. The patient has now discharged all his feces at the groin for fifteen years; and has enjoyed tolerable health and strength during that time. His evacuations are generally fluid; but sometimes of the natural consistence. Whenever he retains his urine, after feeling an inclination to void it, a quantity of clear inoffensive mucus, like the white of an egg, amounting to about four ounces, is expelled from the anus, and this may occur two or three times in the day." (P. 208.)

When the protruded intestine is strangulated, an operation may become necessary for the removal of the stricture. (*Schmucker, Vermischte Chirurgische Schriften*, t. ii.) Two cases, which

terminated fatally from this cause, are mentioned by Sabatier, in a memoir in the 5th tom. de l'Acad. de Chir. Mr. Lawrence also refers to Le Blanc. (*Précis d'Opérations de Chir.* tom. ii. p. 445.) We should always endeavour to prevent such protrusions, when a disposition to their formation seems to exist, by the use of a steel truss, which should, indeed, be worn by the patient, independently of this circumstance. If the tumour has become irreducible by the hand, an attempt may be made to replace it by keeping up a constant pressure on the part, the patient being at the same time confined to bed. By these means, as we have already noticed, Desault (*Parisian Journ.* vol. i. p. 178.) returned a very large prolapsus; and by pressure on the opening, the feces were made to pass entirely by the anus, although for four years they had been voided only through the wound. (Lawrence, p. 209, 210.)

In cases of mortified hernia, the wound sometimes closes, except a small fistulous opening, which discharges a thin fluid, and cannot be healed. Mr. Lawrence has related, in his excellent treatise on hernia, a case in which the feces came from the wound some time after an operation, although the bowel did not appear gangrenous when this proceeding was adopted. (P. 211.)

In the appendix to this work, the author adds some further account of the case of artificial anus, which he has related. (P. 208.) The man is sixty years of age, and appears to be healthy, active, and even younger than he really is. He had had a scrotal hernia, which ended in mortification, and involved the testicle of the same side, and a large portion of the integuments, in the destruction. It is now nearly seventeen years since this event, and the feces have, during all this time, been discharged from the groin. He has never made use of a truss, nor taken any step, except that of always keeping a quantity of tow in his breeches.

The prolapsed portion of intestine varies in length and size at different times. It was four inches long when Mr. Lawrence saw it, and the basis, which is the largest part, measured nearly six inches in circumference. The prolapsus never recedes entirely, and it has occasionally protruded to the length of eight or ten inches, being as large as the forearm, and emitting blood. This occurrence is painful, and only comes on when the bowels are out of order. Warm fomentations and a recumbent position afford relief, and accomplish a retraction of the bowel.

The projecting part is of a uniform red colour, similar to that of florid and healthy granulations. The surface, although wrinkled and irregular, is smooth and lubricated by a mucous secretion. It feels firm and fleshy, and can be squeezed and handled without exciting pain. The man has not the least power of retaining his stools. When these are fluid, they come away repeatedly in the course of the day, and with considerable force. When of a firmer consistence, there is only one stool every one or two days, and the evacuation requires much straining. Such feces are not broader than the little finger. When the patient is purged, the food is often voided very little changed. This is particularly the case with cucumber. In this state, he is always very weak. He is sometimes discharged five minutes after taken, being scarcely at all

altered. The bowels are strongly affected by slight doses of purgatives.

J. R. Tieffenbach, *Vulnerum in intestinis lethalitas occasione casus rarissimi, quo colon vulneratum, inversum per 14 annos ex abdomine propendens exhibetur; Haliæ, Disp. Chir. 5. 61. Decussit, in Parisian Chir. Journal, vol. 1.; or Œuvres Chirurg. par Bichat, t. ii. p. 352. &c. Schmeucker's Chir. Schriften, vol. ii. Smaliova Methodus Intestina ulnendi. Viteb. 1798.*

Systema Chirurgiæ Hodiernæ, t. ii. p. 710. &c. Medic. Memor. Anatomico-Chirurgicæ, fol. Milano, 1809. B. Traverser, Inquiry into the Process of Nature in repairing Injuries of the Intestines, chap. viii. 8vo. Lond. 1812. *Dorsey's Elem. of Surgery*. Philad. 1823. *F. Reisinger*, Anzeige einer von dem H. Professor Dupuytren erfundenen, und mit dem glücklichsten Erfolge ausgeführten Operationsweise zur Heilung des Anus Artificialis, nebst Bemerkungen, Augsburg, 1817. *Baron Dupuytren*, Mém. sur une Méthode Nouvelle pour traiter les Anus accidentels, lu à l'Acad. des Sciences en Janvier 1824; Dans la Collect. des Mém. de l'Acad. Roy. de Méd. 4to. Paris, 1825; also, in Leçons Orales de Clin. Chir. t. ii. 8vo. 1832; also, in Diet. de Méd. et de Chir. Pratiques, t. iii. art. "Anus contre Nature." Professor Delpech invented forceps which first took hold of the septum, between the two portions of the bowel, and then divided it by means of two little knives, which, on touching a spring, glided along the interior of the blades and met towards their end. A representation of it may be seen in *Froriep's* 268th plate, fig. 4. The plan of cutting the septum, however, is abandoned, as likely to cause effusion of the contents of the intestinal canal, and peritonitis. *Lallemand*, in Répertoire Gén. d'Anat. &c. rédige, par G. Breschet, t. vii. 1823. *Casamajor*, Obs. d'un Anus contre Nature ouvert dans le Vagin; Journ. Hebdom. de Méd. t. iv. p. 163. 1829. *Sabatier*, in Mém. de l'Acad. de Chirurgie, t. v. 4to.; and Médecine Opératoire, t. ii. ed. par MM. Breschet, Sanson, et Bégum. *Broasie*, in Rust's Magazine, b. vi. p. 239. *Lordat*, Das sur le Traitement de l'Anus contre Nature, Paris, 1819. *Hennen's* Military Surgery, p. 407, &c. ed. 2. Edin. 1830. Three cases from gunshot wounds; the cure effected by aiding nature occasionally with the exhibition of laxatives and clysters. *Breschet*, in Journ. der Chirurgie von C. F. Grafe, und Ph. von Walther, b. ii. p. 273. 479. Berlin, 1821.

FISSURES OF THE ANUS,

As they are termed, consist of longish superficial ulcerations near the anus, between the converging folds of the fine skin and mucous membrane. When the sides of the anus are separated, and the patient is desired to strain, a narrow fissure is seen, the bottom of which is red, and the margins somewhat swollen and callous. But, as Dupuytren observes, it is frequently necessary, for the purpose of ascertaining how high it reaches, to introduce the finger into the rectum. It is more commonly situated at the sides and back of the anus, than at the fore part of it; a favourable circumstance in relation to an operation, particularly in women, in whom this opening is divided from the posterior commissure of the vulva only by a thin partition. The ulceration rarely affects the whole thickness of the mucous membrane. (See Dupuytren, *Clinique Chir.* t. iii. p. 283.) Fissure of the anus is usually productive of violent lancing or burning pain, which gradually augments, and lasts a considerable time after the patient has had a motion. In some cases, indeed, so extreme is the suffering, that the patient, from a dread of obeying the call of nature, refuses, as long as possible, or even nearly starves himself, to render the occasions for emptying the rectum less frequent. The severity of the case arises chiefly from a painful spasm of the sphincter muscles.

Constipation, and the spasm which it excites, are amongst the predisposing causes of fissure of the anus. The indurated fecal matter, either by causing ulceration of the mucous membrane, or by immoderate distention of the passage, may bring on the complaint. The unskilful administration

of clysters, especially with pointed rough pipes, is often the cause. Fissures of the anus are frequently met with in persons who have piles; and, according to Dupuytren, the lodgment of venereal matter near the anus, as happens in many women, may lead to the complaint. Perhaps it would be more correct to say, that the contact of any irritating matter, or secretion, may have this effect.

According to Dupuytren, the spasmodic constriction of the sphincter is the real disorder, and the fissure is only a secondary effect. By putting a stop to this constriction, the disease is cured. With this view, Dupuytren tried what good could be done by the following application:—R. Axungie 3vj., extr. belladonnæ plumbi acetatis à 3j. Misc. A tent of linen or charpie, or, as I should say, a soft rectum bougie, of moderate size, smeared with this ointment, is introduced, and its diameter gradually increased to that of the forefinger. Dupuytren states, that the continuance of this treatment for a few days frequently relieves the pain entirely, and obviates all necessity either for caustic, or the division of the sphincter. Even when the plan does not cure, it always palliates, and therefore should be tried before the latter methods are resorted to.

Baron Dupuytren makes a very useful and practical division of fissures of the anus, into three kinds. Some are below the sphincter, affecting hardly any texture but the skin, and not the mucous membrane. These excite more or less pruritus, but cause little obstruction to the passage of the feces. Fissures above the sphincter, involving the mucous membrane, can only be seen with the aid of a speculum. When the finger is passed into the rectum, a knotty hard cord is felt, and pressure on it creates acute pain. When the patient goes to stool, such fissures give rise to an indescribable sort of tenesmus, which ceases directly after the evacuation; and the excrement on the side nearest the disease, is covered with puriform, or mucous, bloody fluid. Such fissures were found by Dupuytren to be commonly produced by the ulceration of internal piles, excited by the passage of indurated fecal matter. Lastly, fissures on a level with the sphincter, are the worst, being attended with agonising constriction of the sphincter, and other symptoms already specified.

The two first descriptions of fissure may mostly be cured without any operation; some by the dressing them with simple cerate, or ointment containing opium, mercurial preparations, &c.; others by emollient anodyne lotions or applications. But where the fissure was of the third description, Dupuytren considered the operation first introduced by Boyer the quickest and surest means of cure. This consists in dividing the anus and sphincter with a probe-pointed bistoury, passed into the rectum, and cutting directly through the fissure, except when it lies forwards towards the vagina in the female, or the urethra in the male subject. When several fissures existed, Dupuytren sometimes made several cuts in different directions, from three to four lines deep. (See *Clin. Chir.* t. iii. art. 10.)

PRETERNATURAL CONTRACTION OF THE SPHINCTER.

Sir Benjamin Brodie has treated of this as a distinct affection; and, indeed, we find that Dupuytren represents it as being generally the primary

complaint in fissure of the anus. The cases, referred to by the former gentleman, he has met with chiefly in women disposed to hysteria; though sometimes in the male sex. In emptying the rectum, the patient is obliged to strain very much, especially when the feces are solid; then pain is experienced, which lasts a considerable time afterwards. Very often a small ulcer of the mucous membrane of the rectum (the second variety of Dupuytren's fissure) accompanies spasmodic contraction of the sphincter, and is always, according to Sir Benjamin Brodie's description, situated at the posterior part, opposite the point of the os coccygis. When the suffering is not excessive, relief may sometimes be derived from purgatives, given to prevent the evacuations from being hard and figured, from an opiate suppository at night, and from the introduction of a bougie into the anus just before the patient has a motion. In worse cases, Sir Benjamin Brodie recommends the division of the sphincter with a straight probe-pointed bistoury. The fibres of this muscle are thick, and will require two or three strokes for their complete division. An opiate may be given to keep the bowels quiet for two or three days afterwards. Then a dose of castor oil may be exhibited. Simple dressings will suffice to heal the wound. (See Brodie, in *Lond. Med. Gaz.* for 1834, 1835, p. 26.)

EXCRESCENCES OF THE ANUS.

These cases are frequent, the growths receiving a variety of names, according to their supposed resemblance to things, as condylomata, marisca, and fici. Some are much firmer than others; some of them grow, in consequence of irritation of the skin of the anus, by the contact of rancid secretions, or purulent matter. Others are originally piles; for, as Sir Benjamin Brodie observes, when the cavities of external piles become obliterated, they generally form flaps of skin, which gradually waste; but sometimes diseased action takes place in them, and they become converted into excrescences, similar to those which grow from the nymphæ of women. Many excrescences about the anus and perineum are of middling consistency, between that of a wart and that of a polypus. I have cured a great number by stimulating applications, as the nitrate of silver, the tinc. ferri mur., the acetic acid, and the powder of savine, blended with subacetate of copper, or a solution of the sulphate of copper. When their necks have been narrow, I have also extirpated many of them with ligatures. But, in general, I remove the larger kinds with a bistoury. The bleeding, which may be at first copious, does not generally require a ligature, as it stops as soon as lint or linen dipped in cold water, and a T bandage, have been applied. (See HEMORRHOIDS AND RECTUM.)

AORTA. Aneurisms of this vessel have already been treated of; but some other particulars, relating to it, merit notice in a dictionary of surgery.

WOUND OF THE AORTA NOT ALWAYS FOLLOWED BY INSTANTANEOUS DEATH.

A case, exemplifying this fact, was recorded by M. Pelletan. In the month of May, 1802, a young man was brought to the Hôtel Dieu. In a duel, he had been run through with a foil, which penetrated above the right nipple, and came out at the left loin. The most alarming symptoms

were apprehended; but several days elapsed without any serious complaints taking place. The patient was bled twice, and kept on a very low regimen. Every thing went on quietly for a fortnight. He now complained of severe pains in his loins, and he was relieved by the warm bath. He seemed to be recovering, got up, and went to walk in the garden allotted for the sick; but the pain in his loins quickly returned, attended with difficulty of breathing, constipation, and wakefulness. He now became very impatient, and out of temper with the surgeons for not relieving him.

On the 15th of July, two months after the accident, a deformity of the spine was remarked, about the eighth dorsal vertebra. The patient grew rapidly worse, and died in the utmost agony, saying that he felt suffocated; and tearing off his shirt, that his chest might be free from the pressure of all kinds of clothing.

On the body being opened, the right side of the chest was found full of blood, coagulated in various degrees; and an opening, the diameter of which was equal to that of a writing pen, was detected in the aorta above the crura of the diaphragm. All the adjacent cellular substance was injected with blood, and three of the dorsal vertebræ were found carious. No mark of injury was perceptible in any of the thoracic or abdominal viscera. (*Pelletan, Clinique Chir. t. i. p. 92—94.*)

THICKENING AND CONSTRICTION OF THE AORTA.

Meckel met with two cases, in which the aorta was thickened and considerably constricted, just below its arch; yet, in both subjects, there was every reason to believe that the abdominal viscera and lower extremities had been duly supplied with blood. This fluid, which could only pass from the heart with great difficulty, and in small quantities, had, by regurgitating, lacerated the semilunar valves. (*Mém. de l'Acad. Royale de Berlin, 1756, Obs. 17 and 18.*) A similar example is recorded by Stoerck. (*Ann. Méd. xi. p. 171.*) An instance, in which a stricture was met with in the aorta, opposite to the termination of the canalis arteriosus, is described by Sir Astley Cooper. The little finger could hardly pass through the constriction, which impeded the course of the blood through the heart and lungs, and was attended with a considerable dilatation of the right ventricle. (*Surgical Essays, vol. i. p. 103. 8vo. Lond. 1818.* For other facts of this kind, see *Bertin et Bauland, Traité des Mal. du Cœur et des gros Vaisseaux; Reynaud, in Journ. Hebdom. de Méd. t. i. &c.*) Gangrenæ scitis is sometimes connected with disease and morbid deposits within the aorta. (See *Carswell's Illustrations of the Elem. Forms of Disease, Fasc. 7. pl. 3. fig. 2.*) See MORTIFICATION.

OBILITERATION OF THE CAVITY OF THE AORTA.

It is observed by Professor Scarpa, that the whole body may be regarded as an anastomosis of vessels, a vascular circle; and he contends, that this remark is so true, that even an obliteration of the aorta itself, immediately below its arch, may take place, without the general circulation of the blood in the body being stopped. Such a disease of the aorta was seen by M. Paris in the body of a woman. While she lived, the blood, which was expelled from the heart, was transmitted into the trunk of the aorta, below the constriction; and it

got there by passing through the subclavian, axillary, and cervical arteries, into the mammary, intercostal, diaphragmatic, and epigastric arteries. From these latter arteries, the blood passed into the vessels of the thoracic and abdominal viscera, and those of the lower extremities. (See *Desault, Journal*, t. ii. p. 107.; *Brasdor*, in *Recueil Périodique de la Soc. de Méd.* t. iii. No. 18.) Another instance of complete obstruction of the aorta was met with by Monro. (See *Obs. on Aneur. of Aorta*, p. 6.) Dr. Graham, of Glasgow, published another example, in which the aorta was completely obstructed just below the *canalis arteriosus*. (See *Méd. Chir. Trans.* vol. v. p. 287.)

Dr. Goodison, of Wicklow, in examining the dead body of a woman, in the Hospice de la Pitié, at Paris, and endeavouring to trace the origin of the inferior mesenteric artery, discovered a hard tumour, placed upon the aorta, and accompanied with an obliteration of that vessel from the origin of the inferior mesenteric artery downwards the remainder of its length; the left iliac being also rendered impervious down to its bifurcation, and the right for more than one half of its length. The corpora sesamoida of the semilunar valves of the aorta were considerably enlarged, and the mitral and tricuspid valves presented the appearances termed by Corvisart "vegetations." The arch of the aorta was greatly enlarged, and internally was studded with patches of bone. The vessels given off from the trunk, and especially the lumbar arteries, were all noticed to be considerably increased in size. At the obliterated part of the abdominal aorta, there was a firm bony sheath, covering the vessel for about two inches, and filled with a hard fleshy substance, which extended further upwards, and was firmly adherent to the coat of the artery. It was the inner coat itself which was ossified. For a particular account of the vessels, which were chiefly enlarged for the purpose of continuing the circulation, I must refer to Dr. Goodison's description. The general appearance of the body was not unhealthy; and the lower extremities, which were not emaciated, must have been well supplied with blood. The history of the case could not be traced. Mr. Crampton having carefully compared Dr. Goodison's narrative with the preparation taken from this subject, refers the obliteration of the aorta to the effects of the process by which an aneurism had been spontaneously cured; in which particular, this case is quite different from those reported by M. Paris and Dr. Graham. (See *Dublin Hospital Reports*, vol. ii. p. 193, &c. 8vo. 1813.)

The foregoing cases prove, that the obliteration of the canal of the aorta, at any one part, is not incompatible with the continuance of life; and suggested the possibility of the application of a ligature to it being the means of sometimes saving the patient from the doom of certain death.

The next case, which I shall notice, is one of the most memorable in the annals of surgery, since it was nothing less than an operation, in which a ligature was applied, for the first time, to the aorta of a living subject, under circumstances which, at a time when the successful repetition of Brasdor's operation had not been made (see *Wardrop on Aneurism*, 1829), perhaps warranted even this desperate attempt to preserve life. Sir Astley Cooper had often placed ligatures round the aorta in dogs, and found that the blood was readily cur-

ried by the anastomoses to their posterior extremities (see *Med. Chir. Trans.* vol. ii. p. 158.); and he has ascertained, that if the aortic plexus be tied with the artery, the lower extremities are rendered paralytic, and the animal ultimately dies; but, if care be taken to include only the vessel in the ligature, these consequences do not take place. (See *Lancet*, vol. ii. p. 47.)

A porter, aged thirty-eight, was admitted into Guy's Hospital, April 9. 1817, for an aneurism in the left groin, situated partly above, and partly below, Poupart's ligament. The swelling was considerably diffused, and pressure upon it gave a great deal of pain. On the third day from his entrance into the hospital, the tumour increased to double its former size, and the pulsation became less distinct. The blood could be felt in a fluid state within the sac, which was so large that no operation was practicable, without opening the peritoneum. Sir Astley Cooper therefore waited, in order to let the man have the chance of a spontaneous cure. Notwithstanding the practice of venesection and compression, the swelling continued to increase, and, on the 20th of June, a bleeding took place from a point of the tumour, where a slough had formed. The bleeding recurred from time to time; and on the 25th he was so much exhausted by loss of blood, that his feces passed involuntarily, and his immediate death was only prevented by pressure on the opening. At nine o'clock in the evening, this experienced surgeon made a small incision into the sac above Poupart's ligament, and, introducing his finger, tried if it were practicable to pass a ligature round the external iliac artery, within the cavity; but the thing was found impossible, as, instead of the vessel, "only a chaos of broken coagula" could be perceived. At the moment of withdrawing the finger, two students compressed the aorta against the spine, and the incision was then closed with a dossal of lint. Sir A. Cooper now determined to apply a ligature to the aorta itself. "I made (says he) an incision, [three inches long, into the *linea alba*, giving it a slight curve to avoid the umbilicus. One inch and a half was above, and the remainder below, the navel," the cut being inclined towards the left side. "Having divided the *linea alba*, I made a small aperture into the peritoneum, and introduced my finger into the abdomen; and then, with a probe-pointed bistoury, enlarged the opening into the peritoneum to nearly the same extent as that of the external wound. Neither the omentum nor the intestines protruded; and, during the progress of the operation, only one small convolution projected beyond the wound." With his finger-nail he scratched through the peritoneum, on the left side of the aorta; and then gently moving his finger from side to side, he gradually passed it between the aorta and spine, and again penetrated the peritoneum on the right side of the aorta. A blunt aneurismal needle, armed with a single ligature, was next conveyed under that vessel, and tied, with the precaution of excluding the intestines from the noose. The wound was then closed, by means of the quilled suture and adhesive plaster. During the operation, the feces were discharged involuntarily, and the pulse, both immediately and for an hour after the operation, was 144. An opiate was given, and the involuntary passage of feces soon ceased. The sensibility of the right leg was very imperfect. In the

night, the patient complained of heat in the abdomen; but he felt no pain upon pressure; and the lower extremities, which had been cold a little while after the operation, were regaining their heat, but their sensibility was very indistinct. At six o'clock the following morning, the sensibility of the limbs was still imperfect; but at eight o'clock the right one was warmer than the left, and its sensibility returning. At noon, the temperature of the right limb was ninety-four; that of the left, or aneurismal one, eighty-seven and a half. At three o'clock, an enema was ordered. The heat of the right leg was now ninety-six; that of the left, or diseased limb, eighty-seven and a half. It is unnecessary, here, to detail all the various circumstances which preceded the patient's death. Vomiting, pain in the abdomen and loins, involuntary discharge of urine and feces, a weak pulse, cold sweats, &c., were some of the most remarkable symptoms. At eight o'clock on the second morning after the operation, the aneurismal limb appeared livid and cold, more particularly round the aneurism; but the right leg was warm; and between one and two o'clock the same day, the patient died. On opening the abdomen, there was not the least appearance of peritoneal inflammation, except at the edges of the wound; and the omentum and intestines were of their natural colour. The ligature, which included no portion of intestine or omentum, was placed round the aorta, about three quarters of an inch above its bifurcation. When the vessel was opened, a clot, of more than an inch in extent, filled it above the ligature; and below the bifurcation another clot, an inch in extent, occupied the right iliac artery, while the left contained a third, which extended as far as the aneurism. The neck of the thigh-bone was also found broken within the capsular ligament, and not united; an accidental complication. As there were no appearances of inflammation of the viscera, Sir Astley Cooper refers the cause of the man's death to the want of circulation in the aneurismal limb, which never recovered its natural heat, nor any degree of sensibility, though the right leg was not prevented from doing so; hence, says this experienced surgeon, "in an aneurism similarly situated, the ligature must be applied before the swelling has acquired any very considerable magnitude." (*Surgical Essays*, vol. i. p. 114, &c.)

Indeed, the most important conclusions from this case are:—First, that where no other impediments exist, the circulation will continue in the lower extremities, though the abdominal aorta be tied, or suddenly obstructed. Secondly, that suffering aneurismal swellings to become very large, before the operation is done, exposes the patient to considerable disadvantage, on account of the pressure of the disease upon the surrounding anastomoses, whereby the continuance of the circulation is rendered less certain, than it would be, were the operation done at an earlier period.

Sir Astley Cooper mentions, that if he were to perform the operation again, he would cut off the two portions of the ligature close to the knot on the vessel; because the irritation of the bowels by them seems to him a source of considerable danger. He has also said, that if a case like the foregoing should again occur to him, he would seek the aorta behind the peritoneum. (*See Guthrie on Dis. of the Arteries*, p. 363.) Whoever has practised the

operation of tying the common iliac artery on the dead subject must be fully aware of the practicableness of this last method: in my friend Mr. James's case, however, which I am about to notice, he found the peritoneum so firmly adherent to the aneurismal sac, that he says that it would have been absolutely impossible to have detached them from one another; and the method of operating, therefore, without opening the peritoneum, could not have been followed. (*James, in Med. Chir. Trans.* vol. xvi. p. 15.) In a third example, however, of ligature of the aorta, where Dr. Murray was the operator, the latter plan was executed, "without more difficulty than was to be anticipated." The patient died twenty-three hours after the operation. (*See Lond. Med. Gaz. for 1833, 1834, p. 68.*)

Mr. James, of Exeter, had a patient with an aneurism of the external iliac artery, situated so high up that the vessel could not be tied above the tumour. Brader's operation seemed to Mr. James the only feasible one; and he determined to try it, notwithstanding the total absence of pulsation in the groin raised a doubt whether the stream of blood was not altogether intercepted. Such want of pulsation Mr. James himself did not regard as a proof of want of circulation. "Having measured exactly half the distance between the spine of the ilium and the symphysis pubis," says Mr. James, "I made an incision over this point from a little above Poupart's ligament to about three inches down the thigh. A large gland then presented itself, which was dissected to the inside: underneath this the crescentic edge of the fascia lata was visible, which I also divided. I then proceeded, chiefly with my fingers and nails, to separate the parts till I reached the sheath of the vessels, which was at a considerable depth. This I scratched through with a silver knife, and bared the artery, under which I passed Weisse's needle, and tied it about half an inch below Poupart's ligament." (*See Med. Chir. Trans.* vol. xvi. p. 3.) Some diminution of the tumour at first took place; but, on the third day, it began to increase again; and, in about three weeks the integuments had a tense shining appearance, and afterwards a dusky-red cedematous look, denoting that sloughing could not be remote. The increase of the tumour towards the umbilicus appeared to Mr. James also to render some step necessary without delay. After a consultation with Dr. Miller, Mr. Luscombe, Mr. Barnes, Mr. Harris, and other practitioners, it was therefore decided to tie the aorta. Mr. James began the external incision an inch above the umbilicus, and extended it down to two inches below it. After the peritoneum had been opened, great embarrassment was occasioned by the protrusion of the distended bowels. The handle of the aneurism-needle broke at the moment the instrument was passed under the aorta. "The broken part was so sharp," says Mr. James, "that I was obliged to withdraw it for fear of injuring the intestine. With some additional difficulty I got my finger, with Weisse's instrument upon it, under the artery; but, even after this had been effected, it was by no means easy, with the best assistance of my colleagues, to extricate the short needle bearing the ligature, so much did the intestines interfere with every kind of manipulation. When the ligature was underneath, I kept the intestines out of the way with the fingers of both my hands, and

placed one of my thumbs on the vessel, whilst Mr. Luscombe drew it (the ligature) first on my thumb, and then on the artery." The tumour immediately became flaccid, and a deadness in the lower extremities was complained of. We shall only add, that the patient afterwards suffered severe pain in the lower limbs, which never ceased till he died, which event took place three hours and a half after the operation. During this short time, the temperature of the lower limbs was equal to that of the trunk; but it fell in every part of the body. The particulars of the *post mortem* examination are interesting; but I can only state here, with reference to Brasdor's operation, that "the external iliac artery did not terminate in the femoral, as usual, but gave off two trunks of nearly equal size; and from the inner, which corresponded with the profunda, the epigastric was given off." Mr. James does not regard then the result of his attempts as unfavourable to Brasdor's method; "for a considerable and satisfactory alteration was produced by tying only one of the trunks which led from the iliac, and had the distribution been natural, it is not improbable," says he, "a cure would have been obtained." (See *Med. Chir. Trans.* vol. xvi. p. 14.)

On this subject I find the following observations made by my friend Mr. Crosse:—"I meet yearly with recorded instances of a portion of the aorta being entirely obliterated, and the accounts of such cases are often followed by a word of encouragement to repeat the application of a ligature to this vessel. Astley Cooper, James, and Murray are the only names associated with this undertaking; and its intrepid originator allows me to say, that he would not repeat the operation, except under an improved and a more safe plan of conducting it, approaching to the sentiments of a recent writer, who sums up a full consideration of the subject by remarking that *the operation ought not to be again performed.*" (Crosse, in *Provincial Med. and Surgical Trans.* vol. v.) I am disposed to be of this opinion myself; and, at all events, believe with Mr. Guthrie, that the ligature of the aorta may be in almost every instance superseded by that of the common iliac artery. I think also with him, that if the operation ever succeed, it will be when the aorta is taken up by passing the finger under the peritoneum, along the common iliac artery, up to that vessel. (See *Guthrie, Op.* cit. p. 372.)

For tying either the aorta, the common iliac, or the internal iliac artery, Mr. Guthrie gives some directions for computing the point at which the artery is to be tied, in relation to the umbilicus and the anterior superior spinous process and the crest of the ilium. "The aorta," he observes, "bifurcates usually on the body of the fourth, or on the intervertebral substance between it and the fifth vertebra, although it may be higher or lower, which cannot be ascertained previously to the operation; and the most usual place is nearly opposite to the margin of the umbilicus on the left side. It is about half an inch above this that the ligature should be placed on the aorta, and rather lower than higher, on account of the origin of the inferior mesenteric artery. As the aorta is to be reached by carrying the finger along the common iliac, the comparative situation of that vessel is next to be estimated." (See *Guthrie on Dis. of the Arteries*, p. 368.) He afterwards ob-

serves, that the left margin of the umbilicus being taken as a point opposite to that which may be presumed to be the part at which the aorta divides, and the situation of the external iliac becoming femoral being clearly ascertained, a line drawn between the two will indicate the course of these vessels sufficiently to enable the operator to mark with his eye the place where he means to tie the artery, and to regulate the length of the incision, so that this ideal spot may correspond to the centre of it. If a ruler be placed on the crest of each ilium, about one inch and a half behind the anterior superior spinous process, it will pass across the junction of the fifth lumbar vertebra with the sacrum, and a little way behind the point where the common iliac divides into external and internal. The centre of an incision five inches in length, beginning about half an inch above Poupart's ligament, and about the same distance to the outside of the inner ring, and carried upwards, will fall nearly on a line with this point. Mr. Guthrie prefers an incision nearly parallel to the course of the epigastric artery, but a little to the outside of it, with a gradual inclination inwards towards the external edge of the rectus. The several layers of the abdominal muscles having been cautiously divided, and the fascia transversalis torn through, the fingers are passed outwards towards the ilium, and the peritoneum detached from the iliac fossa, and turned with its contents inwards. At the inner edge of the psoas muscle, the pulsations of the external iliac artery are then felt. "It is then to be traced upwards and inwards towards the spine, where the origin of it and the internal iliac from the common iliac trunk will be felt. The point of the forefinger will then be nearly in the centre of a line, drawn from the umbilicus to the anterior superior spinous process of the ilium; and hence the necessity for an incision five inches in length, if the artery is to be tied high up, which is to be accomplished by tracing it in a similar manner to its origin from the aorta." (See *Guthrie, Op.* cit. p. 371.) The aorta itself may be tied by the same method, the only difference being an extension of the incision further upwards, so as to make its length six inches. (P. 372.)

RUPTURE OF THE AORTA WITHIN THE PERICARDIUM.

The surgical writings of Scarpa, in relation to the formation of aneurisms, have now gained extensive celebrity in the world. It is well known that this author maintains the doctrine, that, in all aneurisms, the internal and muscular coats of the artery are ruptured; and that the aneurismal sac is not formed of these tunics, but of the dilated cellular sheath which surrounds the vessel. When a large aneurism bursts, there is always a double rupture; one of the artery, another of the aneurismal sac. The last is that which is the immediate cause of the patient's destruction, by altering the *circumscribed* state of the aneurism into the *diffused*.

There are some exceptions, however, to the foregoing statement; and Scarpa has not failed to point them out. When the internal and muscular coats of the aorta are ruptured in a situation, where the outside of the vessel is only covered by a thin, tense, closely adherent membrane, such membrane may be ruptured at the same time with the proper coats of the artery, and sudden death be occa-

sioned by the effusion of blood in the cavity of the thorax. These events are liable to happen whenever the proper coats of the aorta are ruptured within the pericardium, where the vessel is only covered by a thin layer reflected from this membranous bag. Walther has recorded one example of this kind, and Morgagni several others. A similar case is related by Scarpa. Several specimens are contained in the museum of the London University. (See *Haller, Disput. Chir. tom. v.; Acta Medic. Berlin, vol. viii. p. 86.; Morgagni, De Sed. et Causis Morb. Epist. xxvi. art. 7. 17. 21., Epist. xxvii. art. 28.; Scarpa on Aneurism, transl. by Wishart, p. 81. Also Hodgson on the Diseases of Arteries and Veins.*)

STEATOMATOUS TUMOURS OF THE AORTA.

Two steatomatous tumours were noticed by Stenzel in the body of a male subject. They were situated in the substance of the membranes of the aorta, immediately below its arch. Notwithstanding these swellings had rendered the vessel almost impervious, the man had the appearance of strength, and of having been well nourished. *Hæc corpora fere cor magnitudine æquabant ut omnem propemodum eventui e sinistri cordis thalamo sanguini spatium præcluderent.* De Steatomatibus in principio arteriæ aortæ, &c. Wittemb. 1723. This is another striking fact, illustrating the great power of the inosculations to carry on the circulation.

COMPRESSION OF THE AORTA,

In order to restrain hemorrhage from the inferior half of the body, more especially from the uterus, has been warmly advocated, and, in thin persons, seems calculated to be beneficial. (See *Crosse, Provincial Med. and Surgical Trans., vol. v.*) I have mentioned the adoption of this plan by Sir Astley Cooper, in the case where he opened the aneurismal sac, previously to putting a ligature on the aorta.

APIIÆRESIS (from ἀπαιρέω to remove). A term formerly used in the schools of surgery, to signify that part of surgery which relates to the removal of any portion of the body.

APONEUROSIS. Matter often collects under aponeuroses, particularly under those which cover the muscles of the thigh, leg, and forearm. Abscesses are also sometimes met with under the temporal, the palmar, and the plantar fasciæ; in the tendinous thecæ, which include the flexor tendons of the fingers; and, occasionally, also in the aponeurotic sheath, in which the rectus abdominis muscle is situated.

One particular effect of an aponeurosis, or fascia, lying between a collection of matter and the skin, is materially to retard the progress of the pus towards the surface of the body. Hence, if the case be allowed to take its own course, the quantity of matter increases; the pus spreads extensively under the aponeurosis in every possible direction; separates the muscles from such fascia, and the muscles from each other; and the abscess does not burst till a vast deal of mischief has been produced, together with more or less sloughing of the fascia, tendons, &c. These circumstances cannot happen without a considerable degree of constitutional disturbance, and a permanent loss of the use of certain muscles. Even when a spontaneous open-

ing is formed, and some of the matter escapes, it is often only a very imperfect discharge; for the aperture generally occurs, not in a depending situation, nor over the main collection of pus, but at a part where the aponeurosis is thinnest, and, consequently, where the matter has the least resistance to overcome in getting to the surface of the body.

In all such cases the chief indication is to make an early and a depending opening with a lancet, so as to prevent the extension of the abscess, and to let the matter escape as fast as it is formed. If a spontaneous opening should have occurred in an unfavourable place, a new aperture must be made in a proper situation; or if the former should be sufficiently depending, and near the principal accumulation of matter, but too small, it must be rendered larger with a curved bistoury and a director. Whenever any black dead pieces of fascia present themselves at the opening, they must be taken hold of with a pair of forceps, and extracted.

It is well observed by Mr. Mayo, that "the principal part which aponeuroses and fasciæ play in disease is mechanical; they are tense, strong, and unyielding. But what is salutary support in the healthy condition of a limb, is liable to produce painful and mischievous tension and confinement in disease." (See *Mayo's Outlines of Human Pathology, p. 127.*) Hence one reason for dilating gunshot and punctured wounds, and for the rule of making a free division of fasciæ in operations. These textures may be the seat of phlegmonous, rheumatic, and venereal inflammation. The latter affection has been seen on the aponeuroses of the arm and leg, in connection with syphilitic periosteal inflammation and suppuration of the tibia. (*Mayo, Op. cit. p. 128.*)

APPARATUS. Every thing necessary in the performance of an operation, or in the application of dressings. The apparatus varies according to circumstances. Instruments, machines, bandages, tapes, compresses, pledgets, dossils of lint, tents, sponges, basins of water, towels, &c. &c. are parts of the apparatus, as well as any medicinal substances used.

It is a rule in surgery to have the apparatus ready before an operation is begun. All preparations of this kind should be made, if possible, out of the patient's room and presence, as they might agitate and render him timid.

We have been rightly censured by a French surgeon, for our too common neglect of what has been here recommended. "In France," observes M. Roux, "we are careful not to let a patient, who is to undergo a serious operation, see any of the requisite preparations for it. We hasten as much as possible the immediate preparatory measures, in order not to prolong unnecessarily the restlessness and moral agitation, which the expectation of an operation, and sometimes of the slightest one, always produces. These precautions are neglected by the English surgeons; at least, by most of those whom I saw operate. They even neglect them in private practice, where, more commonly than in hospitals, we have to deal with pusillanimous individuals, who are easily alarmed, and whose extreme susceptibility it is of importance to spare. It was in the very room where the patient lay, of course under his eyes, that the table and all the necessary instruments for lithotomy, were arranged

at an operation, which I saw done in London, during my stay in that capital, by a gentleman at the head of his profession." (See *Parallèle de la Chirurgie Anglaise avec la Chirurgie Française*, p. 105.)

M. Roux, in his visit to London, had also too good reason to complain of the slovenly objectionable practice of leaving the application of the tourniquet, and the dressing of the wound after a surgical operation, to mere novices and students. I entirely coincide with him, that, in respect to the dressings in particular, a surgeon is bound to extend his attention and solicitude a little beyond the moment when the operation terminates.

APPARATUS MINOR; APPARATUS MAJOR; APPARATUS ALTUS. Three ways of cutting for the stone. (See LITHOTOMY.)

AQUA PICIS LIQUIDE. *Dubl.* Take of tar two pints; water, a gallon. Mix them with a wooden rod for a quarter of an hour, and after the tar has subsided, let the liquor be strained, and kept in well-corked bottles. This lotion is often used in porrigo and ulcers surrounded with scorbutic redness. (See LIQUOR.)

ARCOPHTOSIS. See ANUS, PROLAPUS OR.

ARGENTI NITRAS. (*Nitrate of silver, lunar caustic.*) See SILVER, NITRATE OF.

ARSENIC was the chief ingredient in a secret remedy, which long obtained celebrity in Ireland for the cure of cancer, and is now well known amongst surgeons by the name of Plunket's caustic. This application consists of the ranunculus acris, the greater crowfoot, the flammula vulgaris, and the lesser crowfoot, in the proportion of an ounce of each, bruised and mixed with a drachm of the white oxide of arsenic, and five scruples of sulphur. The whole is to be beaten into a paste, formed into balls, and dried in the sun. When required for use, these balls are beaten up with yolk of egg, and spread upon a piece of pig's bladder. The use of the ranunculus is to destroy the cuticle, upon which the arsenic would have no effect; for it is to be observed, that Plunket's caustic was employed for the dispersion of tumours, as well as for the relief of ulcerated cancers. The application is to remain on the part twenty-four hours, at the end of which the slough is to be dressed with any simple unirritating ointment. When arsenic was first recommended as an application for cancers, it used generally to be blended with opium. When Plunket's caustic is employed, so as to form an eschar over a scirrhus tumour, I conjecture, that if it ever do good, it is not by any specific effect of this arsenical application, but simply by its producing a slough, or issue, near the disease. It is highly probable, also, that the swellings, which have been thus dispersed, have never been complicated with the structure characteristic of true scirrhi. With respect to cancerous ulcers, Plunket's caustic sometimes produces a degree of amendment, which, however, rarely lasts for any considerable time; but many inveterate ulcerations, and anomalous sores, derive permanent benefit from it, and are even completely cured by it. Some examples of lupus, ulcerations about the roots of the nails, and reputed carcinomatous sores of the lips, are of this description.

At Paris, an arsenical paste was formerly used by Dubois, and other surgeons of that capital, for cancerous sores of the penis, and other malignant

ulcers. It was composed of seventy parts of cinabar, twenty-two of sanguis draconis, and eight of the white oxide of arsenic, formed into paste with saliva at the time when it is to be employed.

"The pain and inflammation that succeed the use of it (says Mr. Crosse) cannot be equalled by the severest operation with the knife." (*Sketches of the Medical Schools of Paris*, p. 45. 8vo. 1815.) Even death may be occasioned by the absorption of the poison, as appears from the two annexed facts, the first of which is recorded by M. Roux, in his *Médecine Opératoire*. "The day after the paste was applied, the patient complained of colic and severe vomiting, and in two days perished in convulsions, et les plus vives angoisses. The body went quickly into putrefaction. The internal coat of the stomach, and a great part of the intestinal canal, were inflamed, and marked here and there with dark spots." Just before I visited Paris (adds Mr. Crosse), I dissected in London a woman, who died under similar circumstances, and where the same morbid appearances were presented, &c. (*Op. cit.*)

Justamond's applications to cancer were generally combinations of arsenic and sulphur. One formula was an ounce of yellow arsenic, with half that quantity of Armenian bole, and sometimes as much red precipitate. He also employed a sulphuret of arsenic, and a combination of this sulphuret with crude antimony. The arsenical preparation selected for use was scraped, and laid on the middle of the sore, the edges of which were moistened with a combination of the muriate of iron and muriate of ammonia. In some instances, it is alleged, the effects of the treatment were the correction of the fetid smell, melioration of the appearance of the sore, and separation of the cancerous part.

In the *Pharmacopœia Chirurgica*, Justamond's arsenical caustic is directed to be made in the following manner:—℞ antimonii pulverizati, ℥j. Arsenici pulverizati, ℥ij. These are to be melted together in a crucible. The application may be reduced to any degree of mildness by blending with this pulverized caustic a quantity of opium in the form of powder, which was also supposed to act specifically in diminishing pain.

The powder of white oxide of arsenic, unmixd with other substances, has sometimes been sprinkled upon cancerous and other inveterate ulcers; but the practice is now abandoned by every judicious surgeon, on account of the violent pain resulting from it, and the not unfrequently fatal consequences of its absorption. Could I suppose that a man, so rash and ignorant as to revive this murderous practice, yet existed in the profession, I should feel disposed to lengthen these remarks; but I am persuaded that, in this country at least, more judgment and knowledge everywhere prevail. The white oxide of arsenic, however, may be applied with more prudence in other forms; either in one of those already specified; or as a lotion, composed of eight grains of the oxide, and the same quantity of subcarbonate of potash, dissolved in four ounces of distilled water; or as an ointment, formed by rubbing together one drachm of the oxide, and twelve drachms of spermaceti ointment. (See A. T. Thomson's *Dispensatory*, p. 51.)

Febure's celebrated remedy consisted of ten grains of the white oxide of arsenic, dissolved in a pint of distilled water, to which were then added

an ounce of the extractum conii, three ounces of the liquor plumbi subacetatis, and a drachm of laudanum. With this fluid, the cancer was washed every morning. Febure likewise gave arsenic internally; and his prescription was two grains of the white oxide; a pint of distilled water; syrup of chichory, q. s.; and half an ounce of rhubarb. Of this mixture, a table spoonful was given every night and morning, with half a drachm of the syrup of poppies. Each dose contained about one-twelfth of a grain of arsenic; but, in proportion as the patient was able to bear an increased quantity, the dose was gradually augmented to six table spoonfuls of the solution.

The arsenite of potash is an excellent preparation for internal exhibition. It is the active part of the liquor arsenicalis, L. P. The Dublin Pharmacopœia directs the arsenite of potash to be made as follows:—Take of white oxide of arsenic, nitrate of potassa, each an ounce. Reduce them separately to powder; then, having mixed them, put them into a glass retort, and place it in a sand-bath, exposed to a gradually raised heat, until the bottom of the retort becomes obscurely red. The vapours, arising from the retort, should be transmitted through distilled water by means of a proper apparatus, in order that the nitrous acid, extricated by the heat, may be disengaged. Dissolve the residue in four pounds of boiling distilled water; and after due evaporation set it apart, in order that crystals may form. This preparation has long been known under the name of Macquer's arsenical neutral salt. It may be given in the following way:—℞. Potassæ arseniatis gr. ij. Aq. menthæ viridis. ℥iv. Spir. vinosi tenuissimi ℥j. M. et cola. Dosis drachmæ duæ ter quotidie.

The following was Dr. Fowler's method of preparing arsenic for internal use:—Take of the white oxide of arsenic, and pure subcarbonate of potash, each sixty-four grains. Boil them gently in a Florentine flask, or other glass vessel, with half a pound of distilled water, until the arsenic is dissolved. To this solution, when cold, add half an ounce of the compound spirit of lavender, and as much water as will make the whole equal to a pint, or fifteen ounces and a half in weight. The dose of this solution, of which the liquor arsenicalis L. P. is an imitation, is as follows:—From two years old to four M. ij or iij to v; from five to seven, M. v to viij; from eight to twelve, M. viij to x; from thirteen to eighteen, M. x to xii; from eighteen upwards, M. xii. These doses may be repeated every eight or twelve hours, the medicine being diluted with thick gruel, or barley-water. As the preparation is decomposed by the infusion and decoction of cinchona, it should never be ordered with either of these medicines.

Dupuytren was in the habit of employing certain preparations of arsenic, which cleaned the diseased surfaces without destroying them. One of his formulæ was a powder; the other a liquid. The arsenious acid constituted the basis of both. The calomel, joined with it, he conceived might have some effect; but the arsenic was the essential thing. The powder consisted of four parts of arsenious acid, or oxide of arsenic, and ninety-six of calomel. Sometimes the proportion of arsenic was increased to five or six parts in the 100. The liquid preparation was principally the above powder mixed with gum arabic, and moistened with distilled water, so as to make a paste.

In the latter formula, however, Dupuytren usually increased the proportion of arsenic, employing six, eight, ten, or twelve parts of arsenic, with so many parts of calomel as made, with the arsenic, 100. Dupuytren employed this application with considerable success for the cure of many phagedenic ulcerations of the lips, and other parts of the face, approaching almost to cancer in respect to obstinacy. (See *Clinique Chir.* t. iv. p. 471.) In the North London Hospital, I employed Dupuytren's arsenical powder last year, in one or two instances of the same kind, with complete success. In lupus, or noli-me-tangere, it is a valuable application.

It will only be in my power to specify here a few of the numerous surgical cases in which the internal employment of arsenic has been proposed. The following are particularly worthy of attention: tetanic affections; cancer; lupus; elephantiasis; inert cases of lepra (see *Bateman's Pract. Synopsis of Cutaneous Diseases*, p. 33. ed. 3.); various unnamed malignant ulcers; certain forms or sequelæ of the venereal disease, or other unintelligible diseases, which cannot be subdued by mercury; different cutaneous affections, &c. A longer list of diseases, for which a trial of arsenic is suggested, may be seen in some papers published by Mr. Hill. (*Edin. Med. and Surg. Journ.* vols. v. vi.) ●

Arsenic was recommended by Dr. J. Hunter for the prevention of hydrophobia. (See *Trans. of a Society for the Improvement of Medical and Chir. Knowledge*, vol. i.) Later trials of it, however, do not appear to entitle it to any confidence. Dr. Marcet found it quite unavailing, though not less than three drops of Fowler's solution were taken every other hour, in two drachms of peppermint, or sweetened water. (See *Med. Chir. Trans.* vol. i. p. 141. 156.) After the symptoms of hydrophobia have once begun, arsenic is decidedly useless.

But although it fails in hydrophobia, some facts published by Mr. Ireland, and certain observations and experiments, detailed in Dr. Russel's work on Indian serpents, make it appear a truly valuable remedy for the effects of the bites of serpents. (See *Med. Chir. Trans.* vol. ii. p. 393.)

In cases of poison by arsenious acid, or arsenite of potassa, practitioners universally agree respecting the first indication, which is to empty the stomach as quickly as possible, with the stomach pump or an emetic. In this country, if the pump be not at hand, the common practice is to exhibit an emetic of sulphate of zinc, or sulphate of copper, which (it is said) ought to be preferred; first, because it does not require much dilution for its action—a circumstance of no small importance where poisons act by being absorbed; and, secondly, because it is extremely expeditious, a dose of fifteen or twenty grains producing almost instantaneous vomiting, without exciting that previous stage of nausea, which so frequently characterises other emetics, and which produces a state of the vascular system highly favourable to the function of absorption. (See *Pharmacologia*, by Dr. Paris, p. 232, vol. i. ed. 5.) If the pump be used, Dr. A. T. Thomson is of opinion, that lime-water should be used to wash out the stomach. The union of lime and arsenious acid forms a nearly insoluble salt; so that while we are freeing the stomach from its deleterious contents, we are also lessening the virulence of any part of it which may remain. If

the above emetics be given, lime-water should be drunk immediately after the first act of vomiting. Oil, and also milk, may be given; but no diluent fluid, calculated to dilute and dissolve the arsenious acid. Alkaline solutions are objectionable, because the alkaline arsenites are very soluble, and as poisonous as arsenic itself. (See *Thomson's Elements of Therapeutics and Materia Med.* p. 518. ed. 2.)

On the other hand, instead of the use of violent emetics, like antimon. tart. and sulphate of zinc, which, Orfila says, always increase the irritation created by the poison, he prefers exciting vomiting by making the patient drink large quantities of warm water, milk, water containing sugar or honey, linsed tea, and other mucilaginous fluids, the experiment of tickling the throat with a feather, or finger, not being omitted. After as much of the poison has been discharged by vomiting, as can be thus evacuated, the stomach may be mechanically washed out with the stomach pump; a plan, first proposed by Boerhaave, and afterwards improved by MM. Dupuytren and Renault. (See *Orfila, Toxicologie Générale*, t. i. p. 132. ed. 2. 1818. See also Mr. Jukes's *Obs.* on this subject in *Med. and Phys. Journ.* for Nov. 1822, and June, 1823; also *Lancet*, vol. i.) By this means, the contents of the stomach may either be pumped out at once, or any fluid may be first injected, and then drawn out again. As arsenic produces its fatal effects chiefly by being absorbed, an important indication, according to this principle, is to administer only such liquids as are least liable to dissolve the arsenic in the stomach. On this account lime-water has been recommended as proper to be drunk after the stomach has been emptied by vomiting. It is remarked by Orfila, that lime-water with milk offers no particular advantage in cases of poison with the solid arsenical acid; but, where this acid is fluid, he admits the great utility of lime-water, as, in this circumstance, an insoluble arsenite of lime is formed, the action of which is very weak. This last observation is confirmed by experiments on dogs. (*Toxicologie Générale*, t. i. p. 233. ed. 2.)

When inflammation of the abdomen, and alarmingly nervous symptoms prevail, the means of relief are leeches, venesection, the warm bath, fomentations, emollient clysters, and antispasmodic narcotic medicines.

Success will depend, in a great measure, upon the regimen observed during the patient's convalescence: he should be chiefly nourished with milk, gruel, cream, rice, and beverages of a mucilaginous nature. (See *Orfila*, t. cit. p. 235.)

In 1834, the peroxide, or hydrated protoxide, of iron was discovered, by Dr. Bunsen, to be a powerful antidote, if administered in time. (See *J. G. Crosse*, in *Proc. Med. Trans.* vol. v. p. 51.; *J. Robson*, in *Lond. Med. Gaz.* Nov. 5. 1836.)

ARTERIES. The process, by which a divided or punctured artery is healed, is particularly considered under the word **HEMORRHAGE**; while the general principles, which ought to be observed in the application of the means for the stoppage of bleeding, may be collected partly from the remarks contained in that part of the work, and partly from what is stated in the articles **AMPUTATION**, **ANEURISM**, and **LIGATURE**. As the condition of a bleeding patient admits of no delay, and the preservation of his life entirely depends upon proper measures being immediately taken, no man ought to be suffered to profess surgery, who is not competent to

the treatment of wounded arteries, whether injured by accident, or in a surgical operation. Loss of limb, or life itself, is the too frequent consequence of such ignorance. Thus, Langenbeck recites the case of a turf-cutter, who let the instrument with which he worked fall against the lower part of his leg, whereby the posterior tibial artery was wounded. The blood gushed out profusely, and the surgeon who was sent for applied a tourniquet to the popliteal artery, and thus stopped the bleeding for a time; but, unfortunately, the tourniquet was kept so long on the limb, that the foot mortified, and sloughed away. (*Bibl. für die Chir.* b. i. p. 231, 232. Gott. 1806.) From the explanations, delivered in the article **HEMORRHAGE**, it will be seen, that in all bleedings from considerable arteries, nothing is equal to the ligature, as a means of preventing the further loss of blood; and it may be laid down as a standing rule, that each extremity of the wounded vessel should be tied as near as possible to the wound in its coats. As Mr. Hodgson has remarked, "the necessity of tying both ends of a wounded artery is evident from the fact, that the anastomoses in all parts of the body are so extensive, as to furnish a supply of blood, which may pass through the lower extremity of the wounded vessel in a sufficient stream to produce an alarming, and, in some instances, a fatal hemorrhage." (*On Diseases of Arteries*, &c. p. 469.) This correct observation is followed by a case, in which the bleeding from the lower end of a divided brachial artery caused the patient's death. Of course, the inference is, that both extremities of the vessel ought to have been tied directly after the receipt of the wound. With regard to tying the trunk of an artery in a part of the limb, where it can be exposed with facility, when it is difficult to secure its bleeding extremities, as Mr. Hodgson remarks, the practice "was falsely deduced from a knowledge of the fact, that the ligature of an artery at a distance from the disease will effect the cure of an aneurism. But, a more intimate acquaintance with the condition of a limb after such an operation, and the processes by which the cure of an aneurism is effected after the modern operation, afford a complete illustration of the inefficacy and danger of this mode of treating a wounded artery; for it is now fully proved, that, when an artery is tied, a stream of blood continues to pass through it below the ligature." (P. 471.) This well-informed surgeon is aware, however, that instances do occur, in which only the upper end of a wounded artery is tied, and yet the patient recovers without hemorrhage from the lower orifice, which is closed by the natural processes.

In the year 1814, in Holland, I took up the femoral artery, in the middle of the thigh, in a case where the popliteal artery had given way, ten days after the passage of a musket-ball through the ham. I employed only one smallish ligature, which was applied with the precaution of not detaching the artery from its natural connections. The hemorrhage was effectually stopped, and the wound healed in the most favourable manner. Here, no doubt, the inflammation in the ham had obliterated the portion of the artery immediately below the point, at which it had sloughed, or ulcerated; and there might even have been from the same cause some deposition of lymph within the upper portion of the popliteal artery, contributing

to the success of the operation. But, no doubt, it was the diminution of the impulse of the circulation by the ligature of the femoral artery, which enabled nature to complete the obliteration of the wounded part of the vessel. In 1834, I cut down to and tied the popliteal artery in the North London Hospital, to stop hemorrhage from the posterior tibial artery, which had been wounded in a boy, who in cleaning a window slipped, and thrust his leg through a pane of glass. As, in consequence of the house-surgeon having made several ineffectual attempts to stop the bleeding by ligature of the posterior tibial, there was an extensive ill-conditioned wound, I judged it better to tie the popliteal artery, than to increase the disturbed state of the parts lower down. The operation, which was attended with no difficulty, succeeded completely, as the ligature of the femoral artery has done in the hands of Dupuytren, Delpech, and others, for the stoppage of hemorrhage from the tibial arteries in compound fractures of the leg. Sometimes, says Mr. Hodgson, when hemorrhage takes place, a few days after the bleeding from a wounded artery has been stopped by compression, one extremity of the vessel will be pervious, whilst the other will have closed by the natural processes. Cases have even occurred, in which the upper end of the artery has been closed by the natural processes, whilst those processes failed in effecting the obliteration of the lower extremity of the vessel, from which a serious hemorrhage took place. (*Hodgson, Op. cit.* 475.; and *Guthrie, in New Med. and Phys. Journ.* vol. iv. p. 177.) Indeed, in the example, in which I took up the femoral artery myself, it was impossible to say positively, whether the blood came from the part of the popliteal artery above, or below the slough in it, as no incision was made into the hum.

It is observed by Mr. Guthrie, that the lower end of a divided artery is more prone to secondary hemorrhage than the upper; and that when bleeding returns, after having been arrested for a period of four hours, it takes place, in all probability, from the lower end. "This (says he) may always be known by the darker colour of the blood, and by its flowing out in a continuous stream, in the same manner as water rises from a spring, and not with any arterial impulse." (*See Guthrie on Dis. and Inj. of Arteries*, p. 248.) His observations lead him to conclude, that the retraction and contraction of the lower end of a divided artery, is neither so perfect nor so permanent as at the upper end; and that the internal coagulum (see HEMORRHAGE) is in many instances altogether wanting, or very defective in its formation. (P. 251.)

In this work Mr. Guthrie censures the common fear about cutting muscular fibres, in operations to secure wounded arteries; and, in support of his own view, points out the inconveniences attending the plan of taking up the posterior tibial artery, as described by Mr. Harrison (see *Surgical Anat. of the Arteries*, p. 177. vol. ii. ed. 2.) Instead of this, he is an advocate for dividing muscles entirely, or the fibres of a muscle, by an extensive transverse incision, if likely to facilitate the application of the ligature to a wounded artery. (P. 261.) This last maxim, however, is not entirely new, Desault having long ago recommended cutting the sartorius across to get at the femoral artery; Scarpa, the pectoralis major, to get at the wounded axillary artery; and Dupuytren, the an-

terior scalenus, to reach a particular point of the subclavian. (See ANEURISM.) Mr. Guthrie disapproves of the directions given in some of the latest works for the ligature of the wounded posterior tibial and axillary arteries, and makes some remarks on "the manner of securing the ulnar artery, when wounded a little below its origin, and whilst covered by the pronator teres, and the superficial flexors of the forearm; viz. the flexor carpi radialis, palmaris longus, and flexor digitorum sublimis. Here, instead of regarding the operation as impracticable, on account of the intervention of these muscles, or tying the brachial artery, he is an advocate for making a clean incision down to the artery, through all the muscular fibres interposed between it and the surface, avoiding the median nerve, which runs between the two origins of the pronator teres, and placing a ligature above and below the wound in the artery." (P. 271.) "It is necessary to be attentive to the course of the great vessels and nerves, but not to the safety of muscular fibres, the division of which leads to no permanent injury." (P. 319.) Mr. Guthrie also strongly protests against Dupuytren's practice of tying an artery injured by gunshot, or a fractured bone above the place of injury, instead of exposing the vessel at the wounded point, and applying a ligature above and below the opening in it; a subject which I shall notice in subsequent articles. (See FRACTURE AND GUNSHOT WOUNDS.)

The principle, respecting the application of a ligature to each end of every large divided artery, is to be extended also to punctured arteries, one ligature being placed above, and the other below the opening in the vessel.

When an artery is merely cut or torn, but not completely divided, it seems to Mr. Guthrie to be in the same state, with regard to hemorrhage, as if it had given way by ulceration. It can neither retract, nor contract; and, unless pressure be accurately applied, and maintained, will continue to bleed, until the patient is destroyed. "The practice to be pursued (says he), is to divide the vessel, if it be a small one, such as the temporal artery, when it will be enabled to retract and contract, and the bleeding will soon cease. If an artery of larger dimensions be wounded, a ligature should be applied above and below the wound; and the vessel may, or may not, be divided between them, at the pleasure of the surgeon." (*On Dis. and Inj. of A. &c.* p. 253.)

From some observations in the article ANEURISM, it will be seen, that, when the impulse of the circulation has been lessened by the ligature of the main trunk of an artery, some distance above the wound, the hemorrhage from the more remote portion of the vessel may sometimes be effectually restrained by pressure, which, previously to the stoppage of one great current of blood to the part, had proved unavailing. This fact is worth remembering in cases, in which the arteries of the hand or foot are wounded.

Mortification is observed to be more frequent after the ligature of an artery for a wound, than for an aneurism. In wounds Mr. Hodgson, very correctly, I think, refers the difference to the frequent injury of the surrounding parts, and particularly of the veins and nerves, and to the loss of blood, and want of quietude, and proper care after the accident. The principal anastomosing vessels are also sometimes divided. (P. 479.)

In the article ANEURISM, I noticed the questions about the propriety and safety of tying both carotids, and whether this could be done without extraordinary risk, when no interval was left between the two operations. With respect to these points, I find that M. Manec is decidedly of opinion, that both the common carotid arteries may be tied at once in the same individual, without any marked or lasting derangement in the functions of different parts of the head. He believes, that the numerous anastomoses, which exist in the interior of the skull, between the terminating branches of the vertebral arteries and those of the internal carotid, are more than sufficient for the ready conveyance of blood from the former into the latter, and for the prevention of the brain from being sensibly affected by the obliteration of the two common carotids. Externally, the numerous communications between the branches of the external carotids, and those of the two subclavian arteries, more particularly the free anastomoses of the lower thyroid with the superior thyroid arteries, and those of the ascending cervical with the occipital arteries, leave no doubt in M. Manec's mind respecting the correctness of the opinion which he has advanced. He has frequently tied both the common carotids in animals, without the slightest impairment of their intelligence, or of their general health. At the period when he was recording his views of this subject, there was in the dissecting room of the hospital a large strong healthy dog, on which he had performed this operation four years previously: and whose intelligence continued perfectly undiminished. So fully convinced is M. Manec of the safety with which it may also be practised on the human subject, that he wished to undertake it on a young man who had an extensive tumour of erectile tissue on the face, but who would not submit to the proposal. (See *Manec, Traité de la Lig. des Artères*, pl. iv.)

Having explained in the article ANEURISM the plans adopted by some of the most celebrated operators, in cutting down to and tying many of the principal arteries, I will now introduce some additional instruction on this very important subject.

Perhaps, in no operation of tying an artery, is the exclusion of the vein and nerves of so much consequence, as it is in that of applying a *ligature to the common carotid artery*. As Dupuytren remarks, this fact depends upon the importance of the organs to which the adjacent nerves are distributed, viz. the heart, lungs, and stomach. (See *Leçons Orales*, &c. t. iv. p. 17.)

The right common carotid trunk is much shorter than the left; the former arising from the brachiocephalic trunk, the latter from the arch of the aorta. Both terminate opposite the space between the os-hyoides and upper edge of the thyroid cartilage; and behind each of them are the longus colli and rectus capitis anticus muscles, placed in front of the cervical vertebræ. In the lower part of the neck, the trachea is near their inner side; higher up, the thyroid gland; and still higher up, the larynx and pharynx. The external side of the common carotid is in contact with the internal jugular vein, which partly overlaps it; while, between the two vessels, but rather behind them, and enclosed in the same common sheath with them, the pneumogastric nerve descends. In the lower part of the neck, the carotid sheath has behind it the recurrent laryngeal nerve

and the inferior thyroid artery. The descending branch of the ninth nerve commonly lies upon the forepart of the sheath, closely connected to it, and about the middle of the neck, forms a plexus, with some filaments from the second and third cervical nerves. At the upper part of the neck, it lies rather towards the outer side of the sheath; at the lower, on the inner side of it. Mr. Harrison has often found it within the sheath, behind the jugular vein. The sympathetic and cardiac nerves are situated between the sheath and the rectus anticus major muscle. The common carotid artery is covered below by the skin, platysma, and cervical fascia, and also by the sterno-mastoid, sterno-hyoid, and sterno-thyroid muscles. Opposite the upper rings of the trachea, it is crossed by the omohyoideus. But, from this point to its bifurcation, the vessel is covered only by the skin, platysma, and fascia. The omohyoideus, as it proceeds from the shoulder behind the sterno-mastoid muscle, divides the artery into an upper and lower portion, and the side of the neck into two triangular spaces. In the lower triangle, bounded by the trachea, clavicle, and omohyoideus itself, the common carotid is concealed by the sternal origin of the mastoid muscle, and lies deeply. But, in the upper triangle, bounded externally by the margin of the sterno-mastoid muscle, above by a transverse line, denoting the uppermost extent of this space below the os hyoides, and below by the omohyoideus, the vessel is much more superficial. Here, however, a plexus of veins often lies directly in front of the carotid sheath. (See *Velpeau, Nouv. Élém. de Méd. Opér.* t. i. p. 234.; *Quain's Anatomy*, ed. 2. p. 437.; *Harrison's Anat. of Arteries*, vol. i. p. 19, ed. 2.; *Manec, Traité de la Lig. des Artères*, No. i. pl. iv.) A chain of absorbent glands lie near the carotid sheath, principally on its external side, and are partly concealed by the sterno-mastoid muscle, and covered by the cervical fascia. In young subjects, they are large and numerous; "they are frequently enlarged and indurated by chronic inflammation; the muscles and fascia press them closely to the vessels; they become fixed, and have a pulsation communicated to them, so as to resemble aneurism." (*Harrison, Op.* vol. cit. p. 21.)

The operation of tying the common carotid, is sometimes performed while the patient is in the sitting posture; but, on account of the chance of his becoming faint, I consider the recumbent position best, with the chest somewhat raised, the neck moderately extended, and the chin turned towards the opposite side. If the artery is to be tied below the omohyoideus, the front edge of the sterno-mastoid muscle is to be first felt for, and an incision, three inches long, made in the direction of it, commencing opposite the cricoid cartilage, and directed towards the sterno-clavicular articulation, a little above which it is to terminate. On the other hand, when the artery is to be taken up above the omohyoideus, the incision through the skin should begin higher up, and not be continued so low down. The second stroke of the knife divides the platysma myoides, and cervical fascia, so as to bring into view the fibres of the sterno-mastoid muscle. Unless this last incision be made over the latter muscle, it is best to pinch up a portion of the cervical fascia with the forceps, and cut it across, so as to make a small opening in it for the introduction of a director, on which it is to be slit

ap. (See *Quain's Anatomy*, p. 450. ed. 2.) An assistant now draws the inner margin of the wound, and the sterno-thyroid and sterno-hyoid muscles, towards the median line, while the surgeon himself draws the external margin of the wound, and the sterno-mastoid muscle, outward. For this purpose, blunt hooks are sometimes preferred, as not concealing the parts so much as the fingers.

The omohyoides is now seen running across the wound in the form of a red cord, and above and below it are the vein and artery, enclosed in their common sheath.

This sheath should be opened over the artery, and not over the vein, with the aid of a pair of forceps and a director. If the jugular vein swell up so much as to conceal the parts, pressure is to be made on it at the upper angle of the wound. (See *Velpeau, Nouv. Elém. &c. t. i. p. 241.*) Then an eye-probe, or aneurism-needle, is to be conveyed between the vein and artery, and under the posterior surface of the latter, without meddling with the pneumogastric nerve, the great sympathetic, or any of their branches.

It seems to M. Velpeau, that if the surgeon were to cut at first to the inner side of the mastoid muscle, there would be some risk of mistaking the sterno-hyoides for it, and getting wrong. He thinks it better, therefore, to cut down upon the surface of the sterno-mastoid muscle, a few lines from its anterior margin. As the coats of the vein are very thin and easily torn, the knife is never to be applied near it.

If the sheath were not duly opened, the pneumogastric nerve, situated within its posterior layers, between the carotid and jugular vein, would certainly be tied, and the cardiac nerves and descendens noni be in danger of suffering the same fate.

The ligation of the common carotid above the omohyoides is rendered easier by the more superficial situation of the vessel, which is merely covered by the skin, platysma, and the cervical fascia. The incision is to commence a little below the angle of the jaw, and be continued down to the extent of about three inches in the upper triangle of the neck, that is in the interspace between the sterno-mastoid muscle and the larynx. The skin and platysma having been divided, the cervical fascia is to be pinched up with a pair of forceps, and an opening made in it by cutting it across. Then a director is to be introduced, and the operation finished according to the directions already given, as applicable to that below the omohyoides.

In the operation of applying a ligature to the subclavian artery, on the outside of the scalenus anticus, the patient is to lie on his back, with his shoulders somewhat raised. The head and neck are to be turned towards the sound side, while an assistant depresses the shoulder, and raises the arm from the side. The first incision is to be made transversely, an inch above the clavicle, as Velpeau prefers, or near, or even upon, as many other surgeons prefer, from the outer edge of the sterno-mastoid muscle to the front edge of the trapezius. After the integuments have been cut, the platysma myoides is to be divided. The external jugular vein itself may generally be drawn aside with a blunt hook; but, if this cannot be readily done, a double ligature must be put under the vein, and then, after which it is to be cut through in the interspace. Then the cervical fascia is soon ex-

posed, which is to be cautiously opened, by pinching a piece of it up with the forceps, and making a small opening, which is to be enlarged with the aid of a director. The edge of the scalenus anticus can then be immediately felt under and within the sterno-mastoid muscle. After having lacerated or separated the cellular tissue, absorbent glands, &c. in the bottom of the wound with a probe, or a director, the finger is conveyed towards the insertion of the scalenus, where the tubercle of the first rib will be felt; a little behind and on the outside of which the artery is always situated.

When once the artery is found, it is not necessary to bring it into view; for the nail being applied to its posterior and external side, serves as a guide for the bent eye-probe or aneurism-needle, the point of which is to be passed from before backwards, and a little from without inwards, the surgeon keeping his finger over the artery, between it and the lowermost nerve of the brachial plexus, so as to steady the vessel. (See *Velpeau, Nouv. Elém. &c. t. i. p. 229.*)

With reference to the ligation of the external iliac artery, I have but little to add to the account given of this subject in the article ANEURISM. From the sacro-iliac symphysis, where the common iliac artery bifurcates, down to the crural arch, the external iliac artery describes a gentle curve, which is more marked in the female than the male subject, and the convexity of which is turned outwards and backwards. The artery descends along the inner margin of the psoas muscle, to which it is connected by a thin membrane, derived from the iliac fascia, situated behind the artery. Although the production from the iliac fascia is so thin that the artery and vein can be seen through it, yet it is sufficiently strong to prevent them from being displaced or separated. (See *Harrison's Surgical Anat. of the Arteries*, vol. ii. p. 117.) The vein lies to the inner side of the artery, and at first rather behind it; but, near Poupart's ligament, it is on the same plane as the artery, resting upon the os pubis, and upon a few fibres of the psoas and pectineus muscles. The anterior crural nerve is on the iliac side of the artery, but on a plane posterior to it, and separated from it by the psoas, between which and the iliacus internus the nerve covered by the iliac fascia is imbedded. "Two or three small branches from this nerve, and from the lumbar plexus, are connected to the artery, and descend along its external side. These branches are distributed to the spermatic cord and to the integuments of the groin." (See *Harrison, Op. cit.*) The ureter, in its descent behind the peritoneum, crosses over the anterior surface of the external iliac artery, and so does the vas deferens. As for the peritoneum, it is connected to the external iliac artery merely by loose cellular tissue, and below quits the vessel entirely to be reflected over the posterior surface of the parietes of the abdomen. The only branches of importance, which the external iliac artery gives off, are the circumflexa ili and the epigastric, which usually arise opposite the ilco-pectineal line, though sometimes a quarter or half an inch above, or below this point. The absorbent glands, which lie in the course of the external iliac artery, being sometimes enlarged, excite a suspicion of diseases which do not exist. On the right side, the cœcum, and, on the left, the sigmoid flexure of the colon, are the only

viscera, interposed between the external iliac artery and the parietes of the abdomen. As MM. Bogros and Velpeau have noticed, nothing is easier, in a thin person, whose abdominal muscles are relaxed, than to make effectual pressure on this artery. M. Velpeau had an opportunity of ascertaining the truth of this observation in a young man, who met with an accidental wound of the artery above the origin of the epigastric, requiring the injured vessel to be tied without delay. (See *Velpeau, Nouv. Elém. de Méd. Opér. t. i. p. 172.*)

In Abernethy's method of tying the external iliac artery, an incision is made, about three inches and a half in length, in the direction of the artery, down to Poupart's ligament. The aponeurosis of the external oblique muscle being thus exposed, is to have an opening cautiously made in it; and, a director being now introduced, the aperture is enlarged in the direction, and to the same extent, as the wound in the integuments. "The internal oblique and transverse muscles, which are closely connected with each other, are to be carefully cut into at the lower part, so as to allow a director, or the point of a finger, to be introduced below them, when they also are to be divided, the finger separating them from the fascia transversalis and peritoneum. The fascia transversalis, running from Poupart's ligament, to the peritoneum, is now to be torn through with the nail, immediately over the pulsating artery, and the peritoneum is to be separated by the finger, and pushed upwards until sufficient room is obtained; which, in this, as well as in all other operations on the iliac arteries, is sometimes difficult, on account of the protrusion of the intestines, covered by the peritoneum, when the patient is not sufficiently tranquil. The artery is yet at some depth, and covered by a dense cellular membrane, connecting it to the vein on its inside, and which must be torn through with the nail. The aneurism-needle should be passed between the vein and the artery, and the point made to appear on the outside of the artery." (See *Guthrie on Dis. &c. of Arteries*, p. 373.) This description, with the observations in the article ANEURISM, will suffice to render Abernethy's plan very intelligible.

To the account of Sir Astley Cooper's method of taking up the external iliac artery, given in that part of the Dictionary, I have nothing to add.

In the article ANEURISM, a description is given of the operation of *tying the femoral artery* in the upper third of its course. If it were indispensable to apply a ligature to it in the *groin, or just below the crural arch*, the surgeon should remember, that here the situation of the artery corresponds to the mid point between the anterior superior spinous process of the ilium and the tuberosity of the os pubis; though, in women, in whom the pelvis is wider, the artery is rather nearer the pubes. The vessel may also be readily felt as it is passing over the os pubis, being only covered by the integuments, superficial fascia, some lymphatic glands, and the fascia lata. Immediately below Poupart's ligament, the femoral vein lies on the pubic side of the artery. The anterior crural nerve lies about half an inch away from the iliac side of the artery, imbedded between the iliac and psoas muscles. (See *Harrison's Surg. Anat. of Art. vol. ii. p. 136.*) Here the sartorius is completely to the outer side of the artery, not interfering in any way with its

exposure, nor serving as a direct guide to it, as it does in the middle third of the thigh. In the operation, the limb should be extended and rotated outwards; an incision made, beginning about an inch above Poupart's ligament, and extended downwards in the direction of the artery, to the distance of two inches below this ligament. The layers of the superficial fascia are then to be divided to the same extent; and any lymphatic gland in the way pushed to one side, or, if enlarged and diseased, removed. The fascia lata is next to be divided, and the sheath of the femoral vessels pinched up with a pair of forceps, and cautiously opened. Lastly, the aneurism-needle, or eye-probe, used for the conveyance of the ligature under the artery, is to be introduced on the pubic side of this vessel, between it and the vein, so as to leave the latter completely safe. As in some individuals the origin of the profunda is unusually high up, and of nearly the same size as the femoral, one of them might be mistaken for the other. The profunda, however, is the more external of the two. The effect of pressure on each, in checking the hemorrhage, or the pulsation of an aneurism, will also be a guide to the operator. (See *Harrison, Op. vol. cit. p. 160.*) Sometimes a double femoral artery has been met with.

The direction, given by M. Malgaigne, to place the ligature as closely as possible above the origin of the profunda (*Man. de Méd. Opér. p. 188.*), if adopted, would be very likely to be followed by secondary hemorrhage, for reasons elsewhere explained. (See HÆMORRHAGE.)

The operation of *tying the femoral artery in the middle third of the thigh*, not having been fully described in the article ANEURISM, I annex the following particulars. — This artery, in its course from the crural arch to the lower third of the thigh, runs in the direction of a line, which, drawn from the centre of Poupart's ligament, descends obliquely inwards round the limb to the middle of the popliteal space. This description is nearly correct; but, as Dr. Quin observes, as this line runs along the inner surface of the thigh, its course is more oblique than that of the vessel, which is placed much nearer the shaft of the femur. (*Elem. of Anat. p. 505. ed. 2.*) In the middle third of the thigh, the femoral artery is more deeply placed than in the upper, because, in addition to the integuments, superficial fascia, and fascia lata, it has the sartorius lying over it, beneath which there is also another fascia extended over it, from the adductor muscle to the vastus internus. This fascia, though thus above, becomes very dense where the artery approaches the opening in the adductor magnus. In the groin, the femoral vein lies close to the inner side of the artery; but, as it descends, it gets more under the latter vessel, and, in the popliteal space, it is situated quite to the outer side of it.

An incision, three inches in length, is to be made along the inner edge of the sartorius, which is the common rule, and perhaps better than Lisfranc's modification, which consists in making an incision of this length in the mid space between the gracilis and sartorius; for, by exposing the fibres of the latter muscle, their very course affords useful instruction to the surgeon; for he then knows immediately where he is, and what ought to be done. The integuments and superficial fascia having been divided, and the fascia lata to the same extent, the

inner edge of the sartorius is exposed. This is to be gently raised, and drawn outwards. The fascia, extending from the vastus internus to the adductor, and covering the artery, is brought into view, and with the aid of a pair of forceps, and a director, it is to be cautiously opened, by which means the sheath of the femoral vessels will be exposed. Here the great saphænal nerve lies within the sheath, on the anterior and external side of the artery, and the rule is not to include it in the ligature. Lastly the aneurism-needle is to be conveyed under the artery, between it and the vein. In making the incision through the integuments, the great saphænal vein should be avoided, by not directing the knife too obliquely downwards and backwards.

In addition to what has been stated in the article ANEURISM, respecting the *ligature of the brachial artery*, I may observe that the course of this vessel corresponds to an oblique line, drawn from the armpit to the middle of the bend of the elbow. The median nerve, which above runs along its radial margin, soon gets in front of it, and, crossing it very obliquely, passes quite to its ulnar side below. Two satellite veins usually accompany the artery, and even sometimes cover it, and thus separate it from the median nerve. The ulnar and internal cutaneous nerves, which lie near it above, separate further and further from it as they descend, in order to reach the inner part of the forearm. The artery, lying at first near the humerus, between the coraco-brachialis and the tendon of the latissimus dorsi; afterwards passes over the insertion of the coraco-brachialis, and gets upon the brachialis anticus, a little behind the inner margin of the biceps, which last muscles it accompanies to its termination. In the supine state of the hand, the brachial artery is less covered by the biceps; and hence in the operation of taking it up, this position is advantageous. (See *Manec, Man. de Méd. Opér.* p. 166.) In thin subjects, the fascia is almost contiguous to it, and sends off a duplicate to include the artery, its two accompanying veins, and the median nerve, all which form, as it were, one common fasciculus.

The whole is covered by the common integuments, and, in the lower third of the arm, by the trunk of the basilic vein. The anomalies of the brachial artery are very frequent. Velpeau, and most other surgeons, have seen it divide near the axilla, and at nearly every other point between this and the elbow. In one subject, Velpeau found its bifurcation take place two inches above the trochlea of the humerus, to form the ulnar and posterior interosseous. In another, the latter was completely independent of both the ulnar and the radial. Sometimes the two trunks, produced by the bifurcation, pass down to the forearm parallel to one another; in other instances, they cross once, or several times; and it is not uncommon to find one piercing the fascia, so as to get immediately under the skin, while the other, which then gives off the radial and the interosseous, retains its ordinary relations. (See *Velpeau, Nouv. Elém. de Méd. Opér.* t. i. p. 210.)

In the operation of placing a ligature on the brachial artery at the bend of the elbow, the surgeon should remember, that the course of the vessel there corresponds to a line drawn obliquely inwards and upwards, from the middle of the front of the elbow, to the inner border of the biceps. Its course is also denoted by the median basilic

vein, which passes under the skin, almost in the same line as the artery. An incision, between two and three inches in length, is to be made through the skin, on the inner side of this vein, which is to be carefully drawn out of the way. Then, with the aid of a director, the fascia, and the fibrous production given off from the tendon of the biceps, are to be divided, which having been accomplished, the artery will present itself, bounded on the right and left by its two venæ sodales, the median nerve lying three or four lines from its inner border. To facilitate the passage of the aneurism-needle or director under the artery, the elbow is to be a little bent, and the instrument passed from within outwards under the vessel. (See *Manec, Op. cit.* p. 166.) If the operation were performed somewhat higher, the surgeon must remember, that two or three inches above the trochlea of the humerus, the median nerve would begin to be in front of the artery.

In the upper part of the arm, the brachial artery lies at the inner border of the coraco-brachialis, and has the median nerve at first external to it, and then in front of it. Below the insertion of the coraco-brachialis, it is situated at the inner edge of the biceps. Four circumstances are enumerated as guides for the external incision. 1. The inner edge of the coraco-brachialis above, and that of the biceps below. 2. A line drawn from the middle of the axilla to the middle of the bend of the elbow. 3. Placing the fingers on the median nerve, and cutting on its inner side. (*Lisfranc.*) 4. The pulsations of the artery. The knife is carried in the direction of the artery, from above downwards in the right arm, and from below upwards in the left, and an incision made in the integuments, about three inches long.

With the forefinger the surgeon next endeavours to feel the median nerve, which presents itself as a round very hard cord; and to distinguish the artery by its pulsations. He then divides, with the aid of a director, one after the other, the fascia, and the sheath given off by it to the median nerve; and breaking, with the end of a probe or director, the fibro-cellular covering of the vessels, separates the artery from the veins, and puts a ligature under it. Except when anomalies occur, the operation is simple. M. Velpeau has only once seen the median nerve under the artery. In all ordinary cases, it is the first cord met with behind the inner margin of the biceps. (See *Velpeau, Nouv. Elém. &c.* t. i. p. 211.)

As some very celebrated surgeons have made the serious mistake of tying the median nerve for the brachial artery, I advise the practitioner never to tighten the ligature, until he has tried the effect of pressure on what he supposes to be the artery.

In order not to mistake the ulnar for the median nerve, and to be led to seek for the artery where it will not be found, it is an excellent rule to proceed in the operation from the anterior to the posterior part of the arm. (See *Manec, Man. de Méd. Opér.* p. 167.)

Ligature of the Radial Artery behind the Carpus.—If the thumb be forcibly extended, the tendons of its great abductor and long extensor will be made very prominent behind. In the depression between them, the pulsations of the radial artery can be felt. The thumb being drawn away from the forefinger, an incision, an inch and a half in length, is to be made in the direction of the foregoing

tendons, first through the skin, and then through the fascia. The artery is then to be separated from some veins and nervous filaments, with a probe or director. (See *Manec. Op. cit.* p. 163.)

After the radial artery leaves the fore part of the wrist, it may be taken up by making an incision "on the outside of the insertion of the extensor primi internodii pollicis, and the inside of the extensor tertii internodii pollicis. Betwixt these tendons, the artery lies very deep, and over it is the extreme branch of the muscular spiral nerve. We find the artery going close to the notch, betwixt the os scaphoides and trapezium." (*Sir C. Bell, Op. Surgery*, vol. ii. p. 373.)

Ligature of the Radial Artery in the Lower Third of the Forearm.—Here the artery can readily be felt, being only covered by the fascia and the skin. On each side of it is a vein; but the radial nerve is considerably to the outer side of it, having passed under the supinator radii longus, a little below the middle of the forearm. An incision, two inches and a half long, is to be made a little way from the radial margin of the flexor carpi radialis, between this and the supinator longus. The fascia is to be opened, and the ligature passed from within outwards, or from without inwards, as the surgeon may choose, as it is a matter of indifference, the nerve being out of danger.

Ligature of the Radial Artery in the Upper Third of the Forearm.—Here the artery runs in the space which separates the supinator radii longus from the pronator teres and palmaris longus, covered by the internal border of the first of these muscles, and of course by the fascia and the skin. It is always accompanied by two veins, and has the radial nerve at its outer side. Its course is accurately indicated by a line, drawn from the middle of the bend of the elbow to the mid point between the styloid process of the radius and the tendon of the palmaris longus.

In the direction of this line, M. Roux makes an incision, about two inches and a half in length, commencing a little below the elbow. If the median vein is met with, it is pushed aside. The fascia is then slit up with a director, and the border of the long supinator drawn outwards, without dividing it. The artery having been brought into view, the aneurism-needle, or eye-probe, is passed under it from without inwards, on account of the nerve. (See *Manec, Man. de Méd. Opér.* p. 164.)

Others adopt the following plan: A finger is to be put on the insertion of the tendon of the biceps. A little below this insertion, an incision, about two inches and a half in length, is to be made in the integuments, in the oblique direction, denoted by the inner edge of the supinator radii longus. The subjacent fascia is then to be divided, and the inner edge of the supinator muscle drawn a little from the outer side of the arm: in the space between that muscle and the flexor carpi radialis, the radial artery immediately presents itself, passing over the tendon of the pronator radii teres, and the flexor longus pollicis. Afterwards it runs down between the latter-named tendon and the flexor carpi radialis. (See *Camper's Demons. Anat. Pathol.* lib. i. tab. 1. fig. 2.)

Ligature of the Ulnar Artery at the Wrist.—Here the artery passes on the radial side of the pisiform bone, with the ulnar nerve on its outer side, and a vein on each side of it. In this place an incision, two inches long, is to be made through

the skin, cellular tissue, and palmar fascia, one after the other. The artery having been thus exposed, an eye-probe is to be passed under it from without inwards.

Below the middle of the forearm, the ulnar artery is superficial, and, may easily be taken up by making an incision upon the radial side of the flexor carpi ulnaris, between the tendon of which muscle and that of the flexor profundus digitorum, the vessel is situated. The artery, however, will not be reached until a thin aponeurosis under the fascia of the forearm has been divided. The nerve is rather more under the tendon of the flexor carpi ulnaris, than the artery. When the ulnar artery arises from the brachial above the elbow, it pierces and runs above the fascia, and is easily taken up in any part of its course.

For bringing into view the ulnar artery at the upper third of the forearm, the situation and breadth of the flexor carpi ulnaris muscle must first be ascertained. An incision is then to be made from above downwards, beginning two inches below the inner condyle of the humerus, and following the course of the inner margin of the above muscle to the extent of two inches and a half. The fascia is then to be divided; and the flexor carpi ulnaris drawn a little away from the flexor sublimis. In this opening, rather under the margin of the latter muscle, the ulnar artery will be felt with the finger, continuing its course over the flexor profundus. The ulnar nerve is situated on the ulnar side of the artery. Mr. Guthrie's opinion, respecting the propriety of dividing the muscles which conceal the upper third of the ulnar artery, have been noticed in the beginning of the present article.

Ligature of the Anterior Tibial Artery on the Foot.—The anterior tibial artery becomes superficial about six inches above the ankle, from which point it descends between the tendon of the tibialis anticus and that of the extensor of the toes. It passes with these tendons under the annular ligament, and rather nearer to the internal malleolus than the external; thence inclining inwards, it penetrates between the first and second metatarsal bones to the sole of the foot, where it inosculates with the external plantar artery. The inner branch of the deep dorsal nerve of the foot is at its inner side; its corresponding vein at its outer side. It is covered,—1st, By a thin fibro-cellular expansion, separating it from the adjoining tendons. 2dly, By adipose cellular tissue. 3dly, By the fascia of the instep. 4thly, By the common integuments. On the instep, the first tendon of the extensor communis digitorum pedis, lies upon the outer side of the artery; that of the extensor of the great toe upon its inner side.

An incision, two inches and a half long, is made in the skin, in the direction of an oblique line from the middle of the instep, to the first interosseous space. The skin, adipose substance, and fascia, are to be divided; the fibro-cellular aponeurosis, between the tendons of the first two toes, opened; and the artery tied, after being separated, by means of a director, from the accompanying nerve and veins. (*Velpéau.*)

Ligature of the Anterior Tibial Artery in the Leg.—The two upper thirds of this artery lie close to the interosseous ligament; but lower down the artery advances towards the outer side of the spine of the tibia; consequently, the higher it is, the

more deeply it is situated. The two veins accompanying it, innosculate across it by several small branches. The anterior tibial nerve crosses over it obliquely inwards and downwards, though sometimes it continues on its outer side down to the instep. The artery, veins, and nerve are included in cellular tissue, which does not, however, form a true sheath for them. Above, the artery lies between the tibialis anticus and the extensor communis; in the middle of the leg, between the tibialis anticus and the extensor of the great toe; and still lower down, between the extensor of the great toe and the extensor communis.

In order to lay bare the anterior tibial artery, a little above the middle of the leg, the finger is to be passed along the outer side of the spine of the tibia, and the breadth of the tibialis anticus muscle is to be ascertained. Along the outer margin of this muscle, an incision is to be made through the integuments and fascia, two inches and a half in length. The knife is then to be introduced between the outer margin of the tibialis anticus muscle and the extensor longus of the great toe. In this space, at the depth of about an inch, the anterior tibial artery is situated. (See *Haller's Icon. Anat. fasc. v. tab. 4.* Also *J. P. Manec, De la Lig. des Artères*, pl. 12.)

Ligature of the Anterior Tibial Artery in its Lower Third.—The skin, the subcutaneous fat, the cellular tissue, and the fascia, are to be divided in succession, to the extent of about three inches, and in the direction of a line drawn from the mid point between the head of the fibula and spine of the tibia to the instep. Then, with a director or the fore-finger, the tendon of the extensor muscle of the great toe is to be separated from that of the tibialis anticus, pushing it outwards from the extensor communis, if the operation be at the upper part of the lower third of the leg; but inwards, if the operation be done quite at the inferior extremity of the leg. Nothing, then, remains to be done but to separate the artery from its accompanying veins, and from the anterior tibial nerve, which in this part of the limb is at its inner side, having crossed it from the outer in its descent. (See *Manec*, pl. xii. fig. 1.; *Velpeau, Nouv. Élém.* &c. t. i.)

Ligature of the Anterior Tibial Artery in its Middle or Two Upper Thirds.—Lisfranc makes an incision extending obliquely from below upwards, from the spine of the tibia towards the fibula. Having cut transversely through the fascia, the interspace between the tibialis anticus and the extensors is sought for.

In the ordinary method an incision is made in the track of the artery, as determined by the line above specified, about an inch on the outside of the spine of the tibia. The skin and fascia are divided to the extent of three inches. The muscular interspace, at the bottom of which the artery will be found close to the interosseous ligament, is denoted by a yellowish line. In order to convey the ligature round the artery, Velpeau passes a director under it very obliquely, from below upwards, and from the fibula towards the tibia.

Ligature of the Posterior Tibial Artery.—From its origin, a little below the popliteus muscle, to its division into the external and internal plantar arteries, the posterior tibial artery follows very precisely the direction of a line, with a slight convexity inwards, from the middle of the upper

part of the calf to a point half an inch behind the internal malleolus. Two veins usually accompany it, sometimes forming by their anastomoses a complete network round it. In the upper part of the leg, the posterior tibial nerve lies to the inner or tibial side of the artery, but soon passes over it to the outer or fibular side. In the two upper thirds of the leg, the posterior tibial artery is deep seated, lying in the upper third upon the tibialis posticus, in the middle third upon the flexor digitorum communis; while lower down it is separated from the tibia only by fat and cellular tissue. From the gastrocnemius and solaeus, it is divided by the deep crural fascia, which muscles lie over its two upper thirds. In the lower third, no muscles cover it.

In the arch of the os calcis, the posterior tibial artery is in contact with the fibrous sheath of the flexor communis digitorum, about half an inch from the posterior border of the inner malleolus. Here the nerve is behind it, the veins at the inner side. The artery is enveloped in cellular and adipose tissue. The internal ligament of the tarsus, a fibrous layer continuous with the fascia of the leg, after covering the artery, becomes blended with the dense cellular tissue interposed between the vessel and the skin. (*Velpeau*.) Between the internal malleolus and the lower part of the calf, the posterior tibial artery is somewhat further from the internal edge of the tibia, and the nerve is rather on its outer side than behind it. The deep-seated fascia, which is here very thin, keeps the artery bound down upon the tibialis posticus, flexor longus communis digitorum, and flexor longus proprius pollicis. External to this fascia is the tissue that fills the sheath of the tendon of Achilles, and then the common fascia of the leg directly under the skin.

In the calf, the posterior tibial artery is very deeply seated, almost on the same plane as the posterior surface of the tibia, and much nearer to its external or fibular edge than its internal. It is covered by a strong fascia, that lies over the flexor muscles; and then by the fibial portion of the solaeus; the internal head of the gastrocnemius; the fascia of the leg; the subcutaneous cellular tissue, in which are found the great saphenous vein and the internal saphenous nerve; and lastly, the skin. (See *Velpeau*.)

Ligature of the Posterior Tibial Artery.—The leg is to be bent and laid upon its outside.

Behind the malleolus internus. An incision, slightly curved, with its concavity forwards, is to commence an inch above, and to terminate an inch below the posterior edge of the malleolus internus, and to be at least three lines behind it. It will, therefore, be between the malleolus internus and the tendon of Achilles. If the operation is to be performed in the hollow of the os calcis, it is necessary, as M. Velpeau directs, to divide the tissues cautiously, layer by layer, and to introduce a director under the fascia, previously to its division, lest the artery, which is sometimes very superficial, be wounded. If the incision were made too near the malleolus, the fibro-synovial sheath of the groove, which that process contributes to form, would be opened: if too far backward, the artery would be more difficult to find. (See *Velpeau, Nouv. Élém. de Méd. Opér. t. i.*) In fact, behind the lower end of the tibia, the tendons of the tibialis posticus, and of the flexor commun-

digitorum, pass in a kind of furrow. Along with these two tendons, but somewhat nearer to the os calcis, the posterior tibial artery descends to the sole of the foot.

The depth of the posterior tibial artery in the two upper thirds of the leg, makes it difficult to take it up in these situations. When necessary, however, it may be exposed, and tied above and below the wound in it, by proceeding as follows:—An incision, four inches in length, is made along the inner side of the tibia; the solæus muscle detached from the bone to the same extent, and reflected. The internal saphenous vein is to be avoided. Under the solæus muscle is found the fascia, which separates the muscles of the calf into superficial and deep-seated. When this fascia has been divided, the posterior tibial artery may be seen, or felt, deeply situated, running on the tibialis posticus and flexor muscle of the toes. (See Haller, *Icon. Anat.* fasc. v. tab. 5.; Manec, *De la Lig. des Artères*, fol. Paris, 1822, pl. 13.)

The method of trying to take up the posterior tibial artery, by making the incision at the inner and posterior edge of the tibia, is disapproved of by Mr. Guthrie on account of its difficulties. "The operator (says he) has cut his four inches, has turned up the edge of the gastrocnemius, and has insinuated his director under the head of the solæus, which he has also sliced away from the bone. The artery is still an inch inward, bound down by a strong fascia," which "must be cut immediately over, or by the side of the artery: it will not do to separate it from the bone, and then to push it over; it cannot be done." Then supposing the fascia to be divided in the best way, Mr. Guthrie deems the separation of the two veins from the artery, and the passage of the aneurism-needle under the artery from without inwards, so as to avoid the nerve, almost impracticable. "If a bystander should inquire why this most painful, difficult, bloody, tedious, and dangerous operation is done? the answer would be, solely because it was not usual to make a longitudinal incision in the muscles of the calf of the leg,—an incision, which, if made by accident, would be pronounced to be one attended with little danger, and not likely to lead to any subsequent detriment." (See Guthrie on *Inj. and Dis. of Art.* p. 259.)

Instead of this method, Mr. Guthrie advocates the following:—An incision is to be made, six or seven inches in length, through the integuments and muscles of the calf down to the fascia. If the case is a gun-shot wound, the centre of the incision is to be on a line with the shot-holes; or if they are diagonal to each other, between them. The smoothness of the fascia points it out; and the loose cellular membrane, connecting the divided muscles to it, allows the edges of this long incision to be easily separated and the fascia cut, so as to expose the nerve, artery, and veins. The tourniquet is now to be unscrewed, and the bleeding denotes where the artery is injured. The knife may be applied perpendicularly to the fascia, and the artery laid bare for three or four inches in extent. (P. 261.) Perhaps the length of the incision as here described, is rather greater than actually necessary. Five inches will afford a great deal of room; but, where the muscles of the calf are very bulky, it will be requisite to make the wound long.

Ligature of the Peroneal Artery.—Here, in

following Mr. Guthrie's directions, the incision should also be made through the muscles of the calf, towards the fibular side of the leg; and after the deep fascia under them has been divided, the artery will be found covered by the fleshy fibres of the flexor longus pollicis, at any point below three inches and a half from the head of the fibula. These fibres having been divided, the artery will be found close to the inside of the bone. Above the point specified, the artery lies upon the tibialis posticus, under the deep fascia interposed between it and the muscles of the calf. No nerve accompanies it.

Ligature of the Axillary Artery.—In proportion as this vessel approaches the hollow of the axilla, it gets nearer to the vein, and becomes surrounded by those nervous fasciuli, by means of which, one portion of the brachial plexus communicates with another. Hence, to cut down to the artery in this place in the living body, and to tie it separately, is acknowledged to be an arduous task. The difficulty is further increased by the distance of the vessel from the surface. Hence, M. Manec objects to any attempt being ever made to apply a ligature to the artery between the pectoralis minor and the lower border of the subscapularis. Independently, says he, of the difficulties of the operation, this part of the axillary artery would be unfavourable to its success, on account of the several branches which are given off from it, near one of which the ligature must be placed.

Directly the axillary artery has arrived opposite the lower border of the great pectoral muscle, the difficulty ceases. Here the brachial plexus no longer exists; each of the different nerves arising from it has taken the course to its particular destination, and the artery is only covered by the integuments and fascia. Behind, it rests upon the tendons of the teres major and latissimus dorsi; in front, it corresponds to the coraco-brachialis, from which it is separated by the median nerve. At its inner side are the internal cutaneous nerve, and the axillary vein, which sometimes consists of two or three branches, and renders the dissection of the artery more tedious. Farther backward than the axillary vein are the ulnar and musculospiral nerves. The relation of these last nerves to the artery it is of great importance to recollect, in order that neither of them may be mistaken for the median nerve.

In the operation of taking up the extremity of the axillary artery, the patient should be placed upon his back, and the arm raised from the side. An incision, two inches and a half in length, is to be made six or eight lines behind the anterior margin of the axilla, through the skin and subcutaneous cellular tissue. A piece of the fascia is then to be lifted up with the forceps, and an opening made in it, by cutting transversely close to the end of the forceps; then a director is to be passed into the opening, and the fascia slit up to the extent of the external wound. If the fascia be tough and dense, so as not to afford convenient room, Manec recommends the incision in it to be converted into a crucial one. These things having been accomplished, the further use of the knife is not necessary. The anterior edge of the wound being now lifted up, the coraco-brachialis will be seen, and the median nerve at its inner side. This nerve being detected, the artery will be found behind it.

M. Manec offers valuable cautions with refer-

ence to the manner of avoiding the serious mistake of supposing the ulnar or muscular spiral nerve to be the median. To escape this blunder, he very properly insists upon the prudence of proceeding backwards from the coraco-brachialis, for in doing so the first nerve arrived at is the median. (See *Manec, Traité de la Lig. des Artères*, fol. Paris, 1832, Expl. of pl. 6.) In the case of a wound, however, the surgeon has not exactly the choice of the place for the application of the ligature to the axillary artery. Here he must obey the rule of applying it to the wounded part of the artery, and putting one ligature above and another below the bleeding orifice; or if the artery be completely severed, both its extremities will require to be tied.

In taking up the axillary artery, when it is wounded, Scarpa believes that nothing tends more to embarrass the surgeon, than an injudicious smallness of the first incision through the skin and such other parts as conceal the wound in the artery. An assistant must compress the vessel, from above the clavicle, as it passes over the first rib. When the weapon has penetrated, from below upward, directly into the axilla, the surgeon is to make a free dilatation of the wound upon a director, or his finger. This must be done to a sufficient height to expose a considerable portion of the artery, and the precise situation of the wound in it.

When the weapon has pierced obliquely, or from above downwards, through a portion of the great pectoral muscle, into the axilla, Scarpa advises the surgeon to cut through the lower edge of this muscle, and enlarge the wound, on a director, or his finger, so as to bring fairly into view the injured part of the artery. The thoracic arteries, divided in this operation, must be immediately tied. The clots of blood are then to be removed, and the bottom of the wound cleaned with a sponge, by which means the opening in the axillary artery will be more clearly seen. As this vessel lies imbedded in the brachial plexus of nerves, the surgeon must take care to raise it from these latter parts with a pair of forceps, before he ties it. Two ligatures will be required; one above, the other below, of the wound in the artery.

ARTERIOTOMY (from *ἀρτηρία*, an artery, and *τομή*, to cut). The operation of opening an artery, and taking blood away from the system in this manner, for the purpose of preventing, alleviating or curing disease. The only arteries of any size, from which blood is ever taken in practice, are the trunk and branches of the temporal artery, which lie in such a situation, that after the due quantity of blood has been taken away, the bleeding can be readily stopped by compressing the wounded part of the vessel against the neighbouring portion of the cranium. A narrow sharp-pointed bistoury, or a lancet, a basin for the reception of the blood, a compress, and a roller, are the only things required. In general, it is best to open the trunk of the temporal artery; but sometimes its frontal or occipital branch will yield blood enough. When the part of the artery which the surgeon chooses to open lies near the surface, and its pulsation is very distinct, and even visible, it may be opened at once with a lancet. But, in many instances, it is better first to make a cut in the skin, and then puncture the vessel. In all cases, the surgeon should recollect;—1st. That the temporal artery

and its branches are covered by the skin, adipose cellular tissue, and a thin aponeurosis. 2dly, That the trunk of the artery divides in the temple, about fifteen lines above the zygoma, and is situated about four lines in front of the meatus auditorius. 3dly, That its frontal branch runs forward from its origin, and its occipital branch in the opposite direction. A good place for the puncture is about four lines above the zygoma. In taking away blood from the temporal artery, or one of its branches, the surgeon should never forget the fact, that the loss of arterial blood produces a more debilitating effect than that of venous; but, in many instances, the requisite quantity of blood cannot be drawn by this operation, as every surgeon of experience must have observed. In order to prevent the blood from trickling down over the bedding or clothes, when it does not issue in a jet, the French make a little gutter with a piece of card for conveying it into the basin. After the proper quantity of blood has been taken away, a graduated compress and the nodose bandage are applied. The latter consists of a simple band, four yards long and two fingers' breadth wide, rolled up into two heads of unequal size. The unrolled portion being applied over the graduated compresses that cover the wounded artery, the surgeon conducts the two heads, before and behind, to the opposite temple, where he crosses them, in order to return to the point of departure. He now gives them a turn or twist, which enables him to carry one over the summit of the head, and the other underneath the chin to the sound side, where they meet and cross, as in the first instance. Thence they are conducted in the same course to the point of departure; and a second twist being effected, they are conducted for the third time to the opposite temple; and, for the third time, returned also horizontally and knotted: being conducted finally, one over the vertex and the other underneath the chin, the bandage is terminated by a few circulars of the long head." (See *Cutler's Surgeon's Practical Guide in Dressing, and in the Methodic Application of Bandages*, p. 46. 12mo. Lond. 1834.) A graduated compress and a few turns of a roller round the forehead, temple, and occiput, are generally preferable to the foregoing bandage, the part of which extending under the chin is often very irksome to the patient. In a few cases, notwithstanding pressure, the blood bursts forth from time to time; and when this happens, it is best to cut the vessel completely across, which will enable its ends to retract and contract, and thus promote the process of nature in closing them. In three or four days the wound is generally healed, but occasionally an aneurism follows; an interesting memoir on which subject has been published by M. Desruelles. (See *Mém. de la Soc. Méd. d'Émulation*, t. ix. p. 277.) In one instance, Cavallini effected a cure by dividing the vessel and compression. (*Colletti di Casi Chir.* t. ii. Firenze, 1762.) Sir Benjamin Brodie informed me of a case, which he treated successfully in a similar manner. In the course of the present year, 1836, a woman was under my care in the North London Hospital for a temporal aneurism, which followed cupping on the temple. As the blood found its way freely into the tumour, after one branch had been tied, I divided another, and applied a compress; the plan was then effectual. Sir Astley Cooper informed me of a tem-

poral aneurism, which was produced by a person falling with his temple against the corner of a table.

M. Blandin had a patient, who, in consequence of arteriotomy, suffered acute pains which extended to the top of the head, in the track of the superficial temporal nerve; this consequence, which is uncommon, may be relieved by lengthening the puncture, or incision, at each of its angles, or even cutting out a portion of the nerve. (See *Dict. Je Méd. et de Chir. Pratiques*, t. xiv. p. 422.)

ARTERITIS. *Inflammation of an Artery.* As the coats of arteries possess vessels and nerves of their own, and have an organization more or less similar to that of all the living textures of the body, they must be liable to inflammation, suppuration, ulceration, and gangrene, as well as other morbid changes, especially a deposit of calcareous or atheromatous matter, between the inner and middle coats. Arteritis, as contrasted with phlebitis, or inflammation of veins, is much less perfectly understood, so far as the symptoms and diagnosis are concerned. It is very certain, however, that the arteries are not so irritable as the veins, and, consequently, that arteritis is less frequent than phlebitis. Pathologists divide it into *acute* and *chronic*. The anatomical characters of the acute are, redness of the internal membrane of the artery affected, an effusion of plastic fibrine on its inner surface, thickening of its substance, and sometimes ulceration. When inflammation runs from a wound, or some other point of irritation, along the internal coat of an artery far towards the heart, it is like phlebitis; a formidable disease, rapidly producing great irritative fever, an extremely quick pulse, complete collapse, low delirium, and generally death. Arteritis, by completely obstructing a main artery and its principal branches, is sometimes a cause of mortification. The treatment of acute arteritis consists in bleeding, purgatives, diaphoretics, low diet, cooling diluent drinks, and perfect tranquillity. Digitalis, tartrate of antimony, and super-acetate of lead, are also prescribed on the principle of calming the circulation; but, as Dr. Hope observes, they must be used with discretion. (See *Cyclop. of Pract. Med.* part ii. p. 149.) After the first violence of the inflammation has been checked, mercury is sometimes given, so as to excite gentle but quick salivation.

Chronic arteritis is more common than acute. The internal membrane becomes thickened, softened, and of a deep, dirty red colour. "These appearances (says Dr. Hope) are not uniformly diffused, but more marked in the vicinity of calcareous and other degenerations. Hence, some have supposed that these degenerations were the cause of the inflammation. There can be little doubt, that they tend, in many instances, to keep it up; but, it is highly probable that the degenerations themselves were originally caused by increased vascular actions of a chronic nature." (See *Cyclop. of Pract. Med.* part ii. p. 145.)—The formation of spontaneous aneurisms is now commonly believed to have its origin in chronic arteritis.

ASCITES (*ἀσцитες*, from *ἀσκός*, a bottle). *Abdominal Dropsy*, especially that which consists of an effusion of serous fluid in the cavity of the peritoneum. (See *PARACENTESIS ABDOMINIS*.)

ASPHYXIA (from a privative of, and *σπύζω*, the pulse). Cessation of the action of the heart

from the interruption of respiration; or rather of the effect produced by that function on the blood.

Asphyxia may also be defined to be a suspension of the phenomena of respiration, occurring primarily, and followed by that of all the other functions, and frequently by death. The general causes of asphyxia may be arranged under three principal heads. 1. Asphyxia from deficiency of air. 2. From the air being unfit for respiration, yet not producing any deleterious effect on the economy. 3. From the inspiration of some gas which is deleterious. As M. Duvergie rightly observes, however, the suspension of functions, or the mode of death in the last case, is very different from what is exemplified in the two first; because it is, in fact, a kind of poisoning, brought about by the action of a deleterious principle, either on the nervous system, or the blood, and the individual may perish, though he is actually respiring air. (*Duvergie*, in *Dict. de Méd. et de Chir. Prat.* art. *Asphyxie*.)

Cases of Asphyxia admit of a classification, first, into those into which there is primarily a stoppage of the mechanical phenomena of respiration; and, secondly, into others in which the chemical phenomena are primarily interrupted. As examples of the first mode of asphyxia, it will suffice to mention those in which the muscles of inspiration cannot act. 1. This happens where a heavy mass of earth, or other materials, suddenly falls upon a man, and makes great pressure on the chest, or abdomen. 2. Where the nervous influence does not extend to these muscles, as where the medulla spinalis is injured high up, or the phrenic nerves have been paralysed by the effect of lightning. 3. Where the same muscles are in a state of inaction from the influence of intense cold. Asphyxia, from the passive expansion of the lungs not taking place, may be exemplified in cases where the abdominal viscera are forced through an accidental or natural opening of the diaphragm into the chest, or when the lungs are compressed by fluid in the cavity of the pleura, and various other causes.

Asphyxia depending upon the primary cessation of the chemical phenomena of respiration is of two kinds. In one, it arises from some mechanical impediment to the entrance of air into the lungs, as in cases of foreign bodies entering the trachea, submersion, hanging, &c.; in the other, it depends upon a deficiency of air fit for the purposes of respiration.

Asphyxia may be the original affection, or it may be only the termination of another disorder. Thus, a person is attacked by pneumonia, and dies of asphyxia, caused by hepatization of the lungs; or, he is seized with pleurisy, and is ultimately destroyed by an effusion of serous fluid in the chest. (See M. Duvergie, in *Dict. de Méd. et de Chir. Prat.* art. *Asphyxie*.)

As the salutary effect of respiration depends upon the air, which is respired, containing a due proportion of free oxygen, the deficiency or absence of this element must necessarily produce asphyxia. On this principle, azote, hydrogen, carbonic acid gas, and air too highly rarified, will cause asphyxia. Carbonic, and some other gases, act fatally also, on the principle of being positively deleterious to life, when introduced into the air-cells. One manner in which asphyxia may be occasioned, is by submersion, the lungs of warm-blooded animals not having an organisation, qualifying them to derive from the oxygen contained in water the

salutary influence on the blood, which they collect from the respiration of atmospheric air.

Asphyxia may likewise arise from various circumstances preventing the entrance of air into the lungs; as, the lodgment of a foreign body in the larynx, trachea, or œsophagus; a swelling of the membrane of the larynx; obstruction of this organ and the trachea with fibrine, as in croup; tumours formed near, or pressing upon, some part of the respiratory tube, and pressure upon the same organ from any other cause, as is exemplified in strangulation.

It has been explained that some causes of asphyxia operate by destroying the mechanism of respiration; that is, by rendering the muscles concerned in this function paralytic. Thus an injury of the medulla spinalis, as high up as the third cervical vertebra, by destroying the influence of the phrenic nerves, will paralyse the diaphragm. It will, at the same time, paralyse the other principal muscles concerned in producing the requisite changes in the dimensions of the chest; and, consequently, a fatal asphyxia must take place. This was well illustrated in a case lately brought into the North London Hospital. The ends of the neck-handkerchief of a youth, aged fifteen, were caught by the wheel of some machinery, which drew his neck with great force against the works, and at the same time caused violent strangulation. In about one minute the handkerchief was cut through, and the constriction removed: he was brought to the hospital with his respiration stopped, and asphyxia from this cause. Attempts were made to restore respiration, and the action of the heart, first, by blowing air into the lungs, through the nostrils. Whenever this was done, the action of the heart returned, the pulse rose, and the livor of the lips and countenance disappeared; but, as soon as the inflation of the lungs was discontinued, then the pulse sunk so as to become undistinguishable, and the skin assumed the purple colour again. Finding that this happened repeatedly, a suspicion was entertained that the cervical vertebræ had sustained injury; but, in order that the inflation of the lungs might have every chance of doing good, in the event of other injury not existing, I performed tracheotomy, and air was introduced into the lungs with a pair of bellows and a tube. All this, however, was in vain; and galvanism was equally unsuccessful. The boy was kept in a state exhibiting signs of life, for about six hours from the period of the accident; but, his temperature continuing to get lower and lower, he at length sunk. In the *post mortem* examination, a fracture of the arch of the third cervical vertebra, a laceration of the front ligament of the spine, an effusion of blood on the medulla, and also another effusion behind the pharynx, were detected.

Formerly, the cessation of the action of the heart in hanging, or drowning, was referred to a mechanical impediment to the transmission of blood through the lungs to the left cavities of the heart. But the experiments of Goodwyn and others prove, that no such mechanical obstruction exists; and that, even after the fullest expiration, the air, remaining in the air-vesicles of the lungs, distends them sufficiently to permit the blood to circulate freely through them. The real obstacle arises out of the interruptions of those chemical changes which atmospheric air produces on the blood while circulating in the pulmonary vessels, and which convert it from venous to arte-

rial blood. In fact, the blood, which in asphyxia thus retains its venous character, does, for a time, pass through the pulmonary circulation, and is conveyed into the left ventricle, which propels it into the aortic system of arteries. But, this blood, which is thus substituted for arterial, has deleterious properties, depriving the organs, to which it is sent, of the power of performing their respective functions. Sensibility, irritability, together with all the physical and vital actions depending upon them, are suspended. (See *Roget*, in *Cyclop. of Pract. Med.*, art. *Asphyxia*.) From the investigations of Bichat, it appears that the primary effect of the circulation of venous, or what he calls black blood, is on the brain, and that this effect extends, through the intervention of the brain, to the whole nervous system. Loss of sensibility, therefore, precedes the suspension of the action of the heart, and takes place as soon as the venous blood, sent into the arteries, reaches the brain. (See *Bichat*, *Recherches sur la Vie et la Mort*.)

The face of a person who has been drowned is, in general, pale, though slightly livid. A frothy liquid, and some water, are found in the trachea, bronchi, and air-cells of the lungs: the latter organs are of a violet colour, but contain less blood, than where asphyxia has been occasioned by carbonic acid gas; the right auricle and ventricle are filled with black blood; in the stomach there is generally more or less water, which has been swallowed; the surface of the brain is of a darker appearance than usual, but its vessels not particularly turgid; and the air remaining in the lungs contains little oxygen. (*J. F. Berger*, *Essai sur la Cause de l'Asphyxie par Submersion*, Genève, 1805; *Goodwyn on Connexion of Life with Respiration*, p. 19.)

When the person, at the time of falling into the water was intoxicated, stunned by a blow on the head, or in a state of syncope, there can have been no struggle. Under such circumstances, the trachea will contain a little water, but no froth; the lungs will be of their natural colour, and not much expanded; no water will be found in the stomach; and the blood in the venous system will not be so disproportionate to that contained in the arterial. As *Dr. Roget* justly observes, the great diversity in these and other circumstances "will enable us, perhaps, to explain the differences that are met with in the time, during which the body may remain under water, compatibly with the possibility of restoring life. If the submersion have not exceeded five minutes, and no blow against a stone or other violence has occurred to complicate the effects, our efforts at resuscitation, if properly conducted, will generally be successful. After a quarter of an hour, recovery is not very common; after twenty minutes, or half an hour, it may be considered as nearly hopeless. The longest period, recorded in the Reports of the Humane Society, is three quarters of an hour. On the other hand, some, who have only been a few minutes under water, cannot be restored to life, even by the prompt application of proper means." (*Dr. Roget*, in *Cyclop. of Pract. Med.*, art. *Asphyxia*.)

In the endeavour to resuscitate a person whose animation has been suspended by immersion, the wet clothes should be promptly removed, and the body covered with blankets, and placed on a table, with the head and chest raised; the nostrils and mouth are to be freed from froth, and kept per-

fectly unobstructed. The lungs are then to be inflated with the kind of bellows employed by the Humane Society, and provided with a short flexible tube, one end of which is adapted to the nozzle of the bellows, and the other to a silver tube, designed for introduction into the nostril. As the glottis is open, air, conveyed into one of the nostrils, while the other and the mouth are closed, and the larynx is pressed towards the vertebrae, so as to close the œsophagus, must necessarily pass into the lungs. The lungs being thus filled, are next to be emptied, by an assistant compressing the chest, and expelling the air. The same operations are to be repeated until natural respiration begins, or until this and other approved measures have been tried, at least, six hours. (*Dr. Curry, Obs. on Apparent Death, &c.*) When this method fails to fill the lungs with air, tracheotomy may be performed; but, in the opposite case, it is not necessary. As the body is insensible, there is, indeed, commonly, little or no difficulty in passing any bent tube of moderate diameter and proper length into the glottis, when the tongue is drawn forwards, and tracheotomy, under these circumstances, cannot be needed. Thus, with an ordinary silver catheter, air may be blown into the lungs. Together with inflation of the lungs, gentle friction of the body with warm flannels or the hand, stimulating the nostrils with hartshorn, and injecting warm stimulating fluids into the stomach with a syringe and tube passed down the œsophagus, are plans generally commended. Slight shocks of electricity, or galvanism, through the heart and diaphragm, may also be tried, if the apparatus be ready at hand.

After the breathing has been restored, the patient is to be watched, lest he yet fall a sudden victim to a returning accumulation of black blood in the brain, or to the violent effects of reaction in the system.

The treatment of persons whose animation is suspended by *strangulation*, is the same as that of persons in a similar condition from submersion. Here, however, the fulness of the sinuses of the brain may render bleeding indispensable.

In cases of asphyxia depending upon obstruction of the glottis, larynx, or trachea, by disease, foreign bodies, or tumours, tracheotomy or laryngotomy, according to circumstances, is frequently the only means by which life can possibly be saved. (See LARYNGOTOMY and TRACHEOTOMY.)

The treatment of asphyxia from carbonic acid gas, consists in removing the body immediately into the fresh pure air, sprinkling it with cold water, if its temperature be high, galvanising it, and endeavouring to restore the breathing, by blowing air down the glottis: oxygen gas, if at hand. Differences of opinion are entertained about the utility of bleeding. (See *Goodwyn's Connexion of Life with Respiration*, Lond. 1788. *A. Portal, Obs. sur les Vapeurs Méphitiques sur les Noyés, &c.* 8vo. Paris, 1787. Also, *Instructions sur le Traitement des Noyés*, Paris, 1811. *W. F. Edwards, De l'Influence des Agents Physiques sur la Vie*, 8vo. 1824. *Bichat, Recherches sur la Vie et la Mort*, 8vo. Paris. *Babington*, in *Med. Chir. Trans.* vol. i. *Coleman on Natural and Suspended Respiration*, ed. 2. 1802. *James Curry, M.D., Obs. on Apparent Death from Drowning, &c.* ed. 2. 8vo. 1815. *P. M. Roget, M.D. in Cyclop. of Pract. Medicine, art. Asphyxia, Reports of the Royal Humane Society.* Also, *Détail des Sociétés de l'Etablissement faite en faveur*

des Personnes Noyées, Paris, 1773. *Marc des Moyens de Constater la Mort, par Submersion*, Paris, 1808. *Orfila, Secours à donner aux Personnes empoisonnées, ou Asphyxiées*, ed. 3. Paris, 1825. *J. Leroy, Recherches Expér. sur l'Asphyxie*, 8vo. Paris, 1829. *P. A. Piory, Nouv. Expér. sur les Effets de l'Insufflation de l'Air dans les Poumons, &c. Journ. Hebdom. de Méd.* t. iii. 1829.)

ATHEROMA. (From *ἀθήρα*, pap.) An encysted tumour, so named from its contents being of the consistence of pap. (See TUMOURS, ENCYSTED.)

ATROPHY. (From *α* privative, and *τροφή*, nutrition.) A deficiency in the nutritive powers of a part, in consequence of which its natural dimensions are reduced, and the number of its constituent molecules diminished. (*Townsend*, in *Cyclop. of Prac. Med. art. Atrophy.*) According to another pathologist, atrophy is degeneration of growth, deficiency in the size and weight of a part, and commonly of one or more of its usual constituents in particular. (*Mayo, Outlines of Human Pathology*, p. 16.) When the functions of organs cease, or are long suspended, an atrophy of them usually follows. Thus in a limb, kept for a long while unexercised in consequence of disease, the bones suffer atrophy, as well as the soft parts. But certain states of disease and injury, frequently lead to atrophy of various organs and textures. This fact is often exemplified in the testicle. Wounds of the occiput and back of the neck were remarked by *Larrey*, in Egypt, to be often followed by atrophy of this organ. The want of a free supply of blood and nervous energy, leads necessarily to weakness and atrophy of parts. In old age, various parts undergo what is termed *senile atrophy*. Thus, in advanced life, the ovaries and mammary glands are reduced to mere rudiments.

According to *Dr. Carswell*, atrophy "is the modification of bulk, which takes place in consequence of a diminution in the quantity of the solid materials which enter into the healthy composition of organs and tissues." This diminution of bulk, which constitutes the essential physical character of atrophy, is described by him as depending upon diminished exercise of the nutritive functions. (See *Carswell's Illustrations of the Elementary Forms of Disease*, p. 10.) In this valuable work, one of the most correct ever published on this interesting branch of pathology, notice is taken of certain forms of *congenital atrophy*, as exemplified in *monstrosities*, and occurring as the consequences of the formative process having been arrested at certain periods of the evolution of particular organs. *Dr. Carswell* next adverts to the atrophy, or even total disappearance of organs, soon after birth, which performed functions essential to the existence of the fœtus, but which are now no longer necessary to the maintenance of life; as the ductus arteriosus, umbilical arteries, the thymus gland, supra-renal capsules, &c. Different from these two forms of atrophy is that which, as *Dr. Carswell* observes, takes place in advanced life, "as the fulfilment of a general law of nature, so conspicuously manifested in the limited duration of all organised beings, which, having attained the maximum of their development, decline, after a variable period of time, and tend gradually towards decay." *Senile atrophy*, as *Dr. Carswell* terms it, is carried to a great extent in the vesicular structure of the lungs, the spongy structure of the penis,

the testes, the lymphatic and mammary glands, the uterus, and ovaries. The bones in general lose much of their weight; and, as every surgeon of experience knows, fracture of the neck of the thigh-bone is rendered common in old persons, in consequence of the effects of senile atrophy. After seventy, the brain is diminished from $\frac{1}{3}$ to $\frac{1}{10}$ of its average weight, and becomes specifically lighter, and the trunks and branches of the nerves are reduced in size. The muscles, especially those of voluntary motion, participate likewise in the general decay: and so do the blood-vessels, which always bear a relation to the increased or reduced size of the organs to which they are distributed.

This fact is exemplified in the size of the large, or the number of small arteries being lessened. The general interstitial absorption of John Hunter, the atrophy of the whole body, or the marasmus and emaciation from diseases deranging the important functions of digestion, respiration, and the qualities of the blood, from fevers, profuse suppuration, and various severe and organic diseases, I need not consider in this place. But, besides these forms of atrophy affecting the whole body, there are others which are local, and divided by Professor Carswell into three classes. 1. Atrophy from a diminished supply of blood. 2. From diminished exercise of the function of innervation. 3. From diminished exercise of the functions of the organ. For numerous original, philosophical, and practical remarks on these heads, I refer to *Carswell's Illustration of the Elementary Forms of Disease*, fasc. 10.

AUSCULTATION. Mediate auscultation, or the method of judging of the nature and conditions of various diseases by the particular sound which they communicate either to the unassisted ear, or to that organ, through the medium of the *stethoscope*. Thus, in diseases of the lungs and pleura, the practitioner may derive important information, respecting the condition of those organs, by attending minutely to the changes in the sound of respiration, to the sound of the voice and coughing within the chest, and to what is called the *rattle*, and other sounds occasionally heard in the same situation. The *stethoscope*, then, in many ambiguous cases, must be deemed an instrument of great importance in practice. For a particular description of it, however, I refer to Laennec's invaluable work on diseases of the chest, in the translation and improvement of which, by numerous instructive notes, Dr. John Forbes has rendered himself a benefactor to medical science. In surgery, the *stethoscope* is usefully employed in detecting the real nature of various doubtful swellings, particularly those of an aneurismal character. By M. Lisfranc it has been found of considerable service, in enabling him to judge with more accuracy of the collision of the sound against calculi, or other substances in the bladder, in the operation of *sounding*. M. de Kergaradac has used the *stethoscope* with much success for ascertaining pregnancy, where the history was obscure. It has also been found of great utility in determining the existence and state of various collections of fluids, and particularly of pus; and it has enabled practitioners to ascertain, with certainty, the communications occasionally existing between abscesses of the liver and the interior of the lungs, as well as the occasional communication of pulmonary abscesses with the abdominal cavity. In cases of fracture, where the *crepitus* is obscure, the *stetho-*

scope removes all ambiguity. In all diseases about the heart, and large blood-vessels near this organ, much useful information may be derived from the it; but, the method of using it, and the circumstances by which it affords instruction, must be gathered from a careful perusal of Laennec's and other works.

De l'Auscultation Mediate, vol. ii. 8vo. Paris, 1826, ed. 2. *L'Annuaire de Kergaradac*, Mem. sur l'Auscultation, 8vo. Paris, 1822. J. Lisfranc, Mem. sur des Nouvelles Applications du Stethoscope, 8vo. Paris, 1823. J. Forbes, M.D., Original Dissections, &c. Illustrating the Use of the Stethoscope, 8vo. Lond. 1824. Also, the Notes in his Transl. of Laennec on Dis. of the Chest. W. Stokes, Introduction to the Use of the Stethoscope, 8vo. Edinb. 1825; also, P. A. Piorry, De la Percussion Mediate, &c. 8vo. Paris, 1828. P. M. Laatham, M.D., Lectures on Subjects connected with Clinical Medicine, vol. i. 8vo. 1836.

BALSAMUM COPAIVÆ. Its properties closely resemble those of turpentine. Exhibited by surgeons principally in gonorrhœa, gleet, fluor albus, piles, and some diseases of the bladder. The common dose is from ten drops to half a drachm, two or three times a day. Mr. Brande gives the following formula: R. Mucil. Acaciae ʒss Copaivæ ss terere simul et addo gradatim Aq. Menth. vir. ʒj. Tinct. Capsici mv. ʒi. ft. Haustus bis vel ter quotidie sumendus. (See *Manual of Pharmacy*, p. 70.) Copivæ may also be given in a solid form. For this purpose it may be combined with an alkali and made into a soap, which can be made into pills, the dose being from gr. xii to ʒj. (See A. T. Thomson's *Mat. Med. and Therapeutics*, p. 859, ed. 2.)

BANDAGE. The use of bandages is to keep dressings, compresses, remedies, &c. in their proper situation; to compress blood-vessels, so as to restrain hemorrhage; to rectify certain deformities by holding the deranged parts in a natural position; to unite parts in which there is a solution of continuity; and, in particular, to prevent such parts from moving, or quitting the desirable position. As the application of bandages is an important branch of surgery, authors have not neglected it. Much has been written on the subject, and almost every writer has devised new bandages, perhaps without real benefit to the art. Unfortunately, it is next to impossible to give clear ideas of the numerous sorts of bandages by a printed description of them, especially when it is not accompanied by diagrams or engravings. The surgeon can only acquire all the necessary instruction from experience and practice. Hence, I shall confine myself to a general account of the subject.

Bandages should be made of materials, possessing sufficient strength to fulfil the end proposed in applying them, and, at the same time, they should be supple enough to accommodate themselves to the parts. They are made of linen, cotton, or flannel. If possible, they should be without a seam, or selvage, which is likely to cause unequal and painful pressure.

In particular cases, a bandage should have a degree of firmness, that does not belong to the materials usually employed. This circumstance is exemplified in hernia, and in all examples in which there is occasion for elastic bandages. As already observed, linen, flannel, and cotton (calico), are the common materials. The first employment of flannel bandages is imputed to the Scotch surgeons, who preferred them to linen ones, in consequence of their being better calculated for absorbing mois-

ture, while, being more elastic, they yield in a greater degree in cases requiring this property; as in the swelling subsequent to dislocations, fractures, &c. It has been asserted, that linen is better than flannel, because more cleanly; but neither one nor the other will continue clean, unless care be taken to change it often enough. Where the indication is to keep the parts warm, flannel is of course preferable both to linen and calico.

In applying a bandage, care must be taken that it be put on tight enough to fulfil the object in view, without running any risk of stopping the circulation, or doing harm in any other way. If it be not sufficiently tight to support the parts in a proper manner, it is useless; if it be too tense, it will produce swelling, inflammation, and even mortification.

In order to apply a roller skilfully, the part which is to be covered, must be put into its proper situation and position, while the head of the roller is held in the surgeon's hand, and only so much unrolled as is necessary for the commencement of the application.

In general, the bandage should be applied in such a manner as will admit of its being most conveniently removed, and allow the state of the subjacent parts to be examined, as often as occasion may require, with the least possible disturbance of them. Thus, when a broken leg is placed on M'Intyre's apparatus, three rollers are employed. One is applied to keep the knee steady; another to maintain the foot and lower part of the limb motionless; while the central one covers the fracture, and can be taken off, so as to let the fracture be examined, or a wound dressed, without any occasion to meddle with the other pieces of bandage, or disturb the fracture in the slightest degree. Hence, one cause of the remarkable success, with which fractures of the lower limbs are treated in the North London Hospital.

For the same reason, in fractures of the leg and thigh, the eighteen-tailed bandage is often preferred to a simple roller. The former may be loosened and tightened at pleasure, without occasioning the smallest disturbance of the affected limb; a thing which could not be done were a common roller to be employed in the ordinary way, with ordinary splints.

As soon as the bandage has fulfilled the object for which it is applied, and it has become useless, its employment should be discontinued; for, by remaining too long on parts, it may obstruct the circulation, diminish the tone of the compressed fibres and vessels, and thus do serious harm.

Bandages are either *simple* or *compound*. They are also sometimes divided into *general* and *particular*. The latter often derive their names from the parts to which they are usually applied.

A *simple bandage* is a long piece of linen or cotton, of an indefinite length, and from three to six inches in breadth. When about to be applied, it is commonly rolled up, and the rolled part is termed its *head*. When rolled up from each end, it is called a *double-headed roller* or *bandage*.

The chief of the simple bandages are the *circular*, the *spiral*, the *uniting*, the *retaining*, the *excellent*, and the *creeping*.

The *circular bandage* is the simplest; consisting merely of a few circles of a roller covering or overlapping each other.

The *spiral bandage* is the most frequently used

of all; for it is this which is seen in such common employment on the limbs, in cases of ulcers, varices, fractures, &c. In applying a common roller to the whole of a limb, the bandage must be carried round the part spirally: for otherwise the whole member cannot be covered. When the leg is the part, the surgeon is to begin by surrounding the foot with a few turns. Then carrying the head of the bandage over the instep, he is to convey it backward, so as to make the bandage unroll, and apply itself just above the heel. The roller may next be brought over the inner ankle; thence again over the instep, and under the sole; and the surgeon then brings the bandage spirally upward once more to the outer part of the leg. After this, every circle of the roller is to be applied, so as to ascend up the limb in a gradual, spiral form, and cover about one-third of the turn of the roller immediately below it. The unequal diameter of the limb is one great cause, which brings into view the unskilfulness of a surgeon in this operation; for it prevents the roller from lying smoothly, although spirally applied, unless a particular artifice be dexterously adopted. The plan alluded to is, to double back the part of the roller that would not be even, were the application to be continued in the common spiral way, without this manœuvre. When the bulk of the limb increases very suddenly it is sometimes necessary to fold, or, as it is termed *reverse* every circle of the bandage in the above manner, in order to make it lie evenly on the limb. It is manifest that the pressure of the roller will be greatest where the duplicatures are situated; and hence, when it is an object to compress any particular part, the surgeon should contrive to reverse the turns of the bandage just over the situation where most pressure is desirable.

When a roller is to be applied to the forearm, it is often best to put a few of the first turns of it round the hand.

Particular care must be taken not to make the bandage very tight, if it be intended to wet it afterwards with any lotion; for moisture always renders it still more tense.

Mr. John Bell describes the principal purposes for which a roller has been employed, as follows: "Although, in recent wounds, it is with plasters and sutures that we unite the parts point to point, yet it is with the bandage that we support the limb, preserve the parts in continual and perfect contact with each other, and prevent any strain upon the sutures, with which the parts are immediately joined; and we often unite parts by the bandage alone. But, it is particularly to be observed, that, in gunshot wounds, and other bruised wounds, though it would be imprudent to sew the parts, since it is impossible that they should altogether unite, yet the gentle and general support which we give by a compress and bandage, prevents them from separating far from each other, unites the deep parts early, and lessens the extent of that surface which must naturally fall into suppuration.

"In the hemorrhage of wounds, we cannot always find the artery; we dare not always cut parts for fear of greater dangers; we are often alarmed with bleedings from uncertain vessels, &c. or from veins as well as arteries: these hemorrhages are to be suppressed by the compress; which compress, or even the sponge itself, is but an instrument of compression, serving to give the bandage

its perfect effect. Frequently, in bleedings near the groin, or the armpit, or the angle of the jaw,—wherever the bleeding is rapid, the vessels uncertain, the cavity deep, and the blood not to be commanded by a tourniquet, and where the circumstances forbid a deliberate and sure operation, we trust to compress and bandage alone.

"Bandage" is very powerful in suppressing bleeding. At one period of surgery, it took place of every other method, &c. If a compress be neatly put upon the bleeding arteries, if there be a bone to resist the compress, or even if the soft parts be firm below, and the bandage be well rolled, the patient is almost secure. But such a roller must be applied smoothly from the very extremity of the fingers or toes; the member must be thoroughly supported in all its lower parts, that it may bear the pressure above. It is partial stricture alone that does harm, creates intolerable pain and anxiety, or brings on gangrene. Hemorrhage requires a very powerful compression, which must therefore be very general, &c. It must not be made only over the bleeding arteries, which is all that the surgeon thinks of in general, &c.

"In abscesses, where matter is working downwards along the limb, seeking out, as it were, the weak parts, undermining the skin, and wasting it, insulating and surrounding the muscles, and penetrating to the bones, the bandage does every thing. The expelling bandage, the propelling bandage, the defensive bandage, were among the names which the older surgeons gave to the roller, when it was applied for these particular purposes; and these are properties of the roller, which should not be forgotten." (See *Principles of Surgery*, vol. i.)

Soon after this description, in which the advantages of the roller in gun-shot wounds, and hemorrhage, are rather exaggerated, Mr. John Bell proceeds to explain in what manner this most simple of all bandages may be put on a limb.

"Practice will convince you, that the firmness and neatness of a bandage depend altogether upon these two points; first, upon the turns succeeding each other in a regular proportion; and, secondly, upon making reverses, wherever you find any slackness likely to arise from the varying form of the limb. Thus, in rolling from the foot to the ankle, leg, and knee, you must take care, first, that the turns, or, as the French call them, *dolaires*, of the roller lie over one another by just one third of the breadth of the bandage; and, secondly, that, at every difficult part, as over a joint, you turn the roller upon the limb, with the opposite flat side towards it: you must turn the bandage so as to reverse it, making what the French call a *renversee* of the roller at the ankle, at the calf of the leg, and at the knee. You must be careful to roll your bandage from below upwards, and support the whole limb by a general pressure. That you may be able to support the diseased part with a particular pressure, you must lay compresses upon the hollows and upon the bed of each particular abscess, and change the place of these compresses from time to time, so as now to prevent matter sinking into a particular hollow, now to press it out from a place where it is already lodged, and again to reunite the surface of an abscess already completely formed, from which the matter has been discharged." (See *Principles of Surgery*, vol. i.)

In applying a roller to the leg, as Dr. Cutler ob-

serves, the turns cannot be laid down flatly, as the upper border will compress the salient part of the limb, while the lower one hangs loose. This inconvenience is obviated by reversing it at every turn, so that the inferior becomes the superior, and the external face the internal. The hand should press lightly over each reverse so as to flatten it. Two things are to be observed in applying this reversed bandage; one is not to unroll, in making the angle, more of the band than is absolutely necessary; the other, to carry the angles upwards, in a perpendicular line, and always far from the part affected. (See *Cutler's Surgeon's Pract. Guide in Dressing*, &c. p. 18.)

In the article *JOINTS*, I have noticed the good effects of the pressure of the roller in the cure of some diseases of the knee. Here Mr. John Bell's sentiments upon the subject merit attention:—"In a diseased bursa, as in a relaxation of the knee-joint, that disease which, with but a little indulgence, a very little encouragement of fomentations, poultices, bleeding, and low diet, would end in white swelling of the knee, may be stopped even by so simple a matter as a well-rolled bandage." (Vol. i. p. 127.)

The *uniting bandage*, or *spica descendens*, used in rectilinear wounds, consists of a double-headed roller, with a longitudinal slit in the middle, three or four inches long. The roller, having one head passed through the slit, enables the surgeon to draw the lips of the wound together. The two heads are then carried in opposite directions round the limb again, and when they meet, another slit is made, through which one of them is passed. The same manœuvres are repeated, along the whole line of the wound. This bandage is a bad one; for it cannot be made to lie equally on the part. Neither can it be removed, without cutting it. Modern surgeons rarely employ it.

Heister, Henckel, and Richter describe a sort of uniting bandage, that allows the surgeon to see the wound, over which only small ligatures cross.

When we make use of a single-headed roller, merely as a *retentive bandage*, we should remember always to begin the application of it on the side opposite the wound. The obvious reason for so doing is to prevent a further separation of the lips of the wound, as the contrary manner of applying the roller would tend directly to divide them. (See *Coach*, vol. i. p. 143.)

The intention of the *expellent bandage* is to keep the discharge sufficiently near the orifice of the wound to prevent the formation of sinuses. In general a compress of unequal thickness is necessary; the thinner part of the compress being placed next, and immediately contiguous to, the orifice of the wound; the thicker part below. Before the bandage is applied, the pus must be completely pressed out, and the rolling begin with two or three circular turns on the lower part of the compress. The bandage must then be carried spirally upwards, but not quite so tightly as below. It is afterwards to be rolled downward to the place where it began.

The *creeping* is a simple bandage, every succeeding turn of which only just covers the edge of the preceding one. It is employed in cases in which the object is merely to secure the dressing, and not to make any considerable, or equal pressure.

A bandage is termed *compound*, when several

pieces of linen, cotton, or flannel, are sewed together in different directions, or when the bandage is torn or cut, so as to have several tails. Such are the T bandage, the suspensory, the capistrum, &c.

The *eighteen-tailed bandage* is one of the most compound. This is in common use for fractures of the leg and thigh; sometimes, but not often, for those of the forearm, and, frequently, for particular wounds. Its great recommendation is the facility with which it can be undone, so as to allow the parts to be examined, and its not creating, on such an occasion, the smallest disturbance of the disease, or accident. In the North London Hospital, where M'Intyre's apparatus is employed for fractures of the lower extremities, the eighteen or many tailed bandage is not very often used.

The eighteen-tailed bandage consists of a longitudinal portion of a common roller, and a sufficient number of transverse pieces, or tails, to cover as much of the part as is requisite. Each of the cross pieces is to be proportioned in length to the circumference of the part of the limb to which it is to be applied; so that, in making this sort of bandage for the leg, or thigh, the upper tails will be twice as long as the lower ones. After laying the long part of the bandage on a table, fix the upper end of it in some way or another. Then arrange the tails across it, in sufficient number to cover such part of the limb as requires the bandage. Each tail must be long enough to extend about two inches beyond the opposite one, when they are both applied. The tails being all arranged across the longitudinal band, they are to be stitched in this position with a needle and thread. When the bandage is intended for the leg, a piece of the longitudinal part of the roller below is to extend beyond the tails. This is usually brought under the sole of the foot, and then applied over the inner ankle, directly after the bandage has been put under the limb. Then the surgeon lays down the first of the lower tails, and covers it with the next. In this way, he proceeds upward, till all the cross pieces are applied, the uppermost one of which he fastens with a pin. This bandage has a very neat appearance. The tails are said to lie better, when placed across the longitudinal piece a little obliquely.

The T bandage is, for the most part, used for covering parts of the abdomen and back, and, especially, the scrotum, perineum, and parts about the anus. Its name is derived from its resemblance to the letter T, and it is, as Mr. John Bell remarks, the peculiar bandage of the body. If the breast, or belly, be wounded, we make the transverse piece, which encircles the body, very broad; and having split the tail-part into two portions, one of these is to be conveyed over each side of the neck, and pinned to the opposite part of the circular bandage, so as to form a suspensory for the latter, and prevent its slipping down. But, says Mr. John Bell, if we have a wound, or disease, or operation, near the groin, or private parts, the tail-part becomes the most important part of the bandage: then the transverse piece, which is to encircle the pelvis, is smaller, while the tail-part is made very broad. When the disease is in the private parts, perineum, or anus, we often split the tail according to circumstances; but, when the disease is in one groin, we generally leave the tail-part of the bandage entire and broad.

The *scissum lineum*, or *split-cloth*, is a bandage applied occasionally to the head, and consists of a central part, and six or eight tails, or heads, which are applied as follows:—

When the cloth has six heads, the middle, or unsplit part of the cloth, is applied to the top of the head. The two front tails go round the temples, and are pinned at the occiput; the two back tails go also round the temples, and are pinned over the forehead; the two middle tails are usually directed to be tied under the chin; but, as Mr. John Bell observes, this suffocates and heats the patient, and it is better to tie them over the top of the head, or obliquely, so as to make pressure upon any particular point. (*Principles of Surgery*, vol. i. p. 131.)

The old surgeons usually split this middle tail into two parts, a broad, and narrow one. In the broad one, they made a hole to let the ear pass through. This broad portion was tied under the chin, while the narrow ends were tied obliquely over the head. As Mr. John Bell has observed, though this gave the split-cloth the effect of eight tails, yet, the ancient surgeons did not name it the split-cloth with eight tails. When they split the cloth into eight tails, and especially when they tied the eight tails in the following particular manner, they called the bandage *cancer*, as resembling a crab in the number of its legs. The *cancer*, or *split-cloth of eight tails*, was laid over the head, in such a manner, that four tails hung over the forehead and eyes, while the other four hung over the back of the head. They were tied as follows:—first, the two outermost tails, on each side in front, were tied over the forehead, while the two middle tails in front were left hanging over the knot. Then the two outermost or lateral tails behind were tied round the occiput. Next the middle tails were tied, the two anterior ones being made to cross over each other, and pass round the temples, to be pinned at the occiput; while the two middle tails behind were made to cross each other, and pass round the temples, so as to be pinned over the ears, or near the forehead. (See *John Bell's Principles*, vol. i. p. 132.)

The *triangular bandage* is generally a handkerchief doubled in that form. It is commonly used on the head, and, now and then, as a support to the testicles, when swelled. The French term it *couvre chef en triangle*.

The *nodose bandage*, called also *scapha*, is a double-headed roller, made of a fillet four yards long, and about an inch and a half broad. It must be reversed two or three times, so as to form a knot upon the part which is to be compressed. It is employed for the stoppage of hemorrhage, or for securing the compress after the performance of arteriotomy in the temples. It is more particularly described in another place. (See *ARTERIOTOMY*.)

The most convenient bandage for the forehead, face, and jaws, is the *four-tailed one* or *single split-cloth*.

It is composed of a strip of cloth, about four inches wide, which is to be torn at each end, so as to leave only a convenient portion of the middle part entire. This unsplit middle portion is to be applied to the forehead; if the wound be there, and the two upper tails are carried backward, and tied over the back part of the head, while the two lower ones are to be tied either over the top of the head, or under the chin, as may seem most convenient.

When the wound is on the top of the head, the

middle of the undivided part is to be applied to the dressings. The two posterior tails are to be tied forward, and the two anterior ones are to be carried backward, so as to be tied behind the head. This is sometimes called *Galen's bandage*. It is curious, that writers on bandages should use the terms *head and tail*, synonymously; and hence this *four-tailed bandage* is often called the *sling with four heads*. Such confusion of language is highly reprehensible, as it obstructs the comprehension of any, the most simple, subject.

If the upper lip be cut, and a bandage needed, which is seldom the case, it is almost superfluous to say that this bandage will serve the purpose. It serves also in cuts of the lower lip, though in them, also, we trust rather to the twisted suture than a bandage.

The single split-cloth is particularly useful for supporting a fractured lower jaw; and, in such cases, is the only one employed in modern surgery. This bandage, when used for this particular purpose, namely, supporting the lower jaw, is named *capistrum*, or *bridle*, because it goes round the part somewhat like a bridle.

"In some cases (says Mr. John Bell), the circumstances require us to support the chin particularly, and then the unsuit part of the bandage, is applied upon the chin with a small hole to receive the point; but, where the jaw is broken, we pad up the jaw-bone into its right shape, with compresses pressed in under the jaw, and secured by this bandage. When we are in fear of hemorrhage after any wound, or operation, near the angle of the jaw, we can give the sling a very remarkable degree of firmness. For this purpose, we tear the band into three tails on each side, and we stitch the bandage at the bottom of each slit, lest it should give way, when drawn firm," &c. (*Principles of Surgery*, vol. i.)

We have already described one way of applying a handkerchief, as a bandage to the head, in our notice of the *triangular one* or *couvre chef en triangle*. The other manner of applying the handkerchief, called the *grand couvre chef*, is as follows:—

You take a large handkerchief, and fold it, not in a triangular, but a square form. You let one edge project about three finger-breadths beyond the other, in order to form a general border for the bandage. You lay the handkerchief upon the head, so as to make the lower fold, to which the projecting border belongs, lie next the head; while the projecting border itself is left hanging over the eyes, till the bandage is adjusted. The two corners of the outermost fold are first to be tied under the chin; the projecting border is then to be turned back, and pinned in a circular form round the face; while the corners of the fold next the head are to be carried backward and tied.

After the outer corners of this bandage have been tied under the chin; after the inner corners have been drawn out and carried round the occiput; and after the border has been turned back and pinned; the doubling of the handkerchief over each side of the neck hangs in a loose, awkward manner. It remains, therefore, to pin this part of the handkerchief up above the ear, as neatly as can be contrived. (See *J. Bell's Principles*.)

The *grand couvre chef* has certainly nothing to recommend it, either in point of utility, or elegance. A common nightcap must always be infinitely

preferable to it. In the event, however, of a cap not being at hand, it is proper that the surgeon should know what contrivances may be substituted to fulfil the objects in view.

Having, in numerous articles of this Dictionary, noticed the mode of applying bandages in particular cases, and allotted a few separate descriptions for such bandages, as are not here mentioned, but which are often spoken of in books, we shall conclude for the present with referring the reader for further information to *Rees's Cyclopædia*; *John Bell's Principles of Surgery*, vol. i. *Dict. des Sciences Méd: art. Bandage*. Galen and Vidus Vidius are reckoned the best of the old writers on the subject; M. Sue, Thillaye, Heister, Juville, Lombard, Bernstein, J. Bell, and Cutler, of the modern ones. The Treatise of the latter is entitled *The Surgeon's Practical Guide in Dressing and in the Methodic Application of Bandages*, 12mo. London, 1834. Illustrated by numerous engravings. BARK, PERUVIAN. (See CINCHONA.)

BELLADONNA. (*Deadly Nightshade*.) A powerful sedative and narcotic. The leaves were first used externally for discussing scirrhus swellings, and they have been subsequently given internally, in scirrhus and cancerous diseases, amaurosis, &c. Five grains of them dried are reckoned a powerful dose; one is enough to begin with. At present, the extract, in doses of half a grain, gradually increased to three, is more commonly prescribed.

It is said that the recent leaves powdered, and made into an ointment with an equal weight of lard, more effectually prevent priapism, and relieve chordee, when rubbed on the penis, than any other application. (*Paris's Pharmacologia*, vol. ii. p. 110, ed. 5.)

In neuralgia of the testicle, breast, and other parts, the use of the extract of belladonna, in the form of a plaister is well known.

From the power which belladonna is known to possess, of lowering the action of the whole arterial system, it seems to be a fit medicine in many surgical cases, where that object is desirable, particularly in examples of aneurism.

An ointment, composed of one drachm of the extract, and seven drachms of lard, and rubbed on the perineum, affords great relief in hemorrhoids, and chordee. (See *A. T. Thomson's Mat. Med. &c.* p. 433, ed. 2.) It may also be applied directly on the tumours, or the induration itself.

Belladonna has the power of producing a dilatation of the pupil, when applied to the eyebrow and eyelids. The late Mr. Saunders, a little while before undertaking the operation for the congenital cataract, was accustomed to introduce some dissolved extract of belladonna between the eyelids, or rub the eyebrow and skin about the eye freely with the same application. The consequence was, that, if there were no adhesions of the iris to other parts, a full dilatation of the pupil was produced in less than an hour, and the whole of the cataract was distinctly brought into view. This was unquestionably a considerable improvement in practice, as the iris was kept out of danger, and the operation materially facilitated. I allude here more particularly to Mr. Saunders's own method, in which he introduced the needle through the cornea, in front of the iris, and then conveyed it to the cataract through the enlarged pupil. Belladonna was also externally applied by Mr. Saunders,

after the operation, with the view of preventing the edge of the iris from becoming adherent to the edges of the torn capsule. The influence of belladonna on the iris led also Professor Reimarus to propose its use for facilitating the extraction of the cataract. In iritis, the same plan is an important part of the treatment. It must, however, be admitted, that the iris, when much altered by inflammation, is not affected by belladonna; but, even under such circumstances, its use is not attended with any disadvantage. But it is not from its effects on the pupil alone, that the extract of belladonna should be applied. Very decided relief is obtained from its application in cases where there is a deep-seated pain, extending from the eyeball to the temple and especially in rheumatic inflammation. It may be used as recommended by Beer, in the form of ointment, rubbed in upon the temple (half a drachm of the extract, with an equal quantity of mercurial ointment every night), or the extract alone, softened with water and daubed over the lids and brow, and kept moist for one or two hours, with a light fold of old linen, wetted every ten minutes, may be preferred. (See *Jacob in Trans. of Assoc. of Physicians of Coll. Ireland*, vol. v. p. 476.) Whenever the state of the eye, behind the pupil, requires to be minutely examined, the plan of dilating this aperture by means of belladonna, very materially facilitates the examination. Stramonium is found to have the same effect upon the iris as belladonna. Some experiments, in which the fact is clearly proved, were detailed many years ago, by a namesake of my own in the United States. (See *A. Diss. on the Properties and Effects of the Datura Stramonium*, &c. by Samuel Cooper, Philadelphia, 1797. C. Himly, *De la Paralysie de l'Iris par une application locale de Jusquiame*, &c. 2d. ed. 12mo. Altona, 1805. J. Bailey, *Obs. relative to the Use of Belladonna in painful Disorders of the Head and Face*, 8vo. Lond. 1818.)

BINOCULUS (from *binus*, double, and *oculus*, the eye). A bandage for keeping dressings on both eyes. Its application will easily be understood by referring to *Monoculus*.

BISTOURY. (*Bistoir*, French.) Any small knife for surgical purposes.

BLADDER, PUNCTURE OF. The making of an artificial outlet for the urine is an operation to which we are sometimes obliged to have recourse, after having in vain employed all the other means indicated for the prevention of the bad, and even fatal, consequences of a stoppage of the evacuation of this fluid, and distension of the bladder. Various accidents and diseases, both acute and chronic, may occasion this dangerous state, as will be more particularly noticed in the article **URINE, RETENTION OF**. In some cases, however, the artificial outlet is not made, at the present day, so frequently by puncturing the bladder, as by opening the distended part of the membranous portion of the urethra, behind the stricture.

The bladder, which can conveniently hold about a pint and a half of urine, is no sooner dilated, so as to contain two pints, than uneasy sensations are experienced. The desire of discharging the water now becomes urgent, and if the inclination be not gratified, and the bladder be suffered to be dilated beyond its natural state, for a certain time, it loses all power of contraction, and becomes paralytic. The desire, indeed, continues, and the efforts are renewed in painful paroxysms; but, the power is lost, and

the bladder becomes more and more distended. When this viscus is dilated in the utmost degree, and neither its own structure, nor the space in the abdomen, can allow a further distension, either the bladder must be lacerated, which it rarely is, so equally is it supported by the pressure of the surrounding parts, or its orifice must expand and the urine begin to flow. After the third day of retention, the urine often really begins to flow, and whatever descends from the kidneys is evacuated in small quantities from time to time, and at this period, the bladder is distended in as great a degree as it ever can be, however long the patient may survive. This dribbling of the urine, which begins when the bladder is dilated to the utmost, and continues till the eighth or tenth day, or till the bladder sloughs, has long been understood, and is named by the French, "*Rétention par érogement*." To practitioners, who do not understand it, the occurrence is most deceitful. The friends felicitate themselves, that the urine begins to flow; the surgeon believes it; basins and cloths wet with urine are easily produced; but the patient lies unrelieved. The continued distension of the bladder is followed by inflammation of it and the peritoneum. The insensibility, and low delirium of incipient gangrene, are mistaken for that relief, which was expected from the flow of urine, till either hiccough comes on, and the patient dies of fever and inflammation, or the urine gets into the abdomen through an aperture, formed by mortification. Let no surgeon, therefore, trust to the reports of nurses and friends, but lay his hand upon the hypogastric region, and tap with his finger, in order that he may distinguish the distended bladder, and the fluctuation of urine. As the bladder suffers no further distension after the third day, why should it burst? Not from laceration; for it is supported by the uniform pressure of the surrounding viscera; not by yielding suddenly, for it is distended to its utmost on the third day of the retention, and yet seldom gives way before the tenth; not by attenuation, for it becomes thickened. The term *luceration* was never more wrongly applied, than in this instance; for, when there is a breach in the bladder, it is found, on dissection, to be a small round hole, such as might be covered with the point of the finger. The rest of the viscera, and the adjacent bowels, are red and inflamed, while this single point is black and mortified! Delay is more dangerous than even the worst modes of making an opening into the bladder; and, while life exists, the patient should have his chance. (See *John Bell's Principles of Surgery*, vol. ii. part 1. p. 262, &c.) That many patients die after paracentesis of the bladder is an undoubted truth, and this circumstance has rather intimidated practitioners against the operation. It appears to me, however, that in general death may be more fairly ascribed to the effects of the disease, than to the puncture of the bladder, and that, if the making of an outlet for the urine, in some way or another, were not deferred so long as it often is, the recoveries would be more numerous. Hence, when relief cannot be obtained by the treatment described in the article **URINE, RETENTION OF**; when no urine at all has come away for three days, and no catheter can be introduced, the making of an outlet for the urine should not be delayed. Indeed, in urgent cases, one should rather operate earlier. Indeed, as Sir Benjamin Brodie has observed, it is impossible to lay down any general rule concerning the period, beyond which the operation ought not to

be deferred. "Sometimes there will be no reason for resorting to it, until after the lapse of three or four days, and, at other times, it ought to be performed within thirty-six hours, or even sooner. After all, however necessary it may be to the safety of the patient in some instances, it is an operation that is very rarely required; surgeons, who see a great number of cases of retention of urine, may be called upon to perform it in a few instances. Those who perform it frequently, must often perform it unnecessarily. (See *Brodie on Dis. of the Urinary Organs*, ed. 2. p. 41.) These remarks, I infer, apply more particularly to puncturing the bladder, and not to the less serious operation of opening the membranous part of the urethra behind the urethra; one of the modern improvements of surgery, for which we are indebted to Sir Astley Cooper, and which, in cases of insuperable retention from stricture, renders a puncture of the bladder itself but rarely advisable. Puncture of the bladder "in the male (says Sir Astley) is not the operation which I perform, nor do I recommend it as a general practice." (*Lectures*, &c. vol. ii. p. 307.) In another place, he pronounces the puncture of the bladder, in the male to be scarcely ever necessary. (P. 315.) Being called many years ago to a case of retention of urine from a stricture, situated in the urethra behind the scrotum, he tried to pass different instruments, without success. "Reflecting upon the case (says he), it appeared to me to be exposing the patient to unnecessary pain and danger, if I punctured his distended bladder; as, when I directed him to make attempts to discharge his urine, the urethra swelled excessively behind the stricture, from the urine passing as far as its seat. I therefore determined to make an incision into the urethra only." (p. 316.) This was opened behind the scrotum, and the urine readily discharged. The patient rapidly recovered. Sir Astley Cooper gives other instances of the success of this practice, which has also an advocate in Sir Charles Bell (see *Surg. Reports*, part v.); and I believe, in all the best surgeons of this country. Sir Astley introduces a female catheter through the wound to prevent extravasation; but he deems this not absolutely necessary. If any difficulty were experienced, he recommends a catheter or staff, to be passed to the stricture; and, under the guidance of its beak, an incision to be made, and extended an inch backward, in a line with the beak. "The state of the urethra in stricture (he adds) is very different from that which exists with fistula in perinaeo: in the former case, it is large behind the obstruction; in the latter, it is contracted, and very difficult to find." (*Lectures*, &c. vol. ii. p. 318.)

No doubt, a man who is exceedingly skilful in the use of the catheter, and knows how to practise, with science and judgment, all the other means for relieving the retention of urine, will not frequently find it necessary to have recourse to any operation. This is said to have been so much the case with the eminent Desault, that, in the course of ten years, he had occasion only once to puncture the bladder in the Hôtel Dieu, where diseases of the urethra are always numerous. (See *Œuvres Chir. de Desault*, par Bichat, t. ii. p. 316.) M. Roux is stated never to have met with a single instance, in which there was a necessity for puncturing the bladder. (See *Velpeau, Nouv. Élém. de Méd. Opér.* t. iii. p. 960.) When, however, this superior manual dexterity with the catheter is not

the acquirement of the practitioner, the timely performance of paracentesis of the bladder, or at all events, the making of an outlet for the urine in some way or another, should not be neglected. It is gratifying to know, however, that, at the present day, the absolute necessity for puncturing the bladder is rendered less frequent, not only by the treatment of diseases of the urethra being better understood than formerly, but also by the very great perfection to which the construction of elastic gum catheters is brought, instruments, from which the most essential assistance may frequently be derived. Strictures in the urethra, and enlargement of the prostate gland, are the two cases most frequently producing a retention of urine; and, in both of them, Sir Astley Cooper considers the operation of puncturing the bladder (with very few exceptions) entirely unnecessary; an opinion with which my own observations lead me fully to concur. In cases of enlarged prostate gland, a skilful surgeon will almost always succeed in introducing a catheter of proper shape and length; and in examples of retention from stricture, when relief cannot be afforded by ordinary means, the best plan, generally, is not to puncture the bladder, but to make a small opening in the part of the urethra between the stricture and the prostate gland; a part which is most commonly much dilated.

I. PUNCTURE THROUGH THE PERINEUM.

This operation was first performed by M. Tolet, the author of a treatise, entitled *Traité de Lithotomie, ou de l'Évacuation de la Pierre hors de la Vessie*, troisième édition, Paris, 1681. According to Sabatier, it was customary in the time of Dionis to make the opening with a narrow-pointed scalpel, about four or five inches long, which was plunged into the bladder, at the place where the incision in the apparatus major terminated. (See *LITHOTOMY*.) The escape of the urine indicated when the surgeon had reached the bladder. A straight probe was conducted along the knife, and then a cannula was passed over the probe into the bladder, where it was allowed to remain as long as necessary, care being taken to fix it by means of tapes, put through the rings at the broad part of the instrument. The opening was then closed with a linen tent. Dionis first suggested the method of opening the bladder on one side of the perineum, at the part where Frère Jacques used to perform lithotomy, and he conceived that this mode had advantages, because neither the urethra, nor the neck of the bladder was injured. A narrow scalpel was first introduced, so as to make a passage for the probe, and along this the cannula was guided into the bladder. The idea of substituting for these unsuitable instruments a trocar originated in 1721, with Juncker (see *Conspectus Chirurgie*, tab. 97. p. 674.) unless the following passage be correct: "In the year 1717, or 1718, M. Peyronie showed in the King's garden a long trocar, which he had successfully employed in a similar puncture." (*Desault's Parisian Chir. Journ.* vol. ii. p. 267.)

The patient having been placed in the same position as for lithotomy, an assistant is to press with his left hand on the region of the bladder, above the pubes in order to propel that viscus as far downward into the lesser pelvis as possible, while, with his right hand, he supports the scro-

tum. The surgeon is then to introduce the trocar at the middle of a line, drawn from the tuberosity of the ischium to the raphe, of the perineum, two lines more forward than the verge of the anus. The instrument is first to be pushed in a direction parallel to the axis of the body; and its point is afterwards to be turned a little inwards. Here, according to Bichat, there is no occasion to convey the cannula so far into the bladder, as is done when the operation is performed above the pubes. The portion of this viscus which is to be pierced, being incapable of changing its position, with regard to other parts in the perineum, if the cannula only project a few lines into its cavity, it will not be liable to slip out. It would be wrong, indeed, to carry it in further; for the pressure of its end against the posterior parietes of the bladder would do harm. Lastly, the canula is to be fixed in its place by means of the T bandage. (See *Œuvres Chir. de Desault*, t. iii. p. 320.) As a silver cannula, when kept introduced too long, becomes covered with a thick incrustation rendering its extraction difficult and painful, care should be taken to withdraw it after five or six days, and replace it, as soon as it has been cleaned, or else substitute another for it, according as the circumstances of the case. When Dr. Ehrlich visited London, Mr. Chandler tapped the bladder through the perineum, and introduced a cannula, which, after remaining in the puncture three weeks was so thickly covered with an incrustation, that its extraction produced considerable laceration of the parts, and a great deal of inflammation followed by an urinary fistula. (See *Dict. des Sciences Méd.* t. ii. p. 205.)

The parts, divided in the puncture, are the skin, perineal fascia, a good deal of adipous and cellular substance, the levator ani muscle, and that portion of the lower part of the bladder which is situated on one side of its neck.

The puncture of the bladder from the perineum is now universally abandoned by British surgeons. "We may esteem it fortunate," says Desault, "if the trocar penetrates directly into the bladder, after piercing the fat and the muscles, situated between the tuberosity of the ischium and the anus; and, as this viscus is subject to much variation in its form, the surgeon will often be defeated, unless he be perfectly clear in his ideas respecting its situation and figure. This disappointment is not without example, and there is sufficient cause to deter a practitioner from performing this operation, independently of the danger of wounding with the trocar the vasa deferentia, vesiculae seminales, ureter," &c. (*Parisian Chir. Journ.* vol. ii. p. 267.) Sabatier conceives that the operation would be more safe if the surgeon were to begin with making a deep incision in the perineum, as is practised in the lateral way of cutting for the stone, and if he were to desist from plunging the trocar into the bladder until he had assured himself of the situation of this viscus, and felt the fluctuation of the urine. (*Médecine Opératoire*, t. ii. p. 127.) Sir Astley Cooper, also directs an incision to be made in the perineum, as in lithotomy; the bulb of the penis to be pushed towards the patient's right side; the knife then carried within the branch of the ischium till it reaches the prostate gland, which is likewise to be pushed towards the patient's right side; and, lastly, the instrument to be passed obliquely up-

wards into the bladder, the operator's finger resting on the prostate gland. (*Lectures, &c.* vol. ii. p. 314.)

2. PUNCTURE ABOVE THE PUBES.

The method of tapping the bladder above the pubes was suggested by the possibility of extracting calculi from that viscus, by what is usually denominated the high operation. The first performers of the puncture above the pubes are said to have employed a straight trocar. The consequence was that when such a trocar was too long, its cannula hurt the opposite parietes of the bladder, so as to occasion inflammation and a slough, on the separation of which the urine was liable to insinuate itself either into the abdomen, or rectum, as happened in a case mentioned by Mr. Sharp, where no more urine was discharged through the cannula, and the patient died of a sort of diarrhoea. When the trocar is short, the bladder, on subsiding and contracting itself, gradually quits the cannula, which becomes useless, and a necessity for making another puncture may be produced. Whatever pains may be taken to direct the trocar obliquely downwards and backwards, so that the cannula may be, in some degree, parallel to the axis of the bladder, one or the other of these accidents cannot always be prevented.

Their prevention, however, may be effected by merely employing, instead of a straight trocar, a curved one, which will naturally take a suitable direction. This improvement was soon embraced by Frère Côme.

To this way of operating, Mr. Sharp was partial, and Mr. Abernethy has recommended it, under certain circumstances. It is an operation generally of no difficulty to the surgeon, and of little pain to the patient, the violence done to the bladder being at a distance from the parts affected. It is equally applicable whether the disorder be in the urethra or prostate gland; and when there are strictures, the use of bougies may be continued, while the cannula remains in the bladder. (*Critical Inquiry*, p. 125. ed. 4.)

Some surgeons recommend making an incision, about two inches long, through the linea alba, a little way above the pubes, and then introducing a trocar into the bladder. Others deem this preliminary incision quite useless, asserting, that the operation may be performed with equal safety, and less pain to the patient, by puncturing at once the skin, the linea alba, and the bladder. If the person were very corpulent, an incision might be proper; but, in ordinary cases, it is not necessary. When the trocar has been introduced, the stylette must be withdrawn, and the cannula kept in its position by a riband, passed through two little rings, with which it should be constructed, and fastened round the body. The orifice of the cannula should be stopped up with a little plug, so as to keep the urine from dribbling away involuntarily, and taken out as often as may be necessary. (*Encyclopédie Méthodique; Part Chirurg. art. Paracentese de la Vessie.*)

The trocar should be introduced in a direction obliquely downward and backward; for, as this corresponds with the axis of the bladder, the instrument will be less likely to injure the opposite side of that organ.

Nearly all writers advise the puncture to be made an inch, or an inch and a half, above the

pubes. The reasons for so doing are the following:—"If the puncture be made close to the os pubis, the bladder in that part, often rising with an almost perpendicular slope, leaves a chasm between it and the abdominal muscles, or, to speak more strictly, a certain depth of membrana cellularis only, so that, if the trocar penetrate but a little way, it possibly may not enter into the bladder. If it penetrates considerably, it may pass through the bladder into the rectum, or if not in the operation itself, some days afterwards, when by the course of the illness and confinement the patient is more wasted; for, the abdominal muscles, shrinking and falling in, occasion the extremity of the cannula to press against the lower part of the bladder, and in a small time, to make a passage into the rectum." (*Sharp, in Critical Inquiry*, p. 127.) Though the reasons here adduced seem formidable, does not the danger of injuring the peritoneum form an objection to plunging in a trocar at the above distance from the pubes? Certain it is, peritonitis would be more apt to be induced by such practice, than by introducing the instrument nearer to the pubes. Richerand decidedly condemns the plan, principally because the higher the puncture is made, the more apt the bladder will be to quit the cannula, on the urine being discharged. (See *Nosog. Chir.* t. iii. p. 472. ed. 2.) In Desault's works, by Bichat, the puncture is advised to be made immediately above the pubes (t. iii. p. 318.) Some of Sharp's objections are removed, by taking care to pass the trocar into the bladder in the axis of this viscus, and employing one which is somewhat curved, as Hauter, Frère Côme, Sabatier, &c. have advised. Sharp confirms the danger of using too long a cannula, by mentioning an accident, which occurred in his own practice. Though he introduced the instrument more than an inch and a half above the os pubis; yet, having pushed it full two inches and a half below the surface of the skin, its extremity in six or seven days insinuated itself into the rectum. (*Critical Inquiry*, p. 127.) The instrument should be more or less long, according as the patient is fat, or otherwise; but, the ordinary length should be about four inches and a half. The curvature should be uniform, and form the segment of a circle, about eight inches in diameter. (*Œuvres Chir. de Desault par Bichat*, t. iii. p. 317.)

A catheter left in the bladder longer than ten days, may gather such an incrustation from the urine, as to render the extraction of it difficult. Surgeons, therefore, should never leave the cannula in the bladder quite a fortnight; or, if it must be kept introduced so long, Sharp advises a second one to be introduced, made with an end like that of a catheter. (*Critical Inquiry*, p. 129.)

Mursinna, however, has reported one example, in which a cannula was kept in for a long time without inconvenience: (*Hecker, Annales der Ges. Medicin.* 1810., Jul. p. 39.) I have seen one such case myself; and another example of the same kind is mentioned by Sir Astley Cooper (*Lectures*, vol. ii. p. 310.)

Mr. Abernethy recommended making an incision between the pyramidal muscles, passing the finger along the upper part of the symphysis pubis, so as to touch the distended bladder, and introducing a common trocar, of the middle size, in a direction obliquely downwards. On withdrawing the stilette,

he directs a middle-sized elastic catheter to be passed through the cannula into the bladder. The cannula is withdrawn, and the catheter left in till the urine passes through the urethra. After a week, the instrument is taken out, and a new one introduced. (*Surgical Obs.* 1804.) It might be objected to this plan of employing a gum catheter, that, as it is smaller than the wound, the urine is not kept from passing between the instrument, and parts, into which it is introduced, as well as through the tube itself. This happened in Mr. Abernethy's case; and, though no urine in this instance got into the cellular membrane, it might sometimes do so, because it is not till after inflammation has taken place that the cavities of the cellular tissue are closed with coagulating lymph. In one instance where I performed this operation, and substituted an elastic catheter for the silver cannula, on the second day it was suspected that some small quantity of urine had got between the catheter and side of the wound; for, in the *post mortem* examination, pus was found in the course of the puncture, and inflammation of the neighbouring parts. After two days, however, the cannula of the trocar may be safely withdrawn, and the elastic gum catheter employed.

The following is one of Sir E. Home's conclusions:—"When the puncture is made above the pubes, the cannula which encloses the trocar is not to be removed, till the surrounding parts have been consolidated by inflammation, so as to prevent the urine, in its passage out, from insinuating itself into the neighbouring parts; for wherever the urine lodges, mortification takes place. Any advantage, therefore, which may arise from a more flexible instrument remaining in the bladder, is more than counterbalanced by its not filling completely the aperture through the coats of the bladder, and allowing the urine to escape into the cellular membrane." (*Trans. of a Soc. for Med. and Chir. Knowledge*, vol. ii.)

In six or eight days, when the track of the cannula is surrounded by the adhesive inflammation, and a kind of pseudo-membrane, some surgeons withdraw the tube entirely, believing that, after this space of time, there is no risk of effusion of urine. (See *Manec Man. de Méd. Opér.* p. 684.) Whether this should be done, or not, seems to me to depend materially upon the circumstance whether the urine has resumed its natural course or not. In the latter case, I would not discontinue the employment of the tube.

Some surgeons prefer this method to tapping the bladder from the rectum. It is easy. The little thickness of the parts which are wounded, renders it quick and triflingly painful. With moderate care, it is almost impossible to miss the bladder, except it be exceedingly contracted, which, I believe, was the case in an instance where I saw the late Mr. Abernethy fail to make the trocar reach that organ. If the trocar be directed too much downwards, it may also not enter the bladder, but pass between it and the pubes. It should, therefore, be pushed in a line towards the upper part of the hollow of the sacrum, and not in one leading to the point of the coccyx. There is no risk of piercing the cavity of the abdomen. Anatomy proves, that here the bladder is in immediate contact with the recti muscles, or rather the fascia transversalis, and that when it is distended with urine, it pushes the peritoneum upwards and back-

wards, under which it enlarges, and thus makes the point of the trocar become more and more distant from the peritoneum. No nerves nor vessels of importance are exposed to injury. No difficulty is experienced in fixing the cannula, the presence of which does not hinder the patient from sitting, standing up, or even walking about in his chamber. (See *Œuvres Chir. de Desault*, t. iii. p. 319-324.)

This operation (according to Sir Astley Cooper,) is easily performed, and not liable to the objections formerly made to it. To prevent the urine from passing through the cannula incessantly, a stopper is employed, and withdrawn as often as necessary. In the female, it is the only proper one in cases of retention of urine from retroversio uteri, and from an obliteration of the meatus urinarius by cancerous disease; for (says he) opening the bladder through the vagina, "would probably cause a fistulory orifice, by which the urine would constantly irritate the vagina." He adds, that, in the female, the operation above the pubes appears on every account preferable to all other methods. (See *Lectures*, vol. ii. p. 319.)

The following passage in a modern publication is decidedly a mistake:—"Whenever the bladder rises fairly an inch and a half above the pubes, it is in contact with the peritoneum, lining the wall of the abdomen, in addition to its own peritoneal covering. In other words, the shining surface of the peritoneal covering of the bladder is in contact with the same surface of the peritoneum lining the muscles of the abdomen; so that an instrument, to penetrate this part of the organ, must traverse the peritoneum twice." (T. King, *Lithotomy and Lithotomy compared*, &c. p. 31. 8vo. Lond. 1832.) About a year ago, I was called upon to tap the bladder above the pubes, in the North London Hospital, in a case of enlarged prostate gland, where the spiral course of the urethra through that body, and the existence of a perforation in it, frustrated the attempts to make the catheter pass by the natural route into the bladder. The patient died on the third or fourth day after the operation. The parts, which are preserved in the museum of University College, exhibit the track of the trocar, completely below the peritoneum, which has not been penetrated at all. After the puncture, above the pubes, the patient may easily lie on his side, so as to discharge all the urine contained in the bladder.

3. PUNCTURE FROM THE RECTUM.

This method is not, like the puncture in the perineum, liable to the objection, that the wound is made in diseased or inflamed parts, which afterwards become gangrenous. Nor is it, like the puncture above the pubes, attended with a chance of the urine diffusing itself in the cellular tissue. It has also the advantage of emptying the bladder, completely. It is attended with little pain, since there is no skin nor muscles to be wounded, merely the coats of the bladder and rectum, at a point where these viscera lie in contact with each other.

We read in the *Phil. Trans.* for 1776, of a case of total retention of urine, from strictures, where the bladder was successfully punctured from the rectum. The plan was suggested to Mr. Hamilton, who did the operation, by his feeling the bladder exceedingly prominent in the rectum, when his finger was within the bowel. The patient was

placed in the same position as that for lithotomy; a trocar was passed along the finger into the anus, and pushed into the lowest, and most projecting part of the swelling, in the direction of the axis of the bladder. A straight catheter was immediately introduced through the cannula, lest the bladder, by contracting, should quit the tube which was taken away, and, as soon as the water was discharged, the catheter was also removed. Notwithstanding the puncture, the bladder retained the urine as usual until a desire to make water occurred. Then the opening made by the instrument seemed to expand, and the water flowed in a full stream from the anus. The urine came away in this manner two days, after which it passed the natural way, with the aid of a bougie, which had been passed through the urethra into the bladder, and which was used till all the disease in this canal was cured.

The method was originally proposed in 1750, by M. Fleurant, surgeon to *La Charité*, at Lyons; and Pouteau, in 1760, published an account of it, and three cases in which Fleurant had operated. It was also the feel of the bladder, on the introduction of a finger *intra anum*, which led the latter surgeon to make the puncture in this situation. The urine was immediately discharged, and the cannula supported in its place with the T. bandage, until the natural passage had been rendered pervious again. But as the cannula was left in the rectum, it annoyed the patient when he went to stool, and the inconvenience was vastly increased by the continual dribbling of the urine from the mouth of the instrument. Hamilton avoided both these inconveniences, by withdrawing the cannula at first. In another instance, however, Fleurant left the cannula in the anus and bladder, thirty-nine days, without the least inconvenience.

In order to lessen the tenesmus, and other inconveniences attending the presence of the cannula, Fleurant suggested, that it would be better to employ a flexible tube, and some of the moderns approve the plan of passing a flexible catheter through the silver one into the bladder, and withdrawing the latter instrument.

In the first volume of the *Mem. of the Medical Society of London*, two cases are related, in which, after the bladder had been from the rectum, the cannula was immediately withdrawn, without any bad effect; and a similar fact is recorded in the *Medical Communications*, vol. i.

A curved trocar five inches in length, is the best for performing the operation, and was recommended by Pouteau. It should be introduced into the prominence made by the distended bladder a little beyond the prostate gland, exactly in the centre of the front of the rectum; but not imprudently far up the intestine, lest the cul de sac of the peritoneum be injured. For some useful cautions on this head, the profession are indebted to Mr. Carpue, who has adverted to the very low point, to which the portion of peritoneum reflected over the rectum descends. (*Hist. of the High Operation*, &c. p. 178. 8vo. Lond. 1819.)

The trocar should be introduced in the direction of the axis of the bladder, or nearly in an imaginary line drawn from the spot to be punctured to the middle point between the navel and the symphysis pubis.

The patient should be placed nearly in the same posture as that adopted in lithotomy; but

the hands and feet need not be bound together, it being sufficient to let the assistants support the legs. The left forefinger, smeared with oil, is to be introduced up the rectum, where a portion of the distended bladder will be felt behind the prostate gland, and between the converging vasa deferentia. The vesiculæ seminales, which are on the outside of the vasa deferentia, are less exposed to injury. Behind the prostate gland, as Sir Astley Cooper correctly explains, "there is a triangular space, which affords room for the instrument. In the fore part, it is bounded by the meeting of the vasa deferentia, which forms the apex of the triangle; the sides are formed by the vasa deferentia, which diverge as they pass from the prostate backwards; while the basis of the triangle is formed by the peritoneum, which is reflected from the posterior part of the bladder to the rectum. Taking advantage of this space of the bladder, which is not covered by the peritoneum, the trocar is introduced through it into the bladder, about three quarters of an inch behind the prostate gland. The instrument must not be introduced directly behind the prostate, as the vas deferens on one side or the other, would certainly be wounded. If the trocar be carried three quarters or half of an inch behind the prostate, the vasa deferentia will be safe. (*Lectures, &c.* vol. ii. p. 311.) Here the surgeon is to let the end of his finger continue, until, with his right hand, and under the guidance of the left forefinger, he has brought to the same point the extremity of the curved trocar, the concavity of which is to be kept forwards. Great care must also be taken not to let the stilette project out of the cannula too soon, that is to say, before the end of the tube has been placed exactly upon the spot, at which the puncture is to be made. The bladder having been emptied, the cannula is fixed with tapes, passed through the rings on the handle, and fastened in front and behind to a band applied round the body. It is to be further supported with a double T bandage. A stopper may be employed; or if the patient be on his side, the urine may be conducted from the tube into a pot or urinal, by attaching to the cannula a flexible catheter. When the patient has a motion, the T bandage is removed, and the cannula raised and supported with the hand.

It is not necessary to retain the cannula in the puncture, after the inflammation has consolidated the sides of the wound; for there is no danger of the aperture closing up, before another passage is made for the urine. Sir E. Home thinks, that, after about thirty-seven hours, the cannula may be taken out. (*Trans. of a Soc. for Med. and Chir. Knowledge*, vol. ii.) Indeed I am not acquainted with any fact, showing the ill effect of removing the cannula early; for, here the urine has only to pass through a mere opening, without any longitudinal extent, like what remains after the puncture above the pubes. The general safety and simplicity of tapping the bladder from the rectum, will always recommend this method. When, however, the rectum is diseased, or there is much inflammation about the neck of the bladder, or the prostate gland is considerably enlarged, this plan is not eligible.

The late experienced Mr. Hey is amongst the advocates for this operation; and as his opinion has considerable influence, I shall quote

the following passage from his valuable work, particularly as the observations confirm some other points, adverted to in the present article:—"It is sometimes impossible, from various causes, to make a catheter pass through the urethra. The puncture of the bladder then becomes necessary, if the retention of urine continues. This operation may be performed, either above the pubes, or through the rectum. I have seen it performed in both these methods; but give the preference to the latter. It is more easy to the surgeon; and less painful to the patient. Pouteau's curved trocar is a very convenient instrument, and may be used with safety for puncturing the bladder through the rectum; but the operator should cautiously avoid wounding an artery, which may be felt running towards the anus, where the bladder is most protuberant. The finger, which is introduced into the rectum to guide the trocar, may be conveniently placed a little on either side of this vessel. It is not always necessary to leave the cannula in the bladder, as the urine sometimes begins to flow through the penis, within a few hours after the bladder is emptied. Perhaps, this event may be the most frequent, when the introduction of the catheter has been prevented by a stricture in the urethra. If the wound becomes closed before the power of expelling the urine is regained, recourse must be had to a repetition of the operation, which gives very little trouble to the patient; neither is he much incommoded by suffering the cannula to remain two or three days in the bladder. This is sometimes necessary, and seldom improper." (*Hey's Pract. Obs. in Surgery*, p. 430, 431. ed. 2.)

The objections made to the puncture through the rectum are three: first, the annoying tenesmus sometimes produced by the presence of the cannula; secondly, the irritation and ulcerated state of the rectum occasionally resulting from the dribbling of the urine through it; and, thirdly, the possibility of a sinus being formed between this bowel and the bladder. (*A. Bonn, Bemerkungen ueber den Harnverhalt, &c.* Leipz. 1794.) Sir Astley Cooper knows of some cases, in which such inconveniences followed, and in particular, one instance, in which the patient died, of the subsequently diseased state of the rectum. Hence, the puncture of the bladder from the rectum is not a practice, on which he bestows any commendation.

In the foregoing columns, I have briefly adverted to the proposal of cutting into the urethra behind the obstruction, instead of puncturing the bladder. This plan was first adopted and recommended by Sir Astley Cooper; and it afterwards had an advocate in Sir Chas. Bell. Mr. Grainger, of Birmingham, a few years ago, also recommended cutting into the urethra, immediately in front of the prostate, and relieving the bladder by the introduction of a female catheter through the gland, or (if that could not be accomplished) by the division of its substance with a scalpel. (*Med. and Surg. Remarks, &c.* 8vo. Lond. 1815.) The operation of cutting into the membranous portion of the urethra, behind the stricture, seems to me one of the greatest improvements in modern surgery; for, as it is chiefly in a few cases of stricture that an artificial outlet for the urine is required, the new plan, which, as compared with a wound of the bladder, is a trifling injury, nearly obviates all necessity for puncturing the bladder in any way.

Women rarely stand in need of paracentesis of

the bladder, an occasional impossibility of introducing the catheter from a retroversion of the womb, and an obliteration of the meatus urinarius by disease, being almost the only cases ever placing them in this condition. The only method, applicable to them, is the puncture above the pubes, with the exception of the plan of introducing the trocar directly from the vagina into the bladder; a practice which Sir Astley Cooper justly condemns, on account of its leading to the formation of an urinary fistula in the vagina, and a great deal of disease and irritation in that passage, from the contact of the urine.

Consult *Sharp*, On the Operations, chap. xv. and his Critical Inquiry. *Ambr. Bertrandi*, Trattato delle Operazioni di Chirurgia, accresciuto di note, &c. dal Chirurgh. G. A. *Pncichienati e G. Brugnone*, 8vo. Torino, 1862. *Bertrandi* was an approver of the puncture from the rectum: so was *Le Blanc*; *Operat. de Chir.* t. i. Mélanges de Chirurgie, *Poucau*, Lyon, 1760, p. 500. L'Encyclopédie Méthodique, Partie Chirurgicale, art. Paracentèse de la Vessie. *Schmucker*, Chir. Wahrnehmungen, 2th. No. 39: puncture from the rectum. *Sabatier*, Médecine Opératoire, t. ii. *Mursinna*, Journ. für die Chirurgie, &c. iv. p. 46. 67. Cases of Puncture from the rectum, and above the pubes. In illustration of the operation of puncturing the bladder, *Camper's* plates are the best; see his *Demonst. Anat. Pathol.* lib. ii. In this work, the danger of letting the end of any long instrument, when introduced, press against the inside of the bladder, is proved by a case, in which that organ was perforated by the extremity of a catheter, p. 11. *Kloss*, Dis. de Paracentesi Vesicæ Urinariæ per intestinum rectum. Jen. 1791. A. *Bonn*, Anat. Chir. Bemerkungen über die Harnverhaltung, und den Blasenstich. Lelp. 1794: prefers the puncture above the pubes. *J. Houslip*, in Pract. Obs. on Diseases of the Urinary Organs, p. 214, 8vo. Lond. 1816, and in Treatise on Complaints affecting the Secretion and Excretion of the Urine, p. 412. Lond. 1823: thinks the operation from the rectum generally superior to the other methods. *Sir E. Home*, in Trans. for the Improvement of Med. and Chir. Knowledge, vol. ii. *Abernethy's* Surgical Observations, 1804. *John Bell's* Principles of Surgery, vol. ii. *Œuvres* Chir. de Desault par *Bichat*, t. iii. p. 315, &c. *W. Schmidt*, Ueber die Krankheiten der Harnblase, &c. 8vo. Wien, 1806. *Richerand*, Nosogr. Chir. t. iii. edit. 4. *Itey's* Practical Obs. in Surgery, p. 430, edit. 2. *Parisian Chir. Journal*, vol. ii. p. 156, and p. 265. *S. T. Sommering*, Ueber die schnell und langsam tödlichen Krankheiten der Harnblase, &c. Frankfurt, 1809. The author is an advocate for the puncture above the pubes. In preference to that through the rectum, which he thinks right only in one case, viz. when the bladder is so contracted that it does not rise out of the lesser cavity of the pelvis, and the fluctuation of the urine can be felt in the rectum, but not above the pubes. In this opinion he is joined by *Langenbeck*. (Bibliothek, b. iii. p. 719.) *Calliaco*, Systéma Chirurgiæ Hodiernæ, t. ii. p. 277, &c. Chirurgische Versuche von *B. G. Schröger*, b. i. p. 211, &c. 8vo. Nürnberg, 1811; gives the preference to the puncture above the pubes. *Edward Grainger*, Med. and Surg. Remarks, &c. with Obs. on the different modes of opening the bladder in retention of urine, &c. 8vo. Lond. 1815. Dict. des Sciences Méd. art. *Ischurie*, 1818. *Sir C. Bell*, Surgical Obs. 8vo. part v. Lond. 1818. *C. Arctill*, Short Treatise of Operative Surgery, p. 174, &c. Lond. 1823. *Sir A. Cooper's* Lectures vol. ii. p. 306. Lond. 1825. *Maigne*, Man. de Méd. Opératoire p. 680. *Alf. A. L. J. Pelneau*, Nouv. Elémens. de Méd. Oper. t. iii. p. 560. 8vo. Paris, 1832.

BLADDER, TUMOUR EXTERPATED FROM.

Mr. Warner has recorded a case, in which an excrescence, growing from the inside of a young woman's bladder, was successfully removed. The patient, on the 24th of June, 1747, strained herself in endeavouring to lift a great weight, and she was immediately seized with a pain in the small of her back, and a total retention of urine. In April, 1750, she applied to Mr. Warner, who found that she had never been able, from the moment of the accident, to void a drop of urine without the assistance of the catheter; that she was in continual pain, and had lately been much weakened, by having several times lost consider-

able quantities of blood, occasioned by the force made use of in introducing the instrument into the bladder.

Mr. Warner, upon examining the parts with his forefinger, introduced into the meatus urinarius, discovered a considerable tumour, which seemed to be of a fleshy substance, and took its rise from the lower part of the bladder, near its neck. When the patient strained to make water, and the bladder was full, the excrescence protruded a little way out of the meatus urinarius; but, upon ceasing to strain, it presently returned. A purgative having been given the day before the operation, and the rectum emptied by means of an emollient clyster, Mr. Warner directed the patient to strain, so as to make the swelling project. He then hindered it from returning into the bladder by passing a ligature through it, and endeavoured to draw it further out, which was found impracticable. Seeing this, Mr. Warner dilated the meatus urinarius on the right side, by cutting it upwards, about half way towards the neck of the bladder, when, by pulling the swelling forwards, he was enabled to tie its base, which was very broad. For three days a good deal of pain was felt in the abdomen. On the sixth day, the tumour dropped off. From the first day, the urine came away, without assistance, and the patient perfectly recovered. The tumour resembled a turkey's egg in shape and size. (*Warner's Cases in Surgery*, edit. 4. p. 303.)

I lately placed in the Museum of University College, a scirrhus tumour, which I found in the bladder of an elderly man, whose thigh-bone broke as he turned himself in bed, in consequence of being weakened by the pressure of a cancerous tumour upon it. (*See Med. Chir. Trans.* vol. xvii. p. 51.)

For an account of other tumours of the bladder, I refer to J. Houslip *On Complaints affecting the Secretion and Excretion of Urine*, 8vo. Lond. 1823.

BLADDER, HERNIA OF. See HERNIA.

Besides this case, the bladder in females is liable to prolapsus and inversion, through the meatus urinarius.

BLADDER, HYDATIDS VOIDED FROM.

This case is exceedingly rare. In one example, under Dr. Duncan, the hydatids discharged from the urethra were formed in the kidney. The symptoms were frequent desire to make water, and sometimes difficulty in making the evacuation, and pain about the hip, perineum, and glans penis. The pain in the perineum was generally felt six or seven hours before each hydatid was expelled. The expulsion of the hydatids was promoted by exhibiting twelve minims of diluted muriatic acid thrice a day. The hydatids voided were of a globular shape, and of the genus acephalo-cyst, and varied in size from that of a pea to that of a pigeon's egg. Probably they had enlarged after their descent into the bladder. (*See Liverpool Med. Journ.* for July, 1834.)

The following curious account of the post mortem appearances in an instance of this kind is given by Dr. Tyson:—"Therein, upon operation (says Dr. Tyson), we discovered a very strange sort of cystes, or bags, of the exact figure of eggs, of several dimensions, some larger than goose eggs, others as big as hen eggs, to the number of twelve

in all; and about eight of them whole, and replete with limpid serum; all of them loose and free, without the least adhesion, either to one another, or the coat of the bladder. Nor could we imagine that this miserable patient could possibly make any water, but what happened upon the breach of some of these watery tumours, when the bladder was crowded beyond its dimensions. The ureters were of the largeness of the small guts in children, so that they could easily admit two fingers into their cavity. One of the vesiculæ being opened, had a large cluster of small ova, as big as grapes, all replete with liquor. All the rest contained nothing but serum." (*Tyson, in Philos. Trans. 1687.*)

BLADDER, INSECTS DISCHARGED FROM.

The instances in which worms are stated to have been discharged from the bladder are numerous. Many are referred to in *Voigtel's Handbuch der Pathologischen Anatomie*, b. iii. p. 337—342. An interesting example is recorded by Mr. Lawrence. (*See Med. Chir. Trans. v. ii. p. 382, &c.*)

About two years ago, I received from Mr. Law, of Penrith, Cumberland, many specimens of substances voided from a young woman's bladder, supposed by him to be portions of tænia. But, on submitting them to the examination of Mr. Richard Owen, at the College of Surgeons, he ascertained, perfectly to his own satisfaction, that the substances were only pieces of the intestines of pigeons, or other small birds, cut and prepared so as to bear some resemblance to tænia; and, consequently, that the woman is guilty of some trick or imposture, from monomania or other inexplicable cause. Mr. Law seems convinced, however, that the case is different from the view of it taken by Mr. Owen.

BLADDER, DEFICIENCY OF.

Numerous examples in which this deviation from the natural structure has occurred, are recorded. The publications, however, which contain the most ample information on the subject, are, a Gottingen inaugural dissertation, entitled, "*De Vesicæ Urinariæ Prolapsu Natio*," by Dr. Roose, late professor in Brunswick, and a paper entitled, *An attempt towards a systematic account of the appearances connected with that malconformation of the Urinary Organs, in which the ureters, instead of terminating in a perfect Bladder, open externally on the surface of the Abdomen*, by A. Duncan, jun. in *Edin. Med. and Surg. Journal*, vol. i. In this last may be seen references to the most noted cases on record, both male and female. (See also *Handbuch der Pathologischen Anatomie von J. F. Meckel*, b. i. p. 650. 8vo. Leip. 1812.)

BLADDER, RUPTURE OF THE.

Many examples of this accident, occasioned by blows, or sudden violent pressure on the hypogastric region, and followed by fatal extravasation of urine, are upon record. So fatal is the occurrence, that Dr. Harrison is not aware of any instance, the particulars of which are published, having had a favourable termination. (*See Dublin Journ. of Med. Science*, vol. ix. p. 350.) The urinary bladder, in its empty and contracted state, as he correctly observes, lies so deeply in the male pelvis, as to be almost perfectly secured against any injury or accident, except that of a gun-shot wound, or a surgical operation. When, however, it becomes distended with

urine, it rises up above the pubes, presses forward against the abdominal parietes, and is in a position much exposed to external injury. In this state, also, its coats are tense, expanded, and thin; conditions in which their tissue is more easily ruptured. Excluding from present consideration penetrating wounds and lacerations by spiculæ of fractures of the os pubes, the bladder is generally burst by violence, applied directly to the hypogastric region, as by a blow, or fall on this part, or the heavy pressure of a cart, or carriage wheel. In the museum of University College, are two specimens of ruptured bladder; in one the accident was occasioned in the following manner:—a man who had been drinking, and whose bladder was very full, went out of the house where his party was; but, it being dark, he struck the hypogastric region against a post, which he did not see. The consequence was the rupture of the bladder. The other specimen was taken from a fine young man, a patient of my own; the injury having occurred while the bladder was very full of urine, as he was wrestling with another person, whose knee in the fall made violent pressure on the abdomen, just above the pubes. Also the accident has sometimes been caused by a general concussion of the whole frame, such as a fall from a height, without any direct force acting on the vesical region itself. (*See Cusack's case in Dublin Hosp. Rep.* vol. ii.) Again, the bladder may be ruptured by violent exertion, and repeated straining to empty it when overdistended, in consequence of some obstruction to the flow of urine, or during the violent efforts of parturition. Lastly, it sometimes gives way from gangrene, when it has been long in a state of forced distension, or when, being in a state of plenitude, it is subjected to the long-continued pressure of the uterus during a protracted labour, or, in the earlier periods of utero-gestation, to the pressure on it caused by a retroversion of the womb, as exemplified in the cases recorded by Dr. William Hunter. (*Med. Obs. and Inq.* vol. iv. and v. Lond. 1771.; *Harrison, in Dublin Journ. of Med. Science*, vol. ix. p. 352.) In retention of urine, a rupture of the bladder from straining to empty it, is not a common event. One instance of it is mentioned by Sir Benjamin Brodie (*On Dis. of the Urinary Organs*, p. 12.) and another by Sir Everard Home. (*On Strictures*, vol. ii. p. 240.) But, as Dr. Harrison observes, it is doubtful, whether, in the latter case, the opening in the bladder was the effect of a sudden laceration, caused by muscular exertion, or of some preceding ulcerative, or gangrenous affection at the particular point, where the organ gave way. Generally, however, in retention of urine from stricture, when the urine becomes effused, it is not from a rupture of the bladder, but from that of the urethra behind the stricture, or in the immediate vicinity of the prostate gland. (*Harrison, in Dub. Jour. Méd. Science*, vol. ix. p. 352.)

It would appear from Dr. Harrison's investigations, that, when the distended bladder in the male has been ruptured by a fall or blow on the hypogastric region, or by a general concussion, that portion of it, which is covered by the peritoneum has very generally been the seat of rupture; the urine has consequently been effused in the abdomen, and the patient has been destroyed by peritonitis. (p. 354.)

The following is the explanation, offered by Dr.

Harrison of the fact, that, when the bladder is ruptured by a blow, or general concussion, the laceration is always found in that part of the organ, which is covered by the serous membrane. "The several tunics of the bladder allow of considerable distention, but least of all the peritoneal: when, therefore, the bladder becomes fully distended, and is then subjected to any sudden, or violent compressing force, this tunic, which is then tense, and comparatively unyielding, will crack, while the subjacent tunics, which are connected to it will be torn along with it; whereas, in other situations, where cellular tissue occupies the place of the serous membrane, the coats of the bladder will yield considerably before they give way, or admit of laceration. (See *Dub. Jour. of Med. Science*, vol. ix. p. 371.) The bladder being pressed forcibly against the promontory of the sacrum in the male, seems to Dr. Harrison also to account for the rent being usually in the posterior region of that viscus. The rarity of the accident in females is ascribed by him to the greater size of the pelvis, the cavity of which is not so extensively occupied by the bladder when this is full of urine. Nor (says he) does the bladder incline so much backwards as in the male; on the contrary, it inclines more forwards, and enlarges more in the transverse direction; while the uterus and its lateral broad folds, may assist to break the shock of any external violence, applied to the hypogastric region, and so prevent the direct concussion of the bladder against the sacral promontory." (Vol. cit. p. 372.) The comparative infrequency of a rupture of the bladder in children and boys, is referred by Dr. Harrison to their rarely suffering the bladder to become much distended with urine, and, in part, to the smaller size of the sacral promontory, and to the bladder, when full, lying in early life more in the abdomen.

With respect to the diagnosis of the kind of rupture of the bladder now under consideration, it is judiciously observed by Dr. Harrison, that as it is the effect of only two species of injury, the account of the accident will afford useful information. Thus, says he, every case on record has been the result, either of some force, directly applied to the abdomen, or of a general concussion of the whole frame. In this latter case, the injury is more likely to be overlooked, particularly if the individual has suffered in any other and more obvious manner: hence, after such accidents, the attention of the practitioner should be early directed to the urinary discharge, and, if there be any inability to pass the urine, and a desire to do so, the catheter should be introduced. When the rupture has been the effect of violence, directly applied to the hypogastric region, the symptoms are more obvious. The patient himself is often aware of the accident: he knew that his bladder was full at the time of the injury; perhaps, he felt it burst within him. Then the sensation of sinking and sickness, the pain in the abdomen, and the peculiar feeling about the præcordia, are all circumstances indicative of the rupture of some viscus. In addition to these symptoms, there will be a desire to make water, without the power of doing so; great pain in the belly and perineum, during the attempts; tension of the abdomen, the fulness being diffused, and not circumscribed, as in common retention of urine. When a catheter is introduced into the bladder, it meets with a peculiar resistance; and

the urine flows through it, not in a stream, but as if it merely filled and overflowed the instrument slowly; at one time only in a few drops; at another, in considerable quantity; "this difference depending on some alteration in the direction of the instrument, or, in the degree of pressure, with which it is pushed against the bladder, whereby the edges of the rupture must be separated, and more or less of the abdominal and pelvic urine be discharged." (Harrison, in *Dub. Journ. of Med. Science*, vol. ix. p. 377.)

In one case, recorded by Mr. Cusack, only a few drops of urine could be drawn off with the catheter, on the day of the accident. On the next, no urine flowed at first; but, by changing the direction of the instrument, and on making pressure with the finger in ano, about three pints were discharged. On the third day, as all the symptoms continued unabated, the abdomen was punctured in the linea alba, midway between the umbilicus and the pubes; and a large quantity of clear urine, escaped, and, at the same time, it flowed freely from a catheter in the urethra. The relief was only temporary, the patient having died delirious on the eighth day. On dissection, marks of intense inflammation were noticed in the hypogastric region, where the intestines were glued together into one mass. At first no urine was seen; but, on breaking the adhesions and raising up the intestines, about a pint of it was sponged out from between the rectum and the bladder. "The pelvic portion of the peritoneum was completely coated with lymph; the bladder was contracted and empty; the rupture, about an inch in extent, was in its posterior part and right side, and in an oblique direction." (See *Cusack*, in *Dub. Hospital Reports*, vol. ii. p. 312.)

In the *post mortem* examination of a case under Dupuytren, traces of severe inflammation were observed in the hypogastric region. Adhesion existed between the abdominal parietes, and the bladder, and the sides of the latter and the adjacent viscera were all so agglutinated together, that a kind of pouch was formed, considerably advanced in organization, whereby the urine was circumscribed, and effusion to any further distance prevented. (See *Archives Gén.* June, 1834, p. 294.) In general, the bladder, though the seat of injury, is itself but little inflamed, except at the posterior portion of its serous coat. (Harrison in *Dub. Jour. of Med. Science*, vol. ix. p. 375.)

In the treatment, the principal indications are to withdraw, if possible, the effused fluid from the abdomen; to prevent, if possible, any return or increase of such effusion; and to resist and subdue that unavoidable and very fatal affection peritonitis. With this view, any accumulation of urine in the bladder should be prevented by the introduction of an elastic gum catheter, of full size with a long and large curve; and if, by changing its direction, or other manœuvres, its beak can be passed through the rent, or made to reach its vicinity so as to open it, a considerable quantity of urine may be drawn from the cavity of the peritoneum. Pressure with the finger in ano is also to be tried. (Harrison, vol. cit. p. 379.) In the case which I attended, a catheter of full size was kept continually introduced. In this way, we endeavour to lessen the exciting cause of the inflammation, which, however, is sure to follow the effusion of so irritating a fluid as the urine. Inflammation must therefore be resisted by local and general bleeding; calomel,

opium, and mild saline purgatives given with the effervescing mixture. If the disease advance, and the pains in the abdomen become more intense, with swelling and fluctuation, ought the surgeon to perform paracentesis? As Dr. Harrison remarks, this has been done in two instances, but without success. "The urine which is effused is principally lodged in the pelvic cul-de-sac, and is more or less confined to that region, partly from its depending position, and partly from the adhesions, which we have reason to expect under proper and active treatment, may have been formed between the bladder and the adjacent viscera, at the upper orifice of the pelvis." This view leads Dr. Harrison to consider cutting a small opening through the rectum; into this cul-de-sac, the best and safest plan for the discharge of the irritating fluid. Here a new cavity has been formed, coated internally like an abscess; and the opening is not to be regarded as extending into the general cavity of the peritoneum. The operation might be done with a trocar, or a long curved bistoury, with a sheath, and a cutting edge only on its extremity. The patient being in the recumbent posture, with his knees drawn up and somewhat separated, the finger of the left hand might be passed up the rectum, as far as possible, and pressed against its fore part. The catheter in the bladder might also assist in guiding the finger to the cul-de-sac behind that organ. The cannula of a long curved trocar might next be passed along the finger, and, when its extremity had been placed against the fore part of the rectum exactly in the median line, the stillette might be pushed through it, and the peritoneum opened. Dr. Harrison conceives that the quantity of effused fluid would protect the small intestines from reach of the instrument; and he says, that in the cases which he has examined, he did not find any of their convolutions in the pelvis. Supposing this operation were ever attempted, ought the cannula to be left in the part? or ought it to be withdrawn, and the catheter trusted to the prompt discharge of the urine afterwards? The latter method is preferred by Dr. Harrison. (See *Buer, Mal. Chir.* l. ix. p. 61; *C. Montague, in Med. Communications.* vol. ii. p. 284; *Cusack, in Dub. Hospital Reports,* vol. ii. p. 312; *Dupuytren, Archives Gén.* June, 1834, p. 294. *Johnstone, in Mem. of Med. Soc. of Lond.* vol. iii. p. 543; and, particularly *Dr. Harrison's Cases and Obs. in Dubl. Journal of Med. Science,* vol. ix. p. 349, to whom I am indebted for the chief information in the foregoing article.)

BLADDER, Wounds of. (See GUNSHOT WOUNDS.)

BLEEDING. By this operation is understood the taking away of blood for the relief of diseases. Bleeding is called *general*, when practised with a view of lessening the whole mass of circulating blood; *topical*, when performed in the vicinity of the disease, for the express purpose of lessening the quantity of blood in a particular part.

General Blood-letting is performed with a lancet, and is subdivided into two kinds; viz. the opening of a vein, termed *phlebotomy*, or *venesection*; and the opening of the temporal artery, or one of its branches, termed *arteriotomy*.

Topical Blood-letting is performed, either by means of a cupping-glass and scarificator, or leeches, or by dividing the visibly distended vessels with a lancet, as is frequently done in cases of *ophthalmia*. See *ARTERIOTOMY; Cupping, Leeches, Scarification, and Venesection.*

BLEEDING. (See ARTERIES, HEMORRHAGE, LIQATURE WOUNDS.)

BLÉNORRHOÏA, or *Blénorrhœa*, (from *βλένω*, mucus, and *ῥέω*, to flow.) A discharge of mucus. Swediaur, who maintains, that gonorrhœa is attended with a mucous, and not a purulent, discharge, prefers the name of blenorhœgia for the disease. However, in treating of gonorrhœa, we shall find, that this last appellation is itself not altogether free from objections.

BLEPHAROPTOSIS (from *βλέφαρον*, the eyelid, and *πτῶσις*, a falling down.) Called also *ptosis*. An inability to raise the upper eyelid. (See PTOSIS.)

BLINDNESS. An effect of many diseases of the eye. See AMAUROSIS; CATARACT; CORNEA OPACITIES OF; GLAUCOMA; HYDROPHTHALMIA; LUCOMA; OPHTHALMY; PTERYGIUM; PUPIL, CLOSURE OF; STAPHYLOMA, &c.

BLISTERS. Applications, which, when put on the skin, raise the cuticle in the form of a vesicle, filled with a serous fluid. Various substances produce this effect; but the powder of cantharides is what is commonly employed. The blister-plaster is thus composed:—R *Cantharidis in pulv. subtilissimum trita* lbj. *Emplastri cereæ* lbss. *Adipis præp.* lbss. The wax plaster and lard being melted, and allowed to become nearly cold, the powdered cantharides are added.

When it is not wished to maintain a discharge from the blistered part, it is sufficient to make a puncture in the cuticle to let out the fluid; but, when the case requires a secretion of pus to be kept up, the surgeon must remove the whole of the detached cuticle with a pair of scissors, and dress the excoriated surface in a particular manner. Practitioners used formerly to mix powder of cantharides with an ointment, and dress the part with this composition. But, such a dressing not unfrequently occasioned very painful affections of the bladder, a scalding sensation in making water, and most afflicting stranguities. An inflammation of the bladder, ending fatally, has been thus excited. The treatment of such complaints consists in removing every particle of cantharides from the blistered part, which is to be well fomented, and administering freely mucilaginous drinks. Camphor is now suspected to prove more hurtful than useful.

These objections to the employment of salves, containing cantharides, for dressing blistered surfaces, led to the use of mezereon, euphorbium, and other irritating substances, which, when incorporated with ointment, form very proper compositions for keeping blisters open, without the inconvenience of irritating the bladder.

The favourite application, however, for keeping open blisters, is the powder of savine, which was brought into notice by Mr. Crowther, in the first edition of his book on the White Swelling. He was led to the trial of different escharotic applications, in the form of ointment, in consequence of the minute attention, which caustic issues demand; and, among other things, he was induced to try powdered savine, from observing its effects in the removal of warts. Some of the powder was first mixed with white cerate, and applied as a dressing to the part that had been blistered; but the ointment ran off, leaving the powder dry upon the sore, and no effect was produced. Mr. Crowther next inspissated a decoction of savine, and mixed

the extract with the ointment, which succeeded better, for it produced a great and permanent discharge. At last, after various trials, he was led to prefer a preparation analogous to the unguentum sambuci P. L. The following formula answers every desirable purpose: — *R. Sabinæ recentis contusæ lbij. Cerae flavæ lbj. Adipis suillæ lbiv. Adipe et cera liquefacta, incoque subinam et cola.*

The difference of this formula from that, which Mr. Crowther published in 1797, only consists in using a double proportion of the savine leaves. The ceratum sabinæ of Apothecaries' Hall, he says, is admirably made: the fresh savine is bruised with half the quantity of lard, which is submitted to the force of an iron press, and the whole is added to the remainder of the lard, which is boiled until the herb begins to crisp; the ointment is then strained off, and the proportion of wax ordered, being previously melted, is added. On the use of the savine cerate, immediately after the cuticle, raised by the blister, is removed, it should be observed, says Mr. Crowther, that experience has proved the advantage of using the application lowered by a half, or two thirds, of the unguentum cera. An attention to this direction will produce less irritation and more discharge, than if the savine cerate were used in its full strength. He found fomenting the part with flannel wrung out of warm water a more easy and preferable way of keeping the blistered surface clean, and fit for the impression of the ointment, than scraping the part, as has been directed by others. An occasional dressing of the unguentum resinae flavæ he found very useful in rendering the sore free from an appearance of slough, or rather dense lymph, which is sometimes so firm in its texture as to be separated by the probe with as much readiness as the cuticle is detached after blistering. As the discharge diminishes, the strength of the savine dressing should be proportionally increased. The ceratum subina must be used, in a stronger or weaker degree, in proportion to the excitement produced on the patient's skin. Some require a greater stimulus than others for the promotion of the discharge, and this can only be managed by the sensations which the irritation of the cerate occasions.

Mr. Crowther tried ointments, containing the flowers of the clematis recta, the capsicum, and the leaves of the digitalis purpurea. The two first produced no effect; the last was very stimulating. He also tried caustic potassa, mixed with spermaceti cerate, in the proportion of one drachm to an ounce: it proved very stimulating, but produced no discharge. One grain of the oxymuriate of mercury, blended with two ounces of the above cerate, proved so intolerably painful, that, at the end of two hours, it became necessary to remove the dressing; and the patient was attacked with a severe pyalism. (*Practical Obs. on the White Swelling*, &c. 2d ed. 1808.)

Instead of keeping a blister open, it is frequently a judicious plan to renew the application of the emplastrum cantharidis, after healing up the vesication first produced, and to continue, in this manner, a succession of blisters, at short intervals, as long as the circumstances of the case may demand. Where the skin is peculiarly irritable, and, particularly, in young children, where the emplastrum cantharidis sometimes acts so violently as to produce sloughing, or, in any cases, where the plaster

produces strangury and irritation of the urinary organs, I am informed that the inconvenience may be avoided, and the cuticle raised very well, if a piece of silk paper be interposed between the plaster and the integuments. Dr. A. T. Thomson recommends for the same purpose a piece of thin gauze, wet with vinegar, and applied smoothly and closely over the plaster. (*Dispensatory*, p. 717. ed. ii.) For infants, a proportion of opium has sometimes been added to the plaster, in order to render its action less violent; a proposal made, I believe, by the late Mr. Chevalier. Others recommend the plan of not letting the blister continue so long applied to children as to other patients.

In the North London Hospital, the nitrate of silver is often used for making blisters, as particularly recommended by Mr. Higginbottom. It causes less irritation, and its effects are more prompt, than those of cantharides. It may also be used in persons, in whom cantharides produce strangury. It excites a copious discharge, without heat or pain after the first few hours, and the vesicated part heals about the fifth day, no ulceration having been occasioned. (See *Higginbottom on Nitrate of Silver*, p. 161.) By means of the application of nitrated silver, repeated every six or eight days, and of perfect quietude of the part, secured by means of a splint and bandage, many a diseased joint has been cured in the North London Hospital.

"In applying blisters to infants," says Dr. Cumming, "we must take particular care not to allow them to remain on for more than three or four hours. When a blister is applied for a longer period, excessive general irritation is apt to be induced; and such is the delicacy of the infant's skin, that the blistered parts not unfrequently become gangrenous. Under such circumstances, the death of the child has been sometimes the consequence. Though vesications may not have formed, at the time when the blister is removed, they generally take place after the application of the dressing. In some habits, the blistered surface takes on an unhealthy action, and runs into eating and irritable ulcers, which are long in healing. In such cases, I have found an emollient poultice, when the inflammation is considerable, and afterwards the black and yellow washes, the most useful applications. In infants of an irritable habit, it will sometimes be advisable to dilute the blistering plaster with an equal quantity of the emplastrum cera." (Dr. Cumming in *Trans. of Assoc. of Coll. of Physicians, Ireland*, vol. v. p. 55.) — See *Paris's Pharmacologia*, vol. ii. p. 186. ed. 5. A. T. Thomson's *Dispensatory*, and *Elements of Mat. Med.* ed. 2. John Higginbottom on the Use of Nitrate of Silver, p. 161. ed. 2. 8vo. 1829. Mayo's *Outlines of Human Pathology*, ch. i.

BOIL. (See FURUNCULUS.)

BONES, EXCISION OF. This operation is sometimes applicable to the articular portions of bones, but still more frequently to other parts of them. The circumstances under which it is practised for the removal of diseased, or very severely injured joints, and the plans then to be adopted, will be hereafter considered, (See JOINTS, EXCISION OF.) Neither shall I dwell at present upon the removal of the projecting ends of broken or dislocated bones; nor upon sawing off the extremities of old ununited fractures; subjects noticed in the account of *Dislocation and Fracture*. In the articles

AMPUTATION and GUNSHOT WOUNDS. I have called the reader's attention to the praiseworthy method of cutting down to, and removing, all loose splinters of the os brachii, and even the sharp end of that bone itself, from certain gunshot injuries of the shoulder, so as frequently to obviate the necessity for amputating the limb. The cases demanding the removal of portions of the skull, and the manner of accomplishing it, will be described under the head *TREPANE*. Towards the conclusion of the observations upon *AMPUTATION*, some account has already been given of the *excision of certain bones of the hand and foot*. It is difficult, as M. Malgaigne observes, to lay down any precise directions for the *excision of the bones of the tarsus*. The following plan was adopted by Moreau, the father, for an extensive caries:—Over the cuboid bone, there was one ulcer an inch in diameter; and another between the third and fourth metatarsal bones, resulting from an incision made a few days previously for the discharge of an abscess. A probe penetrated into the cuboid bone. An incision was made along the outer side of the foot, and extended across the ulcer, from the posterior third of the fifth metacarpal bone to above the anterior tuberosity of the os calcis; and, as the incision already made for the abscess could now be made serviceable, this and the other incision were conjoined by a transverse one, and the square flaps reflected. The diseased bones were thus brought into view, and it was necessary to remove the cuboid, the third cuneiform, the posterior end of the fourth metatarsal bone, the inner side of the extremity of the fifth, and the articular surface, by which the os calcis is united to the cuboid bone. The tendon of the peronæus longus was preserved. The flaps were then laid down, and united with two sutures. The patient, who was young, got completely well. The vacancies, occasioned by the extrication of the bones, were filled up by a substance which afterwards ossified. In the end, the patient was able to walk well; the foot having assumed its natural shape and motions. (See *Malgaigne, Man. de Méd. Opér.* p. 243.) The operation of removing the metacarpal bone of the thumb, or the metatarsal bone of the great toe, is not deemed by Mr. Liston an advisable proceeding; because the rest of the thumb or toe is left without support, and is useless. He has seen cases treated in this way; but the result was unsatisfactory. However, Monro removed the *whole of the first metatarsal bone* on account of caries, and M. Barbier did the same thing at the Val de Grâce after a dislocation of the bone; and, in each case, the result was in every respect successful. (See *Malgaigne, Op. cit.* p. 243.) The *excision of the metacarpal bone of the thumb* has been performed with success by M. Roux and M. Blandin. The thumb was at first shortened and useless; but gradually became capable of executing all its natural movements. (See *Malgaigne, Man. de Méd. Opér.* p. 232.) An incision is to be made along the radial edge of the bone, and to extend about half an inch beyond each of its articulations. Then the integuments and extensor tendon are to be detached from its dorsal, and afterwards the muscles from its palmar surface. While an assistant holds aside the lips of the wound, the surgeon opens the outer side of the carpal joint with the point of the knife, cuts through the tendon of the long abductor, which is inserted into the metacar-

pal bone, and then carries the knife completely through the joint. He now tries to dislocate the bone outwards, and to pass the knife along its inner side, so as to effect its total detachment from the muscles. Lastly, the articulation with the first phalanx is opened by cutting in succession the internal and external lateral, and the anterior, ligaments. The radial artery may be avoided; but, were it wounded, the application of a ligature to it would be attended with no difficulty. The wound is to be brought together, and the thumb supported in its natural position with soft pads placed in the palm. (See *Malgaigne, Op. cit.*) *Excision of the anterior portion of the first metatarsal bone*, seems to M. Blandin advantageous, because, when the rest of it can be saved, the foot remains with a more solid support. A flap is formed at the inner side of the bone, with the base backward. The bone is exposed to the point where it is intended to divide it; sawn perpendicularly to its axis; then detached from its connections, from behind forwards; and finally disarticulated from the phalanx. With respect to the phalanges of the other four toes, amputation is commonly preferred to excision of them; and so it is to excision of the heads of their metatarsal bones. (*Malgaigne, Op. cit.* p. 242.) Although, the *excision of the metacarpal bone of the index and little fingers* may easily be performed by cutting along the outer margin of it, M. Malgaigne is probably correct in stating, that such an operation, in consequence of the subsequent shortening of the finger, would leave after it as much deformity as amputation would produce, and even greater weakness of the hand. This observation is not applicable, however, to the *excision of the metacarpal bones of the middle and ring fingers*, which will still retain their connection with the contiguous ones, and the strength of the hand be preserved. An incision is made along the dorsal aspect of the bone, by the side of the extensor tendon, which should not on any account be divided, and the disarticulation is to be begun at the knuckle. (See *Malgaigne, Man. de Méd. Opér.* p. 233.) The removal of dead, or softened and carious, portions of the carpal and tarsal bones, Mr. Liston admits, is sometimes successful; but, operative interference with these, or with more extensive and formidable articulations, is not advisable, unless the soft parts be not largely involved, and the general health tolerably good. If the ligaments, bursæ, and cellular tissue are much affected, Mr. Liston considers the chance of the discharge ceasing, and of the return of health, entirely hopeless. Amputation above the diseased parts will still be indispensable; and, in consequence of the more reduced and deranged state of the constitution, this second operation is less likely to answer than if it had been undertaken earlier. (See *Liston's Elem. part iii.* p. 398.) It is right to mention, however, that after necrosis of the first phalanx of the thumb, and the extraction of the fragments, M. Velpeau has known the part regain its motion. If an incision were necessary for the removal of this phalanx, it should be made along the radial side of the thumb, and the metacarpal articulation, which is the looser one, being opened first, the phalanx should then be luxated outwards, and dissected out. (See *Malgaigne, Man. de Méd. Opér.* p. 231.) In a few cases, Mr. Liston has removed several of the *tarsal and carpal bones*; as practised by Mr. Dunn of Scarborough (see

Amputation), in others, one, or a portion of one, with success. In one instance, the greater part of the *astragalus* was taken away along with the ends of the *tibia* and *fibula*. There remained a large opening across the joint, through which a seton was passed to promote the gradual and piecemeal discharge of the remaining portions of diseased bone. The articulation could be seen through. The seton was gradually diminished, and the aperture closed. The foot was preserved, and the leg was somewhat shortened; but the limb proved extremely useful, though the ankle retained little power of motion. Mr. Liston, as well as many other surgeons, has also trephined the *os calcis*, and removed large portions of it. He has likewise taken away the *cuboid bone*, along with the bone of the *metatarsal bone* or bones, in connection with it. In some of these cases an excellent cure followed; in others, amputation of the foot was afterwards necessary. (Vol. cit. p. 400.) Examples of the removal of extensive portions of the *os calcis* are reported by Hey, Moreau, and M. Roux. In the North London Hospital, there was a young woman, in 1835, from the outer part of whose *os calcis* Mr. Liston removed a considerable piece with a trephine. The case was a scrofulous caries. Some amendment followed; but the caries penetrated too far to admit of complete removal in this manner. A fine specimen of the same thing was lately put into my hands by Mr. Morton, of University College, the part having been finally amputated in the Newcastle Hospital. In one case, where the *scapoid bone* of the carpus was dislocated by an injury, occasioned by machinery, Sir Astley Cooper successfully removed that bone. The rule proposed by him for any analogous case, is to take away one, or even two, of the carpal bones, if displaced; but, if the mischief is greater, to amputate.

I am not disposed to bestow much commendation on such an operation as the *excision of the ribs*, notwithstanding the high and respectable authorities which may be quoted in sanction of it, with the exception of its performance in cases where a sequestrum is nearly or entirely loose. The most remarkable excision of the ribs yet recorded is that performed by Mr. Richerand in 1818, on a medical officer, who was afflicted with cancer of the thorax. The middle portion of four ribs was removed to the extent of several inches. It was also necessary to extirpate the contiguous part of the pleura, which was very much thickened, and transformed into a cancerous substance. Thus, the pulsations of the heart, within the pericardium, were brought completely into view. The case afterwards went on favourably for a time; but in the end proved fatal by a return of the cancerous disease. I scarcely need advise British surgeons not to attempt any similar operation, where the disease of a rib, or indeed, of any other bone, is the effect of a primary cancerous affection of the soft parts. Such an experiment must inevitably terminate in the return of the original malignant disease, unless the patient's accelerated death happen not to leave sufficient time for this result. These observations are directed chiefly, however, to the particular case here specified; for, as the excision of portions of ribs has been performed by several eminent surgeons with success, I conclude that circumstances may occur in which the plan is justifiable. Not to lay any stress upon the instances of the practice in ancient times by Galen,

Aymond, Sediller, Lecat, Ferrand, &c., it has been twice resorted to subsequently to Richerand's operation, and with success, by Attadini in Italy; also in the Hospitals Beaujou and La Charité at Paris; and by Dr. Mott, of New York. The operation consists in extending the incision through the soft parts beyond the extent of the diseased portion of the rib, both in front and behind, and then, after detaching the bone from the pleura at the point where it intended to divide it first, it may be sawn through with one of Hey's saws, or, what will be more convenient, divide with a pair of cutting pliers. The divided end of the bone should then be inclined outwards, and separated from its connections, so as to facilitate the safe division of it beyond the opposite extremity of the disease. A principal thing in the operation is to avoid injury of the pleura, as much as possible.

In 1825, the *excision of the radius* was accomplished with complete success by Dr. R. Butt, of Virginia; and in 1826, M. Velpeau had a case in which he was desirous of practising a similar operation, on account of disease entirely restricted to that bone; but the patient preferred amputation. (See *Velpeau, Nouv. Elém. de Méd. Opér.* t. i. p. 565.) An incision is made along the outer and anterior part of the radius. The edges of the wound are to be held apart, and the muscles detached from its anterior and posterior surfaces; a little below its middle part, where it is most superficial; a chain saw is to be used, a director is now being introduced at the ulnar side of the bone, will serve to convey the chain saw behind it. In the place specified the bone is sawn through, and the two fragments carefully dissected out. If sufficient room were not obtained for the action of the saw by the longitudinal incision, a transverse one should also be made. (*Velpeau, ib.*) A strong pair of cutting forceps would divide the radius with less difficulty than a chain saw.

In an example of *necrosis of the or third of the clavicle*, M. Velpeau removed the scapular portion of it. Two incisions, in a circular form, and four inches long, were made, the flaps raised, the acromio-clavicular ligaments, and some parts of the origin of the deltoid and trapezius divided. The bone was then raised with a lever passed into the joint, and its detachment completed. M. Malgaigne conceives, that a better plan would be to make first an incision, parallel to the clavicle, but a few lines below it, and ending at the acromion, and then another shorter one at a right angle with this extremity of the first, so as to form a triangular flap. Instead of a chain saw, the clavicle may be very safely divided with one of Hey's saws, or a pair of cutting pliers, care being taken to pass a flexible copper spatula under the part.

The *sternal end of the clavicle* was removed many years ago by Mr. Davies, a surgeon of Bungay in Suffolk, on account of its being displaced backwards, and dangerously compressing the œsophagus; in consequence of the scapula being forced very much forwards by a deformity of the spine. (See *Sir Astley Cooper on Dislocations*.) In this operation a piece of leather was placed under the bone to protect the subjacent parts from the saw. The interclavicular ligament was torn through, so as to free the sternal end. The patient was alive six years after the operation, and in good health.

The whole clavicle affected with osteo-sarcoma,

was removed by Dr. Mott, of New York. The tumour was of the size of two fists, and reached upwards nearly to the hyoid bone, and angle of the jaw. A semilunar incision, with its convexity downwards, was made below the swelling, from one end of the bone to the other. Another incision was next made above the tumour from the acromion to the external margin of the internal jugular vein. The platysma, and a portion of the trapezius having been divided, a director was passed under the bone, near the acromion, and a division here effected with a chain saw. Not being yet able, however, to displace the tumour, Dr. Mott, with the aid of a director, extended the first incision, inwards; and, having applied two ligatures to the external jugular vein, and cut it through in the interspace, he next divided the clavicular portion of the sterno-mastoid muscle, and found it necessary also to tie and divide the internal jugular vein. The subclavian vein and thoracic duct were separated from the diseased parts with the handle of the scalpel. Lastly, the great pectoral muscle, the costo-clavicular ligament, and the subclavian muscle having been divided, the disarticulation of the sternal end of the clavicle was accomplished. The bleeding required forty ligatures for its suppression. In six weeks the wound was nearly healed, and the patient afterwards, with the aid of a mechanical substitute for the clavicle, retained the power of moving the limb, with but little impairment.

The *excision of the scapula*, to a greater or lesser extent, has been performed on several occasions. In one instance a considerable portion of the scapula was removed by M. Janson, on account of a tumour involving it. Two semi-elliptical incisions were made, so as to circumscribe the swelling; as much skin as possible was dissected up and saved: the tumour and bone were then detached from their connections in every direction, as low down as the fossa subscapularis. The attachments of the trapezius, supra and infra spinatus having been divided, and the portion of the bone above the spine ascertained to be sound, all the other diseased part was sawn off, and the shoulder joint left uninjured. One more incision was necessary to expose the whole of the tumour, and facilitate its excision. The wound was altogether six inches in breadth, and nine in length. The motion of the shoulder was preserved. A large tumour of the scapula was removed two or three years ago by Mr. Earle; but, as the disease returned, Mr. Skey removed it a second time, together with the greater part of the scapula. The disease, however, being of a malignant character, again returned and proved fatal. Several cases of this description have been lately met with in the hospitals of this metropolis. One was in the North London Hospital under Mr. Liston. I heard of another in the Westminster Hospital.

Excision of the whole of the fibula with the exception of its head, was performed by M. Scutrin. The particulars are contained in M. Malgaigne's Manual. Many arteries required ligature, and amongst them, the posterior tibial. The external popliteal nerve was also divided. As the tibia was slightly affected, the osseous was applied to it. In two months the wound was healed, and, in four, the patient could bear nearly as well on this leg as on the other.

In the articles *Amputation*

Gunshot

Wounds, I have noticed the excision of the upper head of the humerus; and in that on *Anchylosis*, some account is given of Barton's *excision of the head and neck of the femur*; an operation, to which an allusion is made in the writings of C. White, of Manchester, and which has been performed by Sir Benjamin Brodie, Mr. Anthony White, and in Germany by Oppenheim. Sir Benjamin Brodie lately informed me that his patient died sometime afterwards of phthisis. I believe the case was one, in which it was suspected, that the disease was restricted to the head of the femur. My friend, Mr. Anthony White has favoured me with the following particulars of the case in which he performed the operation:—John West, a twin of delicate make, was born and resided in Westminster. When between four and five years old, he suffered from scrofulous inflammation in the left hip joint, which passed through the stages of elongation, dislocation, and subsequent retraction, and the femur was finally lodged in a very high position, on the dorsum of the ilium, "About three years subsequent to the commencement of the disease, and when he was about eight years old, I first saw him. He was much emaciated; several abscesses had formed during this period around and over the diseased structures, leaving many fistulous openings, through which the probe easily detected the surface of the displaced bone to be in a state of caries, and several small exfoliations had occurred, from the ilium, ischium, and os pubis, over which bones abscesses had formed. In the progress of the disease the knee of the affected limb had become inverted and firmly embedded on the lower and inner part of the opposite thigh, from which position it could not be removed, and every attempt to do so was accompanied with exquisite pain. All further attempts, therefore, were abandoned, and the limb left undisturbed. He had now lain nearly three years, on the opposite side, with the body considerably incurvated and without the power of changing his position. A profuse and debilitating discharge was constantly issuing from the numerous apertures leading to the carious surface of the displaced bone. In other respects, the health of the boy was tolerably good. Reflecting on this poor boy's case, it was evident, that, unless the knee could be removed from its firm lodgment on the opposite thigh, he must remain in the position above described during the remainder of his life, and this could only be effected by removing the upper portion of the femur, which, from its trifling mobility, induced the belief that a firm union was taking place between its under surface and that of the ilium, with which it had been long in contact, and the form of which was very apparent under the thin integuments with which it was covered. Considering, also, that as an entire destruction of every texture, which forms a healthy joint had taken place, no danger could be reasonably entertained from meddling with parts in their existing condition, and attempting the removal of the head of the displaced bone; and, further, that the strength of the boy, from the profuse discharge kept up by the caries of the bone was never likely to be restored: I was induced, after mature reflection, to propose an operation for the removal of the upper part of the femur as far as it should be found in a state of caries, which, from examination with the probe, appeared to ex-

tend probably a little lower than the great trochanter. If this could be accomplished, it would set free the lower portion of the bone embedded on the opposite thigh, and enable me to draw outwards the whole limb, and possibly place the boy in a condition equally favourable with those cases where a similar disease had occurred, and in which a compensatory joint is formed, on which locomotion is effected with or without the aid of a crutch. I proposed to divide the integuments covering the bone, beginning above its head, which was easily detected, and carry it downward, in the centre, as low as might be found necessary, and separate the soft parts from the shaft of the bone towards either side. I then proposed to divide the bone at the lowest exposed part with a small saw and to elevate it with a lever from the dorsum of the ilium. I hoped that the wound would heal over the divided end of the bone, which (now being set free) might be brought into a straight line, and which motion would incline deeply into the wound the end of the divided bone. The wound itself was to be treated as a common incision with adhesive plaster and bandage, and rigid quietude. My colleague, the late Mr. Morel, saw the case, concurred in the proposition, and offered to be my assistant. The late Mr. William Smith, member for Norwich, and to whom the mother of the boy was well known, informed the late Sir E. Home of this proposed operation. The boy, at his request, was conveyed to St. George's Hospital; and, after an examination of the case with his colleagues, a written document, signed by him and them, was given to the mother of the boy, declaring that the contemplated operation would not only be useless, but impracticable; and, most likely, if attempted be attended with loss of life. I was not present at this consultation and only knew of it by being shown this document or protest by the boy's mother. Of course, with such a published declaration, I abandoned the case altogether. After the lapse of some months, Mr. Travers, whilst attending at Mr. Smith's house in the city, to which the boy West had been removed with his mother, was requested to look at him; and being told of the proposed operation by the mother, who was an exceedingly intelligent person, at once saw and understood the principles and plan of the proposition. He subsequently wrote me a note, expressing his entire concurrence in the measure, and kindly offered to assist me in the operation, notwithstanding the formidable protest which had been issued shortly before. Glad of the concurrence of so distinguished an individual, and my own opinion as to its practicability being unchanged, I gladly accepted of the offer. A lodging, in Westminster, was procured for the boy and his mother. We met in consultation, and an early day was fixed for the operation.

"In April, 1821, we met; and the boy being placed on a table of convenient height, I proceeded to divide the integuments covering the bone, carrying the incision from an inch above the head, directly along the middle line of the bone, about two inches below the greater trochanter: this was completed at one incision down to the surface of the bone. The integuments were dissected inwards and outwards, thus leaving the bone entirely bare, a little lower down than the lesser trochanter, which was distinctly visible. A spatula was now placed under that part of the

bone which was intended to be sawn through, so as to protect the structures underneath. This was readily accomplished. A smaller spatula was then introduced into the space made by the saw, and used as a lever to raise the bone; which, with a little dissection, was removed from the dorsum of the ilium. No vestige of the acetabulum remained, neither was any caries of the ilium discovered. The thigh was now readily brought into a straight line, and the knee liberated from its position on the thigh. The wound was closed by adhesive plaster, and no portion of the bone was left exposed. Splints and an eighteen-tailed bandage were applied, and the limb placed in the straight position. The boy bore the operation well, and not more than two ounces of blood were lost. The head, neck, and trochanters, were very apparent, the curies being superficial, and not extending lower than the lesser one. The case proceeded very favourably, and, in a few weeks every sinuous opening had healed, and also the incision made in the integuments. The patient rapidly acquired strength and flesh. At the end of two months, I began to examine the parts to ascertain if they had formed any attachment to the surrounding structures; and, on attempting to move the limb in different directions, I discovered that the boy himself had the power of raising the thigh upwards, which power gradually increased, and, finally, a very extensive motion was accomplished by the spontaneous action of the muscles. I now proceeded to examine whether he could bear pressure upon this foot without inconvenience, which was the case, at the expiration of about four months from the time of the operation. He was put on crutches, and in a very short time could bear considerable pressure on the foot, and, at the end of a year, he could walk on a high stirrup without his crutches. Finally, it was clearly ascertained, that a new and useful joint had been formed, the boy being enabled to walk several miles without the aid of a crutch or stick. He acquired great latitude of motion, except in rotating the thigh outwards, and separating the thigh laterally outwards. He was apprenticed to a lady's shoemaker, and five years after the operation; he became phthisical, and died of diseased lungs in the Westminster hospital. The limb was removed with half the pelvis, and is in the possession of the Royal College of Surgeons; but the parts have not yet been examined, in order to ascertain the changes which had so successfully been employed in giving almost a perfect joint as a compensation for the original. The shaft of the femur appeared to have lost the power of further elongation; for, on frequent admeasurement during the life of the patient, it was discovered not to have increased in length. Probably the fact is not generally known, that bones do not increase in length after the amputation of their heads."

EXCISION OF THE SUPERIOR MAXILLARY BONE.

In the article ANTRUM, certain states of disease of this cavity are noticed, in which the only chance of depends upon the entire removal of the upper jaw-bone itself. I allude to osteo-sarcomatous, fibrous, and other tumours, which originate within the antrum, and by enlargement produce such an impairment of, and pressure upon, the surrounding organs and textures, as must ultimately prove fatal,

unless a bold attempt be made to extirpate every part of the osseous texture, serving as a place of attachment to the swelling. Merely excising the alveoli, and front of the antrum, and then attacking the tumour with the knife, cautery, or caustic, generally fails. Baron Dupuytren was led to suspect that, by the excision of the upper jaw-bone, its total extirpation might be performed with a successful result. He was induced to form this opinion from the consideration of the examples on record, where the patients recovered after most severe mechanical injuries of the face, and necrosis, occasioning the destruction of the bone. Camper mentions a case, in which the whole of the bone came away; in consequence of necrosis, and the patient was cured. Aculthus is stated, indeed, to have actually removed the upper jaw-bone for a tumour of the face, as long ago as 1693. Bidloo and Desault also anticipated Dupuytren in the belief, that the upper jaw-bone might be successfully extirpated, though they never undertook the operation themselves. The bulletin of the Faculty of Medicine at Paris prove that Dupuytren removed, at all events, the greater part of the bone, in 1824; but, as MM. Pillet and Gensoul contend, probably not the whole of it. M. Velpeau states that, in 1824, Mr. Rogers of New York removed both upper jaw-bones, as far back as the pterygoid processes, and this without making scarcely any incision through the lip. (See *Nouv. Élém.*, t. i. p. 549.) In 1826, Mr. Lizars also advocated the removal of the whole of the upper jaw-bone, and he performed the operation with success, in 1827, 1828, and 1830. In May, 1827, M. Gensoul, surgeon to the Hôtel Dieu, at Lyons, removed every part of this bone, together with the whole of the palate bone, on account of a fibro-cartilagenous tumour, and the patient got completely well. (See *Velpeau, Nouv. Élém. Méd. Opér.*, t. i. p. 247; *Jh. Gensoul. Lettre Chir. sur quelques Maladies Graves du Sinus Maxillaire, &c.*, p. 18. 8vo. Paris, 1833.)

In this work, M. Gensoul states that, several years previously, he had known patients die of very tedious operations, undertaken for the removal of cancerous and other tumours of the antrum. Reflecting on the fate of these unfortunate individuals, he was led to conclude, that others, labouring under similar disease, might be cured by an operation, which consisted in freely denuding the antrum and upper jaw-bone, so as to be able to divide the sound parts, instead of meddling with the diseased ones, and of searching for the precise limits of the disease in the midst of blood and the remains of the affected textures. In short, he was induced to think, that the same principle should be acted upon in this operation as is followed in others, undertaken for the extirpation of cancerous tumours in general.

If the face of the skeleton be examined, it will be seen that the upper maxillary bone is fixed to the others only at three principal points:—1. By means of its nasal process, and at its connections with the os unguis and ethmoid bone. 2. By means of the orbital process of the malar bone, as far as the spheno-maxillary fissure. 3. By means of the connection of the upper jaw-bone to its fellow, next to the palate bone. There is, indeed, a point of contact behind with the pterygoid process and palate bone; but this readily gives way on depressing the upper jaw-bone towards the mouth. In

attacking these different points, no large vessel is injured; the trunk of the internal maxillary artery generally escapes, and, if wounded, may be readily tied, as was exemplified in the removal of the whole of the superior maxillary bone, performed by Mr. Liston in the North London Hospital, on the 27th Feb. 1836. If the hemorrhage during the operation were to be greater than calculated upon, the carotid artery might be compressed against the transverse processes of the cervical vertebræ. As for nerves, the only one of consequence necessarily divided is the superior maxillary; but it may be easily cut through before the bone is displaced, and then the laceration of it avoided, if judged advisable. This proceeding is strongly advocated by M. Gensoul; but, in the operations which I have seen performed, no preliminary division of the trunk of this nerve was practised, yet no ill consequences were the result.

The patient should be seated in a chair, with his head inclined backwards, and supported on the breast of an assistant. One of the incisor teeth is to be extracted at the place where the division of the bone is to be effected below. An incision is now to be made from the inner canthus of the eye down to the upper lip, which is to be cut through opposite the canine tooth; and the incision may then be made from a point five or six lines to the outer side of the external angle of the eye, down to the termination of the first. This will leave the parotid duct safe below it. The flap is next to be raised up as far as the lower border of the orbit. This plan is more simple, and less disfiguring, than that of M. Gensoul, who, after the first incision has been made, makes a second from the level of the nostril, to a point about four lines in front of the lobe of the ear; and then a third, extending from a point five or six lines behind the external angular process of the os frontis, down till it meets the termination of the second cut. The quadrilateral flap, thus formed, is then reflected on the forehead. M. Velpeau prefers an incision commencing at the commissure of the lips, and carried outwards, and then upwards towards the temporal fossa. This would not, however, expose the bone sufficiently for the section of its nasal process, for which purpose the perpendicular cut, from the inner canthus down to the upper lip, is very necessary. When the tumour is large, the circular sweep of the knife, as advised by M. Velpeau, and long ago practised by surgeons in this country, has advantages. The bone having been denuded, the next step is to divide the connection of the malar bone with the external angular process of the frontal, and immediately afterwards the zygomatic process of the malar bone. These excisions are best accomplished with Liston's cutting forceps, which should have long powerful handles; a construction found in the North London Hospital to answer better than jointed handled ones, which cannot be opened so wide, and have a tendency to slip off the bone instead of cutting it. The greater power with which they shut does not, therefore, seem to Mr. Liston to compensate for the inconvenience referred to. At all events, any additional power required can be obtained by simply lengthening the handles.

The next thing is to divide the nasal process of the superior maxillary bone, and the connection of the latter bone with the os unguis and os planum. For this purpose, one blade of the forceps is put

within the orbit, the other within the nose, and the section accomplished.

This having been effected, and a cut made under the lower part of the palate, the upper jaw-bone is divided with the same instrument, at the place where the incisor tooth was extracted, together with the palatine process and palate bone, at the symphysis.

The bone being next pressed downwards, the slight connection with the pterygoid process, through the medium of the palate bone, gives way, when the upper jaw-bone, including the whole of the antrum and dense osseous originating in it, is easily dissected out. The flap is brought down, and the wounds united with the twisted suture, aided with narrow strips of adhesive plaster. Mr. Liston prefers, as less irritating, strips of oiled silk, smeared with a solution of isinglass in brandy. These strips he does not usually remove till the wound is healed. The straight steel needles which he employs for the twisted suture, and the eye ends of which are tipped with red sealing-wax, and the points cut off with pliers directly after their introduction, are removed within the first forty-eight hours, leaving the many twisted silk to come away as soon as it loosens.

The following is Mr. Liston's description of the operation:—"To expose the bone, the cheek is divided from the angle of the mouth to the origin of the masseter; and a second incision made from the inner canthus, to the edge of the upper lip, near the mesial line, detaching the ala of the nose from the maxillary bone. The flap of the cheek, thus formed, is dissected up, and the nasal process of the maxillary bone, and the body of the os maxillæ are divided with a saw, or with strong cutting pliers. An incision having been made through the covering of the hard palate, near the mesial line, a small convex-edged saw is applied to the bone, and the alveolar process is cut through with the pliers, after extraction of the middle and lateral incisors. The bone is then pulled downwards and forwards, and its remaining adhesions separated by means of the knife or pliers. During the progress of the operation, the cut branches of the facial and temporal arteries are commanded by ligature or pressure, and the violence of the hemorrhage is moderated by pressure on the carotids. After removal of the bone, the deep vessels, branches of the internal maxillary, are secured either by ligature, or by firm pressure with charpie, or dossils of lint. The facial flap is replaced, brought together over the charpie by which the cavity is filled, and united by interrupted or convoluted suture. (See *Liston's Elem.* part ii. p. 160.)

In the examples of this operation which I have seen, any preliminary ligature of the common carotid artery would have been totally unnecessary. In one instance the internal maxillary was cut, but secured with the greatest facility. In a case, operated upon by Mr. Liston in the North London Hospital, not a single ligature was necessary.

It is an important object to prevent, as much as possible, the blood from flowing towards the throat, in the early part of the operation: hence the advantage of the sitting posture, and of Gensoul's plan of beginning with the division of the cheek-bone, or zygoma, before the nasal process of the upper jaw-bone itself is attacked.

See *Jh. Gensoul, Lettre Chir. sur quelques Maladies Graves du sinus Maxillaire et de l'Os Maxillaire Inférieur*, 8vo. Paris, 1833. *Liston*, in *Elements of Surgery*, part ii. 8vo. 1831; also in *Trans. of Royal Med. Chir.*

Soc. vol. xx. G. J. Guthrie, in *London Med. Gaz.* 1835, 1836. *A. L. M. Velpeau*, *Nouv. Elem. de Méd. Opératoire*. *G. Regnoli*, *Sull' Estrazione della Quasi Totalità dell' Osso Mascellare Superiore Sinistro per Osteo Sarcoma* Memoria, 8vo. Pisa, 1832. *Professor Regnoli* makes only one external incision, which reaches from the external canthus to the commissure of the lips. Also *Sull' Estrazione d'un Osteo Sarcoma*, &c. Pisa, 1831; and *Mem. Intorno L'Apoftazione di Gran. Parte dell' Osso Mascellare Superiore destro*. This operation was performed in 1828. *J. F. Nivison*, *Malignant Tumour successfully removed from left Antrum*, in *Ed. Med. Surg. Jour.* No. 83. *Irving's Obs.* on the same, No. 84. *James Syme*, in *Ed. Med. Surg. Jour.* No. 100, p. 218, and No. 101, p. 238. *Mr. Lister's cases*, I believe, are recorded in the *London Med. Gaz.*

EXCISION OF LOWER JAW-BONE.

The practicableness of this operation was long ago evident enough from cases in which the greater part of the bone had been torn away by gun-shot injuries, or where it had exfoliated from necrosis. Boyer relates an instance in which it was torn away by machinery, and Wepler quotes a case where it was amputated in his time. Mr. Anthony White, Surgeon to the Westminster Hospital, removed, at Cambridge, a considerable portion of the bone for an osteo-sarcoma many years ago. Unfortunately, the case was not published; so that the revival and execution of the operation are generally referred to Dupuytren, who, in 1812, performed his earliest excision of the body of the lower jaw-bone. The parts removed weighed a pound and a half; the bone was affected with exostosis caries and necrosis, softened in several places, and combined with a hard fibrous fungus. The patient recovered, and was in perfect health twenty-one years after the operation. (*Dupuytren, Clinique Chir.* t. iv. p. 628.)

Subsequently to the year 1812, the operation has been frequently repeated by Dupuytren, Dr. Mott, Richerand, Lallemand, Delpech, Roux, Cusack, Martin, Gerdy, Magendie, Cloquet, Wardrop, Lisfranc, Warren, Gensoul, Grafe, Walther, Wagner, Randolph, Liston, Lawrence, Ph. Crampton, Velpeau, &c. By McClellan, Walter, and Grafe, nearly the whole of the bone has been taken away. By many other operators, disarticulation has been performed at one of the condyles. (See *Cusack*, in *Dublin Hospital Reports*, vol. iv. p. 13; *Liston's Elem.* part ii, &c.)

The method of performing the operation varies according to the extent of the disease. To expose the tumour, and allow the bone to be readily divided, there must necessarily be a free division of the soft parts. Previously, also, to fixing upon the plan of operation, the extent of the disease must be correctly ascertained. (See *Liston's Elem.* part ii. p. 224.) When only the central portion of the body of the bone was to be removed, the following was Dupuytren's plan:—"the patient is seated, and his head held steady against the breast of an assistant, who is to stand behind him, and, if necessary, make pressure on the facial arteries. The surgeon standing in front of the patient and on his right side, is to take hold of the right portion of the lower lip with his left hand, while an assistant takes hold of the left portion. In this way, the lip is rendered tense, and separated from the other. With a common scalpel, an incision is then made completely through it, from above downwards to the base of the jaw. The next thing is to extend the wound through the skin and cellular tissue from this point down to the prominence of the os hyoides. Thus, two flaps

are produced each of which is to be dissected up, as far as the extent of the disease requires, with the knife kept close to the bone, so that the facial arteries may not be wounded. The exact places having been ascertained to which the saw is to be applied, a tooth, on each side must be extracted. The operator then taking a fine metacarpal saw, or one of Hey's, goes behind the patient, in which position the saw can be employed without any risk of its extremity being pushed against the palate. If requisite, the nose and upper lip may be protected with a piece of paste-board. But, according to my observations, the best plan is only to make a groove, or partial division of the bone with the saw, and then to complete the section on each side with the cutting pliers, which expedite the business very considerably, and with no risk of injury to the contiguous parts. The bone, having been cut through on each side, the surgeon takes hold of the portion about to be removed, with his left hand, and while it is inclined forwards, he introduces a straight bistoury from below upwards, close behind it, and detaches it from the soft parts to the right and left, keeping the edge close to the bone. An assistant takes care to keep the tongue out of the way with a spatula, or the handle of a director. The vessels are now secured, the ends of the bone approximated to one another, and the flaps of skin united with sutures; care being taken to leave a small portion of the wound open below for the insertion of a bit of charpie, or lint, and an outlet for the discharge, in the event of matter being formed.

If the portion of bone to be taken away were so extensive as to require the excision of a part of the integuments, Dupuytren made two incisions, one in each side of the lip, which were extended down, so as to meet at the os hyoides, and formed together one in the shape of a V. When a perpendicular cut will not suffice, on account of the extent of the disease, it may be converted into a crucial wound, by making an incision along the base of the jaw.

One danger attending the opération is the retroversion of the tongue into the pharynx, as soon as the attachments of the genio-glossi muscles behind the symphysis have been cut. In this state, the tongue presses the epiglottis towards the glottis, and the patient is in imminent peril of suffocation. Indeed, in one case, M. Lallemant would have lost his patient had he not instantly performed tracheotomy. Hence, Delpsch, before he divided the muscular connections of the tongue, behind the symphysis, used to seize the extremity with a double tenaculum, which was then entrusted to an assistant; and afterwards, in applying the suture, he passed the thread of one of them through the frænum of the tongue and the skin together: if the interrupted suture were employed, or, supposing the twisted suture to be preferred, the ends of the thread, passed through the frænum, were twisted round the pins. In one case, Delpsch introduced a piece of gold wire through the apex of the tongue, and fastened it to the contiguous teeth. The wire soon cut its way out, leaving a sufficient adhesion. In few instances, the circumstances of the disease may be such as to make it necessary to remove only a portion of the depth of the bone.

As the retroversion of the tongue, though not constant, is always a possible event, I concur with

Malgaigne (*Man. de Méd. Opér.* p. 255) in the prudence of attending to the advice delivered on this subject by Delpsch, or else of taking care not to cut through the insertions of the genio-glossi muscles, until the possible displacement of the tongue has been guarded against.

In the excision of the whole of the horizontal portion of the lower jaw-bone, one plan consists in making an incision along its base, and extending it a line or two beyond its angles. A large flap is then dissected up, and turned over the face. The bone is sawn on each side beyond the limits of the disease, and then detached from the soft parts which are connected with it behind, with the precautions and according to the directions above particularised.

If the disease were to extend high up in the ramus, an incision should be made along the posterior edge of each ramus, so as to meet the extremities of the first wound.

Another method, specified by M. Malgaigne, is easier than the foregoing. After the horizontal incision has been made, a perpendicular one is made completely through the lower lip, and carried down in the middle line till it meets the horizontal wound. Both the lateral flaps are then dissected up.

In the excision of one half of the horizontal portion, several methods are adopted. In one, preferred by several British surgeons, and also by J. Cloquet, a horizontal incision is begun at the commissure of the lips, and terminates at the distance of one or two lines beyond the ramus of the jaw. To this first incision are added two vertical ones; one descending from the border of the lip to the base of the bone; the other taking a parallel course, descends behind the ramus to a point a few lines below the angle. The flap is dissected from above downwards; the soft parts are next detached from the inner surface of the jaw; and, lastly, the bone is sawn through. In the latter proceeding I particularly recommend Hey's saw, or a small metacarpal one, for making a groove in the bone, which can then be divided with the cutting pliers at one stroke, as practised by Mr. Liston, and always demonstrated by me in the Lectures on Operations at the London University.

Mr. Liston has likewise expressed himself, as follows, in favour of one method, in which the flap is made from above downwards:—"The cheek may be divided (says he) by passing through it a long narrow bistoury, close to the anterior edge of the masseter muscle, and carrying the instrument forwards, and through at the angle of the mouth. From each extremity of this incision, another is made downwards; the anterior one inclining forwards, the other backwards. By reflection of the flap thus formed, the bone is exposed more easily, rapidly, and perfectly, than by the former mode of incision, in which the flap is made by a semi-lunar incision along the base of the jaw." (*See Liston's Elem.* part ii. p. 225.)

In the plan adopted by Dr. Mott of New York, two flaps are formed. A curved incision is made, with its convexity downwards, from a point in front of the ear, and on a level with the condyle to the vicinity of the chin, below the commissure of the lips. The upper flap is raised and reflected on the face. A second incision, descending from the upper end of the first to the angle of the jaw, enables the surgeon to form a lower flap. The bone is sawn through, first in front, and then behind, as high up

as the circumstances of the case require. If above a certain point, Dr. Mott recommends the inferior maxillary nerve to be cut through, before the bone is drawn outwards, and the lingual branch of the fifth pair to be carefully avoided.

A *third method*, which has the names of Cusack, Lisfranc, Liston, Malgaigne, &c., in its favour, consists in making, first, a vertical incision through the lip down to a point below the chin, and then a horizontal cut, extending from the first along the base of the jaw to two lines beyond its angle. The flap is then dissected off the tumour, in the direction from below upwards, and reflected on the face. The bone is then sawn through in front and behind, and the flap united with sutures. I am of opinion with M. Malgaigne, that this plan is more simple than the others; no lodgment of pus is likely to follow it; and the scar will produce but slight disfigurement. I recommend, however, the front portion of the bone to be divided before the posterior part of it, as facilitating the safe detachment of the mylohyoides and other parts connected with its inner surface.

One method, described by Mr. Liston, is a modification of the foregoing:—"If the tumour is included between the lateral incisor tooth and last molar, on the same side, these teeth must be extracted to permit division at these points. A semi-lunar incision may then be made along the base of the jaw, the horns of the incision pointing upwards, and passing over the spaces which were occupied by the extracted teeth. The flap is dissected up, and the membrane of the cheek divided along the line of the incision. The bistoury is then carried along the inside of the bone, so as to divide the membrane of the mouth, and separate the attachments of the muscles. The tongue is pushed aside, and a copper spatula placed under the jaw at the part to be divided, in order that the soft parts may not be injured during the sawing. A small narrow saw, or one commonly known by the name of Hey's, is applied to the bone at the points where the teeth were extracted; and, by a few motions of this instrument, a notch is made of no great depth; a pair of strong cutting-pliers are placed in the track, and by them division of the bone is accomplished with equal neatness and much more rapidly than if the use of the saw had been continued. The pliers should be strong in every point, and the handles long, to afford the advantage of a powerful lever." The chain saw, he says, is not to be depended upon, and is slow in its operation. (See *Liston's Mem.* part ii. p. 224.)

A *fourth plan*, described by M. Malgaigne, may be applicable where the disease extends more in the direction backwards than forwards. In such a case, perhaps, it may be sufficient to make a semi-lunar incision along the posterior border of the ramus and the base of the bone, from the ear to the chin. Thus only one flap would be formed, and no cicatrix would be seen on the face.

M. Malgaigne lays it down as a maxim, that, in making the flaps in any of these operations, the skin and cutaneous muscles alone should be divided, and that the masseter should be cut through, and removed at the same height as the bone itself.

The facial artery is readily secured. All those operators who have had recourse to the ligation of the carotid artery, as a preliminary measure,

have subjected their patients to a very needless proceeding.

Even in the excision of one half the lower jaw-bone at its articulation with the temporal bone, the ligation of the carotid artery is quite uncalled for. One plan consists in making an incision along the base of the jaw; a second one is then made perpendicularly through the lower lip down to the first; and a third begins at the zygoma, and extends behind the ramus. The flap is raised, and the fore part of the bone sawn through. The soft parts are then detached from its inner surface, and the tendinous attachment of the temporal muscle to the coronoid process cut through from within outwards. Lastly, the disarticulation of the condyle is effected: for this purpose, the external lateral ligament should first be divided; and, while the bone is depressed and twisted, in order to render the capsular ligament tense, the latter part may either be cut through with scissors, as recommended by M. Malgaigne, and then the probe-pointed bistoury used, or it may be divided at once, together with the external pterygoid muscle, by means of the probe-pointed bistoury kept close to the highest part of the inner side of the condyle, so as to leave the internal maxillary artery safe at the inner side of the neck of the bone. A great deal of the safety of this operation will depend upon the edge of the knife being kept close to the inner surface of the bone, so that the lingual branch of the fifth nerve may be left uninjured and upon attention being paid to the directions given for the disarticulation, which, after the insertion of the temporal muscle has been divided, is greatly facilitated by depressing the anterior part of the bone forcibly, and twisting the condyle itself. The hemorrhage will be chiefly from the facial, dental, and branches of the temporal and internal maxillary arteries.

Instead of making the flap exactly in the manner above described, I prefer making, first, the anterior perpendicular incision, and then another, beginning a little way in front of the lobe of the ear, extending down along the posterior border of the ramus, and then forward along the line of the base till it meets the lower termination of the first wound. This is more simple, and enables the surgeon to get more readily at the external lateral ligament.

In the horrible operation of extirpating the whole of the lower jaw-bone, the incision should extend from a point, a few lines in front of the lobe of one ear, down the posterior edge of the ramus, along the whole base, from one angle to the other, and then up to a point, a few lines in front of the lobe of the other ear. Care having been taken to prevent retroversion of the tongue, and the front portion of the flap raised, the soft parts behind the symphysis should be cut, and the bone sawn in this situation. Then the rest of the vast flap is to be raised on each side, and each half of the bone to be removed according to the foregoing directions.

On the subject of this operation, consult *Dupuytren, Leçons Orales de Clinique Chir.* t. ii. art. xv. 8vo. Paris, 1834. *W. Cusack*, in *Dub. Hospital Reports*, vol. iv. p. 1. *Ph. Crampton*, vol. cit. p. 537. *Jh. Gensoul*, Sur quelques Maladies Graves du Sinus Maxillaire, &c. 8vo. Paris, 1833. *Robert Liston*, Elements of Surgery, part ii. p. 223, 8vo. Lond. 1831. *J. F. Malgaigne*, Man. de Méd. Opér. 12mo. Paris, 1834. *A. L. M. Velpeau*, Nouv. Élém. de Méd. Opér. t. i. p. 537, 8vo. Paris, 1832. *G. Regnoli*, Intorno l'Amputazione di Quella Metà della Mascella Inferiore Brevi Cenni. 8vo. Pisa,

1834. *Id.* Dell' Amputazione di una Porzione di Mascella Inferiore per Epulide Cancerosa ed Osteo-Sarcoma. 8vo. Pesaro, 1826.

For other observations connected with the excision of bones, see AMPUTATION; CARIES; JOINTS, EXCISION OF; NECROSIS; and STUMPS.

BONES, PATHOLOGY OF.

As a living texture, that of the bones is subject to many of the diseases which affect other parts endued with vitality, and in which the functions of circulation, innervation, absorption, and nutrition are continually going on. Thus it is liable to atrophy, hypertrophy, inflammation, suppuration, a change resembling ulceration, and another like mortification of other parts. The nerves, it is said, have never been demonstrated in the osseous texture; yet, if it be the seat of pain, our judgment must infer the existence of what may not be discernible by the eye. M. Sanson very aptly compares the organisation of bone to something between that of an organic and that of an inorganic body, its vitality being necessarily obscure, and correspondent to its constituent elements. The organic actions seem indeed to be carried on in it, with greater difficulty, the more the earthy matter in it predominates over the animal part. Thus, in children, irritation, inflammation, and every action in the osseous texture are quicker, than in old persons; because the bones in early life contain a greater proportion of animal matter than at a later period, when the phosphate of lime is more abundant. However, even in children, and still more conspicuously in adults and old persons, the diseases of the bones are generally marked by a slowness of character which has attracted the notice of all pathologists. Many weeks are required for the completion of a provisional callus, and nearly twelvemonth for that of a definitive one; while a few days, and often a few hours will suffice for the union of the wound of the soft parts. In consequence also of the inferior, or inconsiderable connection of the bones with the nervous system, they frequently appear to inflame and undergo disease, without involving the rest of the system in any sympathetic disturbance, till the irritation is propagated to the surrounding parts, or suppuration comes on. As M. Sanson observes, a necessary consequence of these facts is, that therapeutic means, even those of the most energetic kind, frequently have but little power over affections of the osseous tissue; and, if they prove effectual, it is not till after a long perseverance with them. (See *Sanson in Dict. de Méd. et de Chir. Prat.* t. 12, p. 308.) See ANTRUM, CANCER, CARIES, EXOSTOSIS, FRAGILITAS, JOINTS, MOLLITIES, NECROSIS, OSTEO-SARCOMA, OSTEITIS, PERIOSTITIS, RICKETS, SPINA, RHIZA, STUMPS, TREPANE, VENEREAL DISEASE, and VERTEBRÆ.

The following works, relative to the pathology of bones, deserve notice:—*P. C. Spaccioli, De Sensibilitate Ossium Morbosa*, 4to. Gotti, 1811. *J. Murray, De Sensibilitate Ossium Morbosa*. (Lundæ Script. Neur. 4.) *O. Murray, Diss. Acad. de Sensibilitate Ossium Morbosa*. Frank. Del. Op. 12. *A. Bonn, Tab. Ossium Morbosorum præcipue Thesauri Hoviani*, fol. Amst. 1745-1788. *G. F. Clessius, Ueber die Krankheiten der Knochen*, 12mo. Tübing. 1799. *R. Nesbitt, Human Osteogeny*, two Lectures on the Nature of Ossification, 8vo. Lond. 1736. *Sandifort, Museum Anatomicum*, 2 vol. fol. Lugd. 1793. *Wiedmann, De Necrosi Ossium*, fol. Francof. 1793. *Brodie, On Diseases of Joints*, 8vo. last ed. *J. Henshaw, in Med. Chir. Trans. Cruveilhier, Anat. Pathol.* 1. fol. Paris, 1829-1835. *Dr. Cunnin*, in *Edin. Med. and Surgical Journ.* &c. 82. *J. E. Paletta, Exercit. Pa-*

thol. 4to. Mediol. 1820-26. *B. Bell, On Dis. of the Bones*, 12mo. Edinb. 1827. *Dr. Casswell's Illustrations of the Elements of Disease*, Vol. *Herbert Mayo, Outlines of Human Pathology*, ch. 1. 8vo. Lond. 1835. *J. L. Sanson, Art. Os. et Osteitis in Dict. de Méd. et de Chir. Prat.* t. xii. Paris, 1834. And various other publications specified at the end of the article Necrosis.

BOUGIE is a smooth and generally a flexible instrument, which is introduced into the urethra for the cure of diseases of that passage (see URETHRA); and so named from its bearing some resemblance to a wax taper, in French, bougie. However, the kinds of bougies are various, and some of them, employed in modern surgery, so far from having any similitude to a wax taper, are formed altogether of metal or catgut. They admit of being divided into those which are solid, and others, which are hollow, and more commonly named catheters. (See CATHETER.)

The exact period when bougies were first used is a doubtful point. By Andrew Lacuna, a Spanish physician, the invention is ascribed to a Portuguese empiric; and, in 1551, the same author published what had been communicated to him upon this subject. In the year 1554, Amatus Lusitanus published a work, in which he refers to several witnesses to prove, that the empirical practitioner above alluded to had learned from him the use of bougies; while, on the other hand, he candidly owns that he himself was indebted to Aldereto of Salamanca, for a knowledge of these instruments. In 1553, however, Alph. Ferri, of Naples, endeavoured to show that his acquaintance with the utility of bougies reached as far back as 1548, and of course that he had anticipated Lacuna, and perhaps even Aldereto. But, instead of representing himself as the original inventor of bougies, he mentions that they were known to Alexander of Tralles, which, if true, carries back the invention to the sixth century. A. Ferri, also, before describing bougies and escharotic ointments, mentions various means for examining the state of the urethra, and, amongst other things, cylinders made of flexible lead, and of different sizes. Escharotic ointments for what were termed *caruncles* of the urethra, and bougies, were also described by Petronius in 1565, and afterwards by A. Paré. The oldest bougies, which were wicks of cotton, or thread, covered with wax, and escharotic plasters, were in time succeeded by those composed of linen smeared with wax. This change was made with the view of letting them have a hollow construction; an improvement, first noticed by Fabricius ab Aquapendente. (*Op. Chir.* 1617.)

In the middle of the 17th century, the manner of making and using bougies was well known to Scultetus, as appears from his *Anamentarium Chirurg. tab.* 13. fig. 9, 10.

Darwin, and some of the older writers, attributed the efficacy of their bougies to the composition used in forming them. On the contrary, Mr. Sharp apprehended that it was chiefly owing to the pressure, which was made on the affected part; and Mr. Aikin adds, that, as bougies of very different compositions succeed equally well in curing the same diseases in the urethra, it is plain that with the exception of caustic bougies, they do not act from any peculiar qualities in their composition; but by means of some common property, probably their mechanical form.

Plenck recommended bougies of catgut, which may be easily introduced into an urethra, even

when it is greatly contracted, their size being small, their substance firm, and dilatable by moisture. It is objected to catgut, however, that it sometimes expands beyond the stricture, and gives great pain on being withdrawn.

The invention of elastic gum bougies and catheters originated with Bernard, a silversmith at Paris, who, in the year 1779, presented some instruments of this kind to the Academy of Surgery, which period was prior to the date of the claim made by Professor Pickel of Wurzburg to the discovery. (See *Journ. de Méd. an. 1785.*)

For the composition of bougies, elastic resin, or gum, is thought to be very desirable, as it unites firmness and flexibility. Mr. Wilson, in his *Pharmacopæia Chirurgica*, is inclined to think that the art of making these instruments consists in finding a suitable solvent for the Indian gum. As this substance, if dissolved in æther, completely recovers its former elasticity, upon the evaporation of this fluid, it is supposed that æther, though rather too expensive, would answer, I find it positively asserted, however, in a modern work of great repute, that the idea of elastic gum being the substance really employed is a mistake, as the material used is nothing more than linseed oil, boiled for a considerable time, and used as a varnish or the silk, linen, or cotton tube. (See *Dict. des Sciences Méd. art. Bougie.*)

Solid elastic gum bougies sometimes cannot be introduced, when a wax bougie can; and from the trials which I have made of them, I conceive that it arises from their elasticity and continual tendency to become straight, when they reach the perineum, so that the point presses on the lower surface of the urethra. Hence, when the obstruction is on that side, it must be difficult to get the end of the bougie over it.

A few years ago, Mr. Smyth discovered a metallic composition, of which he formed bougies. These bougies are flexible, have a highly polished surface, of a silver hue, and possess a sufficient degree of firmness for any force necessary for the cure of strictures of the urethra. The advocates for the metallic bougies assert, that such instruments exceed any other bougies which have yet been invented, and are capable of succeeding in all cases, in which the use of a bougie is proper. They are either solid or hollow, and are said to answer extremely well as catheters; for they not only pass into the bladder with ease, but may also be continued there for any convenient space of time, and thus produce essential benefit. (W. Smyth, *Brief Essay on the Advantages of Flexible Metallic Bougies*. 8vo. Lond. 1804.) The greatest objection which has been urged against them is, that they are attended with a risk of breaking. I have heard of an eminent surgeon being called upon to cut into the bladder, in consequence of a metallic bougie having broken, and a piece of it passing into that organ, where it became a cause of the severe symptoms which are commonly the effect of a stone in the bladder. For the particulars of an interesting case, in which a metallic bougie broke in the urethra, the reader may consult *London Med. Repository*, vol. ix. No. 51. The manufacture of metallic bougies, however, is now brought to such perfection, that we rarely hear of their breaking; but it is most prudent not to be too bold with these of small diameter.

The bougie with its application, says Mr. Hun-

ter, is perhaps one of the greatest improvements in surgery which these last thirty or forty years have produced. "When I compare the practice of the present day, with what it was in the year 1750, I can scarcely be persuaded that I am treating the same disease. I remember, when, about that time, I was attending the first hospitals in the city, the common bougies were either a piece of lead, or a small wax candle; and, although the present bougie was known then, the due preference was not given to it, nor its particular merit understood, as we may see from the publications of that time."

Of armed bougies, as well as of some other kinds, and of the manner of using bougies in general, I shall speak in the article *URETHRA, STRICTURES OF.*

See J. Hunter, on the Venereal Disease, p. 116. Sharp's Critical Inquiry, chap. iv. Aikin on the External Use of Lead. Lوران, Obs. sur les Maladies de l'Utrère, 12mo. Paris, 1748 and 1769. Ollivier, Lettre dans laquelle on Démontre les Avantages que l'on peut retirer de l'Usage des Bougies creuses, &c. 8vo. Paris, 1750. Desault, Journ. de Chir. t. ii. p. 375, and t. iii. p. 123, 1752. Smyth's Brief Essay on Flexible Metallic Bougies, 8vo. Lond. 1804. Dict. des Sciences Médicales, t. iii. p. 265, &c. 8vo. Paris, 1812.

BRAIN. (For concussion, compression of, &c. see HEAD INJURIES OF. For hernia of, see HERNIA Cerebri.)

BREAST. (See CANCER; MAMMARY ABSCESS; MAMMARY DISEASES AND REMOVAL OF; and NIPPLE.)

BRONCHOCELE, (from *βρόγχος* the wind-pipe, and *κελε* a tumour.) The Swiss call the disease *gotte*, or *goitre*. Heister thought it should be named *tracheocele*. Prosser, from its frequency in the hilly parts of Derbyshire, called it the *Derbyshire neck*; and, not satisfied respecting the similitude of this tumour to that observed on the necks of women on the Alps, the *English Bronchocele*. By Alibert the disease is called *Thyrophaxia*.

1. The simple bronchocele, or thyrophaxia, is the most common form of the disease, and is a mere hypertrophy, in which the thyroid gland is simply enlarged, but not changed in structure. It is common in young girls and in women, has a regular even surface, a uniform resistance, and seldom presents any distinct divisions, or lobes. The integuments covering the part are quite unchanged. It is also well known to be in general free from danger; the office of the thyroid gland not being of such importance in the animal economy, as to be essential to the continuance of life. Alibert has seen one example, in which the tumour became cancerous and destroyed the mother of a family.

2. The compound bronchocele presents the greatest variety, and astonishes every beholder. Sometimes a more or less voluminous cyst is formed round it, filled with a pulraceous, or purulent matter. Sometimes, in compound bronchoceles, calcareous, tuberculous, melanotic, cartilaginous, and other adventitious substances are found. Once, in the situation of the thyroid gland, M. Andral met with a hard body, about the natural size of that gland. It consisted of two parts; one a true osseous texture, formed of very distinctly interlaced fibres, irregular and knobby on the surface; the other, a cavity, the parietes of which were composed of this osseous investment, and which had numerous slender filaments extend-

ing across it, like those of the spongy texture of bones. Between them was a small quantity of reddish fluid, of the consistence of syrup. (See *Andral, Précis d'Anat. Pathol.* t. i. p. 304.) In two cases, Alibert found, on the outside of the enlarged gland, a yellow fatty mass; and, in a third instance, the gland itself formed a true sarcoma. (*Nosol. Nat.* t. 1. p. 464, 465, *folio*, Paris, 1817.)

Simple bronchocele always signifies, in this country, hypertrophy of the thyroid gland, which, with the disease of the surrounding parts, sometimes not only occupies all the space from one angle of the jaw to the other, but forms a considerable projection on each side of the neck, advancing forward a good way beyond the chin, and forming an enormous mass, which hangs down over the chest. The swelling, which is more or less unequal, generally has a soft spongy elastic feel, especially when the disease is not in a very advanced state; but no fluctuation is usually perceptible, and the part is exceedingly indolent. The skin retains nearly its ordinary colour; but, when the tumour is of very long standing and great size, the veins of the neck become more or less varicose.

It is stated by Dr. Sacchi, of Treviglio, that simple hypertrophy may often be cured; but, if not dispersed, the gland becomes in time variously altered; assuming either a scrofulous or an encysted character. The scrofulous goitre frequently attains an immense size; but does not give rise to corresponding inconvenience or danger. It is generally lobulated. In time, one or more of these lobes may become soft, and present a feel of fluctuation. This constitutes the soft, hydatid, or lymphatic goitre of authors. The structure has become vesicular, and contains fluid, which may be watery or albuminous:—in a few cases it is more like milk or pus. Some goitres, however, having a feel like that of fluctuation, really have the consistence of a spongy substance, like that of the placenta, and do not contain fluid. According to Dr. Sacchi, some goitres undergo a partial softening, and it is a mistake to suppose, that they always become harder and harder the longer they continue.

According to Prosser, the tumour generally begins between the eighth and twelfth years. It enlarges slowly during a few years; but, at last, it augments rather rapidly, and forms a bulky pendulous tumour. Women are far more subject to the disease than men, and the tumour is observed to be particularly apt to increase rapidly during their confinement in childhood. Sometimes bronchocele affects the whole of the thyroid gland, that is to say, the two lateral lobes, and the intervening portion; and in this kind of case, it is not unusual to remark three distinct swellings, for the most part of unequal size. Frequently, only one lobe is affected; while, in many other cases, the three portions of the thyroid gland are all enlarged, and so confounded together, that they make, as it were, only one connected globular mass. Finally, in some dissections, the thyroid gland has been found quite unchanged, the whole of the tumour having consisted of a sarcomatous disease of the adjacent lymphatic glands and cellular membrane. (*Postiglione*, p. 21.) When only one lobe of the thyroid gland is affected, it may extend in front of the carotid artery, and be lifted up by each distal end of this vessel, so as to have the pulsatory motion of an aneurism. (*A. Burns's Surgical Anatomy of the Head and Neck*, p. 195, and *Parisian*

Chirurgical Journ. vol. 2. p. 292, 293.) Alibert believes that he first made the remark, that the right lobe was more frequently enlarged than the left. (*Nosol. Nat.* t. 1. p. 465.) The same thing was invariably noticed in every case seen by Mr. Rickwood in the neighbourhood of Horslam in Sussex. (See *Méd. and Phys. Journ.* for August, 1823.)

The ordinary seat of bronchocele, as Flajani remarks, is the thyroid gland; but sometimes cysts are formed in the cellular membrane. (*Colles. d'Obs.* t. 3. p. 277.) And Postiglione also observes, that the swelling is sometimes encysted, and filled with matter of various degrees of consistence, resembling honey, &c.; in some cases, it is emphysematous, or filled with air; and, in other instances, it is sarcomatous, having the consistence of a gland, which is enlarged, but not scirrhous. These different characters prove, says he, that the treatment ought not to be the same in all cases. (*Memoria sulla Natura del Gozzo*, p. 20.)

Bronchocele is common in some of the valleys of the Alps, Apennines, and Pyrenees. Indeed, there are certain places where the disease is so frequent, that hardly an individual is totally exempt from it. Larrey, in travelling through the valley of Maurienne, noticed, that almost all the inhabitants were affected with goitres of different sizes, whereby the countenance was deformed, and the features rendered hucous. (*Mém. de Chir. Mil.* t. i. p. 123.) And Postiglione remarks, that in Savoy, Switzerland, the Tyrol, and Carinthia, there are villages, in which all the inhabitants without exception have these swellings, the position and regularity of which are there considered as indications of beauty. (*Memoria sulla Natura del Gozzo*, p. 22.) In many the swelling is so enormous, that it is impossible to conceal it by any sort of clothing. A state of idiotism is another affliction, which is sometimes combined with goitre, in countries where the latter affection is endemic. However, all who have the disease, are not idiots, or cretins as they have been called; and in Switzerland, and elsewhere, it is met with in persons, who possess the most perfect intellectual faculties. When bronchocele and cretinism exist together, Foderé, and several other writers, ascribe the affection of the mind to the state of the thyroid gland. (See *Traité sur le Goitre et le Cretinisme*, 8vo. Paris, an. 8.) However, this opinion appears to want foundation, since the mental faculties are from birth weak, and in many the idiotism is complete where there is no enlargement of the thyroid gland, or when the tumour is not bigger than a walnut, so that no impediment can exist to the circulation to or from the brain. (*Burns on the Surgical Anatomy of the Head and Neck*, p. 192.) The direct testimony of Dr. Reeves also proves, that in countries where cretins are numerous, many people of sound and vigorous minds have bronchocele. (See *Dr. Reeves's Paper on Cretinism*, *Edin. Med. and Surg. Jour.* vol. v. p. 31.) Hence, as Mr. A. Burns remarked, the combination of bronchocele and cretinism must be considered as accidental; a truth that seems to derive confirmation from the fact, that, in some parts of this country, bronchocele is frequent, where cretinism is seldom or never seen.

Bronchocele is not confined to Europe: it is met with in almost every country on the globe. Professor Burton, in his travels amongst the Indians settled at Oneida in the state of New York, saw the com-

plaint in an old woman, the wife of the chief of that tribe. From this woman Barton learned, that bronchoceles were by no means uncommon amongst the Oneida Indians, the complaint existing in several of their villages. He found also that the disease resembled that seen in Europe in respect to its varieties. He did not indeed himself see the pendulous bronchocele, which descends over the breast; but he understood, that it was not uncommon amongst the women on the banks of the Mohawk river, who wore a particular dress for its concealment. In North America, bronchocele attacks persons of every age but it is most frequently seen in adults; a difference from what is noticed in Europe. Bronchocele is said to be frequent in Lower Canada. Bonpland, the companion of Humboldt, informed Alibert, that the disease was endemic in New Granada, and that it prevailed in such a degree in the little towns of Honda and Monpa, on the banks of the Magdalena river, that scarcely any of the inhabitants were free from it. The blacks, and those who led an active laborious life, however, are reported to escape the complaint. Some of the natives of the Isthmus of Darien are said to be terribly disfigured by it. (Alibert, *Nosol. Nat.* t. i. p. 468.) Also, *Observations sur quelques Phénomènes peu connus qu'offre le Goitre sous les Tropiques dans les Plaines et sur les Plateaux des Andes, par A. de Humboldt, in Journ. de Physiologie, par F. Magendie, t. iv. p. 109. Paris, 1824.*

In European women, bronchocele usually makes its appearance at an early age, generally between the eighth and twelfth year, and it continues to increase gradually for three, four, or five years, and is said sometimes to enlarge more during the last half year, than for a year or two, previously. It does not generally rise so high as the ears, as in the cases mentioned by Wiseman. Sometimes, however, this happens, as we see in the case of Clement Desenne, of whom Alibert has given an engraving. In this patient, a part of the tumour, as large as a hen's egg, projected into the mouth. (*Nosol. Nat.* t. i. p. 466.) The swelling extended from the ears to the middle of the breast. A seton produced a partial subsidence of it; but, when it was withdrawn, the orifices closed. After two years more, the swelling became painful, suppuration took place, and fifteen pints of matter were discharged; and six ounces every day after the swelling had burst, came away with the dressings for three months; but, notwithstanding all this suppuration and more afterwards, the tumour was only partially lessened. The disease mostly has a pendulous form, not unlike, as Alibucasis says, the flap, or dewlap, of a turkey-cock, the bottom being the largest part of the tumour. Alibert mentions a case in which the swelling hung down to the middle of the sternum, and the large mass, which was quite a burthen to the patient, used to become hard, and, as it were, frozen, in very cold weather. This author, however, cannot be right, when he adds, that it was an inert body, *destitute of vitality.* (*Nosol. Nat.* t. i. p. 466.) In another curious instance, the tumour formed a long cylinder, which reached down to the middle of the thigh, the diameter becoming gradually smaller downwards. (P. 468.) The common seat of bronchocele is the thyroid gland; but, frequently, the surrounding cellular membrane is more or less thickened, and contributes to the swelling. Sometimes also the neighbouring lym-

phatic glands are affected, when its base is widened, and extends from one side of the neck to the other. In this circumstance, the swelling gradually loses itself in the surrounding parts, and is not circumscribed, as in ordinary instances. (*Postiglione, Mem. sulla Natura del Gozzo, p. 20.*) It is soft or rather flabby to the touch, and somewhat moveable; but, after a few years, when it has ceased enlarging, it becomes firmer and more fixed. When the disease is very large, it generally occasions a difficulty of breathing which is increased by the patient's catching cold or attempting to run. In some subjects the tumour is so large, and affects the breathing so much, that a loud wheezing is occasioned; but there are many exceptions to this remark. Sometimes, when the swelling is of great size, patients suffer very little inconvenience; while others are greatly incommoded though the tumour is small. In general the inconvenience is trivial. The voice is sometimes rendered hoarse; and, in particular cases, the difficulty of speech is very considerable. (See *Fajani, Collez. d'Oss. t. iii. p. 271.*)

The difficulty of respiration, produced by the pressure of the tumour, and the enlargement of other glands, as this author remarks, is the most dangerous effect of the disease, since, by disordering the pulmonary circulation, it renders the pulse irregular and intermittent, and a strong throbbing is excited in the region of the heart, followed by fatal disease of the lungs themselves; consequences often not suspected to have any connection with the bronchocele, though it is in reality the immediate cause of them. (Vol. cit. p. 278.)

The causes of bronchocele are little known. To the doctrine, that bronchocele is brought on by the earthy impregnation of water used for drink, the following objections offer themselves:—1. The water of Derbyshire, in districts where this disease is considered endemic, contains much supercarbonate of lime; but that in common use about Nottingham, where the disease is also prevalent, is impregnated with sulphate of lime. However, that the disease is not produced by water, impregnated with sulphate of lime, is evident; for, as Alibert observes, the waters of St. Jean, St. Sulpice, and St. Pier where bronchocele is frequent, contain much less of this earth than the waters of Upper Maunienne, where the disease is hardly ever noticed, though the houses are built upon a vast quarry of gypsum. The same fact was observed by Bonpland in New Granada. (*Nosol. Nat.* t. i. p. 471.) Nor, as Foderé explained, can the cause of the disease be correctly referred to the use of any particular kind of food. Certain localities, however, seem to contribute to its frequency; for this author observes, that the disease is not prevalent in very high places, nor in open plains; but that it becomes more and more common, as we descend into deep valleys made by torrents, where there is a good deal of marsh and abundance of fruit trees. The air is here constantly humid. 2. Abstinence from unboiled water does not diminish, or interrupt the gradual progress of the disease. 3. Patients are cured of the disease, who still continue to drink water from the same source as before, without taking any precaution, as boiling, &c. 4. The disease in this country is less frequently found among men. 5. Many instances may be related of a swelling in the neck, sometimes very painful, and generally termed bronchocele, being produced

very suddenly, by difficult parturition, violent coughing, or any other unusually powerful effort. (See *Edin. Med. and Surgical Journal*, vol. iv. p. 279.) When the gland is suddenly enlarged during a violent exertion, the distention is said to be produced by the passage of air from the trachea into the substance of the thyroid gland and surrounding cellular membrane. But whether this statement be a fact or not, it is unquestionably true, that, in many patients, the tumour always increases when they speak loud, sing, or make any effort. (*Flajani, Collez. d'Oss. &c. t. iii. p. 276; and Postiglione, p. 24.*) The disease is sometimes seen in scrofulous subjects; but there is every reason to believe, that it is quite independent of the other disorder, as Prosser, Wilmer, and Kortum have particularly explained. The following are some points of difference between bronchocele and scrofula, as indicated by Dr. Postiglione.—1. The true bronchocele is simply a local disease of the neck, the constitution being unaffected. On the contrary, scrofula extends its effects to the whole system, attacking not only the lymphatic glands, but also the muscles, cellular membrane, ligaments, cartilages, and bones. 2. Both diseases chiefly occur in young subjects; but bronchocele often begins at a later age than scrofula, and does not, like the latter, spontaneously disappear, as the patient approaches puberty and gains strength. 3. Scrofulous glands often suppurate and ulcerate; bronchocele more rarely undergoes these changes. 4. The thickening of the upper lips of scrofulous subjects is not an attendant on bronchocele; and, while the former patients generally enjoy their mental faculties in perfection as long as they live, the latter disease in certain countries is often joined with cretinism. Scrofula is likewise always hereditary, while bronchocele is not so; no healthy persons become scrofulous by living a long while amongst scrofulous patients, but many individuals contract bronchocele by going from a country where this disease is unknown, and taking up their residence in places where it abounds. 5. Nature alone often cures scrofula, while art is rarely successful; on the contrary, bronchocele is seldom cured by nature, but very frequently by art. 6. The mode of life, recommended by Fourcroy for the cure of scrofula, is always useless; but, in bronchocele, it proves a valuable remedy. (*Postiglione, Memoria sulla Natura del Gozzo, &c. p. 25.*) The error of confounding bronchocele with scrofula is now generally acknowledged. At the Hospital St. Louis, says Alibert, scrofulous patients are numerous, while those with bronchocele are very rare. (*Nosol. Nat. t. i. p. 465.*) In Derbyshire, Genoa, and Piedmont, bronchocele has been attributed to drinking water cooled with ice. To this theory, many of the objections, concerning the earthy impregnation of water, stand in full force; with this additional reflection, that “in Greenland, where snow-water is commonly used, these unsightly protuberances are never met with; nor (says Watson) did I ever see one of them in Westminster, where we have higher mountains and more snow than in Derbyshire, in which country they are very common. But what puts the matter beyond a doubt is, that these wens are common in Senegal, where there is no snow, during any part of the year.” (*Watson's Chemical Essays*, vol. ii. p. 157.) The above opinion was also related by Fodéré, who remarks, that the Swiss, who reside at the

bottom of the glaciers, are the least subject to the disease. Bronchoceles are also said to be unknown in Lapland.

Respecting the influence of particular water in bringing on the disease, Dr. Odier gives credit to the opinion; because it has appeared to him, that distilled water prevented the increase of the tumour, and even tended to lessen its bulk. (See *Manuel de Médecine Pratique*, 8vo. *Genève*, 1811.) However, that every explanation, hitherto devised of the causes of bronchocele, is quite unsatisfactory, is fully proved by the observations of the celebrated Humboldt. Persons afflicted with bronchocele (he remarks) are met with in the lower course of the Magdalena river (from Honda to the conflux of the Cauca); in the upper part of its course (between Neva and Honda); and on the flat high country of Bogota, six thousand feet above the bed of the river. The first of these three regions is a thick forest, while the second and third present a soil destitute of vegetation: the first and third are exceedingly damp, the second is peculiarly dry: in the second and third regions, the winds are impetuous; in the first, the air is stagnant. To these striking differences we will add those relative to temperature. In the first and second regions, the thermometer keeps up, all the year, between 22 and 33 centigrade degrees; in the third, between 4 and 17 degrees. The waters drunk by the inhabitants of Mariquita, Honda, and Santa Fé de Bogota, where bronchoceles occur, are not those of snow; and issue from rocks of granite, freestone, and lime. The temperature of the waters of Santa Fé and Mompox, drunk by those who have this disease, varies from nine to ten degrees. Bronchoceles are the most hideous at Mariquita, where the springs, which flow over granite, are, according to my experiments, chemically more pure than those of Honda and Bogota, and where the climate is much less sultry, than upon the banks of the Magdalena river. Perhaps it may be thought, that the atony of the glandular system (?) depends less upon the absolute temperature than upon the sudden refrigeration of the atmosphere, the difference of temperature in the night and day; but, in the Magdalena valley, where the constancy of low tropical regions prevails, the extent of the scale that the thermometer pervades in the course of the whole year, is only a small number of degrees, &c. (*Humboldt, in Journ. de Physiologie, par T. Magendie*, t. iv. p. 416.)

The same distinguished observer confirms previous account of the variety of bronchoceles amongst the original copper-coloured natives of America and negroes. It appears, also, that in South America, bronchocele is progressively extending itself from the lower provinces to the flat elevated regions of the Cordilleras; and this, in so serious a degree, that in 1823 the subject was adverted to in a report made to Congress by M. Restrepo, one of the Colombian ministers.

An observation, lately made by an intelligent writer, would lead one to conclude, that cretinism depends upon malformation of the head. Speaking of goitre, as it appears among the inhabitants of the valley of Maurienne, Baron Larrey informs us, that, in many of these people, with this frightful deformity is joined that of the cranium, of which the smallness and excessive thickness are especially remarkable. (*Mém. de Chir. Milit. t. i. p. 123.*) Dr. Leake thinks that tumours of this sort may be

owing to the severity of the cold damp air, as they generally appear in winter, and hardly ever in the warm dry climates of Italy and Portugal. The latter part of the observation, however, is not correct; for Dr. Postiglione and other Italian writers assure us, that the disease is extremely common in some of the warmest parts of Italy. "*Qui in Napoli, e per tutto il regno si veggono molti gozzuli, ma non in numero tale, come in Casoria, ed in pochi altri villaggi.*" (P. 21.) Prosser is inclined to consider the bronchocele as a kind of dropsy of the thyroid gland, similar to the dropsy of the ovary; and he mentions, that Dr. Hunter dissected one thyroid gland, which had been considerably enlarged, and contained many cysts filled with water. These, he erroneously concludes, must have been hydatids. Dr. Baillie remarks, that when a section is made of the thyroid gland, affected with this disease, the part is found to consist of a number of cells, containing a transparent viscid fluid.

In all probability, the ordinary bronchocele is entirely a local disease, patients usually finding themselves, in other respects, perfectly well. The tumour itself frequently occasions no particular inconvenience, and is only a deformity. There is no malignancy in the disease, and the swelling is not prone to inflame or suppurate, though, as Dr. Hunter remarks, abscesses do occasionally form in it. Alibert's case of bronchocele becoming cancerous is rather uncommon. Mr. Gooch never knew life to be endangered by this sort of tumour, however large; a remark very much at variance with the observations of some other practitioners; but he had seen great inconvenience arise from it, when combined with quinsy. In fact, the pressure of a large bronchocele may not only greatly afflict the patient, by rendering respiration difficult, but actually cause death by suffocation. (See *Obs. sur un Goître volumineux, comprimant la Trachée-artère par L. Winslow*, in *Bulletin de l'Athénée de Méd.* &c.) "Some persons, as Alibert remarks, have the disease all their lives, without suffering any inconvenience from it; some experience a suffocating oppression of the breathing; and in others there is an impediment in the circulation, and a tendency to apoplexy, arising from the stranguation which afflicts them." (*Nosol. Nat. t. i. p. 466.*) Dr. Hunter says, that the bronchocele frequently appears two or three years before or after the commencement of menstruation, and that it sometimes spontaneously disappears, when this evacuation goes on in a regular manner. Mr. A. Burns affirms the same thing. On the contrary, according to Prosser, this change in the constitution hardly ever affects the tumour.

Scarpa believed that the thyroid gland was never primarily affected with true scirrhus, maintaining, that the disease was always consecutive to cancer, or scirrhus of the tongue, œsophagus, parotid or submaxillary gland. Dr. Saccchi relates a case, however, proving that, on this point, Scarpa was incorrect; and he also details an instance of fungus hæmatodes of the thyroid gland. Of this last disease, there are at least two specimens in the Museum of University College.

Besides the forms of goitre, already noticed, there is another sometimes termed *aneurismatic*, and consisting of an extraordinary development of the thyroid arteries and their branches. Every point of the tumour has a strong pulsation, not however, like that of an aneurism, but giving a

sensation as if the blood were flowing very rapidly into numerous vessels, with an obscure buzzing noise, or tremulous murmur, which is more distinct over the thyroid trunks. I think, a case of this description was once shewn to me by Mr. Pilcher. In two cases recorded by Dr. Saccchi, the tumours had existed many years, and begun during the efforts of parturition.

TREATMENT OF BRONCHOCELE.

That certain localities, perhaps not yet correctly understood, contribute to the origin of this disease, is well proved by a fact stated by Alibert, viz. that change of air has more effect on the complaint than medicines, as he has known many Swiss ladies, who came to Paris with bronchoceles, in whom the tumour subsided after they had resided some time in that city. (*Nosol. Nat. t. i. p. 473.*)

A blister, kept open, has put a stop to the growth of the tumour; but, this method is not much followed at present, as better plans of treatment have been discovered. A few years ago the favourite mode of curing bronchocele, consisted in giving internally burnt sponge, and occasionally a calomel purge, at the same time that frictions were made upon the tumour itself. The utility of burnt sponge in the treatment of bronchocele, as Dr. Coudet and others have now fully proved, depends upon the iodine in its composition.

The efficacy of burnt sponge was thought to be greatest when exhibited in the form of a lozenge, composed of ten grains of this substance, ten of burnt cork, and the same quantity of pumice stone. These powders were made into the proper form with a little syrup, and the lozenge was then put under the tongue and allowed to dissolve. To the latter circumstance much importance was attached. Some practitioners gave a scruple of burnt sponge alone, thrice every day; while others added a grain of calomel to each dose. A purge of calomel was ordered about once a week, or fortnight, as long as the patient persevered in the use of the calcined sponge; but, when mercury was combined with each dose of this medicine, no occasional purgative was deemed requisite.

External means may very materially assist the above internal remedies. Frequently rubbing the swelling with a dry towel, bathing the part with cold water; rubbing the tumour two or three times a day with the liq. ammon. acet. or the camphor liniment, are the best steps of this kind which the surgeon can take.

"In the treatment of bronchocele," says Mr. A. Burns, "repeated topical detraction of blood from the tumour is highly beneficial. Electricity also has sometimes a marked effect; but, there is no remedy which I would more strongly advise than regular and long-continued friction over the tumour. By perseverance in this plan, a bronchocele, treated in London, was materially reduced in the course of six weeks. Its good effects I have likewise witnessed myself; and it is a remedy highly recommended by Girard, in his '*Traité des Loupes*.' It has also been much used in scrofulous tumours by Mr. Grosvenor of Oxford, and by Mr. Russell, of Edinburgh." (*Surgical Anatomy of the Head and Neck*, p. 204.) Mr. A. Burns recommends the friction to be made with

flannel, covered with hair-powder, and the part to be rubbed, at least, three times a day, for twenty minutes.

In two cases of bronchocele, related by Dr. Clarke, the patients were cured, by "the steady use of the compound plaster of ammoniac and mercury, combined with the internal exhibition of burnt sponge, and occasional purgatives." (See *Edin. Med. and Surgical Journal*, vol. iv. p. 280.)

We learn from Professor Odier, that, in Geneva, bronchocele used to be cured by burnt sponge, exhibited in powder, or infused in wine, and combined with purgatives, to prevent the cramps of the stomach which sometimes accompany the disappearance of the swelling. Muriate of barytes has likewise been recommended. (See *Manuel de Médecine Pratique*.)

Mr. Wilmer, credulously imputing great influence to the changes of the moon, used to begin with an emetic, the day after the full moon, and to give a purge on the ensuing day. The night following, and seven nights successively, he directed the above-mentioned lozenge to be put under the tongue at bed-time, and administered every noon a bitter stomachic powder. On the eighth day, the purge was repeated, and, in the wane of the succeeding moon, the whole process except the emetic was renewed. (*Cases in Surgery, Appendix*.) This, which is often called the Coventry plan of treatment, is said to be greatly assisted, by rubbing the tumour with an ointment containing tartar emetic.

Prosser succeeded with his medicines, though the patient was nearly twenty-five years old, and the swelling had existed more than twelve years. It is said that no instance of cure has been known after the patient was twenty-five. Prosser orders one of the following powders to be taken early in the morning, an hour or two after breakfast, and at five or six o'clock in the evening, every day, for a fortnight, or three weeks. The powder may be taken in a little syrup, or sugar and water. R Cinnab. opt. levigat. milled. ppi. et pulv. a ã gr. x. Sponge. calcin. ʒ. M.

These powders should be taken for two or three weeks, and then left off for a week or nine days, before repetition. At bed-time every night, during the second course of the powders, some purgative pills, composed of mercury, the extractum colocynthid. comp. and rhubarb, are to be administered; and, in general it will be proper to purge the patient with ipecacua, or salts, before beginning with the powders. Prosser erroneously puts no faith in external applications.

Some have recommended giving two scruples of calcined egg-shells, every morning, in a glass of red wine; half a drachm of the sulphuret of potash every day, dissolved in water; or ten, or fifteen drops of the tinct. digt. twice a day, the dose being gradually increased. Murated barytes, cicuta, and belladonna, have also been exhibited. Postiglione commends the muriate of lime as a medicine possessing great efficacy. The remedy is made into a bolus with honey, to which is sometimes added burnt sponge with cinnamon in powder. He employs also frictions with flannel, liniment, and sometimes purges with calomel. The bolus is placed under the tongue, and allowed to dissolve there. (P. 59. &c.)

Sir J. Wylie, physician to the Emperor of Rus-

sia, prescribes three grains of the submuriate of mercury, three of the ammoniacal muriate of iron, four of burnt sponge, and ten of the bark of laurus cassia, divided into twelve doses, one of which is given twice a week, with a gentle anodyne at night. He also directs twenty-four lozenges to be made, by triturating an ounce of burnt sponge, with an equal quantity of the powder of gum arabic, and fifteen grains of cinnamon, first blended with a sufficient quantity of the syrup of orange-peel. One of these lozenges is put under the tongue daily, and allowed to dissolve there. Lastly, to the tumour itself, he applies a plaster, composed of half an ounce of litharge, a drachm of the submuriate of mercury, and ten grains of antim. tartariz. (Alibert, *Nesol. Nat. t. i. p. 474.*)

The virtues of burnt sponge, in the cure of certain forms of bronchocele, are now ascertained to be owing to the iodine which it contains. Iodine was discovered in 1813 by Courtois, manufacturer of saltpetre at Paris; but six years elapsed before it was tried as a medicine. From the first memoir of Dr. Comdet, addressed in 1820 to the Helvetic Society of Natural Sciences, it appears, that, as he was searching for a formula in the work of Cadet de Gassicourt, he found, that Russell had recommended the ashes of the *fucus vesiculosus*, or bladder wrack, under the name of *Æthiops vegetabilis*, for the cure of bronchocele; and he was led from analogy, between this substance and burnt sponge, so long celebrated for its efficacy in the treatment of bronchocele, to suspect that iodine was the active principle of both. "The great and unequalled success which resulted from its use in the treatment of bronchocele, at once indicated the power of iodine as a therapeutic agent, and encouraged Dr. Comdet to pursue his researches in rendering it an efficient article of the materia medica; and about the close of the same year, when Dr. Comdet had employed iodine in treating goitre for six months at least, his conjecture was confirmed by the discovery which Dr. Fyfe of Edinburgh made, that this substance was actually contained in the ashes of the burnt sponge, &c.

"It has been generally understood among the profession, that the happy conjecture, which introduced iodine into medical treatment, originated with Dr. Comdet, of Geneva; yet, we find that his claim to this honour is disputed by one of his countrymen, Dr. J. C. Straub, of Hofwyl, in the Canton of Berne.

"Dr. Straub, whose communication is found in Professor Meisner's Physical Intelligence of the General Helvetic Society for 1829, states, that, before the discovery of iodine, attempts had been made to compound a substitute for burnt sponge, but without success; and that this failure, and his observation of the similarity of smell between iodine, burnt sponge, and other marine productions, led him to suspect the existence of iodine, or its salts, in these substances, and that its absence in the artificial compounds was the cause of failure in these experiments. This conjecture, which appears to have been made previously to 1819, led Dr. Straub to examine the real burnt sponge; and he informs us, that, though his time did not permit him to ascertain exact quantities, yet he obtained from 1½ oz. of burnt sponge, as much iodine as to render his conjecture probable, and to be astonished that the ingre-

dient should have escaped notice. He was therefore at once induced to think of its use in medicine; and in the same paper, from which we obtain these facts, impressed with the poisonous quality ascribed by Orfila to iodine, he recommended, first the trial of its salts, especially the hydriodates of soda and lime, and then that of the substance itself.

"The communication of Dr. Straub is dated Dec. 1819, and was actually published in Professor Meisner's periodical work in February, 1820; five months, at least, before the first memoir of Dr. Coindet was communicated to the Helvetic society of Natural Sciences at Geneva. It is unnecessary to have recourse to any supposition of injustice done to Dr. Straub; much less would it be right to deprive Dr. Coindet of the merit of originality in substituting the direct and certain action of iodine for the irregular, and sometimes inert, qualities of burnt sponge in the treatment of goitre. Coincidence of this kind is not uncommon in science: in the present instance, the ingenuity of Dr. Straub does not diminish the merit of Dr. Coindet." (See *Edin. Med. and Surg. Journal*, No. 80. p. 210, &c.)

That iodine is a medicine of considerable efficacy in bronchocele, not a doubt can be entertained, after the many cases now recorded in proof of the fact; and that it is useful in some other chronic tumours, especially those of a serofulous nature, has now been fully proved. In bronchocele, friction with the ointment on the swelling may often be advantageously conjoined with the use of one of the preparations for internal exhibition.

In the *Archives G n rales de M decine* for July, 1823, Dr. Coster mentions the opportunity which he had had of remaining eight months at Geneva with Dr. Coindet, and of observing correctly the good effects of iodine in enlargements of the thyroid gland, and in serofulous tumours. Dr. Coindet first of all employed this medicine under the form of alcoholic tincture, and obtained very surprising effects from its administration in goitre. He next tried friction on the tumour itself, with an ointment, composed of the hydriodate of potash and lard; and the success of this practice was so great, that of nearly one hundred individuals affected with goitre, whose cases Dr. Coster collected, more than two-thirds were completely cured by it. Soon after these successful results, iodine was employed, sometimes internally, and sometimes in the form of friction, in serofula. "I shall not affirm (says Dr. Coster) that success was as uniform in the latter, as in the former disease; but it is certain, that serofulous tumours yield sooner to the action of iodine than to that of any other remedy at present known: when the tumours, whether of the thyroid gland, or of the lymphatic glands, are hard and resistent, experience proves that the effects of iodine are much more prompt, when the frictions are preceded by the application of leeches, and a low regimen. Notwithstanding these precautions, however, the tumour sometimes continues stationary." In such a case, Dr. Coster put the tumour twice a day, for ten or twelve minutes, under the influence of the positive pole of the voltaic pile, taking care to change sides each time of using it: so that, in the morning, he made use of friction with iodine on the right side, and the action of the pile on the

left; and, in the evening, applied the friction to the left side, and the galvanism to the right. In twenty days, not the least trace of the bronchocele was left. It is stated, that, in this instance, the voltaic pile, unassisted with the frictions of iodine was as ineffectual as the friction by itself had been. By the internal and external use of iodine, I once dispersed a bronchocele, which had formed in the neck of a young lady, aged about 12, who was brought to my house by my neighbour, Mr. Blair. The disease began to diminish in less than a week from the commencement of the treatment, and in six weeks the cure was complete. Since this, I have treated several other cases with an equally favourable result. An interesting case, in which a similar plan was attended with success, is recorded by Dr. Roots. (See *Med. Chir. Trans.* vol. xii. p. 310.) Another instance of its decided efficacy is reported by Dr. Barlow, of Bath (see *Edin. Med. Journ.* No. 79. p. 337.); but, whoever wishes to have a large and convincing body of evidence on this point, should consult the cases and observations published by Dr. Manson, of Nottingham, where bronchocele is said to be endemic. He gives the results of one hundred and twenty cases of bronchocele in which he administered iodine. Fifteen were in males, and one hundred and five in females. When the disease was complicated with diseased lymphatic glands, the thyroid gland first yielded, and then the others. In the fourth case, a serofulous swelling of the foot yielded during the use of iodine. Of the hundred and twenty cases referred to, eighty-seven were cured, ten much relieved, and only two or three discharged without relief. (See *Manson or Medical Researche on the Effects of Iodine in Bronchocele, Paralysis, Chorea, Scrofula, Fistula Lacrymalis, Deafness, Dysphagia, White Swellings, and Distortions of the Spine*, Lond. 1825.) Some further notice of this gentleman's practice, as well as of the results of Mr. Buchanan's experience, will be taken in the articles, *EAN, IODINE, JOINTS, SCROFULA, VERTEBRÆ, &c.* For the preparations and doses of Iodine, see *IODINE*.

In South America a remedy for bronchocele, called *aceite de sal*, was found, by M. Roulin, to contain a proportion of iodine. (See *Magendie, Journ. de Physiologie*, t. v. p. 273.) The same gentleman has also proposed the trial of chlorine, or the free hydro-chloric acid.

Notwithstanding the numerous cures of bronchocele, accomplished by means of iodine, the plan fails in many instances. As Dupuytren observes, the disease depends on different causes. Sometimes it is a simple hypertrophy; sometimes a scirrhous degeneration; and, on other occasions, it is composed of cysts, filled with matter of different kinds. Iodine cannot answer equally for so many affections of diverse character. (*Clinique Chir.* t. iv. p. 467.) According to Dr. Saccchi, iodine is chiefly useful in the hypertrophic and serofulous forms: less so in the lymphatic; and perfectly ineffectual against small isolated hard goitres. The best mode of using iodine seems, to Dr. Saccchi, to be friction, with an ointment of hydriodate of potash, continued from one to several months.

Petit, Heister, and Schmucker make mention of inveterate bronchoceles, which gradually subsided, in consequence of suppuration. Volpi states, that such ulcerations are not unfrequent.

He has published two facts of this kind, which occurred after a nervous fever; and he records a third case, where the swelling inflamed in consequence of a blow, suppurated, and sloughed, so as entirely to disappear. (See *Léveillé, Nouvelle Doctrine Chir.* t. iv. p. 128.) A similar fact is recorded by Zipp. (*Siebold, Samml. Chir. Beob.* b. ii. p. 229.)

The disease, in its inveterate form, has also been sometimes removed by the application of caustic; (*Mesny in Journ. de Médecine*, t. xxiv. p. 75.; *Timaeus, Cas.* p. 283.) ; the establishment of issues (*Jeitteles, Obs. Méd.*) ; the making of an incision into the swelling, or the introduction of a seton through it. (*Foderé, Essai sur le Goitre et le Cretinisme*, p. 75.; *Klein, in v. Siebold, Sammlung Chir. Beobacht.* b. ii. p. 11.; *Flajani, Collezione d'Osservazioni di Chirurgia*, t. iii. p. 283.)

Bronchoceles have sometimes been removed by the part having been accidentally or purposely burnt to a considerable depth. (*Motte, in Blegny, Zodiac. ann.* 2. Febr. Obs. 11.; *Severinus de Efficaci Medicina*, p. 220.) The disappearance of bronchoceles has also been known to follow a wound. (*Schmidmüller über die Ausführungsgänge der Schilddrüse*, p. 37, Landshut, 1805.) A. Burns sometimes employed blisters, and found them useful. (*Surgical Anatomy of the Head and Neck*, p. 204.) With respect to caustic, which is spoken of by Celsus (lib. 7. cap. 13.), Flajani states that its operation is tedious and painful, and attended with danger: and what he says about the practice of an incision is not more encouraging. When the disease contains a cyst, he prefers making an opening with a trocar, though he confesses that this plan is apt to be followed by a relapse, when the cyst is very thick and hard; in which circumstance it will be necessary to have recourse either to an incision, or the seton, for the purpose of exciting suppuration. Should the disease, however, be merely composed of one cyst of moderate size, Flajani recommends its entire removal. "Of all these methods (says he), proposed for the extirpation of bronchoceles, the seton is the least dangerous, and by means of it a radical cure may be generally effected without any severe symptoms, as I have found by experience in many cases. On the contrary, I have been an eye-witness of the fatal consequences induced by the other plans. I was called to assist a gentleman, about forty years of age, brought to death's door by a bleeding, which arose from the application of caustic to the fore part of the neck. As tourniquets, bandages, &c. proved quite ineffectual, it was indispensable to make pressure on the part with the finger of an assistant, for twenty-four hours, ere the hemorrhage could be stopped; a copious suppuration ensued; and it was three months before the parts were healed. I was likewise present (says he) at the opening of a similar, but larger swelling in the same situation, the disease having afflicted an elderly respectable patient for several years. The incision caused the evacuation of a small quantity of serum, contained in the cellular membrane, but the following day the tumour inflamed, the difficulty of respiration increased, and for some days the patient was in great danger. At length, suppuration was established, followed by a destruction of a great deal of the cellular membrane, and several sinuses, and, in five months, the patient lost his life. On

examination of the body, the lungs were found tuberculated, an effect of the impediment to the circulation of the blood through the smaller vessels of those organs." (*Flajani, Collezione d'Osserv.* t. iii. p. 283. 8vo. Roma, 1802.)

The first proposer of the employment of setons for the cure of diseases of the thyroid gland, is perhaps not exactly known; but, it is certain, that the method has been known, and occasionally practised, ever since the middle of the last century. "Dr. Monro, senior (as a well-informed writer has observed), mentions in his lectures, that he has seen a dropsy in the centre of the gland, complicated with bronchocele, cured by a seton, although the glandular swelling still continued." (*A. Burns on the Surgical Anatomy of the Head and Neck*, p. 191.) This statement is given on the authority of some MS. notes taken by Dr. Brown from Dr. Monro's lectures. According to Girard, many cases in his time had been communicated to the Royal Academy of Surgery, at Paris, in which the disease was got rid of either by means of a seton, drawn through the swelling, or the application of an issue. (*Lupiolé, &c.* 8vo. Paris, 1775. (The occasional success of setons was also adverted to by Richter, in the year 1788. (*Bibliothek*, b. ix. p. 478.) And the plan is spoken of in another work, published in 1790, as being eligible, where the disease is conjoined with a cyst. (*Encyclopédie Méthod. Partie Chir.* t. i. p. 231.) The practice was particularly noticed by Foderé, in his valuable treatise on bronchocele; and Alibert mentions the seton as being used at the Hospital St. Louis. (*Nosol. Nat.* t. i. p. 466. fol. Paris, 1817.)

In November, 1817, Dr. Quadri, of Naples, tried this practice, which he erroneously supposed to be quite new. "By means of a trocar-pointed needle, six and a half inches long, I passed (says he) a seton from above downwards through the gland, at the depth of about four lines from its surface. Suppuration took place in forty-eight hours. On the 18th of November, the seton escaped, when the matter was squeezed out, and the irritation, occasioned by replacing it, produced an abscess on the right side of the neck, which was opened on the 23d, when it was found that the suppuration had affected the destruction of nearly the whole gland." The woman, who was thirty-six years of age, was seen by Dr. Somerville, in April, 1818, with the circumference of her neck lessened, from sixteen to thirteen inches French measure. In another case, referred to, a seton was passed through each side of the thyroid gland, and the result was the removal of the tumour on the side, where the seton had been maintained long enough; but, on the opposite side, the seton being withdrawn too early, the matter, collected in the sac, and at the end of four months, a sinus and discharge still continued, the patient refusing to have a counter opening practised. When the seton does not prove stimulating enough, Dr. Quadri sometimes enlarges it, or attaches to it escharotic, or irritating substances. He also frequently uses two setons. In one example, in endeavouring to perforate the gland rather deeply, Dr. Quadri appears to have injured the larger branches of the thyroid arteries, as more than an ounce of blood was discharged, and the tumour swelled, as if injected with blood. The bleeding, however, ceased spontaneously. He states, that

the seton has been passed through the tumour not less than sixteen times, the direction being varied in every instance, without untoward accident; and he is confident, that, unless the needle be pushed deep enough almost to touch the thyroid cartilage, the trunks of the thyroid arteries will not be exposed to injury, while the branches, in the track of the needle, will not cause any danger. He insists also upon the propriety of retaining the seton in the tumour a considerable time; and observes, that it remains to be ascertained whether this practice will answer in every description of bronchocele. For these and several other cases and particulars, the profession is indebted to Dr. Somerville. (*See Med. Chir. Trans.* vol. x. p. 16 &c.)

Mr. Gunting applied a seton in a case of bronchocele in St. George's Hospital; but, in this instance, the irritation brought on sloughing, and the patient after a time died. The particulars of this case, and of three successful examples of the practice in England, have been lately recorded. One of the successful cases was treated by my friend, Mr. James, of Exeter, another by Mr. A. C. Hutchinson, who has taken the trouble to collect the history of them, and the third, by Dr. A. T. Thomson. (*See Med. Chir. Trans.* vol. xi. p. 235.) Percy and Dupuytren also employed setons in bronchocele with success. The plan, however, is sometimes inefficient, as is proved by two cases under Dr. Kennedy, of Glasgow. (*See London Medical Repository*, No. 99. Feb. 1822.) The exact nature of cases relieved by this practice, and their difference from other examples, which are benefited by treatment of a different kind, are still desiderata in surgery.

When a seton was passed through the thyroid gland, Dupuytren always noticed a copious discharge of venous blood; but, he found it soon stop, on desiring the patient to make full inspirations, and applying cold water, and moderate pressure. (*See Clinique Chir.* t. iv. p. 470.) Dupuytren would not have the seton looked upon as capable of curing every bronchocele. Of course, it will produce no favourable change in the scirrhous degeneration of the thyroid gland; but, in cases of hypertrophy, cysts, and hydatids, where iodine and other specifics frequently fail, the disease will be more likely to yield to the seton. (*Ib.* p. 471.)

The diseased thyroid gland has been successfully extirpated; but the operation is one of so much danger, that it ought never to be attempted, except under the most pressing circumstances. The many large arteries naturally distributed to the gland itself; their still greater size in bronchocele, and the vicinity of the carotid arteries, and important nerves, render the undertaking a thing of no common difficulty.

Mr. Gooch relates two cases, which do not encourage practitioners to have recourse to the excision of enlarged thyroid glands. In one, so copious an hemorrhage took place, that the surgeon, though equally bold and experienced, was obliged to stop in the middle of the operation. No means availed in entirely suppressing the bleeding, and the patient died in a few days. In the other, the same event nearly took place, the patient's life being saved only by compressing the wounded vessels with the hand, day and night, for a whole week, by persons who relieved each other in turn. This was found the only way of

stopping the hemorrhage, after many fruitless attempts to tie the vessels.

Hemorrhage is not the only risk: Dupuytren removed a large bronchocele that caused dangerous pressure upon the trachea; the whole gland was taken away, and the four thyroid arteries and many veins secured. Only a few spoonfuls of blood were lost. The woman, however, died soon after the operation, with pale face, hurried respiration, cold skin, sickness, &c. denoting injury of some important nerves.

I do not mention these facts to deter surgeons from the operation altogether, because it is proved by modern experience, and especially by six cases in which Dr. Hedenus, of Dresden, has successfully removed the thyroid gland, that not only it is occasionally a necessary proceeding, but one that may be well accomplished by a skilful operator, as will be particularly explained in a future article. (*See THYROID GLAND.*) When bronchoceles by their pressure dangerously obstruct respiration, deglutition, and the return of blood from the head; and when the disease resists the efficacy of iodine, a seton, blisters, and every other plan of treatment found deserving of trial, what can be done with the view of saving the patient but the bold operation of cutting away the swelling, or that of exposing and tying one or both of the upper thyroid arteries?

When the quantity of blood flowing into a tumour is suddenly, and greatly, lessened, the size of the swelling commonly soon undergoes a considerable diminution. The experiment was once made by Sir W. Blizard: he tied the arteries of an enlarged thyroid gland, and in a week the tumour was reduced one-third in its size. The ligatures then sloughed off, repeated bleeding took place from the arteries, and, by the extension of hospital gangrene, the carotid itself was exposed. The patient died; yet, as Mr. A. Burns observes, this does not militate against a repetition of the experiment; as the same thing might have happened from merely opening a vein, and, in the confined air of an hospital, has actually happened. (*Surgical Anatomy of the Head and Neck*, p. 202.)

In fact, the rationality of the experiment prevented surgeons from being intimidated by the failure in question; and, with that laudable spirit for the improvement of operative surgery every where diffusing itself through the profession, other gentlemen were soon found who had judgment enough to make further trials of the practice. In a young man, twenty-four years of age, whose breathing was much impeded by a bronchocele, and whose upper thyroid arteries were very large and affected with strong pulsations, Walther of Landshut tied the left of these vessels, the left side of the gland being the largest. The operation was done on the 3d of June, 1814. An incision, an inch and a half in length, was made in the direction of the inner edge of the sterno-cleido-mastoid muscle, where the throbbing of the artery was quite distinct. By a second stroke of the knife, the platysma-myoides was divided in the same direction, and to an equal extent. The vessel was then exposed by a cautious dissection, and separated from the surrounding parts, and one arterial branch, which was divided, was immediately secured. A ligature, composed of three silk threads, was then conveyed with an

aneurism-needle under the left thyroid artery, and tied with two simple knots. The wound was then closed with adhesive plaster, and the ends of the ligatures brought out at the angles. The ligature on the large artery came away on the 12th day; and, without any febrile symptoms or other bad consequences, the wound was perfectly healed on the 23d day. As early as the third day after the application of the ligature, the left part of the tumour began to be less tense, and the throbbing feel in it soon ceased. By degrees, it dwindled away, becoming, as it lessened, harder, and, as it were, cartilaginous. In a fortnight, the left half of the swelling was one-third smaller than before the operation; and, at length, only one-third of it remained, while the right side also was somewhat smaller. On the 17th of June, Walther took up the right superior thyroidal artery, which was more difficult to get at, as it lay more deeply, and was much concealed under the enlarged gland, which had pushed it out of its natural situation. The operation lasted three-quarters of an hour; and several large and small arteries which were cut were tied. With respect to the thyroid artery itself, it could not be tied without including a part of the gland in the ligature. No unfavourable symptoms followed this second operation; the ligatures were detached in good time, and the wound healed up very well. The right portion of the bronchocele also now diminished; but, though it was originally smaller than the left, it did not dwindle away so completely as the latter. The remains of the tumour, however, two years afterwards, produced no inconvenience, and respiration was quite easy. (See *Neue Heilart der Kropfes*, &c. von Ph. Fr. Walther, p. 25, &c. 8vo. Sulzbach. 1817.) On the 29th of December, 1818, Mr. H. Coates, of Salisbury, took up the superior thyroidal artery for the cure of a bronchocele, which, in a young woman, aged seventeen, made pressure on the trachea and oesophagus, attended with a great noise in breathing. The superior thyroidal arteries were in this instance large, and pulsated strongly. Mr. Coates cut down upon the left of these vessels, separated it from its accompanying nerve, and passed under it a small round ligature, which was drawn moderately tight, and tied. The next day, the patient was headach, and some swelling of the neck and side of the head, with increased difficulty of swallowing, and febrile symptoms. These complaints, however, were relieved by bleeding and antimonial medicines. The ligature came away on the 9th day; and, on the 14th, the wound was completely healed. On the 14th of February, the breathing being much improved, and the tumour reduced nearly to one-half of its former size, the patient was well enough to be discharged from the infirmary. (See *Med. Chir. Trans.* vol. x. p. 312.) The late Mr. Rose once mentioned to me a case, in which a similar operation, done by Sir Benjamin Brodie, did not produce any material diminution of the tumour.

Two successful cases of ligature of the superior thyroid artery are recorded by Chelius. (See J. G. Crosse in *Provincial Med. Chir. Trans.* vol. v.)

Dr. Parry remarked a frequent coincidence either as cause or effect, between enlargement of the thyroid gland, and cardiac diseases. (*Elements of Pathology*, &c. p. 181.) And another mo-

dern writer mentions, that he has lately seen three cases of this complication. (*Medico Chir. Journ.* vol. i. p. 181.) A case is detailed by Flajani, where the disease was accompanied with extraordinary palpitations of the heart. (See *Collezione d'Osservazioni*, &c. di Chirurgia, t. iii. p. 270.) In the instance here referred to, there was great irregularity of the pulse; and the oppression of the breathing was such, that the patient was obliged to submit to venesection at least every month, whereby he was rendered quite emaciated.

Albucasis gave the first good account of Bronchocele. *Witmer's Cases and Remarks in Surgery*, with an Appendix on the Method of Curing the Bronchocele in Coventry, 8vo. Lond. 1779. *Prosser*, An Account and Method of Cure of Bronchocele, or Derby-neck, 8vo. Lond. 1769; also, 3rd edit. 4to. Lond. 1782. *Memoirs of the Med. Society of London*, vol. i. *Gooch's* *Chirurgical Works*, vol. ii. p. 96; vol. iii. p. 157. *Desault's* *Parisian Chirurgical Journal*, vol. ii. p. 292. *Œuvres Chirurgicales de Desault*, par *Beclat*, t. ii. p. 298. *F. Malacarne*, *Lettre sur l'Etat de Gênes*: (Frank. Del. Op.) Edin. Med. and Surg. Journal, vol. iv. p. 279. *Odier's* *Manuel de Médecine Pratique*, 8vo. Genève, 1811. *Dr. Reeves's* Paper on Cretinism. In *Edin. Med. and Surg. Journal*, vol. v. *Traité du Goutre*, et du Cretinisme, par *E. J. Loder*, 8vo. Paris, an. 8. *Richter's* *Anfangsgründe der Wundarzneikunst*, b. iv. kap. 15. von Kropfe. *Surgical Anatomy of the Head and Neck*, by *A. Burns*, p. 191, &c. *Larrey*, *Mémoires de Chirurgie Militaire*, tom. i. p. 123; t. iii. p. 199, &c. *J. P. Achermann*, *Ueber die Kretinen, eine besondere Menschenart in den Alpen*, 8vo. Gotha, 1790. *B. S. Barton*, A Memoir concerning the Disease of Goutre, as it prevails in different parts of North America, 8vo. Philadelphia, 1800. *Memoria Patologica*, *Parlati*, sulla Natura del Goutre, &c. del Dottor Prospero Postiglione, 12mo. Firenze, 1811. *Kortum*, *Comment. de Vitio Scrofuloso*, t. ii. *Giuseppe Flajani*, *Collezione d'Osservazioni e Riflessioni di Chirurgia*, t. iii. p. 270, &c. 8vo. Roma, 1802. *Quonidi*, in *Med. Chir. Trans.* vol. x. 1. Diet. des Sciences Méd., art. Bronchocele. *Ph. Fr. Walther*, Neue Heilart des Kropfes durch die Unterbindung der obern Schilddrüsen Schlagadern nebst der Geschichte eines durch die Operation geheilten Aneurismas der Carotis, 8vo. Sulzbach, 1817. *J. Coates*, in *Med. Chir. Trans.* vol. x. p. 312, &c. *Gualtieri* *Tyrolenseum*, Carynithotum, Styrorumque Struma; Vienna, 1791. *Maas*, Diss. de Glandula Thyroidea Tum Sana quam Morbosa, &c. Wircb. 1810. *Hauschultz*, Ueber Erkenntnis, &c. des Kropfes, in *Horn's* Archiv. b. xii. 1813. *Mühlbach* der Kropf, nach seiner Ursache, Verhütung, und Heilung. Wien, 1822. *Hedenus*, Tractatus de Glandula Thyroidea, &c. Lips. 1822. *Lassus*, Pathologie Chirurg. t. i. p. 408, &c. *Peint*, *Œuvres Posthumes*, t. i. p. 255. *Haller*, Opuscula Pathologica, Obs. v. p. 16. *J. F. Albert*, Nosologie Naturelle, t. i. p. 461, &c. fol. Paris, 1817. *A. C. Hutchison*, Cases of Bronchocele, or Goutre, treated by Seton: *Med. Chir. Trans.* vol. xi. p. 235, &c. *A. D. Humboldt*, Observations sur quelques Phénomènes peu connus qu'offre le Goutre sous les Tropiques, dans les Plaines et sur les Plateaux des Andes; in *Journ. de Physiologie* par *F. Magendie*, t. iv. p. 109, 1vo. Paris, 1821. Observations on the remarkable Effects of Iodine in Bronchocele and Scrofula; being a translation of three Memoirs published by *J. R. Couinet*, M.D. Lond. 1821. *J. C. Straub*, in Naturwissenschaftlicher Anzeiger der Allgemeinen Schweizerischen Gesellschaft, &c. herausgegeben von *Dr. M. J. Zuercher*, 4to. Bern. Feb. 1820. *Breva*, Saggio Clinico sull' Iodio, &c. Padova, 1822. *H. Gaidner*, M.D., Essay on the Effects of Iodine, with Practical Observations on its use in Bronchocele, Scrofula, &c. Lond. 1824. *H. S. Roots*, in *Med. Chir. Trans.* vol. xii. p. 310. *Cost*, in *Archives Générales de Médecine*, Juillet, 1823. *J. Kennedy*, in *London Med. Repository* for Feb. 1823. *Dr. A. Mawson*, Medical Researches on the Effects of Iodine in Bronchocele, &c. Lond. 1825. *M. Roulin*, Note sur quelques Faits relatifs à l'Histoire des Goutres; in *Magendie's* *Journ. de Physiologie Expér.* t. v. p. 266. *J. A. W. Hedenus*, Ausrottung der Schilddrüsen, in *Journ. der Chir. von C. F. Graefe und Ph. Von Walther*, b. ii. p. 237, &c. or *Journ. of Foreign Medicine*, vol. p. 317, &c. *Sacchi*, *Annali Universali*, Dec. 1832. *Dupuytren*, *Leçons Orales de Clinique Chir.* t. iv. p. 464. Paris, 1834. For the best plates of the disease, see *Dr. Baillie's* *Series of Engravings*, &c. fasc. ii. tab. 1.

BRONCHOTOMY, (from *ῥογχος*, the wind-pipe, and *τομή*, to cut.) An operation by which an opening is made into the trachea, either for the purpose of making a passage for the air into and out

of the lungs, when any disease prevents the patient from breathing through the mouth and nostrils, or of extracting foreign bodies, which have accidentally fallen into the trachea: or, lastly, in order to be able to inflate the lungs in cases of suspended animation. The operation is also named *tracheotomy*. When the incision is made in the larynx, the operation is termed *laryngotomy*. (See LARYNGOTOMY and TRACHEOTOMY.)

BUBO, (*Βουβών*, the groin.) A swelling of the lymphatic glands, particularly of those in the groin, from acute or chronic inflammation, with or without suppuration. The term is also occasionally applied to a similar swelling of the absorbent glands in other parts, especially the axilla.

The disease may arise from the mere irritation of a local disorder, from the absorption of some irritating matter, such as the venereal poison, or from constitutional causes.

Of the first kind of bubo, that which is named the *sympathetic* is an instance. Of the second, the venereal bubo is a remarkable specimen. (See VENEREAL DISEASE.)

The *pestilential bubo*, which is a symptom of the plague, and *scrofulous* swellings of the inguinal and axillary glands, may be regarded as examples of buboes from constitutional causes. (See SCROFULA.)

The inguinal glands often become affected with simple phlegmonous inflammation, in consequence of irritation in parts, from which the absorbent vessels, passing to such glands, proceed. These swellings ought to be carefully discriminated from others, which arise from the absorption of venereal matter. The first cases are simple inflammations, and only demand the application of leeches, cold evaporating lotions, and the exhibition of a few saline purges; but the latter render the administration of mercury, or other remedies for syphilis, advisable.

Sympathetic is the epithet usually given to inflammation of glands from mere irritation; and we shall adopt it without entering into the question of its propriety.

The sympathetic bubo is mostly occasioned by the irritation of a virulent gonorrhoea. The pain, which such a swelling gives, is trifling, compared with that of a true venereal bubo, arising from the absorption of matter, and the tumour less frequently suppurates. However, it has been contended, that the glands in the groin do sometimes swell and inflame from the actual absorption of venereal matter from the urethra, in cases of gonorrhoea, and, if this were true, the swellings would be venereal; but the doctrine is now nearly exploded. (*Hunter on the Venereal*, p. 57.)

BUBONOCLE, (from *Βουβών*, the groin, and *κλῆ*, a tumour.) A species of hernia, in which the bowels protrude at the abdominal ring. The case is often called an *inguinal hernia*, of which there are varieties. (See HERNIA.)

BUNYON. An inflammation of the bursa mucosa, at the inside of the ball of the great toe. (See *Brodie's Pathological and Surgical Obs. on the Joints*, p. 320. ed. 3.) The adjacent parts become thickened and indurated; the bones of the joint enlarge, and in process of time suffer a sort of subluxation; the bursa being thus projected more and more against the shoe, is kept in a state of continual excitement. Dropsical effusion, thickening of the membrane, and suppuration, with obstinate

sinuses, may ensue. (See *Symes's Princ. of Surgery*, p. 347.) It is therefore proper to employ, in the early stage of the inflammation, leeches, poultices, and fomentations, or cold applications; and in particular to remove pressure from the swollen part, the foot being kept perfectly quiet, and not in a depending position. I suspect that the subluxation, or projection of the bones inwards at the joint above spoken of, is frequently antecedent to the bunyon, and a principal cause of the disease. I had a patient in the North London Hospital, with an enormous bunyon, and in whom the original conformation of the toe of each foot corresponded to this statement. In fact, he suffered from bunyons in both feet, in consequence of the pressure acting with great effect on the angular projection at the inner side of each of the great toes. I have no doubt, however, that the inflammation and its effects may lead to disease and further displacement of the joint; and perhaps this had happened in the case to which I am referring.

BURNS. A burn is the effect of the action of concentrated heat on the living textures; and it is upon the nature of its cause that its peculiar characters depend, which prevent it from being confounded with any other kind of injury. These characters, seemed to Dupuytren to partake at once of the nature of inflammation, of that of wounds, and of disorganisation. (*Clin. Chir. t. i. p. 417.*) This view does not seem to me strictly correct, unless a chemical injury can be rightly called a wound, and every burn without exception, is essentially accompanied by disorganisation, which is well known not to be the fact, according to the usual import of that term amongst British pathologists.

Dupuytren, indeed, concurs with all surgical writers in representing the effects of the action of caloric, as attended with great diversity in respect to their intensity and severity, according as they may have been produced by radiating heat at variable distances, or by the direct action of flames emitted by the combustion of various substances; or by the direct application of the ignited bodies themselves.

Moderate, but long-continued, radiating heat thickens the cuticle, hardens the skin, blunts its sensibility, and renders it more or less brown. These effects are exemplified in persons habitually exposed to the burning rays of the sun, or whose usual occupations are before vast fires. Thus, as Dupuytren observes, smiths are able to grasp with their rough horny hands pieces of iron of a very high temperature, and even to touch them for a few seconds with impunity.

A higher degree of radiating heat produces marbled discolorations in the skin, and cracks in the cuticle, frequently leading to troublesome ulcerations. Such effects are common on the shins of old persons, who are constantly sitting close to the fire. In a still greater intensity, radiating heat will blister the surface of the body, or cause the formation of vesicles. In hot climates, exposure to the solar rays during sleep is alleged sometimes to have excited inflammation, followed by gangrene, and death on the fourth or fifth day. (See *Dupuytren, Clin. Chir. t. i. p. 419.*)

As for flame, it is described by Dupuytren, not only as occasioning an instantaneous burn, like heated substances directly applied to parts, but also as readily drawing animal substances into a partici-

tion in the movement of combustion, of which it is itself the product. The animal textures subjected to its action rapidly part with their moisture, become shrivelled and bent, or twisted, and emit a flame, which annexing itself to the first, increases its activity and its ravages.

The great depth and fatality of burns produced by the clothes or dress taking fire, are familiarly known to all surgeons; and instances have occurred in which the bodies of individuals in a state of intoxication, or apoplexy, have been entirely consumed in a few hours. The same thing has happened to infants, incapable of extricating themselves from the flames. Dupuytren arranges with burns produced by flame, those caused by the combustion of hydrogen gas, and by the explosion of gunpowder. In general, gases cause only superficial, but at the same time very extensive burns, because they act instantly upon large surfaces. Burns of this description, however, sometimes penetrate through the cutis. The degree of a burn is according to the nature and density of the ignited or heated substances which are immediately applied to the living textures, their capacity for caloric, and the facility with which they relinquish it. Thus, all boiling fluids do not burn with the same force, because they do not all boil at the same temperature. Hence, the burning action of fatty substances, as soup, oil, lard, &c. is more energetic than that of water.

But as Dupuytren justly adds, another cause of this difference depends upon the former adhering to the skin, while water merely runs over it. Solid bodies, when their combustion is rapid, like that of phosphorus, sulphur, and resinous substances in general, occasion deep burns. In the contrary case, the intensity of their effects is determined by their degree of heat, the duration of their application, and the tissues being more or less susceptible of the impression. *Cactis paribus*, a burn is less deep when it takes place on parts habitually exposed to the air, than when it occurs on parts always covered with clothes, and whose cuticle is very thin. (See Dupuytren *Clin. Chir.* t. i. p. 420-422.)

In all burns, then, the quantity of injury depends on the degree of heat in the burning substance, on the duration and extent of its application, and on the sensibility of the burnt parts.

By Fabricius Hildanus, Boyer, and Dr. J. Thomson, burns are divided into several kinds or degrees:—1st. Into such as produce an inflammation of the cutaneous texture, but an inflammation which, if it be not improperly treated, almost always manifests a tendency to resolution. 2dly. Into those which occasion the separation of the cuticle, and produce suppuration on the surface of the skin. 3dly. Into others, in which the vitality and organisation of a greater or less portion of the cutis are either immediately or subsequently destroyed, and a soft slough or hard eschar is produced. (See Thomson on *Inflammation*, p. 585, 586.)

Suppuration is not always an unavoidable consequence of vesifications in burns; but it is a common and a troublesome one. "In severe cases, it may take place by the second, or third day; often not till a later period. It often occurs without any appearance of ulceration, continues for a longer or shorter time, and is at last stopped by the formation of a new cuticle. In other instances, small ulcerations appear on the surface or edges of the burn. These, spreading, form extensive sores,

which are in general long in healing, even where the granulations which form upon them have a healthy appearance." (*Op. cit.* p. 595.)

Heister and Callisen divide burns into four degrees, by adding to the preceding those which occasion, not merely suppuration on the surface of the cutis, but ulceration not necessarily accompanied or preceded by sloughing.

As Dupuytren observes in the above-mentioned classification of burns, attention is paid only to the intensity of the effects of the burn, considered generally, while the nature of the organs which are the seat of them, the textures affected or destroyed, are entirely disregarded. Yet, it is manifest that heat acts first upon the skin, and that then its effects extend to variable and successively increasing depths. Dupuytren therefore preferred another classification, in which burns are divided into six degrees:—1. Erythema, or superficial phlogosis of the skin, without vesicles. 2. Inflammation of the skin, with detachment of the cuticle, and the formation of vesicles, filled with serosity. 3. Destruction of a part of the corpus papillare, and rete mucosum. 4. Disorganisation of the cutis completely down to the subcutaneous cellular tissue. 5. Conversion of all the superficial textures and the muscles into eschars to within a variable distance from the bones. 6. Carbonisation of the whole thickness of the burnt part.

In the first degree of a burn, the parts are of a bright red colour, which is uncircumscribed, and like that of erysipelas, disappears for a moment after pressure with the finger, and the injury is attended with sharp pain. Frequently in a few hours, and always within a few days, the redness ceases, and pain ceases, and the case terminates in desquamation, or a peeling off of the cuticle. However slight this degree of a burn may be, it is not unusual, when an extensive surface is implicated, for the pulse to rise and be accelerated, the tongue to be reddened, and symptoms of gastro-intestinal irritation to come on. When the head is the seat of the burn, the irritation is liable to be propagated to the brain, and then restlessness, delirium, convulsive twitches, coma, and even death may ensue. (Dupuytren, *Clin. Chir.* t. i. p. 424.)

The second degree of a burn is always owing to the action of more intense heat, or the longer continuance of its application. A sharp burning pain is felt, and sometimes at the same moment, but more frequently at the expiration of a few hours, one, or several vesicles, filled with a clear transparent serosity, are formed upon the burnt surface. The pain is then accompanied by a sense of tension. The vesicles either burst or are pricked; the detached cuticle dries, and, in a few days, falls off in large pieces, or peels off in smaller ones, leaving the subjacent rete mucosum covered with new cuticle; yet reddish, thin, and delicate. Sometimes, (to continue Dupuytren's admirable description) the cuticle, instead of forming vesicles, is torn in the first instance from the rete mucosum, which remains exposed. Most severe pain is the consequence of this incident, which is always followed by slight suppuration. But, at length, the denuded surface becomes dry, and soon merely a redness is left, which disappears, without leaving any vestige of the injury behind.

Dupuytren's third degree of burn essentially consists of a cauterisation of the rete mucosum and of the papillary surface of the cutis. It is denoted

by grey, yellow, or brown spots, which are thin, supple, and insensible, if gently touched, but more or less painful if greater pressure be made on them. The vesicles, frequently arising over the points disorganised, in this degree, ordinarily contain a brownish milky serosity, or else a serosity highly tinged with blood; and this appearance is, at the very first, useful in the diagnosis. In these cases, sometimes the eschar is thrown off in a mass at the ordinary period; and, on other occasions, it falls off in fragments, so as to bring into view, in the places covered by the phlyctenæ, more or less extensive but superficial ulcerations, the cicatrices of which, though not complicated with cord-like fræna, will almost always remain conspicuous, on account of the white, dense, shining substance formed as a substitute for the destroyed surface of the cutaneous texture. To this degree belong the majority of burns caused by gunpowder, and the eschars of which are blackened by the materials of which it is composed.

In whatever shape a burn of this degree may at first present itself, the pains, which had subsided at the end of 24 or 48 hours, return acutely; a preliminary inflammation occurs; the eschar becomes circumscribed, loosened, and detached; and the whole soon heals, leaving a scar of a dead white colour. (See Dupuytren, *Clin. Chir.* t. i. p. 426.)

This celebrated surgeon lays it down as a principle, that, though the pain of all burns is acute, it is more intense, when only the surface of the skin is burnt than when this texture is deeply destroyed; a fact of great importance, in relation to the prognosis.

The following are the characters of a burn of the fourth degree, as described by Dupuytren. When an ignited substance is applied to the part for a considerable time, a sharp pain is the effect, but, this ceases as soon as the cause of the burn is removed. The cuticle, rete mucosum*, the whole thickness of the skin, and sometimes also a superficial layer of the subcutaneous cellular tissue, are struck by death, and converted into a deep, yellowish, or blackish, dry mass, which is not at all sensible when touched, and harder and tenser in proportion as its colour is darker. The adjoining sound skin is wrinkled and pinched up, as it were; the radiating folds around the burnt part denoting the degree of shrivelling which this has undergone. In three or four days, the pain returns, and an inflammatory circle forms around the slough, which is generally loosened between the fifteenth and twentieth days. The bottom of the ulcer corresponds to the subcutaneous cellular tissue; the suppuration is very copious; and granulations rise up with vigour.

Burns of the fifth degree only differ from the preceding, by extending to parts more deeply situated, and they are liable to be followed by extremely alarming consequences. The eschars, which comprise aponeuroses, muscles, and tendons, and in the substance of which sometimes vessels and nerves are placed, which have resisted the action of the fire, are sonorous, black, brittle, and depressed, and require a much longer time for their detachment. When they are soft, or occasioned by boiling fluids, they present a grayish, insensible mass, which sinks under the finger,

without any pain being excited. Suppuration is still more profuse, and the cicatrix, involving the muscles themselves, remains mis-shaped; and adherent, and the power of motion in the part is irremediably lost.

In Dupuytren's sixth degree of a burn, the whole thickness of the injured part is involved, and its surface is as black as charcoal, hard, sensible, sonorous when struck, and readily broken by any efforts made to bend it, and, after the detachment of the eschars, a more or less irregular stump is left. (See Dupuytren in *Clin. Chir.* t. i. p. 428.—431.)

Burns then present different appearances, according to the degree of violence with which the causes producing them have operated, and according to the kind of cause of which they are the effect. Burns which only irritate the surface of the skin are essentially different from those which destroy it; and these latter have a very different aspect from what others present, which have attacked parts more deeply situated, such as the muscles, tendons, ligaments, &c. Scalds which are the effect of heated fluids do not exactly resemble burns occasioned by the direct contact of hot metallic bodies, or a combustible substance on fire. As fluids are not capable of acquiring so high a temperature as many solids, scalds are generally less violent than burns in the injury which they produce; but, in consequence of liquids often flowing about with great rapidity, and being suddenly thrown in large quantities over the patient, scalds are frequently dangerous on account of their extent. The danger of a burn is not less proportionate to the size, than the degree and depth of the injury. A burn that is so violent as to kill parts at once, may not be in the least dangerous if not extensive; while a scald, which perhaps only reddens the skin, and raises the cuticle, may prove fatal if very large. The worst burns arise from explosions of gunpowder, or inflammable gases, from ladies' dresses catching fire, and from the boiling over of hot fluids in laboratories, manufactories, &c.

In the slighter degrees of burns, vesicles form; but when the skin is at once destroyed, no vesicles make their appearance over the eschar. In some burns, the parts are killed at the moment of the injury; in others, they first inflame, and then mortify.

The extent of mischief it is often difficult to judge of, directly after the accident, notwithstanding the characters of the various degrees of organic injury are strongly marked; for, at the same time that the heat disorganises the parts on which it acts with the greatest violence, it always affects the textures immediately below them; and though they may not be killed in the first instance, they may not be capable of bearing the subsequent inflammation, and afterwards mortify. Hence, as Dupuytren has remarked (*Clin. Chir.* t. i. p. 433.), the greater number of burns appear deeper and more extensive after the separation of the eschars than at first suspected; and the knowledge of this fact is of great importance in medical jurisprudence, with reference to burns of the third, and other severe degrees, inasmuch as the surgeon is cautioned by it not to pronounce an opinion concerning the degree of danger, until the sloughs have begun to loosen, and the extent of mischief to be settled.

In the various cases, the phenomena, peculiar to each degree, are not exclusively those which pre-

Le corps muqueux, as Dupuytren calls the rete mucosum, is regarded by Brocquet and others merely as an inorganic secretion.

sent themselves. In general, the effects of the different degrees of injury are blended together in the same burn. Thus, as Dupuytren observes, from the point, where the eschar is deepest, where it may even reach down to the bones, and involve the whole thickness of a part, it becomes gradually superficial, until at length it comprehends only the rete mucosum and cuticle.

The principal eschars are frequently surrounded by more superficial ones; and often between the disorganised parts, or in their vicinity, there are only vesicles of different sizes, and again, beyond these, or, in the interspaces between the places of deepest mischief, there may be simply erythematous redness. Lastly, in many cases, all the several degrees of burn are exemplified in the different regions of the body.

Burns, according as they are of little or considerable extent, may be regarded either as purely local affections, or as injuries productive of such constitutional disturbance as may endanger life itself. The effects on the system at large may be the immediate result of a general shock, or, (as Dupuytren terms it) irritation, caused by the action of caloric: or, they may be secondary, coming on during the stages of inflammatory reaction, suppuration, and hectic exhaustion, which often succeed one another in the progress of the case. Hence, the division of the constitutional symptoms into primary, and consecutive. (See Dupuytren, *Clin. Chir.* t. i. p. 434.)

The mere sufferings, immediately occasioned by a burn, may prove instantaneously fatal, death taking place from excessive pain; at least such is the explanation of the fact given by Dupuytren, which, however, it is rather difficult to reconcile with his subsequent observation, that, in such cases, there is congestion of nearly every organ in the great cavities, which congestion, in relation to some important organs, especially the brain, one would expect, ought to have a share in occasioning the patient's death. Be this as it may, he found that the sudden fatality of burns was chiefly exemplified in children and nervous females, more rarely in adults, and still less frequently in old persons.

Supposing death, however, not to be produced thus suddenly, then excessive agitation, restlessness, spasms, convulsions, and intense fever sometimes ensue; while, in other instances, the patients sink into a state of stupor and prostration, the pulse being small and rapid; the skin cold and pale in parts of the body not touched by the fire; respiration slow; the limbs motionless and abandoned to their own weight; and questions unanswered, or replied to reluctantly and imperfectly. This kind of collapse may soon terminate either in death, or in a general reaction.

If the burn is superficial, and does not exceed the second degree; if it is of moderate extent; and especially if the constitution is peculiarly irritable, the formidable symptoms above specified are not evoked, but a general reaction takes place, similar to what happens in erysipelas. The pulse becomes frequent and strong, the skin hot, the tongue dry and red, denoting irritation of the digestive organs, and there is thirst, nausea, or vomiting, loss of appetite, &c. In numerous cases of deep burns, amounting to the third and fourth degrees, no remarkable symptom occurs in the interval between the period of the accident and the time, when the process for the detachment of

the eschars commences. But at this crisis, which is usually about the fourth day, the inflammation excites pain, which is very acute when the burn happens to be in parts where the cutis is largely supplied with bloodvessels and nerves. When extensive surfaces are injured, all the above-mentioned symptoms of nervous and gastric irritation, which take place in a burn of the second degree, may present themselves, but in a far more intense form, and sometimes with such severity, that they quickly prove fatal. (See Dupuytren, in *Clin. Chir.* t. i. p. 434—436.)

It has long been observed, that persons, who die of severe burns, experience a remarkable difficulty of breathing, and oppression of the lungs. The common explanation of this fact was, that, as these organs and the skin are both concerned in separating a large quantity of water from the circulation, their participating in this function would account for respiration being often much affected, when a large extent of skin is burnt. However, the kidneys perform the same office, and they are not particularly affected in burnt patients; so that the asthmatic symptoms, frequently noticed in cases of burns, are probably owing to some other cause. Dupuytren attributes them in the first instance to the impression made on the organs of the circulation and respiration, and then to the secondary development of intense bronchial irritation, or considerable pulmonary congestion.

If the patients have surmounted all the foregoing perils, others still await them; for, as Dupuytren observes, whenever burns are deep and extensive, and consequently leave, after the separation of the sloughs, ulcers of great size, the copiousness and long continuance of the suppuration frequently exhaust the strength, and by degrees bring on great emaciation. In burns, this stage of suppuration and exhaustion is characterised by the same symptoms, as accompany the latter stages of all chronic diseases.

Amongst the severe complications of burns, Dupuytren enumerates erysipelas, particularly phlegmonous erysipelas, which, if not checked, leads to gangrene of the cellular tissue, the production of large abscesses and sinuses, an extensively undermined state of the integuments, and excessively profuse suppuration; circumstances, in which the amputation of the limb, now the only means of preserving life, offers but a doubtful chance of success.

According to the doctrines of Dupuytren, there are then four different periods or stages, in which the patient's life may be successively endangered in cases of severe burns:—

1. The stage of irritation, or, as I should say, the period of the first shock on the system.
2. The stage of inflammation.
3. The stage of suppuration.
4. The stage of exhaustion, or hectic. (See *Clin. Chir.* t. i. p. 438, 439.)

The post mortem examinations of burnt patients, instituted by Dupuytren, tend to prove that, when the sufferer perishes in the flames, or a few instants after having been extricated from them, traces of excessive congestion are observable in the digestive tube, although there has not been sufficient time for inflammation to commence. Not only does the mucous membrane exhibit bright red patches of greater or less size—not only is it gorged with blood, but the cavity of the intestines contains a

certain quantity of this fluid, which has passed into it by exhalation. The brain is largely injected with blood, and the serosity in its ventricles of a reddish tint, which is likewise frequently noticed in the serous fluid of the pericardium, pleura, and peritoneum. The mucous secretion of the bronchi is also bloody; and their investing membrane, at various points, of a bright red colour, and streaked with highly injected capillary vessels. It seems, in such cases, as if the blood, suddenly driven from the skin, made an effort to escape through all the pores of internal surfaces. (*Clin. Chir.* t. i. p. 440.) A boy, about fifteen years old, died in the North London Hospital in the winter of 1835-36, a few hours after the receipt of an extensive and deep burn. I took the opportunity of having the body carefully examined, in the expectation of finding the congestions of the mucous surfaces, and the bloody serosity in the ventricles of the brain, the chest, &c. specified by Dupuytren; but these effects were much less conspicuous than the observations of this distinguished surgeon led me and others to anticipate.

According to Dupuytren when patients die between the third and eighth days after the accident, or in the second stage, in consequence of the violence of the inflammatory action all the signs of gastro-enteritis will be found strongly marked, and ordinarily accompanied by inflammatory affections of the brain and lungs.

Lastly, if the patient has not sunk till a later period, or the stage of suppuration and exhaustion, the viscera, especially the intestines, are found much altered by the previous long-existing inflammation; the mucous coat is studded with patches of redness, and ulceration, and the mesenteric glands are generally enlarged. (Also *Andral, Anat. Pathol.* t. ii. p. 223.)

In a child, three years old, who died in November, 1836, under my care in the North London Hospital, about a month after her admission with several extensive burns of the fourth and fifth degrees, the *post mortem* examination revealed inflammation of the mucous membrane of the bowels in various places, and deposits of pus in the lungs.

The prognosis in burns is to be deduced from their extent, depth, and situation; the nature of the cause which has occasioned them; and the age and constitution of the patient. Strong, sanguineous, young subjects are more exposed than others to such bad symptoms as may originate from excessive inflammation. (*Dupuytren, Clin. Chir.* t. i. p. 442.) Burns of the head and trunk are more perilous than those of the limbs. Vesicles, redness, and burns of the third degree leave behind either no traces of them, or none which are very conspicuous. But burns of the fourth degree, which involve the whole thickness of the skin, if not properly treated, will give rise to deformed cicatrices, and disadvantageous adhesions, especially when the eyelids, face, neck, hands, or feet, are amongst the injured parts. The reason of this is correctly ascribed by Dupuytren to the tendency of all ulcers in the integuments, and more particularly of such as result from burns, to contract, and diminish by the approximation of their margins to the central point. Thus, the fingers may be drawn towards the back of the carpus and confounded with it; the whole hand fixed against the forearm; the radio-carpal articulation dislocated (see *Crucilhier, Anat. Pathol. Livr.* ix.); the foot variously

twisted and constituting only a shapeless mass; the head forcibly drawn to the shoulders; the nape of the neck adherent to the back; the chin to the sternum; the ears to the adjacent portion of the scalp, &c.

In a burn of the fifth-degree, the destruction of tendons and muscles deprives the limb of the power of executing its functions; the thickness of the disorganised tissues is followed by so copious a suppuration, that the patient is in danger of falling a victim to debility; and the exposure of the bones creates a risk of necrosis. A burn of this description may open the synovial membranes, and excite inflammation in them; and if the joint implicated be of considerable size, the most favourable issue can only be looked for in ankylosis or amputation. (See *Dupuytren, Clin. Chir.* t. i. p. 443, 444.)

In the limbs, a burn of the sixth degree renders amputation indispensable.

A burn of the first degree, if very extensive, often proves fatal immediately, or in a few hours after the accident. But, after 24 or 48 hours, resolution begins, and the danger is over. The same observations apply to a burn of the second degree; but it is attended with a greater chance of inflammation of internal organs, the tendency to which continues also for a longer time. In burns of the third degree, the patients are exposed not only to all the dangers accompanying burns of the two first degrees, but to others arising during the inflammation preliminary to the loosening of the eschars: first, to speedy death from the irritation, or shock on the system; to an immediate attack of gastro-enteritis; or of tetanus, spasms, and convulsions; or, in a later stage, to the same consequences. When such a burn is so extensive, as to affect two or three square feet of the skin, it generally proves fatal in the stage of detachment of the eschars, or that of suppuration. In a burn of the fourth degree, and above it, the pain and irritation only continue while the cause is operating; but the patients may perish immediately. If they yet live, sometimes they are plunged in a complete stupor; are seized with an icy coldness, and die in a few hours; while, in other instances, the system rallies, but the patients are cut off by the inflammatory reaction between the fifth and ninth day. Lastly, sometimes they are worn out and destroyed by the profuseness of the suppuration, the length of the disease, or an attack of hospital gangrene, or fever of bad type. Burns of the fifth degree, even though not very extensive, are unavoidably productive of considerable danger, on account of the inflammatory reaction, or febrile disturbance, which must ensue; and the danger is often very much augmented, by almost all the degrees of burns, which are usually noticed in the neighbourhood of a burn of the fifth degree.

Burns, implicating the conjunctiva, may cause ophthalmia and opacity of the cornea; or, if their effects reach more deeply, they may occasion a total disorganisation of the eye. (See *Op. et. Vol.* cit. p. 447—450.)

TREATMENT OF BURNS.

In all ages burns have been objects of empiricism. Sovereign and specific remedies for them have been tried and lauded one after another in endless succession, each falling into oblivion to be succeeded by others of the same temporary and

undeserved reputation. It seems as if nothing would ever open the eyes of those, who search after infallible remedies for these peculiar injuries. The fact, that a burn presents itself in very different states and degrees, and that it is generally a complicated kind of injury; ought at once to render it plain to the most common understanding, that the various conditions and complications of burns must necessarily require great diversity in the treatment; which, as Dupuytren has explained, should be founded upon the following indications:—1. That of keeping down inflammation; and, in the two first degrees of a burn, assuaging pain and irritation, and preventing the extension of effects to internal organs. 2. That of keeping within proper bounds the secondary inflammation, attending the separation of eschars, and the establishment of suppuration. 3. That of promoting the healing of the ulcers. 4. That of resisting the formation of fræna and adhesions, which would interfere with the motions of parts, or even completely destroy their functions. 5. That of relieving the primary constitutional symptoms, and also such consecutive ones as may occur. (See *Clin. Chir.* t. i. p. 483.)

In burns of the first degree, and in those of the second, unaccompanied by detachment of the cuticle, Dupuytren thought that every effort should be made to avert inflammation, and prevent the formation of vesicles or eschars. (See *Clin. Chir.* t. i. p. 484.) This doctrine, which I may say is the commonly received one of the present day, does not agree with the view which was adopted half a century ago by Mr. B. Bell, who did not approve of trying to prevent the formation of vesicles, since he always remarked, that there was less pain when these made their appearance, than when they were hindered from rising by the influence of cold, or astringent applications. All applications, possessing slightly astringent sedative qualities, seem adapted to the fulfilment of this first indication. The part may be dipped in the diluted liquor plumbi acetatis, with a small quantity of alcohol or vinegar in it, or in ice-water, and kept for some time immersed. The late Sir James Earle was a zealous advocate for the use of cold water, or rather ice; but the method is one of great antiquity. "Cold is a remedy which has long been employed to diminish the inflammation of superficial burns. Rhazes directs, that in recent burns, cloths dipt in cold water, or in rose-water, cooled with snow, be applied as soon as possible to the parts which have been injured, and that these cloths be renewed from time to time; and Avicenna says, that this practice often prevents the formation of blisters." (*Lectures on Inflammation*, p. 589.) Sir James Earle's publication, however, had the good effect of drawing considerable attention to the subject, and of leading surgeons to try the method in a great number of instances, in which other more hurtful modes of treatment might otherwise have been employed. The burnt parts may either be plunged in cold water, or they may be covered with linen dipped in the same, and renewed as often as it acquires warmth from the part. The application should be continued as long as the heat and pain remain, which they will often do for many hours. (See *Essay on the Means of lessening the Effects of Fire on the Human Body*, 8vo. Lond. 1803.)

Some caution, however, in the application of

cold becomes necessary, when a scald is of very large size, or situated upon the trunk of the body. In extensive burns, superficial as they may be, the patient is liable to be affected with cold shiverings; and these shiverings may be greatly aggravated by exposure, and by the application of cold. No doubt, therefore, in these examples, warm applications ought to be preferred. (*Dr. J. Thomson's Lectures on Inflammation*, p. 591.)

With respect to the topical applications recommended by this gentleman, he generally prefers, in cases of superficial burns, cooling and refrigerant remedies. When there are vesications, and suppuration takes place without ulceration, he advises us, after refrigerants have ceased to produce beneficial effects, to use the linimentum aquæ calciæ. However, where the progress of cicatrisation is slow, he recommends, instead of this liniment, ointments containing lead or zinc, particularly the ceratum calaminæ.

When immersion is impracticable, linen, wetted with the above-mentioned applications, may be laid over the burnt parts, and frequently renewed; or, if the cuticle is unbroken, a solution of the sulphate of iron, or of subcarbonate of potassa, or ammonia, will produce very good effects. Dupuytren considered it always of importance to preserve the cuticle over a burn in an unbroken state; and, with this view, he particularly recommends the clothes over the injured part to be taken off with slowness and caution.

When vesications form, some surgeons are in favour of opening them immediately; while others assert that they should not be meddled with. Mr. B. Bell disapproved of opening them till the pain arising from the burn had entirely ceased. Then he thought that they should always be punctured; because when the serum remained a long while upon the subjacent skin, he found it likely to bring on ulceration. He was certainly right in expressing a preference to small punctures; a practice which has the sanction of Dupuytren, who observes, that only a single prick of the vesicle with a needle, or the point of a lancet, should be made in its most depending part.

On the subject of opening vesications in burns, Dr. Thomson believes, that the diversity of opinion arises from the different effects resulting from the particular manner in which the opening is made. "If a portion of the cuticle be removed, so as to permit the air to come into contact with the inflamed surface of the cutis, pain, and a considerable degree of general irritation, will necessarily be induced; but if the vesications be opened cautiously with the point of a needle, so as to allow the serum to drain off slowly, without, at the same time, allowing the air to enter between the cuticle and cutis, the early opening of the vesications will not only not occasion pain, but will give considerable relief, by diminishing the state of tension with which the vesications are almost always, in a greater or less degree, accompanied. When opened in this manner, the vesications frequently fill again with serum; but the punctures may be repeated as often as is necessary, without any hazard of aggravating the inflammation. Great care should be taken, in every instance, to preserve the raised portion of cuticle as entire as possible," &c. (See *Lectures on Inflammation*, p. 595.)

When there is much irritation and fever, blood-letting, and such remedies as the particular sym-

ptoms demand, must be advised. On account of the pulse being frequently small, quick, and vibratory, bleeding is at present not often employed. As Dr. Thomson remarks, however, it may become necessary in patients of a strong robust constitution, in whom the symptomatic fever assumes an inflammatory type. He has often seen a single bleeding procure great relief in these cases; and he does not remember a case, where bleeding was followed by injurious effects. (P. 594.)

In burns, if the subject was young, vigorous, and full of blood, Dupuytren advocated local and general bleeding as contributing powerfully to tranquillise the system, and keep down inflammation. He also restricted the patient to low diet in proportion to the severity of the injury.

When the pain and irritation are considerable, Dupuytren, like the generality of surgeons, prescribed opium internally, and with this he combined soothing anodyne applications. The stupor, with which a patient so situated is frequently seized, is sometimes alleged to receive more relief from opium than any thing else.

If, notwithstanding every care, inflammation come on, it is to be moderated, and prevented from invading the uninjured textures, and from attaining a degree in which it may either terminate in gangrene, or produce formidable sympathetic effects on internal organs. According to Dupuytren, therefore, now is the period for having recourse to emollient fomentations and poultices, and to local and general bleeding. If the pain be severe, anodynes should also be prescribed.

The same indications seems to Dupuytren to present itself also in burns of the third and fourth degrees, when the inflammatory process for the detachment of the eschars commences. If the inflammation be too violent, it is to be checked; if the process of separation be languid, it is to be roused. But Dupuytren cautions surgeons never to forget, that, in this case, the employment of too powerfully stimulating applications, or the continuance of them too long, often brings on erysipelas which, originating at the edges of the wound, may invade an extensive portion of the surface of the body, and even prove fatal. Dupuytren affirms, that he generally succeeded in stopping the progress of this kind of erysipelas by laying a blister over the surface attacked. (See *Clin. Chir.* t. i. p. 487.)

But, in the foregoing stage of a burn, other things were insisted upon by this eminent surgeon. One was to cover the burn with fine soft linen, with many holes cut in it, and spread with the saturnine cerate, over which linen was laid a thin stratum of dry charpie for the purpose of absorbing the pus. The detachment of eschars he promoted with emollient poultices; and when they were completely loose, with the exception of a few filaments at the bottom of the ulcer, these he divided with a pair of scissors as closely as possible to the eschars. Sometimes, when the eschar is deep, as in burns of the fourth and fifth degrees, pus collects under it, and its presence is denoted by fluctuation. In this circumstance, Dupuytren recommended incisions to be promptly made, to hinder the matter from extending into the adjacent cellular tissue. When, after the detachment of superficial eschars, or the separation of the cuticle constituting vesications, the exposed cutis was very painful,

a cerate containing opium, or dressings wetted with an aqueous solution of the extract of opium, was the application to which Dupuytren gave the preference. (See *Clin. Chir.* t. i. p. 487.)

Another maxim, enjoined by Dupuytren, and which I consider one of the most important in relation to the treatment of burns, is that of changing the dressings quickly, so that the parts may be exposed to the air for as short a time as possible, and with the utmost tenderness. Hence, he used to uncover only a part of the ulcer at a time, and then dress it, before the other dressings were taken off. For this same reason, he considered the separate pieces of Scultetus's bandage more advantageous than a roller.

In extensive burns, and particularly those of the fourth and fifth degrees, the suppuration is generally so profuse, that Dupuytren deemed it necessary to change the dressings two, or even three times a day. But as patients thus circumstanced soon became dangerously reduced and debilitated, Dupuytren used to allow them a nutritious diet, and tonic medicines, especially quinine. The plan of dressing burns, two or three times a day, appears to me rarely advisable; and I do not remember to have seen a single example, in which this frequent exposure and irritation of a burn would have been likely to have proved beneficial. The advice of Dupuytren on this point, I deem one of the few objectionable things in the view which he takes of the treatment of burns. In fact, some of the most approved methods of treating burns are founded upon the opposite principles of exposing injured parts as little as possible to the air, and of letting the applications remain a good while unchanged. The plans here alluded to, however, repress suppuration very considerably, and the discharge is less than in Dupuytren's treatment.

In the ulcerating state of suppurating burns, Dr. Thomson prefers emollient cataplasms. But, when the discharge continues, or becomes more profuse under the use of poultices, they are to be left off, and astringent washes employed, such as lime-water, the compound decoction of oak bark, a weak solution of sulphate of copper, &c.

Where the parts are destroyed and converted into sloughs, Dr. Thomson does not think it matters much whether vinegar, oily liniments, turpentine, spirits of wine, or emollient poultices be at first employed. He acknowledges, however, that the poultice is the remedy under the application of which the separation of the dead parts is most easily and agreeably accomplished. "The question," says he, "at present most deserving the attention of medical practitioners, with regard to the use of the warm emollient poultice in burns, is, whether we should apply it immediately after the burn has been received, or interpose for some hours, as has been so strongly recommended, dressings with vinegar, spirits of wine, or oil of turpentine. My own experience has not been sufficient to enable me to determine this point to my entire satisfaction. Yet I think it right to state to you, that, in a number of trials made at different times, I have had occasion to see burns, to which common emollient poultices had been from the first applied, slough and granulate faster, and, in a more kindly manner, than similar burns in the same persons, to which in some instances the Carron oil. (lin. aq. calcis), and in others again oil of tur-

pentine, were applied at the same time with the poultices." (See *Lectures on Inflammation*, p. 609.)

In burns, attended with a more or less considerable destruction of textures, the cicatrices which follow are frequently deformed, and sometimes interfere seriously with the free motion of the parts on which they are situated, or even totally prevent the execution of some function. The plan, recommended by Dupuytren for the hinderance of these ill consequences, is to take care that the cicatrix may be of nearly the same extent as the destroyed skin, and that it may not heal by the approximation of its margins to one another. The end may almost always be fulfilled by carefully applying the nitrate of silver to the granulations which are too high; by placing the limb in a proper position; and employing suitable dressings and splints. Thus, if the burn be situated over the flexor muscles, the limb should be kept extended; if over the extensor muscles, bent. Tents, tubes, or pieces of sponge, are to be kept in natural openings, which the healing process may tend to contract or close. Parts, like the fingers, which are disposed to grow together, are to be kept apart with lint or plaster. In the face, where the parts are so moveable and extensible, more or less deformity cannot always be prevented; but the best way of counteracting the tendency to it seemed to Dupuytren to consist in drawing the margins of the ulcer away from one another with straps of adhesive plaster, and other means which circumstances will admit of. But, whenever the attempts to obtain a good cicatrix cause a dangerous degree of suffering, they should be abandoned. (See *Clin. Chir.* t. i. p. 489.)

When the whole thickness of a limb is destroyed, amputation is proper, as substituting a simple wound, the cure of which will be easy, for an eschar, or disorganised mass, the separation of which would be tedious, and followed by an irregular solution of continuity, and a projection of the bone, and other deep textures to which the action of the concentrated heat had least extended. Besides, as Dupuytren justly observes, the operation preserves the patient from the secondary inflammation which would otherwise take place, and not be free from peril. At the same time, before making a decision, the surgeon is to consider the age, constitution, and strength of the patient, and whether he is in a state to bear the process by which the dead parts are to be thrown off. If he were in a condition of stupor, or inflammation had already come on, with fever, &c. the subsidence of these effects, and the establishment of suppuration, must be awaited; after which, a decision for or against amputation should be made, according to the general state of the patient, or that of the ulcerated surface. (See *Dupuytren, Clin. Chir.* t. i. p. 490.)

With regard to constitutional treatment, all surgeons agree with Dupuytren, that when a burn is slight, superficial, of limited extent, and unattended with any disturbance of the economy, it requires no internal treatment. But, although superficial, if it cover a large surface, the patient should be at first restricted to low diet, take cooling diluent beverages, and be kept in a quiet cool room; remote from every thing likely to disturb his mind or body. Dupuytren recommends the same plan to be followed in cases of deep burns. Acute pain is to be assuaged by means

of large doses of opium; and fever and inflammatory symptoms are to be repressed by bleeding, especially in strong plethoric subjects; but, when the large size and the depth of the eschars justify the apprehension of the suppuration being extremely abundant, bleeding should be less insisted upon, because the loss of blood would render the patient incapable of bearing the suppuration, and likely to die of exhaustion. In such cases, Dupuytren confined his means for keeping down inflammation to diluents, low diet, and repose.

Suppuration having taken place, and the fever subsided, Dupuytren then ventured to allow his patients a small quantity of nourishing food. When the suppuration became very profuse, and lasted a considerable time, so as to threaten the patient with a dangerous degree of debility, he used to prescribe steel medicines and bark. When hectic symptoms and diarrhoea came on, he gave the patient, three or four times a day, a pill composed of half a grain of the extract of opium, and one grain of sulphate of zinc. When inflammation invaded any of the viscera, this affection was resisted by appropriate means. (See *Clin. Chir.* t. i. p. 492.)

Dupuytren made some particularly interesting observations on the cicatrization of burns. In the first degree of a burn, there is, as already stated, no solution of continuity, and consequently no process like cicatrization. The cure is by resolution. But, in the second degree, the cuticle being detached from the rete mucosum, it must fall off, and will require to be replaced. Here, the reparation, as Dupuytren explains, is affected in three ways, viz. without suppuration, with a slight suppuration of short continuance, or with a long and copious suppuration. In many instances, when the cuticle forming the vesicle is not removed, but remains applied to the rete mucosum, after the discharge of the serosity, no suppuration whatever takes place. A new cuticle is produced immediately under the old one, with various quickness, sometimes in 24 hours, sometimes in two, three, four, five days, or even later. No vestiges of the burn are then left, but a more or less conspicuous redness, which disappears between the twelfth and thirtieth days, the skin resuming its natural colour. If the action of caloric has been more intense, or the cuticle has been removed, and the rete, mucosum exposed, the surface of the skin will be attacked by inflammation, more or less acute. In some of these cases, after the discharge of serous fluid for a few days, an inconsiderable and short suppuration occurs, without any remarkable alteration of the rete mucosum. Here the result is nearly the same as that of the foregoing example; the suppurating surface drying up, and becoming covered with a delicate pellicle, the rudiment of the new cuticle, and all traces of the injury being obliterated. But, in many other instances, a profuse suppuration comes on, which, under neglect, or even sometimes under the most skilful treatment, continues a long while, and even occasionally for months. Under these circumstances, either the rete mucosum is completely destroyed, or the organisation connected with it deeply impaired; while, in other examples, it is destroyed at some points, but saved, though altered at others. In the first case, the injury has reached to the cutis; the burn has attained the third degree, and the progress of cicatrization is the same as what will

be presently explained as taking place in the latter. In the second case, the colouring matter usually becomes much deeper than in the natural state. Hence, those yellow, tawny, or brown stains, exhibited by the scars after the cure; stains, which are never effaced, and in which time scarcely ever causes any perceptible modification; and in the negro, the skin becomes even blacker than in the natural state. Lastly, in the third case, the surface of the cutis granulates unequally at every point where the rete mucosum has been completely destroyed. The granulations are sometimes very exuberant, and hence irregular prominences, which continue under the new cuticle, and form more or less numerous columns, crossing one another in different directions. The cicatrix then exhibits an odd appearance; for the rete mucosum not being reproduced, or reproduced but very imperfectly, over the points where it has been destroyed, the columns or projections, resulting from such injury, are of a white colour; while the points of the skin, corresponding to those, where the rete mucosum has been merely changed, are of a brownish tint.*

The foregoing views seem to Dupuytren to suggest certain principles in practice; viz. to keep down any inflammation, likely to rise above the ordinary degree, by all suitable means, emollients, discutients and even bleeding, if necessary; to refrain from employing irritating topical applications; to avoid removing the cuticle; to hinder suppuration from coming on; or, if it has taken place, to endeavour to stop it as quickly as possible. But if suppuration has already continued a good while, cannot be checked, and the rete mucosum is deeply altered, or destroyed, then Dupuytren is an advocate for destroying and levelling the granulations with frequent touches of the nitrate of silver, and for dressing the ulcer with fine linen spread with cerate, and having many apertures cut in it. Such astringents as are calculated to accelerate cicatrisation are also to be applied, and even sheet lead which, by its equable pressure, may be of considerable service. In this manner, Dupuytren found that a smooth flat cicatrix would be obtained, free from deformity. But all means commonly prove ineffectual for the dispersion of the diversified stains, of a tawny, yellow, or brown colour, occasioned by the alteration of the undestroyed rete mucosum, or rather of the minute glands, which secrete it and the colouring matter. (See Dupuytren, *Clin. Chir.* t. ii. p. 5 — 12.)

As already mentioned, the third degree of a burn is characterised by the total destruction of the cuticle and rete mucosum, and by a considerable but not complete destruction of the whole thickness of the cutis. Hence, in this case, there is no reproduction of a complete cutaneous texture, as in a burn of the fourth degree. A layer of skin is yet left, and it is from it that other new and more superficial layers are derived. After the detachment of the eschar, comprising the rete mucosum, and a portion of the thickness of the skin, numerous small red points present them-

selves on the surface of the ulcer, which exhibits a whitish ground. According to Dupuytren, this is nothing more than the undestroyed portion of the cutis, which soon becomes entirely concealed by the increasing number of red points, and then the ulcer is of one uniform redness. These red points or granulations, by their progressive development, gradually fill up the chasm left by the separation of the eschar.

It is another remark made by Dupuytren, that however instantaneous the action of the caloric may be, it never extends its effects to precisely the same depth at every point. This is a fact, exemplified in every kind of burn. In burns of the third degree, in some places the rete mucosum alone is destroyed, and the cutis is but very slightly injured; whilst, in other situations, this is more deeply involved, without, however, being completely burnt through. This irregularity in the depth of the injury refers to the inequalities, so often noticed in the granulations, and terminating where cicatrisation is left to itself, in an uneven rugged scar.

In cases of the third degree, Dupuytren considers all those therapeutic means proper which have been specified or called for by burns of the second degree. If the inflammation is too intense, or the suppuration so copious and protracted, as to threaten a complete destruction of the cutis, they are to be diminished. Cicatrisation is to be quickened by appropriate means. Adhesions of parts to one another, and the obliteration of natural openings, are to be prevented by expedients, which will be presently described.

For the correction of the exuberance and irregularity of the granulations, Dupuytren recommends the nitrate of silver to be frequently employed. He also preferred dressings which prevented the pus from lying long upon the ulcer. Hence his custom of covering the whole surface with fine old linen spread with cerate, and full of numerous apertures; of putting over this a layer of dry charpie, and of covering the whole, not with a common roller, but with separate pieces of bandage. Thus the pus, which passed through the perforated linen, was absorbed by the charpie, and, if it was very profuse, it made its escape in the interspaces of the pieces of the bandage.

After a more or less prolonged suppuration, the cellular and vascular granulations are described by Dupuytren as gradually assuming a firmer consistence, and more fibrous character; and the cuticle is deposited over them, which is at first exceedingly fine, and under which the rete mucosum is organised, of a bright red colour, irritable, prone to congestion, and often the seat of erysipelas. The existence of the rete mucosum, though in an imperfect state, and, in most cases, destitute of its colouring matter, was considered by Dupuytren an indisputable fact. Thus, according to his researches, the cicatrix of a burn of this degree is white in the negro, and whiter in the European, than the common skin. In some cases, however, he believed that the pigmentum was entirely or partly reproduced, and imparted to the skin a more or less dark colour. The rete mucosum, when entirely a new formation, seemed to Dupuytren always to be imperfect, and never to resume its original colour: hence irremediable disfigurement.

In the fourth degree of a burn, the whole thickness of the skin is burnt through and destroyed;

* If Breschet's views of the structure of the skin be correct, then, instead of referring these differences to the injured, uninjured, or destroyed state of the rete mucosum itself, we must ascribe them to the accidental condition of the minute glands, which are described by Breschet, as the sources of it, and to the state of the colouring apparatus.

but the subcutaneous cellular tissue, though exposed, is either not all, or but slightly injured. In this case, according to Dupuytren's investigations, cicatrisation takes place in several ways.

1. After the detachment of the eschar, the edges of the ulcer insensibly approach one another, and unite. 2. Or else the edges of the ulcer being retained in their respective situations, a new cutis is produced from the subcutaneous cellular tissue. 3. Or, lastly, both these processes are combined.

After the detachment of the eschar, the bottom of the ulcer is described by Dupuytren as formed by the cellular tissue; its margins exhibit a red circle, which is the rete mucosum, and under it, more deeply, a white circle, which is the cutis. The surface of the ulcer is reddish and granular: it diminishes from day to day; its swollen edges subside and approach one another; the surrounding skin yields, and is more or less displaced and dragged, according to the extent of the chasm. If this extent is too considerable, then, after the skin has yielded as far as possible, a new texture is produced, which serves as a substitute for those which are destroyed. On the contrary, if the edges of the ulcer can be made to meet, their union is accomplished after a suppuration of longer or shorter duration. Dupuytren further states, that this is what happens when the skin is not able to yield, or extend itself, and the parts are put into a position which allows the sides of the ulcer to be brought into contact. But if the approximation of the margins of the ulcer to one another is prevented, either by the unyielding nature of the parts, or by the interference of the surgeon, then a new tissue is generated, which is endowed with very peculiar properties. (*Clin. Chir.* t. ii. p. 17—19.)—This tissue, which is alleged by Dupuytren to be fibro-cellular, constitutes the cutis. As soon as it is formed, the new integuments are promptly completed; a rete mucosum, very imperfect indeed, and destitute of colouring matter, covers the cutis and is itself quickly covered by cuticle, the qualities of which differ but little from those of the original

Dupuytren concurs with Hunter in representing the formation of a new skin as a difficult task for nature, and this texture is always organised slowly, when the ulcer is of considerable extent; but when this has been accomplished, cicatrisation is soon completed. Thus it is surprising to see an ulcer, which has continued for months without any particular change, all on a sudden heal up in a few days. (*See Clin. Chir.* t. ii. p. 25.)

Dupuytren enters into some very interesting reflections on the surgical plans which are to be adopted, in order to make the cicatrix correspond as accurately as possible to the destroyed textures. The first is, *position of the limb or part*. Here the general maxim is to let the position of the part be diametrically the reverse of what would promote the cure, by bringing the edges of the ulcer towards one another. The desideratum is to obtain a cicatrix, whose extent should be equal to that of the destroyed skin, and even somewhat greater, on account of the contractile property of the new texture. Thus, if the burn is on the front of the elbow, the arm is to be kept forcibly extended, until the substance of the cicatrix has been formed. The same plan is applicable to burns of the anterior part of the fingers, hand and wrist, groin, sole of

the foot, ham, &c. Supposing the burn to be on the back of the neck, the chin is to be kept approximated to the chest; but, on the contrary, if the burn is on the forepart or side of the trunk, the opposite position is to be maintained. If the burn is on the front of the knee, or back of the elbow, the leg, or forearm, should be kept half bent, or, what is still better, in a state of complete and forced extension. When the armpit is burnt, the arm should be kept in the position of abduction; but, in that of adduction, when the top of the shoulder is the seat of the burn. (*See Clin. Chir.* t. ii. p. 27.)

Dupuytren notices some circumstances, however, under which it is difficult, or impossible, for the foregoing principle to be acted upon in practice. Such is the case where the skin all round the member has been destroyed to some extent: by adopting one position, the advantages of another would be lost. Here Dupuytren advises a position to be selected which will leave a cicatrix that will interfere least with the free movements of the part. Thus, if the burn occupies the whole surface of the radio-carpal articulation, it is better to keep the wrist extended than bent, because the cicatrix, which would confine the joint in the first posture, would be less inconvenient than one which would fix it in the second. In some of these perplexing cases, Dupuytren considers it advantageous to adopt different positions alternately, and to hasten cicatrisation on one side, and retard it on the other. (*See Clin. Chir.* t. ii. p. 29.)

Mr. Earle is of opinion that, by due attention to certain principles, the deformities from burns may generally be avoided. "I am quite ready to admit (he observes), that it is not in our power to arrest the law of nature, by which a cicatrised surface becomes smaller, and occupies less space, than the original wound; but it is in our power, in most cases, to direct and modify that which we cannot wholly prevent; and thus, at all events, to counteract its injurious effect. We cannot prevent the process of absorption (of the granulations), but we can prevent its taking place in a direction which may interfere with the healthy functions of the part. To take the upper extremity as an example. I will suppose a case, where the whole integuments on the inner and front part of the arm and forearm have been destroyed. If such extremity be kept carefully extended on a splint, not only during the whole progress of healing, but long subsequent to the perfect cicatrisation, you will find that the cicatrised surface will diminish in a circular direction, drawing the healthy integument together from side to side; but, that no contraction will take place in the long axis, in which alone it can impede the due motions of the limb. This permanent extension should be persevered in during the day and night, until all changes have ceased, and the cicatrix has contracted to its smallest dimensions. Care, however, should be taken, during this time, to give passive motion to the different joints, by which the proper secretion of synovia will be kept up, and the eventual free use of the limb will be insured. This plan of maintaining the limb in state of permanent extension should be commenced as soon as the wound has begun to granulate." (*See Earle's Lect. on Burns*, p. 43.)

Cases are noticed by Dupuytren, in which the plans calculated to produce a good cicatrix cannot

be persevered in without danger; as, where the patient is likely to be exhausted by the long and profuse discharge. Here, instead of retarding the formation of the cicatrix, and compelling nature to fill up the chasm with a new texture, it is necessary to expedite it by favouring the approximation of the edges of the ulcer to one another, promoting the development of the tissues of union, or exciting inflammation when it is languid, and repressing it when it is too violent. But, in such cases, it is prudent to follow Dupuytren's advice in apprising the patient, or his friends, of the necessity for this plan, and of the deformity which will unavoidably follow it.

There are also certain regions of the body, specified by Dupuytren, where no advantage can be derived from position, and where it is exceedingly difficult to prevent deformity. Such, in particular, is the face. Thus, if a burn of the fourth degree were to destroy a portion of the lower eyelid and cheek, it would be impossible to hinder the edges of the ulcer from getting nearer together, and the eyelid would be drawn down until it almost formed a junction with the upper lip. If a similar burn were to occur on the forehead, temples, upper eyelid, or scalp, an analogous deformity would be the result. Feeble as the means are which are within the surgeon's reach, when position is unavailing, they should never be neglected. Here, as Dupuytren explains, it is proper, 1. To retard, as much as possible, the detachment of the eschar, which, so long as it remains, has the effect of keeping the edges of the ulcer apart. The healing processes commence under it, and the margins of the chasm, becoming more fixed to the subjacent textures by inflammation, are less disposed to be drawn towards one another when the separation of the eschar does take place. 2. As soon as the latter event has occurred, cicatrization is to be quickened, by frequently touching the ulcer with the nitrate of silver. Care is also to be taken to prevent any cicatrizing points in the centre, or at the circumference of the ulcer, from being destroyed, by the pus being suffered to continue too long in contact with them. Hence, Dupuytren was an advocate for frequently washing the part, and renewing the dressings.

Position, by means of which a good cicatrix has been obtained, is recommended by Dupuytren to be continued a month, six weeks, or even longer, after the cure.

It is not only necessary to place the parts in the desirable position, but also to maintain it by means of a bandage, or apparatus. Thus, when the burn is situated on the anterior, posterior, or lateral part of the neck, the head is to be kept inclined in one direction or another, with straps or bands, fastened to a bandage on the body. When the burn is on some part of the wrist, Dupuytren used to put along the forearm on the side furthest from the injury, a pad of a certain thickness which descended to the joint without going beyond it. Over this he laid a splint of sufficient length to reach to the ends of the fingers, and then, availing himself of the vacancy between the hand and the splint, he kept the former inclined towards the latter with a few additional turns of the roller employed to fix the pad.

When the burn involved the palm of the hand, or passed between the fingers, Dupuytren used to place the pad along the back of the forearm, car-

pus, and metacarpus, and then a splint terminating below in a hand board, and long enough to cover the whole hand, even when the fingers were extended, and widely separated from one another. The hand board, at the points corresponding to the extremities of the fingers, had ten slits in it, intended for the reception of the ends of five pieces of tape, which formed so many nooses for the confinement of the fingers. Or the hand board, instead of having fissures, was adapted to the shape of the hand, and furnished with prolongations for the fingers.

In burns of the second and third degrees, Dupuytren found, that adhesion of contiguous parts might be prevented by keeping them apart by the interposition of some extraneous body, moving them about, and passing a probe between them at every time of dressing them; but that, when the burn was of the fourth degree, these means were not effectual. Thus he found it not enough to maintain the fingers separated and extended, but that it was essential to make more or less pressure directly on the point where the cicatrix began. This pressure was made by means of a long narrow compress, the middle of which was applied precisely to the angle of the commissure of the fingers, while the two ends were carried over the front and back of the forearm, and there fastened. The same principle is applicable to other similar cases.

When a burn of the fourth degree implicated the circumference of natural orifices, as those of the nostrils, vagina, mouth, &c., Dupuytren used to prevent the obliteration of such apertures with dossils of lint, tents, cannulae, prepared sponge, ivory tubes, &c. Attention to this indication seemed to him here as proper as in burns with vesication, or those of the third degree; but, with these differences, 1. That they are even more rigorously indispensable. 2. That the diameter of the foreign bodies must always exceed that of the orifice into which they are introduced. 3. That their use must be continued long after the cure, in order to resist the contractile tendency of the cicatrix.

Amongst the means for fulfilling the indication under consideration, are straps of adhesive plaster. But Dupuytren correctly observes that, though they are very efficient when they are applied across an ulcer, in keeping its edges approximated, their action is but feeble when employed for maintaining them apart. Yet he admits that circumstances occur, in which they are of service. Such are burns of the face, forehead, temples, scalp, &c.; where the parts cannot be operated upon by position and other means.

In burns of the fifth and sixth degrees, implicating the muscles and tendons, a chief object is to keep the limb or part in such a position as will leave after the cure the least inconvenience. In general, as Dupuytren remarks, the disorganisation is so considerable, that the preservation of the patient's life, by promoting cicatrization by every possible means, engages all the surgeon's attention, who has now no opportunity of thinking about the prevention of deformity, or the losses of functions resulting from it. (See *Clin. Chir.* t. ii. p. 33—39.)

OF THE MEANS FOR CORRECTING THE DEFORMITIES, AND RELIEVING THE IMPAIRMENT OF FUNCTIONS ARISING FROM THE UNFAVOURABLE CICATRISATION OF BURNS.

These deformities consist of inequalities, fleshy

hands, fræna, adhesions, depressions, a puckering up of the part, and discolourations or stains of the skin.

With respect to the marbled or mottled discolourations left as consequences of exposure to moderate degrees of heat, the treatment recommended by Dupuytren, consists in removing the exciting cause, and using astringent lotions, particularly those of the acetate of lead. He acknowledges, at the same time, that the plan is generally unavailing, and suspects, that it would prove more successful, if combined with methodical compression. The slow and prolonged action of caloric here adverted to, he found to be not unfrequently the cause of varices.

The following are some examples of the various deformities, which Dupuytren had known to follow burns. In some patients, all the integuments at the base of the skull, and with them, the ears and eyebrows, were strongly drawn upwards by a cicatrix, which had contracted itself towards the top of the head. In others, the eyebrow and upper eyelid were drawn up, and rendered immovable by a cicatrix on the forehead. In one, the eyelids were everted by scars on their tore part, or at the base of the orbit. In another, the commissures of the eyelids were drawn outwards or inwards by cicatrices on the temple, or root of the nose; or the ala of the nose was pulled upwards by a cicatrix above it, and the nostril obliterated. In others, again, the commissure of the lips was drawn upwards, outwards, or downwards, by cicatrices on various parts of the cheek; or the upper lip was united to the septum of the nose; or the lower one to the chin, so as to be incapable of preventing the escape of the saliva. In others, the ears adhered to the temples, and the meatus was contracted, or obstructed; or the chin, with its prominence effaced, was fixed to the front of the neck, or upper part of the chest; or the skin of the neck adherent to the thyroid cartilage, or hyoid bone, whence a difficulty of swallowing, and an incurable *carotement*. In other instances, the shoulder was drawn upwards, and the head to one side, by a cicatrix on the lateral part of the neck. In some girls, in consequence of the horrible mutilation of the breast, the mammary glands could not be developed, or serve for the secretion of milk. In other cases seen by Dupuytren, the trunk was bent forwards, by bands extending from the front of the chest to the abdomen; or the shoulder was depressed towards the hip, and this pulled upwards by a cicatrix on the side of the trunk; or the elbow was fixed close to the side by a cicatrix in the axilla, resembling a kind of fin, when an attempt was made to lift the humerus from the side; or the forearm was held in the bent position by the effects of a cicatrix situated on the front of it, or the upper arm. In other instances, the wrist was bent or extended, or the fingers similarly affected were all united, and blended together in one mass, covered by the cicatrix. Dupuytren had seen the penis either fixed to the linea alba by a cicatrix which represented a sort of fold, like what prevails in quadrupeds, or else drawn to one side, and adherent to the scrotum, which had grown to the thighs. In one case, the thigh, was fixed in the bent posture by a cicatrix in the groin, which cicatrix, though scarcely apparent when the limb was quiet, was converted into a very prominent band by the least movement of

extension. Dupuytren had known the abdominal ring so weakened by a cicatrix in front of it, that a hernia took place, attended with the peculiarity, that the cicatrix formed such a projection when the limb was extended, that it prevented the patient from keeping up the bowels with a truss, until it had been divided. In other cases, he had seen the leg kept permanently bent by bands in the ham; or the feet twisted outwards or inwards, in consequence of burns on the sides of these parts, or the legs, which had occurred in early life; or the toes pointing straight upwards, or downwards, sometimes with their dorsal surface directed towards the ground, so as entirely to incapacitate the patient from walking.

Mr. Earle has known the contraction of the cicatrix of a burn act with such force, as to bring the shoulders towards one another by a partial absorption of the clavicles. He mentions another case, in which, not only the whole head was bowed down towards the sternum, but the lower jawbone curved downwards, so as only to admit of the last molar teeth coming in contact; the mouth being kept permanently open, and the direction of the incisor teeth so altered, that they projected nearly in a horizontal line. In a third case, the arm was pushed to the side, and the hair and scalp drawn many inches down the back between the scapulae. (See *Two Lect. on Burns*, p. 41.) Such, indeed, is the force adverted to, that dislocations may be produced by it. I have known instances of this with reference to the thumb and finger; and Cruveilhier describes the particulars of a rare example, in which the carpus was luxated from the radius from the same cause. (See *Anat. Pathol. Lit.* ix.)

However numerous or diversified the deformities from burns may be, Dupuytren considered all of them as admitting of being classed under a few heads. All of them consist either of *cicatrices*, which are *too narrow*, or *too prominent*; or in *unnatural adhesions*, or *obliterations*, or in *losses of organs*.

With respect to operations undertaken for the cure of deformities from burns, Dupuytren lays down the following principles:—1. The attempt should never be made till several months, or even years, after the formation of the cicatrix. This rule, he says, cannot be deviated from, without the risk of incurring a great loss of substance produced by the destruction of the new-formed substance of the cicatrix. 2. An operation should never be practised, unless a larger and less deformed cicatrix than that which it is wished to correct, can certainly be obtained with the aid of position and bandages. This precept Dupuytren deemed specially applicable to cicatrices on the face, which in general should not be meddled with. 3. An operation should only be undertaken when it will restore the original shape and functions of the parts. Hence, it must be abstained from whenever ankylosis exists, or the muscles and tendons are destroyed. Occasionally, however, it may be performed for the removal of deformity, though the functions of the part cannot be restored by it. (See *Clin. Chir.* t. ii. p. 51. &c.)

But in what manner, and according to what rules, is the operation, if judged advisable, to be performed? Now Dupuytren does not admit, 1. That every operation which leaves the texture of the cicatrix subsisting, will be followed by a

return of the contraction as before. 2. Or that, in order to attain success, it is absolutely necessary to cut away the cicatrix, and then bring the edges of the wound together, so as to unite them by the first intention. He found, that when the cicatrices had, after a length of time, acquired their complete solidity, and the fræna or bands had become perfectly organised, that the substance of the cicatrix is scarcely more disposed to contract than an original texture. Hence the rule which he lays down, that no surgical operation should ever be done until the cicatrices and adhesions have attained this perfect organisation. When the object was to remedy too narrow a cicatrix, Dupuytren used, 1. To make, at various points of the frænum, transverse incisions completely through it, so as to be able perfectly to extend it without removing any of its texture. 2. To extend the parts, and bring them into the opposite direction to that in which they had been drawn by the burn, and thus obtain a cicatrix by the production of a new cutaneous tissue. The requisite position was then maintained by means of bandages, machinery, &c. If the parts were supple and yielding, they were put at once into the right posture; in the opposite case, a slow and gradual extension of them was made, for which purpose Dupuytren conceived that splints furnished with elastic springs, so as to keep up a gentle but permanent effect, would be of great use. In this country splints with hinges, and allowing their angle of flexion to be regulated by a screw, are often employed. 3. The operation having been performed, the case seemed to Dupuytren to be nearly in the same condition, as directly after the separation of the eschar. Hence his advice is, that the formation of the cicatrix should be regulated by the means already specified; and every effort made to hinder it from taking place by the approximation of the edges of the wound. If secondary fræna or bands form, they are to be immediately cut through without sparing one of them. To the neglect of this precept, Dupuytren ascribes the failure of many operations.

If the removal of too prominent a cicatrix was the object, Dupuytren first sliced off the projecting part of it on a level with the skin: secondly, he kept the edges of the wound apart: thirdly, he frequently counterirritated the surface so as to keep it rather below the level of the integuments. (See *Clin. Chir.* t. ii. p. 68.)

Instead of slicing off the prominent cicatrix, Mr. Higginbottom rubs it with the nitrate of silver, exposes it to the air for three days, and then covers the part with ointment. The application is repeated as often as necessary. (See *J. Higginbottom on the Use of the Nitrate of Silver*, p. 157. ed. 2.)

If the deformity consisted in simple adhesions, Dupuytren's practice was as follows:—1. After having divided them, he dissected them freely to beyond their origin. 2. Then he drew the parts asunder. 3. Methodical and constant pressure was maintained on the point whence the cicatrix must proceed, which is always at the angle of union of the parts. (*Clin. Chir.* t. ii. p. 69.)

When the surfaces adherent to one another are extensive, as in cases of union of the arm to the trunk, or the two thighs together, Dupuytren cautions surgeons not to complete the operation at once, as dangerous consequences may follow so

large a wound. The same rule is applicable to extensive callous prominences. Here it is best to proceed by fractions, and to let the wound of one operation be cured before another is undertaken. (P. 73.) Another important caution, given by Dupuytren, is, to be certain, before any operation is attempted, that the limb, retained in a faulty position, is not incapable of being brought into a better one; if there were deformity of the articular surfaces, anchylosis, or atrophy of the limb, the division of the adhesions and contractions would be entirely useless.

Mr. Earle admits that, in recent cases, occurring in any of the extremities, and where the contraction is confined to the integuments, the division of it may remove the deformity for a time; but, he maintains, that when the contraction has been of longer duration, the muscles acquire a new sphere of action, and afford an additional and powerful opposition to the free exercise of the limb. In some cases, he observes, even the bony fabric becomes moulded and altered by the powerful constriction exerted on it. In such circumstances, he regards transverse incisions and other severe operations as promising not even a prospect of temporary alleviation. Hence in a case which was under his care in 1813 (See *Med. Chir. Trans.* vol. v. p. 96. &c.), he was induced, like Hildanus, to remove the whole of the diseased cicatrix, and to bring the healthy integuments together from the two sides of the arm, which was kept extended on a splint, not only during the healing of the wound, but for a considerable time after the new cicatrix had formed. Under such treatment, he conceived, that the contraction would take place in a lateral direction, and not in the long axis of the limb. This case proved completely successful as well as many others under Mr. Earle himself, Sir Benjamin Brodie, Mr. James of Exeter, and Mr. Hodgson of Birmingham. (See *Earle's Lect. on Burns*, p. 51.)

Mr. James constructed an apparatus for keeping, the chin elevated after operations for relieving contractions of the neck. This plan, with certain modifications, Mr. Earle has found answer, not only for curing but preventing such contractions. In slighter cases, a stiff soldier's collar, worn night and day, will be a sufficient protection against contraction, provided the skin directly below the chin be not burnt. (P. 53.)

When Dupuytren had to deal with a contraction or obliteration of some natural opening, 1. It was enlarged, if only lessened; but perforated again, if obliterated, with a cutting instrument or trocar. 2. Dossils of lint, tents, or ivory tubes, much wider than the natural openings, were then introduced, and kept in, not only until the cicatrix had formed, but for a long while afterwards.

For the prevention of the return of the contraction, Dupuytren strongly insisted on the necessity of persevering with the means calculated to resist it, until the cicatrix had lost this tendency by attaining its definitive organisation; and, besides machinery, he had recourse, occasionally, to warm bathing, *douches*, emollient applications, and oily embrocations.

CLEGHORN'S PLAN OF TREATING BURNS.

This consisted in the immediate application of vinegar, which was continued until the pain abated; and when this returned, it was repeated. If there

were eschars, these, after the pain had ceased, were covered with a poultice for six or eight hours, after which, the parts were sprinkled with finely powdered chalk, so as to remove every appearance of moisture. The whole surface was then poulticed again; and the same mode was pursued every night and morning, until the cure was complete. If the use of poultices relaxed the ulcers too much, a plaster, or ointment, containing the acetate of lead, was applied; but the chalk was still sprinkled upon the sore.

With respect to general remedies, Mr. Cleghorn allowed his patients to eat boiled, or roasted fowl, or, in short, any plainly dressed meat which they liked. He did not object to their taking moderate quantities of wine, spirits and water, ale, or porter. He never had occasion to order bark, or any internal medicines, whatever; and he only once thought it necessary to let blood. When the patient was costive, Mr. Cleghorn ordered boiled pot-barley and prunes, or some other laxative nourishing food, and sometimes an injection, *but never any purgative*, as he remarked that the disturbance of frequently going to stool was distressing to a patient with bad sores. Besides, he thought, that a hurtful weakness and languor were always (more or less) brought on by purgatives.

In cold weather, Mr. Cleghorn sometimes warmed the vinegar a little, placed the patients near the fire, and gave them something warm internally. His object in so doing was to prevent the occurrence of tremblings, and chilliness, which, in two instances, after employing cold vinegar, took place in an alarming degree. The account of Mr. Cleghorn's plan was published by Mr. Hunter. (See *Med. Facts and Observations*, v. ii.) In this gentleman's use of fine chalk may be recognised the commencement of the analogous practice of covering burns with flour, which is chiefly useful on the principle of excluding the air.

DR. KENTISH'S PLAN.

The fanciful theories advanced by Dr. Kentish, lead him to believe, that as burns are injuries attended with increased action, there are two indications for restoring what he terms the *unity of action*: viz. the excitement, or action, of the part is first to be gradually diminished; secondly, the action of the system is to be increased to meet the increased action of the part, according to the following law: *That any part of the system, having its action increased to a very high degree, must continue to be excited, though in a less degree, either by the stimulus, which caused the increased action, or some other having the nearest similarity to it, until by degrees the extraordinary action subsides into the healthy action of the part.*

With this view, holding the part to the fire, seems, to Dr. Kentish the best mode of relief; but, as parts of the body are injured, to which this cannot be done, stimulant applications must be used. The strongest rectified spirits, made still stronger by essential oils, are proper, and may also be heated as much as the sound parts can bear. These, and many other applications of the same class, says Dr. Kentish, will give the most speedy relief. They are, after a certain time, to be succeeded by less stimulant applications, until the parts act by common natural stimuli.

The internal mode of relief is, to give those substances which most speedily excite the system to

great action, such as *ether, ardent spirits, opium, wine, &c.*, by which means, the solution of continuity of action is allowed to last the shortest time possible, and the unity of action is restored, which constitutes the cure.

After explaining his principles, Dr. Kentish takes notice of the various substances, which have commonly been employed. Of these he would chiefly rely on alcohol, liquor ammoniæ subcarbonatis, æther (so applied as to avoid the cooling process of evaporation), and spirit of turpentine.

In applying these, we are directed to proceed as follows. — The injured parts are to be bathed, two, or three times over, with spirits of wine, spirits of wine with camphor, or spirit of turpentine, heated by standing in hot water. After this a liniment, composed of the ceratum resinæ softened with spirit of turpentine, is to be spread on soft cloth, and applied. This liniment is to be renewed only once in twenty-four hours, and, at the second dressing, the parts are to be washed with proof spirit, or laudanum, made warm. When the secretion of pus takes place, milder applications must be made, till the cure is effected.

The yellow ointment stops the pores of the cloth, impedes evaporation, and thus confines the effect of the alcohol to the burnt surface. The first dressings are to remain on four and twenty hours. Dr. Kentish thinks it of importance, that the injured surface should be left uncovered as little as possible. It is therefore recommended to let the plaster be quite ready, before the old ones are removed, and then only to take off one piece at a time.

It will seldom be necessary to repeat the application of alcohol, or that of oleum terebinthinæ. The inflammatory action will be found diminished, and, according to Dr. Kentish's principles, the exciting means should therefore be diminished. Warm proof spirits, or laudanum, may be substituted for the alcohol, and the unguentum resinæ flavæ is to be mixed with oleum camph. instead of turpentine. If this should be found too irritating, Dr. Kentish recommends ceratum plumbi acetatis, or cer. calaminæ. Powdered chalk is to be used to repress the growth of exuberant granulations, and to absorb the pus. Into the cavities of separated eschars, and into the furrows, between sloughs and living parts, he introduced powdered chalk. Then a plaster was applied, and, in tedious cases, a poultice over the plaster.

With respect to the internal treatment, the author observes, that great derangement of the system arises in certain persons, from causes, which, in others, produce no effect; and that this depends on a difference in the degree of strength. Hence, he concludes, that as strength resists the sympathetic irritative actions of parts, and weakness induces them, we should, in all cases, make the system as strong as we can, immediately upon the receipt of the injury. In considerable burns, he supposes a disproportion of action to take place between the injured parts, and the system at large, or what he styles a solution of the continuity of action; and that, by a law of the system, a considerable commotion arises, for the purpose of restoring the equilibrium, or enabling the constitution to take on the action of the part. Hence, Dr. Kentish is of opinion, that the indication is to *restore the unity of action of the whole system, as soon as possible, by throwing it into such a state as to avoid the diseased action*, and then gradually bring down

the whole to the natural standard of action, by nicely diminishing the exciting powers. Ether and alcohol, or other stimulants, are to be immediately given in proportion to the degree of injury; and repeated, once or twice within the first twelve hours, and afterwards wine or ale to be ordered, till suppuration takes place, when it will be no longer necessary to excite the system.

In a second essay, Dr. Kentish remarks, that in the first species of burns, in which the action of the part is only increased, he has not found any thing better for the first application, than the heated oleum terebinthine and ceratum resinae, thinned with the same. In superficial burns, when the pain has ceased, he considers it advisable to desist from this application in about four-and-twenty hours, and use at the second dressing a digestive, sufficiently thinned with common oil, beginning, on the third day with the ceratum lap. caluminaris. This author has frequently seen secondary inflammation excited by the remedy. The most certain remedy for this unpleasant symptom, is a digestive ointment, thinned with oil, or a plaster of cerate, and over that a large warm poultice. The cerate will finish the cure. Should there be much uneasiness of the system, an anodyne, proportioned to the age of the patient, should be given.

The growth of fungus, and the profuse discharge of matter are to be repressed, as already mentioned, by sprinkling finely levigated chalk on the surface, and by the use of purgatives in the latter stages.

We learn from Dr. Reese, that Dr. Kentish's treatment is still the most popular in the United States, and that alcohol, spirits of turpentine, and the mixture of linseed oil and lime-water, are in almost universal use. (See *Amer. ed. of this Dict.*)

OF DRESSING BURNS WITH CARDED COTTON.

In America one of the best applications for superficial burns is found to be raw cotton, thinly spread out, or carded, and put directly on the injured parts. (See *Dallam on the use of Cotton in Burns*, in *Potter's Medical Lexicon*, p. 22.; and *Gibson's Institutes and Practice of Surgery*, p. 62. vol. i. 8vo. Philadelphia, 1824.) According to Professor Gibson, it is only in superficial burns that this practice answers; but Dr. Anderson of Glasgow, who has tried it on a large scale, represents it as applicable to injuries, whether occasioned by scalding, or actual fire; whether superficial, or deep, recent or old, vesicated or sphacelated. He states, that it has been long adopted by the inhabitants of the Greek islands. One of its advantages, he says, is, that, except in cases of deep injury, the cure is always accomplished without any appearance of cicatrization. (See *Glasgow Med. Journ.* vol. i. p. 209.) Another is the avoidance of the pain always attending the frequent renewal of other kinds of dressings; for this is left unchanged a considerable time. Some care, says Dr. Anderson, is necessary, both in preparing and applying the cotton. For this purpose, it should be finely carded, and disposed in narrow sheets, so thin as to be translucent; by which means it can be applied in successive layers, and is thus made to fill up and protect the most irregular surfaces. The burnt parts, if vesicated, are to be washed with tepid water, and the fluid evacuated by small punctures. Or, if more deeply scorched, they may be bathed with a spirituous or turpentine lotion. The cotton is then applied, layer after

layer, until the whole surface is not only covered, but protected at every point, so that pressure and motion may give no uneasiness. On some parts it will adhere without a bandage, especially when there is much discharge; but, in general, a support of this kind is useful. Where the vesications have been broken, and the skin is abraded, or where there is sphacelus, more or less suppuration always ensues; and, in such cases, Dr. Anderson admits, the discharge may be so great as soon to soak through the cotton, and become offensive, particularly in summer, so that it may be necessary to remove the soiled portions. This, however, he advises to be done as sparingly as possible, care being taken to avoid uncovering or disturbing the tender surface. (*Op. cit.* p. 213.) According to Dr. Anderson, there appears to be a twofold effect from this kind of treatment. The primary effect arises from the exclusion of the air, and the slowly conducting power of cotton, by which the heat of the part is retained, whilst a soft and uniformly elastic protection from pressure is afforded. The secondary effect, he says, depends entirely on the sheath, or case, formed by the cotton, absorbing the effused serum, or pus, and giving the best possible substitute for the lost cuticle. "But, in order that the full benefit may be derived from this substitute, and to ensure an equal and continued support to the tender parts, until the new skin is formed, it is absolutely necessary that the cotton should not be removed, except under particular circumstances, until the real cuticle is sufficiently formed to bear exposure." (P. 217.) If much constitutional irritation be evinced after the cotton has been for some time applied, Dr. Anderson confesses that it may be necessary to let out the discharge, or even remove the cotton altogether. "We are then to be guided by the symptoms and appearances, whether to reapply the same dressings, or first restore a more healthy action in the constitution." (P. 219.)

Mr. McIntyre, of Newcastle, lately gave me a favourable account of his trials of this method.

Dr. Reese, of New York, the learned editor of the American edition of this Dictionary, admits, that "the exclusion of the air" is the true indication in the treatment of burns; but, that it is imperfectly fulfilled by the carded cotton. "In superficial burns, salt has long been a domestic application, and can only act in this way; yet, when the part is completely covered with a layer of salt, the relief is immediate, and, in superficial burns, is permanent." (See *Reese's Amer. ed. of Cooper's Dict.*)

OF DRESSING BURNS WITH FLOUR.

I believe that one of the most important principles in the treatment of burns, is to exclude them as much as possible from the air, and that it is in this way that the treatment with powdered chalk, the linimentum calcis, the linimentum terebinthinae, flour, &c. proves very commonly advantageous. In particular, several of these applications supersede all occasion for an early or a frequent removal of the dressing, and exposure of the part. When it is considered what agony is thus prevented, we cannot wonder that the simple application of flour should have come into extensive favour. In the North London Hospital, it is employed with great success, fresh flour being sprinkled with a dredger over the parts from day to day, at each point where matter shows itself in the stage of suppuration.

When the flour is to be discontinued, the masses of it are covered with a poultice, which softens them, and makes their removal easy. Then the surgeon may have recourse to the same application, or others, according to circumstances.

The following passage, in relation to this subject, I find in Reppe's American edition of this Dictionary:—"As the relief afforded in burns is generally the result of the exclusion of the air from the raw surface, the modern practice, introduced on the Continent, of covering burns with wheat flour, or other farinaceous material, will be found by far the most immediate in its action, and the most successful in its results; and this application is adapted to every species of burns, whether occasioned by scalding, or actual fire; whether superficial or deep, recent or old, vesicated or sphacelated. In the most desperate burns, where the injury is extensive, and the destruction of the cutis almost universal, the patient is unable to sustain either the refrigerent treatment, or any modification of Dr. Kentish's plan. In these shocking cases, if the flour be applied all over the injured surface, until the air is entirely excluded, the pain is almost annihilated; and, from the most excruciating torture, the patient is instantly placed under circumstances of comparative comfort. The flour should be repeatedly applied, and persevered in, until the acute inflammation is removed, or, in common parlance, 'the fire is out.' No other application, or dressing will be necessary till the acute stage is past; and then the plan of Dr. Kentish, modified according to the circumstances of the case, will be found adequate to the restoration of the injured surface, however extensive. I can confidently recommend this practice, having witnessed its success in the most hopeless cases." (Pease.)

Larrey's method of dressing burns with fine old linen, spread with saffron ointment, is probably useful also on the principle of excluding the air. He continues this application till suppuration has taken place, after which the styx ointment is employed for promoting the detachment of the eschars. As soon as this has been accomplished, the saffron ointment is applied again, and subsequently dry lint, covered with strips of linen spread with cerate. When the granulations rise too much, he uses the nitrate of silver, and sometimes a weak solution of oxy muriate of mercury, or sulphat. of copper. He also prescribes milk of almonds with nitrate of potassa; and allows his patients broth, jellies, eggs &c. (See *Mem. de Chir. Milit.* l. i. p. 93.)

See B. Bell's System of Surgery. Medical Facts and Obs. vol. ii. J. Sedillot, Des Ambustions, Theses, 4to. Paris, 1781. Sir James Earle's Essay on the Means of lessening the Effects of Fire on the Human Body, 8vo. Lond. 1789. Kentish's Two Essays on Burns, the first of which was published in 1798. Robert Lyall, in Edin. Med. and Surg. Jour. vol. vii. p. 313. Boettl. Diss. sistens Observationes circa vulnera ex combustione, &c. 4vo. Caspale, 1804. Larrey, Mémoires de Chirurgie Militaire, t. i. p. 35-36. Boyer, Traité des Maladies Chir. t. i. p. 160. Modes' Dickinson, on Burns and Scalds, Lond. 1818. Lectures on Inflammation, by John Thompson, p. 585, &c. Edin. 1813. Anderson, in Glasgow Medical Jour. vol. i. Gibber's Institutes of Surgery, vol. i. Philadelphia, 1824. Andral Précis d'Anat. Pathol. t. ii. p. 222. J. Hingebottom, on the Use of the Nitrate of Silver, chap. 7. ed. 2. 8vo. Lond. 1829. M. Le Darn Dunoyer, Leçons Orales de Clinique Chirurgicale, t. i. art. 16, et 41. art. 1. 8vo. Paris, 1832. H. Earle, Two Lectures on the Primary and Secondary Treatment of Burns, 8vo. Lond. 1832.

BURSAE MUCOSÆ. Small sacs of synovial membrane, interposed, either between the peri-

teum and the skin; or between the periosteum and muscles; or between the periosteum and tendons, or between tendon and tendon. The slippery fluid, which they secrete, serves to lubricate the surfaces over which it passes. The subcutaneous bursæ are either natural, like those upon the patella, or the olecranon, or are developed in the common cellular tissue by pressure. (See Mayo's *Outlines of Human Pathology*, p. 110.) It is an observation made by Meckel, that it is not uncommon to find in some individuals cellular tissue substituted for certain portions of serous tissue. Thus, in situations where a synovial bursa is met with in one person, simple cellular tissue, containing a larger quantity of unctuous fluid than usual, is found in another. On the other hand, at more than one point, where commonly only cellular tissue exists, a serous cavity, more or less developed, is discovered. Thus, in consequence of long-continued friction between two parts, the intervening cellular tissue may be converted into the serous. When the integuments are subjected to protracted and repeated friction, the subcutaneous cellular tissue is transformed at the part into a synovial sac. In persons with club feet, Bôclard found similar bursæ placed at the point where the skin suffers friction against the projecting bones of the tarsus. When a stump is examined, long after amputation, a serous cavity is frequently found beneath the skin, at the extremity of it. Sir Benjamin Brodie met with an instance of a bursa formed between the projecting part of a curved spine and the integuments, which at this point were continually gliding over the bony prominence. In examples of unreduced dislocations, the bones, in their new relation to one another, frequently require and receive a synovial or serous sac in the interspace between them, which sac, according to Andral, is formed at the expense of the cellular tissue; and the same thing happens in cases of fracture, where the bones continue united. (See Andral, *Précis, Anat. Pathol.* t. i. p. 243.)

Together with synovial bursæ, Sir Benjamin Brodie arranges the sheaths of tendons, as they have the same structure and perform a similar office. In the healthy state, the oily fluid formed by the synovial bursæ is so small in quantity, that it cannot be seen without opening the membrane containing it; but, occasionally, such an accumulation takes place, that very considerable swellings are the consequence. Tumours of this sort are often produced by bruises and sprains, and now and then by rheumatic affections. Sometimes they are not attended with much pain, though in other cases, when pressure is made with the fingers, it is rather acute. The tumours yield, in a certain degree, to pressure; but they rise again, with elasticity, not remarked in other sorts of swellings. At first, they appear to be circumscribed, and confined to a small extent; but, sometimes, the fluid, forming them, is so abundant, that they extend over a great part of the circumference of the limb. The skin, when not inflamed, retains its usual colour.

In this morbid state of the bursæ mucosæ, they contain different kinds of fluids, according to the cause of the disease. When the tumour depends on a rheumatic affection, the contents are mostly thin; but thicker, when the cause is of a scrofulous nature. When the disease is the consequence of

a bruise, or sprain, the effused fluid often contains hard concretions, and, as it were, cartilaginous ones, which are sometimes quite loose, and more or less numerous. I have had some cases, in which they corresponded to Sir Benjamin Brodie's description, in bearing some resemblance, in shape and size, to small melon seeds. This is not unusual when the tumour is of long standing. Such substances may occasionally be felt with the fingers; but, in general, when the swelling is old, the cyst is thick, and prevents them from being perceptible.

In the greater number of instances, inflammation of the bursæ mucosæ produces an increased secretion of synovia. In other cases, the bursa is distended with a somewhat turbid serum, containing floating portions of coagulable lymph. The inflammation sometimes leads to the formation of an abscess; and occasionally the membrane of the bursa becomes thickened, and converted into a gristly substance. Sir Benjamin Brodie has seen it at least half an inch in thickness, with a small cellular cavity in the centre containing synovia. In the North London Hospital, I lately saw a diseased bursa, equal in size to an orange, and the membrane of which was fully half an inch thick. The fluid within it contained numerous small bodies, of the size of melon seeds. In other instances, however, though the inflammation has lasted a considerable time, the membrane of the bursa retains nearly its original structure. (*Pathological and Surgical Obs. on the Joints*, p. 317. ed. 3.)

According to the same authority, the disease may be the consequence of pressure, or other local injury; the abuse of mercury; rheumatism, or other constitutional affection; and, in such cases, the complaint is frequently joined with inflammation of the synovial membrane of the joints. (See *Joints*.) Sometimes it has the form of an acute, but, more commonly, that of a chronic inflammation.

In the beginning, Sir Benjamin Brodie recommends the use of leeches and cold lotions, and afterwards that of blisters or stimulating liniments. In particular cases, he says, these means should be combined with such constitutional remedies as circumstances indicate. When the disease is of long standing, the preternatural secretion of fluid will often continue after the inflammation has entirely subsided. If blisters now fail in procuring its absorption, Sir Benjamin Brodie recommends friction; and, if this be unavailing, he considers it advisable to discharge the fluid by a puncture. The presence of loose substances in the bursa, he thinks, may of itself keep up a collection of fluid.

Dr. Monro met with cases in which the ill consequences of a puncture were such as to render amputation necessary. These he imputed to the air having access to the interior of the bursa. Hence it has been recommended to pass a seton through the swelling, and to remove the silk after it has remained just long enough to excite inflammation of the cyst, when an attempt is to be made to unite the opposite sides of the cavity by pressure.

This practice is sometimes approved of by Sir Benjamin Brodie on other grounds; he has noticed that, after the whole cavity of the bursa has been converted into an abscess, and this has been cured, no fluid generally collects again. Hence, he has sometimes been induced to pass into the puncture a seton, or tent, or (what he deems better) the

blunt end of a probe, for the irritation of the inner surface of the bursa. This practice I tried very successfully on a young woman who was under my care. I punctured the bursa below the patella, and discharged about an ounce of fluid, resembling white of egg. The disease had existed several months, and the bursa was much thickened. I kept the puncture open about ten days, during which time there was a discharge from it of the same kind of fluid, without any tendency to supuration. I therefore introduced a tent into the opening, by which means the necessary degree of inflammation was excited, the bursa suppurated, and the disease was soon permanently cured, without any severe symptoms. At the same time, I believe Sir Benjamin Brodie to be perfectly right in cautioning surgeons against the indiscriminate adoption of this practice. Inflammation and supuration of a large bursa (he says) sometimes disturb the constitution so much, that it may be prudent merely to make a puncture, and keep the patient afterwards perfectly quiet. He mentions a diseased bursa mucosa, which he had seen between the lower angle of the scapula and the latissimus dorsi, and which was not much less than a man's head. In this case, death followed the constitutional disturbance excited by a puncture and a seton. In another example seen by this judicious surgeon, where the patient was in bad health, and the due observance of quitude was neglected, the puncture of a diseased bursa was followed by death. (*Op. cit.* p. 360.) In some instances, the making of an incision into a bursa mucosa has been followed by a fatal attack of phlegmonous erysipelas.

Mr. Mayo believes, that there is never occasion to lay an enlarged bursa extensively open, or to pass a seton through it, or to apply caustic. "If the fluid will not disperse by common means, it is only necessary to puncture the sac several times, when it will either cease to secrete an undue quantity of fluid, or suppurate, and thus get well." (See *Mayo's Outlines of Human Pathology*, p. 111.)

In the North London Hospital, I have had under my care numerous cases of diseased bursa. If inflamed, I find cold applications, leeches, and quitude the best means of relief. Afterwards a blister, or friction with ointment of hydriodate of potassa, or camphorated mercurial ointment. When the swelling suppurates, or resists these plans, I usually make an opening. A large one, which was under the care of Mr. Liston, and the sides of which were nearly three quarters of an inch thick, was successfully removed by means of the knife. It lay between the patella and the skin, and was easily taken out, after a crucial division of the integuments.

When the coats of a bursa are much thickened, and cannot be restored to their natural condition, if superficially situated, it may be removed with as much facility as an encysted tumour. This practice Sir Benjamin Brodie has only as yet applied to the bursa between the patella and the skin, though he entertains no doubt of there being other superficial bursa which would also safely admit of removal.

Consult *Monro's Description of all the Bursæ Mucosæ, &c.* with remarks on their accidents and diseases, &c. fol. Edin. 1788. C. M. Koch, *De Morbis Bursarum, tendinum mucosarum*. Sir B. C. Brodie's *Pathological and*

Surgical Obs. on the Joints, chap. 10. ed. 3. 8vo. Lond. 1834: *Herbert Mayo's Outlines of Human Pathology*, p. 110. 8vo. Lond. 1835.

CÆSAREAN OPERATION. Called also *Hysterotomia*, from *hystera*, uterus, and *tomē*, sectio. Pliny, book vii. chap. 9. of his Natural History, gives us the etymology of it as follows: "*Auspiciatus* (says he) *enectū parente gignuntur, sicut Scipio Africanus prior natus, primusque Cæsar à cæso matris utero dictus; quid de causâ cæsones appellati. Simili modo natus est Manlius qui Curthaginiem cum exercitu intravit.*" Whether this explanation be correct, or not, it is now difficult to settle. According to Bayle, Aurelia, Cæsar's mother, was living at the period when that warrior invaded Britain, so that, if he were taken out of the womb by this proceeding, the life of the mother was also saved. Although the etymology and first practice of the Cæsearean operation are points involved in obscurity, its great antiquity is generally admitted; and thus, notwithstanding no description of it is to be found in the works of Hippocrates, Celsus, Paulus Ægineta, or Albucasis. The earliest account of it in any medical work, is that in the *Chirurgia* Guidonis de Cauliaco, published about the middle of the fourteenth century. Here, however, the practice is only spoken of as proper after the death of the mother. (See *Cap. de Extractione Fetus*. Vigo, who was born towards the close of the fifteenth century, takes no notice of the Cæsearean Operation; and Paré, who greatly improved the practice of midwifery, thinks this measure only allowable on women who die undelivered. (*De Hominis Generatione*, cap. 31.) Rousset, who was contemporary with Paré, collected the histories of several cases, in which the operation was successfully performed; and, after their publication, the subject excited more general interest.

By the *Cæsearean Operation* is commonly understood that in which the fœtus is taken out of the uterus, by an incision made through the parietes of the abdomen and womb. The term, however, in its most comprehensive sense, is applied to three different proceedings. It is sometimes employed to denote the incision, which is occasionally practised in the cervix uteri, in order to facilitate delivery; but this particular method is named the *Vaginal Cæsearean Operation*, for the purpose of distinguishing it from the former, which is frequently called, by way of contrast, the *Abdominal Cæsearean Operation*. With these cases, we have also to class the incision, which is made in the parietes of the abdomen, for the extraction of the fœtus, when, instead of being situated in the uterus, it lies in the cavity of the peritoneum, in consequence of the rupture of the womb, or in the ovary, or Fallopian tube, in consequence of an extra-uterine conception.

VAGINAL CÆSAREAN OPERATION.

Disease, malformation, or a preternatural position of the cervix uteri, may render this practice indispensable. A fibro-cartilaginous hardness of the neck of the uterus is the most frequent cause. When the incarceration is such, that the cervix cannot be dilated, and the patient is exhausting herself with unavailing efforts, the parts should be divided in several directions. This has been successfully done under various circumstances. Cases have been met with, in which the cervix uteri presented

no opening at all, and yet the preceding operation proved quite effectual. Such was the example which Dr. Simson inserted in the third vol. of the *Edinb. Essays*. A woman, forty years of age, became pregnant, after recovering from a difficult labour, in which the child had remained several days in the passage. She had been in labour sixty hours; but the neck of the womb had no tendency to dilate. Dr. Simson, perceiving that its edges were adherent, and left no opening betwixt them, determined to practise an incision, with the aid of a speculum uteri. The bistoury penetrated to the depth of half an inch before it got quite through the substance which it had to divide, and which seemed as hard as cartilage. As the opening did not dilate in the efforts which the woman made, it became necessary to introduce a narrow bistoury on the finger, in order to cut this kind of ring in various directions. There was no hemorrhage; and the only additional suffering which the patient encountered, arose from the distension of the vagina. As the child was dead, Dr. Simson perforated the head, in order to render delivery more easy.

Strong convulsions at the moment of parturition may create a necessity for the vaginal Cæsearean Operation. These sometimes subside, as soon as the membranes are ruptured, and the waters discharged, so as to lessen the distension of the womb. However, if the convulsions were to continue, and the cervix uteri were sufficiently dilated, the child should be extracted with the forceps, or by the feet, according to the kind of presentation. On this subject, Baudelocque has recorded a fact, which was communicated to the Academy of Surgery, by Duboeq, professor of surgery at Toulouse. A woman, forty years of age, had been in convulsions two days. She was alarmingly pale; her pulse feeble and almost extinct; and her extremities cold, and covered with a clammy perspiration. The edges of the opening, which was about as large as a crown piece, felt, as it were, callous; and hardly had this aperture been dilated, when delivery took place spontaneously. The child was dead. The symptoms were appeased, and the woman experienced a perfect recovery. Another case, in which the indurated cervix uteri was successfully divided, is recorded by Lambron, a surgeon at Orleans. (See *Dict. des Sciences Méd.* t. xxiii. p. 297.)

A considerable obliquity of the neck of the womb, combined with a pelvis of small dimensions, may also be a reason for the performance of the vaginal Cæsearean Operation. Not that such obliquity always occasions that of the rest of the uterus; nor is the neck of this viscus invariably directed towards that side of the pelvis which is opposite to its fundus, although this is sometimes the case. In the latter circumstance, as the contractions of the uterus do not produce a dilatation of its cervix, which rests upon the bones of the pelvis, the adjacent part of that organ is dilated and pushed from above downwards, so as to present itself in the form of a round smooth tumour without any appearance of an aperture. Such a case may have fatal consequences. Baudelocque furnishes us with an instance. A woman, in her first pregnancy, not being able to have the attendance of the accoucheur whom she wished, put herself under the care of a midwife, who let her continue in labour pains during three days. When

the accoucheur came, on being sent for again, the child's head presented itself in the vagina, covered with the womb. The portion of the uterus, which included the fœtus, was in a state of inflammation. The os tinæ was situated backward, toward the sacrum, hardly dilated to the breadth of a penny piece, and the waters had been discharged a long time. The patient was bled, and emollient clysters and fomentations were employed. She was laid upon her back, with her pelvis considerably raised. The accoucheur had much difficulty in supporting the head of the child, and keeping it from protruding at the vulva, enveloped, as it was, in the uterus. Notwithstanding such assistance the patient died.

So fatal an event, says Sabatier, might have been prevented, by making the woman lie upon the side, opposite the deviation of the uterus, and employing pressure from above. If these proceedings had failed in bringing the os tinæ toward the centre of the pelvis, this opening might have been brought into such position, by means of the finger, in the interval of the pains, and kept so, until it were sufficiently dilated for the membranes to protrude. This is what was done by Baudelocque in one case, where the womb inclined forward and to the right.

When the obliquity of the uterus is such, that the os tinæ cannot be found, and the mother and fœtus are both in danger of perishing, it is the duty of the practitioner to open the portion of the womb that projects towards the vulva. Lauerjat met with a case of this description. A woman, pregnant with her first child, suffered such extreme pain in her labour, that Lauerjat was solicitous to ascertain the real state of things. He was surprised to find the vulva completely occupied by a body, which even protruded externally, and yielded to the pressure of the fingers, except during the labour-pains. In examining this tumour, he could only find at its circumference a cul-de-sac, half an inch deep, without any aperture through which the child could pass. Other practitioners, who were consulted about this extraordinary case, were also anxious to learn what had happened. They found in the tumour a laceration, which only affected a part of the thickness of its parietes. This laceration was deemed the proper place for making an incision. The operation having been done, the finger was passed into the cavity, in which the child was contained. A large quantity of turbid fluid was discharged. The child presented, and passed through the opening, with a trivial laceration on the right side. Lauerjat, having passed his hand into the uterus, was unable to find either the os tinæ, or the cervix. No particular indisposition ensued, and the lochia were discharged through the wound, which gradually closed. In the course of two months, the os tinæ and neck of the uterus were in their natural position again. (*Lauerjat, Nouvelle Méthode de pratiquer l'Opération Césarienne. Paris, 1788.*)

When the case is a fibro-cartilaginous induration of the cervix uteri, or a laceration of the parietes of this viscus, at the place where it projects into the vagina, the vaginal Cæsarean Operation is attended with no difficulty. It is performed with a probe-pointed bistoury, the blade of which is wrapped round with lint, to within an inch of the point. The instrument is introduced, under the guidance of the index finger, into the opening presented by the uterus, and the aperture is enlarged,

from within outwards, in various directions. But, when the hardness of the cervix presents no opening at all, or when the part of the uterus projecting in the vagina is entire, the incision should be made from without inwards, with the same kind of knife. Too much caution cannot be used in introducing the instrument, in order that no injury may be done to the child. No general direction can here be offered, except that of proceeding slowly, and of keeping the index finger extended along the back of the knife, so that it may be immediately known when the substance of the womb is cut through, into the cavity of which the finger ought to pass as soon as the knife. If it should be necessary to extend, or multiply the incisions, the cutting instrument should be regulated in a similar manner, with the same finger. The cervix uteri having been divided, the expulsion of the child is either to be left to nature or promoted by ordinary means. The wounds require no dressings. If the bleeding should prove troublesome, we are recommended to apply to the incision a dossil of lint, dipped in spirit of wine. (*See Sabatier, Méd. Opératoire, t. i.*) The chief object would here be to prevent adhesions, between the cervix of the uterus and the upper part of the vagina. (*Dict. des Sciences Méd. t. xxiii. p. 298.*)

ABDOMINAL CÆSAREAN OPERATION.

This is a far more serious operation than that which has just now been treated of, and is the proceeding, to which the term Cæsarean Operation is more particularly applied. There are three cases, in which it may be necessary. 1. When the fœtus is alive, and the mother dead, either in labour, or the last two months of pregnancy. 2. When the fœtus is dead, but cannot be delivered in the usual way, on account of the deformity of the mother, or the disproportionate size of the child. 3. When both the mother and child are living, but delivery cannot take place from the same causes, as in the second example.

In many instances, both mother and child have lived after the Cæsarean Operation, and the mother even borne children afterwards. (*See Heister's Institutes of Surgery, chap. xxiii. Mém. de l'Acad. de Chirurgie, t. i. p. 623; t. ii. p. 308. in 4to. Edm. Med. Essays, vol. v. art. 37, 38. Edm. Med. and Surgical Journal, vol. iv. p. 179. Med. Chir. Trans. vol. ix. and xi., &c.*) Dr. Müller, of Lowenburg, in Silesia, performed the Cæsarean section, and saved both the mother and the child. (*Magazin für die gesammte Heilkunde, 1828; b. 28. p. 146.*) An instance of similar success is reported by C. H. Graefe. (*Journal für Chirurgie, &c. b. 9. s. i.*) Two cases occurred in which both women and children were saved, at the hospital of Maastricht, by M. Bosch. (*Bibl. Méd. 1823.*) And in a valuable periodical work one example is reported from Hufeland's Journal, where the mother and twins were all saved by the operation. (*See Quarterly Journ. of Foreign Medicine, &c., vol. iv. p. 625.*)

The most extraordinary case of Cæsarean Operation on record, is one performed by a negro-girl on herself, who recovered. (*See New York Med. and Physical Journ. March, 1823.*) Dr. Mosely mentions the case of a negro-woman at Jamaica, who opened her side with a butcher's knife, and extracted a child, which died of locked jaw. The

woman recovered. (See *Ryan's Manual of Midwifery*, p. 280.)

In England, this operation has been attended with remarkably ill success; and there is scarcely one unequivocal example, in which the mother has here survived the true Cæsaean Operation. In the third edition of this work, indeed, I referred to the case recorded by Mr. James Barlow, of Chorley, Lancashire, who made an incision into the abdomen, extracted a dead child, and saved the mother's life. (See *Medical Records and Researches*, p. 154, 1798; also *J. Barlow's Essays on Surgery and Midwifery*.) My friend, the late Dr. Gooch, however, having obligingly communicated to me his doubts, and those of Dr. Hull, respecting the reality of an incision having been made in this instance into the uterus, I am glad to have the opportunity of expressing my perfect conviction of the more correct view of the case, taken by these physicians. "I suspected from the first (says Dr. Hull), that Mr. Barlow was deceived in this case, from the account he gave of the remarkable thinness of the uterus. And I had formed an opinion, that the child had escaped through a laceration of the uterus into the abdomen, enveloped in the secundines, and that he had merely divided the membranes, when he fancied that he had divided the uterus. Dr. Hull then proceeds to explain the confirmation of his own sentiments by those of Mr. Howard, a very intelligent practitioner at Blackrod, who assisted at the operation. In fact, the particulars stated by this gentleman leave no doubt, that the foetus had escaped through a laceration of the uterus into the cavity of the abdomen. (See *Hull's Defence of the Cæsaean Operation*, &c. p. 72.) The case also referred to by Mr. D. Stewart (see *Edin. Med. Essay*, vol. v.), where the labour had endured twelve days, and the life of the mother was saved, after the dead foetus had been extracted by a midwife, was also probably of the same nature: at all events, the want of authentic particulars, and the circumstance of the operation having been done by a woman, leave the true nature of the case questionable.

If, therefore, when we speak of the Cæsaean Operation, we mean that in which the parietes of the abdomen and those of the uterus are divided by the surgeon, and the foetus extracted, I believe that, with, perhaps, only one exception, under Mr. Knowles, of Birmingham, so far as the history of the practice extends in this country, it cannot be said that the mother has ever recovered after such a proceeding. Some years ago, a calculation was made, that the operation had been done not less than eighteen times in Great Britain; and since then, it has been repeated with nearly the same ill success. (See *Handerson's Case*, in *Ed. Med. and Surg. Jour.* vol. 17.) It is said now, indeed, to have been performed about thirty times in the British dominions. (See *Ryan's Manual of Midwifery*, p. 270.) Several of the children, however, were saved. Thus in the case operated upon in April, 1826, by Mr. Crofton, of Dundee, the infant was preserved, though the mother sunk eight hours after the operation. (See *Edin. Med. and Surg. Jour.* Dec. 1826, p. 54.) Mr. Crose has lately adverted to some recent instances, in which the Cæsaean Operation was performed "in a majority of the conditions, which may demand it, for narrow pelvis; tumours in the uterus, or vagina; extra-uterine conception; rupture of the uterus;

and sudden death from apoplexy and other causes. The operation, (says he) has also been performed, and with success, in the leading countries of the world. In England, we have a single and most critical example of its success by Mr. Knowles, of Birmingham; and, in America, Professor Gibson, has been the first to save the life of both patient and child by this intrepid proceeding. The most frequent examples are to be found in the publications of France and Germany; and I have grounds for stating, that, on some occasions, the operation has been resorted to, where there seemed to be scarcely a hope of any good result; or determined on when not absolutely called for; or neglected still more often, where obviously applicable, not only because calculated to avoid protracted suffering, but to afford a chance of saving life. Rupture of the uterus seldom calls for ventro-section. Amongst the numerous cases of this accident, no less than thirty-four, related by Dr. Collins, there is scarcely one, in which the operation could have been undertaken with propriety. The recovery of two patients, after rupture of the uterus in Dr. Collin's practice, and, under the most unpromising conditions, should impress the lesson of not despairing on the occurrence of so formidable an accident." (See *J. G. Crose in Prov. Med. and Surg. Trans.* vol. v.)

On the Continent, the practice has proved infinitely more successful; for, of 231 cases of this operation to be found in the records of medicine, 139 are said to have terminated successfully. (Kellie, in *Edin. Med. and Surg. Jour.* vol. viii. p. 17.) No doubt, the ill success of the Cæsaean Operation in England was correctly explained by Dr. Hull:—"In France, and some other nations upon the European continent, the Cæsaean Operation has been, and continues to be, performed, where British practitioners do not think it indicated; it is also had recourse to early, before the strength of the mother has been exhausted by the long continuance and frequent repetition of tormenting, though unavailing pains, and before her life is endangered by the accession of inflammation of the abdominal cavity. From this view of the matter, we may reasonably expect, that recoveries will be more frequent in France, than in England and Scotland, where the reverse practice obtains. And, it is from such cases as these, in which it is employed in France, that the value of the operation ought to be appreciated. Who would be sanguine in his expectation of a recovery under such circumstances, as it has generally been resorted to in this country, namely, where the female has laboured for years under *malacosteon* (*mollities ossium*), a disease hitherto in itself incurable; where she has been brought into imminent danger by previous inflammation of the intestines, or other contents of the abdominal cavity; or been exhausted by a labour of a week's continuance, or even longer?" Dr. Hull thus refutes the opinion of Mr. W. Simmons, that our ill success was owing to climate, or some peculiarity in the constitution of the females of this island. (See *Hull's Defence of the Cæsaean Operation*, p. 10.)

M. Velpeau considers it easy to prevent the fluid of the unio and blood from being effused in the peritoneum; and inclines to the views entertained by Dr. Hull, of the causes of the Cæsaean Operation having proved so frequently fatal. (See *Nouv. Elem. de Méd. Opér.* l. iii. p. 679.) The general readiness of continental practitioners

ers to have recourse to the Cæsaſean ſection, has been ſometimes cenſured, becauſe they have even operated in caſes, in which the patients had previously borne children in the natural way. According to Dr. Ryan, however, there are but four ſuch caſes on record:—"One by Nagele, in his *Erfahrungen und Abhandl. aus dem Gebiete des Krankheiten des Weiblichen Geſchlechts*; another by Henderſon, in the *Edin. Med. and Surg. Journ.* No. 66; a third by Meier, in *Siebold's Journ.*; and a fourth in the ſame *Journ.* by Bergen." (See *Ryan's Manual of Midwifery*, p. 279.) Certainly, if a woman had already borne children in the natural way, the fact ſhould be received as a ſtrong argument againſt the neceſſity of the operation, but perhaps not as an abſolute prohibition, ſince every thing muſt depend on the actual dimensions of the lower aperture of the pelvis, in relation to the ſize of the exiſting fetus.

When the fetus is contained in the womb, and cannot be expelled, by reaſon of the invincible obſtacles to which I have already referred, and embryotomy, or the practice of ſacrificing the fetus and extracting it piecemeal by the vagina, be deemed improper, the Cæſarean Operation ſhould be practiſed, before the mother and fetus both periſh from the violence of the pains, hemorrhage, convuſions, &c.

For this purpoſe, it is neceſſary to make an extenſive incision in the integuments of the abdomen, and in the uterus. Some have thought, that cutting the parietes of the belly would be mortal, while others have believed a wound of the uterus equally dangerous. Hence, ſuch perſons have condemned the operation on the principle, that religious reaſons do not authorize taking one life to ſave another. All the opponents of the Cæſarean Operation fear the hemorrhage, which, they ſay, muſt follow. Indeed, if the uterus were not to contract ſufficiently, when the fetus and after-birth had come away, the bleeding would really be perilous. But when the fetus is extracted, together with the placenta and membranes, the uterus contracts, juſt as it does after a natural labour. Beſides, even when the mother is alive, the operation is not commonly done, till the uterus evinces a propenſity to deliver itſelf, and begins to contract. The womb being delivered of its contents, the incision becomes cloſed, the veſſels obliterated, and there is no fear of hemorrhage. The wound muſt alſo make ſo irritable an organ more diſpoſed to contract; but, whatever arguments may be adduced, it is enough to ſay in this caſe: *Artem experientia fecit, exemplo monſtrante viam*. Rouſſet, in 1581, published a work, in French, entitled, *Hystérotomie, ou l'Accouchement Cæſarien*. This book, in 1601, was tranſlated into Latin, and enlarged with an appendix by the celebrated Bauhin. Even then, the practice of the Cæſarean Operation on the living mother had its defenders. Bauhin relates that, in the year 1500, a ſow-gelder performed the Cæſarean Operation on his wife, *non ſollicitus, ut ad partem gemellos et quatuor aditus infans enixa fuerit*.

The poſſibility of operating ſucceſsfully on the living mother, was proved with great perſpicuity and accuracy by Simon. (See *Mémoires de l'Acad. de Chirurgie*, t. i. 4to.) Here is a collection of ſixty-four Cæſarean Operations, more than a half of which had been done on thirteen women. Some of theſe had undergone the operation once

or twice; others five or ſix times. One woman in particular underwent it ſeven times with ſucceſs. But, if the life of the mother ſhould not invariably be preſerved, the Cæſarean Operation ought not to be rejected on this account; it ought always to be done, when relief cannot be obtained by other means; juſt as amputation and lithotomy are practiſed, though they are not conſtantly followed by ſucceſs. Would any thing be more cruel, than to abandon a mother and her child, and leave them to periſh, while there is any hope of ſaving them both? It is true, that, when a pregnant woman dies of any inward diſorder, and not from the pains, and efforts of labour, the fetus is ſometimes ſtill alive in the uterus; but, in caſes of death, after difficult labours, and the great efforts made by the uterus to overcome the obſtacles to parturition, the fetus is generally dead; and the operation therefore is leſs likely to be availing. (See *Bertrandi, Traité des Opérations de Chirurgie*, chap. v.)

It is the opinion of the beſt writers upon this ſubject, that, whenever a woman dies, far advanced in pregnancy, the performance of the Cæſarean Operation is highly proper. The propriety of this practice, in ſuch circumſtances, was known to the ancient Romans; for, by a decree of Numa Pompilius, no woman who died pregnant was ſuffered to be buried ere her body had been opened, with the view of preſerving the infant for the uſe of the ſtate. (*Sprengel, Geſchichte der Chir.* th. i. p. 371.) Experience has proved, that when the fetus has not attained the period at which parturition commonly happens, it will ſometimes ſurvive the operation a conſiderable time, and that, when it iſſual grown, its life may be moſt happily preſerved. Although inſtances are cited, in which the fetus in utero has been found alive upwards of four and twenty hours after the death of the mother, little ſtreſs ſhould be laid on ſuch prodigies. The operation ought to be done without any delay. Even then, we are not certain of ſaving the infant's life. In the greater number of inſtances, the fetus periſhes at the ſame time with the mother, and from the ſame cauſes. The caſes, which are recorded, of the fetus being extracted alive, after the death of the mother, are numerous: I ſhall here only refer to three; two of which reſt on the unimpeachable authority of Flaſani, who was himſelf the operator. (*Osservazioni, &c. di Chirurgia*, t. iii. p. 144—146.) In one of theſe inſtances, the operation was done on a woman, killed by violence, in the ninth month of pregnancy; the child lived ſix hours: in the other, a fetus was extracted from a woman who had died of typhus fever, in the ſeventh month, and though the operation was not done till ſhe had been dead about an hour, the child was taken out alive, and continued to live full ten minutes. A living child was alſo taken out of its mother by Weſling, after her death from typhus. (*Weſch. Obs. Med. Epigram.* No. 74, p. 47; *Sprengel, Geſchichte der Chir.* th. i. p. 374.) On the 16th of April, 1820, Mr. Green, of St. Thomas's Hoſpital, extracted by the Cæſarean Operation, from a woman ſuddenly killed in the ninth month of pregnancy by the paſſage of a stage coach over her, a fetus that lived thirty-four hours after its removal from the uterus. (See *Med. Chir. Trans.* vol. xii. p. 46.) With reſpect to the ſtatements of Cangiamila, a Sicilian practitioner, & juſt Sprengel in conſidering them as incredible exaggerations: five inſtances are given, in which the fetus was taken out of the mother

from fifteen to twenty-four hours after her death, and yet it continued to live. Cangiamila says, that at Syracuse, in the course of eighteen years, the operation had been practised twenty times under the same circumstances; that at Girgenti, thirteen children were saved out of twenty-two women, who had died pregnant; and that, in twenty-four years, at Montereali, twenty-one children were preserved in the same manner. (*Embryologia Sacra. Venet. 1763, fol.*) As Sprengel remarks, one might almost suppose, from this account, that in Sicily pregnancy was generally fatal. If the mother should happen to die in labour, and the neck of the uterus were sufficiently dilated, or disposed to be so, an attempt should be made to accomplish delivery in the ordinary way; for examples have occurred, in which women, supposed to be dead in this circumstance, were in reality alive. Hence, we find, that the senate of Venice, in 1608, enacted a law, by which practitioners were liable to punishment, in case they neglected to operate with as much caution on a pregnant woman, supposed to be dead, as on the living subject; and rules to be observed were again issued by the same government, in 1720. (*Sev. Melli, La Comare levatrice, p. 108. 4to. Venez. 1721; Personè, Diss. sopra l'Operaz. Cesar. p. 15. 8vo. Venez. 1778.*) A law to the same effect was likewise made in 1749, by the king of Sicily, who decreed the punishment of death to those medical men who omitted to perform the Cæsarean Operation on such women as died in the advanced stages of pregnancy. The following case, confirming the propriety of such caution, was recorded by Rigaudeau, surgeon to the Military Hospital at Douay. This practitioner having been sent for to a woman, to whose residence he was unable to proceed till two hours after her apparent death, he had the sheet, with which she was covered, removed, and perceiving that the body retained its suppleness and warmth, he tried whether the fœtus could not be extracted in the ordinary way, which was easily effected as soon as the feet were got hold of. The first endeavours to save the child, were very unpromising; but, after a few hours, they had the desired effect. As the woman continued in the same state, five hours afterwards, Rigaudeau recommended that she might not be buried, before her limbs were quite cold and stiff. He afterwards had the satisfaction to learn, that she was also restored to life. This remarkable case happened on the 8th of June, 1745, and both the mother and child were living at the period when Rigaudeau published. (*See Journ. de Sçans, An. 1749.*)

Almost all the insurmountable obstacles to delivery originate from the bad conformation of the pelvis, depending upon rachitis; though they are not an invariable consequence of it, since there are women, extremely deformed, in whom no imperfection of the pelvis exists, while it prevails in others, whose shape is but trivially disfigured. An examination of the dimensions of the pelvis is the right mode of ascertaining whether there is really such an impediment to parturition. In order that the dimensions may not be an obstacle to delivery, the distance between the upper edge of the sacrum and the os pubis ought to be three inches and a half; and the distances between the tuberosities of the ischium, and between each of these protuberances and the point of the os coccygis, three inches.

Women have indeed been known to be delivered,

without assistance, although the first of the above distances was only two inches and a half; but then the heads of the children were so elongated, that the great diameter was nearly eight inches, while that which extends from one parietal protuberance to the other, was reduced to two inches five or six lines, and the infants were lifeless. If they are to be born alive, they must be taken out of the womb by the Cæsarean Operation; but the latter proceeding should never be adopted, without a certainty that they are actually living; for when dead, they may be extracted in a way that is attended with much less risk to the mother.

It is not always an easy matter to ascertain, with certainty, whether a fœtus in utero be living or dead. If it has entirely ceased to move, after being affected with a violent motion, the probability is, that it is no longer alive. But, to be certain, the auscultation with the stethoscope, or a manual examination is necessary, which may be practised in two ways. One consists in pressing upon the uterus, through the parietes of the abdomen. If the child lives, such pressure makes it move, and the motion can be plainly felt, and distinguished. In the other method, one hand is employed in pressing upon the uterus externally, while, with the fingers of the other hand, passed up the vagina, corresponding pressure is also to be made. The uterus is likewise to be allowed to descend as far as possible, in order to induce the fœtus to move. When no decisive indications can be thus obtained, it becomes necessary to rupture the membranes, if they have not already given way, introduce the hand into the uterus, and put a finger into the child's mouth, for the purpose of making it move its tongue. The finger may also be applied to the region of the heart, so as to examine, whether this organ is beating; and the umbilical cord may be touched, in order to ascertain, whether there is still a pulsation in it. When none of these proceedings furnish unequivocal information, the conclusion is, that the child is dead, and its extraction is indicated, unless the narrowness of the parts be such, that the hand cannot be passed into the uterus, in which case the Cæsarean Operation is indispensable.

But how are we to form a judgment respecting the dimensions of the pelvis? And how can we know, whether that diameter, which extends from the prominence of the sacrum to the os pubis, is long enough to allow the passage of the child? The proper conformation of this part is known by the roundness and equality of the hips, both in the transverse and perpendicular direction; by the projection of the pubes; by the moderate depression of the sacrum; by an extent of four or five inches from the middle of this depression to the bottom of the os coccygis; by an extent of seven or eight inches from the spinous process of the last lumbar vertebra to the highest part of the mons veneris, in a woman moderately fat; and by there being an interspace of eight or nine inches, between the two anterior superior spinous processes of the ossa ilium.

These general calculations, however, are insufficient. In order to acquire more correct opinions, double compasses have been employed. The branches of the first being applied to the top of the sacrum, and middle of the mons veneris, three inches are to be deducted from the dimensions indicated by the instrument; viz. two inches and

a half for the thickness of the upper part of the sacrum (which is said to be constant in subjects of every size), and half-an inch for that of the os pubis. In women who are exceedingly fat, some lines must also be deducted on this account. Hence, when the total thickness of the pelvis, measured in this direction, is seven inches, there will remain four for the distance from the upper part of the sacrum to the os pubis, or for the extent of the lesser diameter of the upper aperture of the pelvis.

For taking the measurement internally, a kind of sector was invented by Coutouly. It bears a considerable resemblance to the instruments employed by shoemakers for measuring the feet. It is passed into the vagina, with its two branches approximated, until one arrives opposite the anterior and upper part of the sacrum, when the other is to be drawn outward, so as to be applied to the pubes. The distance between the branches is judged of by the graduations on the instrument. This was named by its inventor a pelvimeter. According to Sabatier, it is not always easy to place it with accuracy; its employment is attended with some pain; and there are particular cases in which it cannot be used.

Instead of this contrivance, Baudelocque recommended a means, which is safe and simple. The index finger of one hand is introduced into the vagina to the upper part of the projection of the sacrum. The finger, having the radial edge turned forwards, is then to be inclined anteriorly till it touches the arch of the pubes. The point of contact being then marked with the opposite hand, the length from the point in question to the end of the finger is to be measured. This length, which indicates the distance between the sacrum and the bottom of the symphysis pubis, usually exceeds that of the lesser diameter of the pelvis by about six lines. Baudelocque acknowledges that this measurement is not exactly accurate; but he believes it to be sufficiently so, because, unless the narrowness of the pelvis be extreme, two or three lines hardly make any difference in the facility of parturition.

The following is the description of the pelvis of the woman, twice operated upon by Dr. Locher: the ossa pubis, which should be on the same level with the promontory of the sacrum, were found perpendicularly under it; so that the child necessarily extended the abdominal integuments by its own weight, into a pendulous bag overhanging the thighs. For the same reason, nothing could be felt of the child by examination per vaginam. The sacrum, instead of closing the pelvis behind, by a semicircular curve, which forms a kind of conductor for the child in parturition, stretched nearly horizontally backwards. A representation of this pelvis, with a few other particulars, may be seen in a modern publication. (*Med. Chir. Trans.* vol. xi. p. 199.)

The pelvis may be everywhere well formed, and yet present an insurmountable obstacle to delivery. This may happen when an exostosis exists on one of the bones which compose this part of the skeleton. Pineau met with a case of this description in a woman who died undelivered. The tumour originated from one of the ossa pubis. A steatomatous swelling, situated with the head of the child in the upper aperture of the pelvis, might produce the same effect, unless it were detected, and could be pushed out of the way, so as to make

room for the fœtus to pass. Baudelocque mentions a swelling of this kind. It was six or seven inches long, and an inch and a half in width. The extremity of it, which was as large as half a hen's egg, had a bony feel, and contained nine well-formed teeth, the rest of the mass being steatomatous. It had descended into the lesser pelvis below the projection of the sacrum, and a little to one side. It might have been taken for an exostosis of this last bone. The labour-pain continued sixty hours, and the propriety of performing the Cæsarean Operation was under consideration. Baudelocque was averse to this proceeding. He recommended turning the child, and extracting it by the feet, because he thought that the pelvis was sufficiently capacious to admit of delivery. The event proved that it was three inches nine lines from before backward, and four inches nine lines transversely. The fœtus was soon extracted with the assistance of forceps. The child was still-born. The mother, exhausted with numerous unavailing efforts, only survived between fifty and sixty hours.

Among the insurmountable obstacles to delivery may be reckoned such a displacement of the uterus, that it protrudes from the abdomen, and forms a hernia. The records of surgery contain some examples of this extraordinary occurrence. Twice has the Cæsarean Operation been performed, and, in one of the cases, the woman survived so long, that hopes were entertained of her recovery. Indeed, as Sabatier observes, why should not the operation succeed in such a case, where the uterus is only covered by the integuments, and there is no occasion to cut into the abdomen, just as well as in other instances, in which it is indispensable to divide the muscles, and open the cavity of the belly? In the other case on record, delivery was effected in the ordinary way, either by raising the abdomen, and keeping it in this position with towels skillfully placed, or by making pressure on the uterus, which had the beneficial effect of making this organ resume its proper situation.

Having shown the absolute necessity for the Cæsarean Operation, under certain circumstances, it remains to consider the proper time for performing it, the requisite preparatory means, and the method of operating.

With regard to the time of operating, practitioners do not agree upon this point: some advising the operation to be done before the membranes have burst, and the waters been discharged; others, not till afterwards. The arguments in favour of the first plan, are, the facility with which the uterus may be opened without any risk of injuring the fœtus, and the hope that the organ will contract with sufficient force to prevent hemorrhage. The advocates for the second mode believe, that, in operating after the discharge of the waters, there is less danger of the uterus falling into a state of relaxation, in consequence of becoming suddenly empty after being fully distended, and that this method does not demand so extensive an incision. Hence they recommend, as a preliminary step, the membranes to be opened. Whatever conduct be adopted, it is essential that the labour should be urgent and unequivocal, that the cervix uteri should be effaced, and that the os tincæ should be sufficiently dilated to allow the lochia to be discharged; but, at the same time, says Sabatier, if

the operation is not to be done till after the escape of the waters; there ought not to be too much delay, lest the patient's strength should be exhausted, and the violent efforts of labour should bring on an inflammation of the parietes of the uterus.

The propriety of emptying the rectum and bladder is so evident, that it is unnecessary to insist upon it. This precaution is more particularly requisite in regard to the latter of these viscera, which has been known to rise so much over the uterus as to conceal the greater part of it. Baudelocque had occasion to remark this circumstance in a woman upon whom he was operating. The bladder ascended above the navel, and presented itself through the whole extent of the opening made in the parietes of the abdomen.

The instruments, dressings, &c. which may be wanted, are two bistouries, one with a convex edge, the other with a probe-point; sponges, basins of cold water; long strips of adhesive plaster; needles and ligatures; lint; long and square compresses; a bandage to be applied round the body, with a scapulary, &c.

For the purpose of undergoing the operation, the patient should be placed at the edge of her bed, well supported; her chest and head should be moderately raised; her knees should be somewhat bent, and held by assistants, one of whom ought to be expressly appointed to fix the uterus by making pressure laterally, and from above downward, so as to circumscribe, in some degree, the swelling of the uterus, and prevent the protrusion of the bowels. These things being attended to, the integuments are to be divided with the convex-edged bistoury to the extent of at least six inches. The place and direction of this incision differ with different operators.

In the most ancient method, it was customary to make the incision between the outer edge of the rectus muscle, and a line, drawn from the anterior superior spinous process of the ilium, to the junction of the bone of the first rib with its cartilage. This cut was begun a little below the umbilicus, and was continued downward to an inch above the pubes. After the integuments had been divided, the muscles, aponeuroses, and peritoneum were cut, and the uterus cautiously opened. The left index finger was then introduced into this viscus, the wound of which was dilated by means of a probe-pointed bistoury.

This manner of operating is subject to great inconveniences. The place where the incision is made is the situation of muscles, the fibres of which have a different direction, and, on contracting, separate the edges of the wound, and make it gape. The considerable blood-vessels, which ramify there, may be the source of perilous bleeding. The bowels can protrude in that situation more readily than any where else. When the position of the uterus is oblique, and when, consequently, its edges are turned forward and backward, and its surfaces to the right and left, the incision will be made in one of its lateral portions where the trunks of its blood-vessels are known to be situated, and even the Fallopian tube and ovary may be cut. The fibres of the uterus are cut transversely, so that the edges of the incision gape, instead of being in contact. This last circumstance may the more readily permit the uterus to escape into the abdominal cavity, as the uterus is cut nearly throughout its whole length, and there is no cavity, in

which they can accumulate, in order to be discharged through the cervix of that organ.

The linea alba has been frequently considered the most eligible place for making the incision. It was the method adopted by Soleyres and Deleurye, and it had the recommendation of Baudelocque, because there are fewer parts to be cut; and when the uterus is exposed, an incision, parallel to its principal fibres, may be made in its middle part. The method was known to Mauriceau, as we may be convinced of by the following passage, extracted from the chapter in which he treats of the Cæsarean Operation: "*La plupart veulent qu'on incise au côté gauche du ventre; mais l'ouverture sera mieux au milieu entre les muscles droits, car il n'y a en ce lieu, que les ligemens et les muscles à couper.*" Lauerjat, who has made this remark, and cited the Latin edition of Mauriceau, page 247, also observes, that the incision in the linea alba was practised by a contemporary of La Motte, a circumstance which Sabatier was not able to ascertain. (*Méd. Opér. t. i.*) The following is the proper manner of operating in the linea alba. The bladder is to be previously emptied. The operator should first divide the integuments perpendicularly, so as to expose the linea alba, making the wound six or seven inches long. An opening should then be carefully made through the aponeurosis, fascia transversalis, and peritoneum, into the abdomen, either at the upper or lower part of the linea alba in view. A curved bistoury is then to be introduced into the opening, and the peritoneum, fascia transversalis, and linea alba cut from within outward, as far as the extent of the wound in the integuments. The latter cut should be cautiously made, with the crooked bistoury, guided by the forefinger of the left hand, lest any of the intestines be accidentally injured. The uterus must next be carefully opened, and an incision made in it, of the same length as the preceding wound. The foetus is to be taken out through the wound, and then the placenta and membranes. In this way, M. Artisto lately operated, so as to save both mother and child. (*See Edin. Med. and Surg. Journ. vol. iv. p. 178.*)

In this country (where, indeed, the Cæsarean Operation has proved most unsuccessful) the linea alba is preferred, I believe, by the majority of practitioners. That the method is not always attended with the formidable objections urged against it by Sabatier, is quite certain; the case published by Dr. Chisholm, is a decisive proof of this assertion. (*See Edin. Med. and Surg. Journ. vol. iv. p. 178, 179.*)

A third method of performing the abdominal Cæsarean Operation, consists in making a transverse incision, five inches in length, through the parietes of the abdomen, between the rectus muscle and the spine, and in a situation more or less high, according to the more or less elevated position of the uterus. This plan was recommended by Lauerjat. (*See Nouvelle Méthode de pratiquer l'Opération Cæsarienne. Paris, 8vo. 1788.*) Lauerjat acknowledges, that the method had been successfully practised by different persons before himself, and especially in one instance, which was particularly remarkable, as, in consequence of the first incision having been made too high up, it became necessary to make a second one, which extended obliquely from the other.

The side, on which the operation is to be done,

is in itself a matter of indifference. But, if the liver or spleen were to project, one ought to avoid it. Also, if the uterus were to incline more towards one side than the other, it would be proper to operate on the side where this viscus could be most conveniently exposed. The patient being put in a proper position, and her abdomen kept steady by an attendant, who must apply the palms of his hands to the sides of the uterus, the integuments, muscles, and peritoneum are to be divided with the usual precautions. The uterus is then to be opened, and the wound in it enlarged in the requisite degree, by means of a probe-pointed bistoury. Should the placenta present itself, care must be taken not to injure it; but it should be separated, in order to facilitate breaking the membranes at its circumference. The child is next to be extracted. This part of the operation is subject to no general rule. Delivery being accomplished, we are recommended to introduce through the vagina anodyne injections, in order to lessen spasm, and wash out the coagula. This method is preferable to that of clearing out the uterus with the hand. Salubrier condemns the plan, formerly advised by Rousset and Ruleau, of passing a catheter up the neck of this viscus for the purpose of washing out the lochia, as well as the absurd proposal of employing a seton to promote their escape. Should the lochia not pass readily outward, we are recommended to introduce the finger occasionally into the cervix uteri, so as to free it from coagula.

The only dressings, advised by Sabatier, are a large pledget, compresses, and a moderately tight bandage round the body. These are to be changed when soiled with the matter or discharge. In this country, practitioners would not neglect to bring the edges of the wound together, by means of strips of adhesive plaster; for, though they may not act with so much effect in this situation as many others, they undoubtedly assist in promoting one chief aim of the surgeon, which is to heal at least all the upper part of the incision, if possible, by the first intention. I have no doubt, also, that there are many who would be advocates for sutures.

Mr. Wood, of Manchester, performed the Cæsarean Operation, in a case where parturition was prevented by deformity of the pelvis. The incision was made nearly in a transverse direction, on the left side of the abdomen, about five inches in length, beginning at the umbilicus. This part was fixed upon, because the nates of the child could be felt there, and it was evident, that no intestine was interposed betwixt the abdominal parietes and the uterus. There was scarcely any effusion of blood, either from the external wound, or from that of the uterus, though the latter was made directly upon the placenta. Instead of dividing the placenta, Mr. Wood introduced his hand betwixt it and the uterus, and, laying hold of one of the knees, extracted the foetus with ease. His hand readily passed betwixt the placenta and uterus; this produced hemorrhage; but the whole quantity of blood lost did not exceed seven or eight ounces. After the uterus had been emptied, the intestines and omentum protruded at the wound. These having been reduced, the integuments were brought into contact with sutures and adhesive plaster. This operation, however, did not save the woman's life; she died on the fourth day after its performance. (See *Med. and Physical Journal*, vol. ii.)

In this Dictionary, I do not deem it necessary to enter into other plans of performing the Cæsarean Operation, without opening the peritoneum; or wounding the body of the uterus. The methods of Ritgen, Baudelocque, the nephew, and Dr. Physic, are all described by Velpeau, but only to be disapproved of. (See *Nouv. Elem. de Méd. Opér.* t. iii. p. 682., &c.)

As I have already explained, the ill success of the Cæsarean Operation in England has been such, that only a single case has yet happened in which the life of the mother has been preserved after the child was certainly extracted from the womb by incision. The probable reason of this circumstance I have also noticed. Abroad, however, the success of the practice forms quite a contrast to what has occurred in this country, the operation having been often done so as to save the lives both of the mother and child, of which an interesting example was recently published by Dr. Locher, of Zurich. (See *Med. Chir. Trans.* vol. ix. p. 21.) And in vol. xi. of the same work, may be read a case, in which Dr. Meyer, of Münden, saved a woman by the operation, but the foetus was dead: we have also an example, in which Dr. Spitzbarth, in 1819, preserved the lives both of the infant and mother, and another interesting relation of two Cæsarean Operations performed by Lorinser, on a woman still living at Nîmes, in Bohemia. (See *Siebold's Journ. für Geburtshilfe*, &c. vol. iii. part 1. Frankf. 1819.) In 1801, Dr. Schlegel, of Marseburg, likewise operated on a woman, who recovered, notwithstanding the bowels became strangulated, and she is still living, with a hernia in the situation of the wound. (*Schweighäuser, Archiv. des Accouchemens*, p. 135. 8vo. Paris, 1797.) The Cæsarean section has been performed by Graefe, and the woman and child were both saved. (*Journ. b. 9.*) Other instances of success took place in April, 1823, in the practice of Vanderfurh; (see *Revue Méd.*) and in Aug. 1823, in that of Schonberg, of Naples. (See *Satzb. Med. Chir. Zeitung*, for May, 27. 1824.)

From a statement made by Baudelocque, it appears, that the Cæsarean Operation had been performed twenty-four times with success between the year 1750, and the beginning of the present century; and, according to M. Velpeau, even without reckoning Lauverjet's cases, which are incontestable, it has also been practised with a favourable result, twice at Nantes, by Bacquer, on the same woman; once, at Aix, by M. Le Maître; once, by M. Dariste, at Martinique; once, at Dahlen, by Vanderfurh, in 1823; once in May, 1827, in the Hospital of Florence; twice by Schenk; once by Bulk; once by Graefe; once by Burns; and once more quite recently in the colonies. Let not practitioners, however, underrate the true danger of the operation; for, as M. Velpeau justly observes, no doubt every successful case has been brought before the public, while many unsuccessful ones have been kept out of view. His belief is, that at least half of the operations have had a fatal termination. (See *Nouv. Elem. de Méd. Opér.* t. iii. p. 677.)

OF OPERATING WHEN THE FŒTUS IS EXTRA-UTERINE.

Delivery cannot possibly happen in the ordinary way, when the foetus is situated in the ovaries, or Fallopian tube, or in the cavity of the peritoneum;

However, there are many instances recorded of ventral pregnancies, which the mothers survived, the dead fetus having been discharged by fragments out of an abscess in the parietes of the abdomen. A case, under Mr. Gunning, in St. George's Hospital, I had an opportunity of seeing a few years ago, in which the child was discharged piecemeal from an abscess of the abdomen; and I saw another case, under Dr. Blicke of Walthamstow, in which portions of bone and a great deal of matter had been voided through the vagina, though the swelling was altogether on the right side.

Practitioners are occasionally called upon to do a very similar operation to the Cæsarean, when the child has passed into the cavity of the peritoneum, in consequence of the rupture of the uterus. Unfortunately such an accident is not uncommon, and though the causes of it may not be obvious, nothing is more certain, than that the fetus itself is entirely passive, and has no share in producing the misfortune. The symptoms, by which the event may be known, are not always clear. When, however, the pains have been violent; when the last, after being excessively severe, has been followed by a kind of calm; when the countenance loses its colour, the pulse grows weak, and the extremities become cold and covered with a cold sweat; when the abdomen is generally flat and only partially affected with the swelling occasioned by the fetus, which either continues to move, or is dead and motionless; when the patient complains of a moderate degree of heat about the belly; and, lastly, when the child shrinks from the touch of the accoucheur; it is manifest that the uterus is lacerated. If the child has passed completely into the abdomen, its extraction by incision is the only resource; and whether this should be attempted or not, must depend upon circumstances. If a part of the child, however, were yet in the uterus, it might be extracted, with the aid of the forceps, if the head presented, or by the feet, provided only the upper part of the body were in the abdomen.

Baudelocque quotes three instances of gastro-tomy, performed on account of rupture of the uterus. The first is that inserted by Thibaud Dubois, in the *Journal de Médecine*, for May, 1760. Every preparation was made for a natural labour, when, after excessively violent pains about the upper and left parts of the uterus, the child disappeared. Thibaud opened the abdomen, though not till some hours after the accident. The infant was dead; but the mother experienced no ill effects after the operation, except such as are usual after ordinary labours.

The second and third cases were communicated to the French Academy of Surgery in 1775, by Lambron. He practiced the operation twice, on the same woman, with success. In the first instance, he operated eighteen hours after the rupture of the uterus. The child was dead. An ill conditioned abscess formed near the wound; but the patient got quite well in the course of six weeks. She was pregnant again the following year, and the uterus was once more ruptured. Lambron now had recourse to the operation without delay. The child betrayed some signs of life, but soon died. The mother not only survived, but afterwards became pregnant again, and had a favourable delivery.

In a foregoing column, I have adverted to the case in which Dr. Locher, of Zurich, saved both the mother and child by the Cæsarean Operation, performed in the *linea alba*. After her recovery, a small point of the wound, not exceeding two or three lines in length and breadth, required a long time to be quite healed, though no particular inconvenience was experienced from it. Some time afterwards the cicatrix gave way again, and a portion of omentum protruded, which was reduced, when a piece of bowel came out, and was also returned. The edges of the wound were then brought together; but a small superficial ulcer continued open in spite of every effort to close it. In 1818, the year following that in which the Cæsarean Operation had been performed upon her, she became pregnant again, and the chief particularity, which happened during gestation, was an increase in the size of the preceding ulcer, which became three inches in width. The sore, however, was covered with charpie, and the integuments well supported with adhesive plaster. On the 23rd of May, she was seized with labour-pains; and, about seven in the evening, she complained all at once of a very acute pain, and at the same moment voided a considerable quantity of blood from the vagina. On examining by this passage, nothing was discovered; but when the hand was applied below the navel, in the line of the old wound, and under the ulcer, a circumscribed firm swelling was felt, caused by the child's head, of which the sutures were plainly discernible. Dr. Locher naturally concluded that the uterus had burst, so as to allow the child to escape, and the hemorrhage was thus easily explained. A repetition of the Cæsarean Operation was deemed indispensable. The place of the incision was determined by the round swelling, caused by the child's head. An incision six inches in length, was made into the abdomen, where a quantity of coagulated blood was found. When this had been removed, the membranes presented themselves, exhibiting a bluish hue, and, after they had been opened the head of the child immediately appeared. The navel-string passed round the neck, which was also compressed in the opening of the uterus. The child evinced no signs of life. The placenta came away during the attempts to reanimate the child. The uterus contracted, and there was little bleeding. This patient, after a good deal of indisposition, and occasional approaches to a perfect recovery, was at length attacked with inflammation of the stomach and bowels, and died on the 9th of July. The uterus was found contracted to a small size, with an opening, of about the size of an almond, on its anterior surface, with a rounded callous edge. This aperture Dr. Locher thinks had remained ever since the first operation, and had allowed the escape of the child in the second labour; a circumstance which may be doubted, as the hemorrhage indicated the period when the uterus had been lacerated, as this gentleman indeed has in one place particularly noticed himself. (See *Med. Chir. Trans.* vol. xi. p. 182, &c.) An almost incredible case is related of, what may be called, a Cæsarean birth, effected solely by the powers of nature, and, as would appear, by a sudden rupture of the uterus and parietes of the abdomen, after the patient had been in labour three days. (See *Essays and Obs. Physico and Literary*, vol. ii.)

A laceration in the uterus, or the wound made in this viscus in the Cæsarean Operation, may give rise to dangerous and even fatal symptoms of strangulation, if any of the intestines insinuate themselves into the preternatural opening. When such an occurrence happens in the performance of the preceding operation, the intestine must be directly withdrawn and replaced. If the accident were to happen when the child is extracted in the natural way, the bowel is to be pushed back into the abdomen from the uterus. Were the occurrence to take place several days after the operation, Sabatier inquires, what ought to be done? A surgeon is said to have pushed back the intestine from the uterus as late as the third day. Sabatier thinks, that later it could not be done. In this circumstance, Baudelocque advises the operation, suggested by Pignat, namely, that of opening the abdomen and withdrawing the bowel from the place in which it is incarcerated. But the adhesions, which are soon formed, would be likely to frustrate the design.

Gastrotomy has not only been recommended for cases where the child has passed into the abdomen through a rupture of the uterus; it has likewise been advised for instances in which the *foetus* has grown in the Fallopian tube, ovary, or cavity of the abdomen. Here, indeed, the operation deserves to be called Cæsarean; for, in addition to the incision in the skin and muscles of the abdomen, it is necessary to open the pouch, in which the child is contained. The instances of conceptions in the Fallopian tube are not uncommon. Those in the ovary, and cavity of the peritoneum, are more rare. Sabatier conjectures, that most of the cases reported to be of the latter kind, if attentively examined, would have been found to be in reality conceptions in the Fallopian tube.

Extra-uterine conceptions hardly ever arrive at maturity. However, the *foetus* formed in the Fallopian tube has sometimes been known to attain the term of nine months, and then die, either from the impossibility of its expulsion, or from the insufficiency of the nourishment afforded it. The pouch in which it is contained, and the neighbouring parts, have then inflamed, and, after becoming connected together by numerous adhesions, have suppurated. The abscess has burst, partly at some point of the circumference of the belly, and partly into the rectum; and the dead *foetus* has been discharged piecemeal with the matter.

In other examples, the *foetus*, instead of giving rise to abscesses, has become ossified with the enveloping membranes, and continued in this state many years, without any other inconvenience to the patient, than what depended on the size and weight of the tumour within the abdomen.

Most frequently, however, the pouch containing the *foetus* bursts, about the middle of the ordinary period of gestation, and the child passes into the cavity of the peritoneum. At the same moment, the blood-vessels, ramifying on the parietes of the containing parts, usually pour forth into the abdomen so much blood, that the patients generally die in the space of a few hours. (See a case by Dr. Clarke in *Trans. of a Society for the Improvement of Medical and Chirurgial Knowledge. Also another, adverted to by Sir C. Bell, in Med. Chir. Trans.* vol. iv. p. 340.)

Two facts of this kind fell under Sabatier's observation. The women were in the end of the

fourth month of pregnancy. Excepting a swelling, which affected only one side of the abdomen, and frequent dragging pains in this cavity, there was no indication of any thing extraordinary. In other respects, the patients were well. They were both, all on a sudden, attacked with extremely acute pains, which lasted two or three hours. A more violent suffering than the rest was followed by entire ease. The abdomen subsided, and became flat. An equal, moderate warmth diffused itself over this part of the body. The skin lost its colour. Almost continual syncope occurred. The pulse became feeble and concentrated. Cold perspirations ensued, and the women died. The rapid course of these symptoms rendered it impossible for Sabatier to be of any service. The patients were actually dying, when he was called to them. The examination of their bodies evinced, that the abdomen contained a large quantity of blood; that the *foetuses* lay on the intestines, connected with the lacerated Fallopian tube by means of the umbilical cord; and that the tube itself, which was strongly contracted, presented no other tumour, except that which depended on the after-birth.

There is nothing that announces an extra-uterine pregnancy with sufficient certainty, to justify any positive conclusion respecting the nature of the case, before the ordinary time of parturition. In many women, the gravid uterus inclines to one side, and numerous pregnant females have dragging pains, which may depend upon other causes. Things, however, are different when the *foetus* has lived to the ordinary period of parturition, and the woman is attacked with labour-pains; because, besides the unequivocal signs of the presence of child in the abdomen, the womb is empty, and is little changed from its common state. Should we now, asks Sabatier, have recourse to the Cæsarean Operation, just as if the *foetus* were in the womb? Can we be sure that the pouch which contains the child will contract like the uterus, and that the incision which is in contemplation will not give rise to a fatal hemorrhage? Would it be easy to separate and remove the whole of the placenta? How could the discharge, analogous to the lochia, find an outlet, and would not its extravasation in the abdomen be likely to prove fatal? Sabatier thinks, that the risk which is to be encountered is much less when things are left to nature. The child, indeed, must inevitably perish. It will either give rise to abscesses, with which it will be discharged in fragments, or it will remain for a length of time in the abdomen, without any urgent symptoms. Sabatier also calls our attention to the great precariousness of an infant's life, and expresses his opinion, that there can be no difficulty in deciding what conduct ought to be adopted. Happily, practitioners are not often placed in circumstances so delicate, and extra-uterine conceptions mostly perish, before the end of the common period of gestation. We have then only to second the efforts of nature; either by promoting suppuration, if it should seem likely to occur; by making a suitable opening, or enlarging one that may have formed spontaneously; by extracting such fragments of the *foetus* as present themselves; by breaking the bones, when their large size confines them in the abscess, as Littre did in an instance where the abscess burst into the rectum; and, lastly, by employing suitable injections.

An extremely uncommon case of extra-uterine

conception was related a few years ago by Josephi; the foetus having at length passed into the bladder by ulceration, and caused such affliction, as rendered cystotomy indispensable, with the view of extracting the parts of the foetus lodged in that organ. The operation was done above the pubes; but the internal mischief already existing was so great, that the patient did not recover. (*Ueber die Schwangerschaft ausserhalb der Gebärmutter*; Hlostock, 1803, 8vo.)

Govei, p. 401, relates a case of ventral conception, in which instance the Cæsarean Operation was done, and the child preserved. A lady, aged twenty-one, had a tumour in the groin, which was at first supposed to be an epiplocele, but an arterial pulsation was perceptible in it. In about ten weeks the swelling had become as large as a pound of bread. Govei, solicited by the lady, opened the tumour. He first discovered a sort of membranous sac, whence issued a gillion of limpid fluid. The sac was dilated, and a male fœtus found, about half a foot long, and large in proportion. It was perfectly alive, and was baptized. After tying the umbilical cord, the placenta was found to be attached to the parts just behind, and near, the abdominal ring; but it was easily separated. Govei does not mention whether the mother survived. Bertrandi was unacquainted with any example of the Cæsarean Operation being done, in cases of extra-uterine fœtus, so as to save both the mother and infant. This eminent man condemned operating, in ventral cases, on the ground that the placenta could not be separated from the viscera, to which it might adhere, or, if left behind, the subsequent inflammation and suppuration would be mortal. (See *Traité des Opér. de Chir.* chap. v.)

Ruth, a surgeon in Upper Silesia, performed the **Cæsarean Operation** successfully in a case of extra-uterine pregnancy, of some years standing, during which period the woman became pregnant in the usual way, and was safely delivered. (See *Graefe and Walther's Journ.* part 3, vol. vi.) The particulars, which are well deserving of the attention of obstetric practitioners, may also be found in one of our own periodicals. (See *Edinh. Med. and Surg. Journ.* vol. xxiii. p. 429.)

Whether it be the *Cæsarean Operation*, or gastro-
tomy, has been performed, the practitioner is not
merely to endeavour to prevent inflammation, heal
the wound, and appease any untoward symptoms
which may arise; he should also prevail upon the
mother to suckle the child, in order that the lochia
may not be too copious; and, after the wound has
been healed, she should wear a bandage, for the
purpose of hindering the formation of a ventral
hernia.

[illegible]

dora, Obs. duc de Paris Casareo, Erlang. 1793. *Guillardot*, sur l'Opération Casarienne. Strassb. 1793. *Guastavini*, Diss. sur l'Opération Casarienne et la Section de la Symphyse de Puits. Paris, 1808. *J. F. Neumann*, Specimen, sistens Sectionis Casareae historiam. Hal. 1805. *Bandelocque*, Traité des Accouchemens, Paris. 1807. *Denman's* Introduction to Midwifery, 4to. 1808. Also Obs. on the Rupture of the Uterus, &c. 8vo. 1810. *Hall's* Defence of the Casarean Operation, 8vo. Manchester, 1793. Also his Letters to Mr. H. Simmons. *Haigham's* Inquiry concerning the Casarean Operation. *Haigham's* Operation. *P. Barton*, De Sectione Siagutiana et Casarea, haurumque Sectionum luteri et Comperatione: (Coll. Diss. Lovan. 321. *G. Ruchel*, Quæstio, &c. An. et secundum pro actu matris observandum, haurumque incipit et que incipit, quædam et secundum cum matre fortis sectio Casarea? (*Müller*, Diss. (Chr. 3. 525. Paris, 1744.) *A. Tindmann*, De Partu Preternaturali quem sine Matris aut Fortis Sectione absolvere non licet. 4to. Gött. 1755. Med. Obs. and Inquiries, vol. iv. p. 274. &c. *J. Vaughan*, Cases, &c., to which is annexed an Account of the Casarean Section, 8vo. Lond. 1778. *P. J. F. Wilekiers*, de Hystoromotocia, sive Sectione Casarea. Lovan. 1785. Edn. Med. and Surgical Journ. vol. iv. p. 178. vol. VIII. p. 11. *Gaythorpe's* Obs. on Extra-uterine Cases, inserted in the 8th vol. Lond. Med. Journ. *Richter's* Anfangsgr. der Wundarznekunst, b. 7. kap. 5.; Gött. 1804. *C. Bell*, in Medico-Chirurg. Trans. vol. iv. p. 347. &c.; *J. J. Locher*, vol. ix.; and *J. J. Locher*, n. Meyer, *F. Spitzbarth*, and *J. Lorinser*, in vol. xi. of the same work. *J. F. Freyhammer*, De Partu Casareo, 12mo. Marb. Catt. 1797. *J. Barlow*, in Medical Records and Researches, 1798; and in Essays on Surgery and Midwifery. *G. Joseph*, über die Schwangerschaft ausserhalb der Gebärmutter, &c. 8vo. Rostock. 1808. *Fajani*, Osservazioni, &c. di Chirurgia, t. III. p. 148. &c. Roma, 1808. *Rhodi*, Relatio de Sectione Casarea feliciter peracta, 4to. Dorpat, 1803. *A. Sprengel*, Geschichte der Chir. t. i. p. 369. &c. 8vo. Halle, 1808. *M. Bandelocque*, &c. 8vo. 1805. *M. Bandelocque*, Observation, with notes on the Casarean Operation, 8vo. with notes, &c. 8vo. 1805. *Joh. Halk*, über die Manichien, 1811. *E. Heim*, Erläuterung der Schwangerschaften ausserhalb der Gebärmutter, 8vo. Berlin, 1812. *A. J. A. Stevens*, De Conditionibus que apud parturientes Sectionem Casaream, vel potius illam Sympochondria ossium Pubis, prefulant. 4to. Ludg. 1817. Dictionnaire des Sciences Méd. t. 17. p. 419. Paris, 1816; and t. 23. p. 203. &c. 1818. *E. Von Siebold*, Journal für Geburtshilfe, Frauenzimmer und Kinderkrankheiten, b. 3. 8vo. Francf. 1809. *J. H. Graen*, in Med. Chir. Trans. vol. XII. p. 46. &c. *C. F. Graef*, über Minderung der Gefahr beim Kaiserschnitt, nebst der Geschichte eines Falles, in welchem Mutter und Kind erhalten wurden, in Journ. für Chir. &c. b. 9. p. 1. *Aff. A. J. M. Tripod*, Nouv. Étém. de Med. Opér. t. 3. p. 675. &c. 8vo. Paris, 1832.

CALCULUS. Calculi form in the ducts of the salivary glands; in the kidneys, bladder, urethra, gall-bladder, &c. For a paper on calculi of the lachrymal sac, see *Graefe's Journ. für die Chir.* No. i. Berlin, 1820. For an account of stones in the bladder, refer to **URINARY CALCULI.**

CALCULUS IN THE INTERIOR OF THE EYE. See EYE, &c.

CALLUS, *New-bone*, or the osseous substance which serves to unite the ends of a fracture. The process by which it is formed, and the differences between the *provisional* and the *definitive* calli, will be explained in the article FRACTURE.

CALOMEL. (Sublimiate of mercury; Hydrargyri submurias, L. P.) Its extensive utility, in surgical diseases, will be conspicuous in a large proportion of the articles in this work. When prescribed as an alterative, the common dose is a grain once or twice a day; when ordered as a purgative, from three to eight grains may be given; and when directed, with the view of exciting salivation, from two to four grains, combined with opium, are usually administered night and morning, and in urgent cases, like this, sometimes oftener, till a full impression is made on the salivary glands, and system at large.

CAMPION is used externally, chiefly as a means of exciting the action of the absorbents, and thus dispersing many kinds of swellings, extravasa-

tions, indurations, &c. Hence, it is a common ingredient in liniments. It has also the property of raising the action of the nerves, and quickening the circulation in parts on which it is rubbed. For this reason, in paralytic affections, it is sometimes employed. Few applications have greater power in exciting the absorption of any tumour, or hardness, than camphorated mercurial ointment.

Camphor has also been recommended for the relief of stranguries, even those depending on the operation of cantharides. But although it may occasionally have succeeded, when given with this view, it not only does not always do so, but it has been known to cause an opposite effect, sometimes producing great scalding in voiding the urine, and pains like those of labour. (*Medical Trans.* vol. i. p. 470.) In chordee, its utility is generally acknowledged. Persons who cannot procure rest, unless they take very large doses of opium, sometimes find smaller ones answer, if combined with camphor. (See *Brande's Manual of Pharmacy*, p. 46.)

CANCER. (Derived from the Latin *cancer*, a crab, to which a breast affected with this disease, and surrounded by varicose veins, was anciently fancied to have a resemblance.) Also *Carcinoma*, from the Greek *καρκινος*. Although the terms *cancer* and *carcinoma*, considered with reference to their etymology, seem decidedly to possess little recommendation, the moderns employ them with a far more precise and settled meaning than the ancients, unenlightened as they were by pathological anatomy. Still our knowledge of cancer is not even now sufficiently advanced to enable us to answer, conclusively, various questions respecting it. (See *Bégin in Dict. de Méd. et de Chir. Pratiques*, t. iv. p. 425.)

Formerly, a vast number of morbid alterations of structure, entirely different from one another, were confounded together under the name of cancer. The French ascribe to Laennec the merit of having first demonstrated the elementary texture of true cancer, and thus freed the subject from a great deal of confusion. I believe, however, that Hume, Baillie, Hay, and Abernethy, had all promulgated their observations on cancer, when Laennec published. According to the latter distinguished pathologist, the human body is liable to two classes of accidental productions, or new formations: to the first belong certain abnormal textures, to which some of the natural tissues are more or less analogous: to the second appertain other abnormal textures, which have nothing analogous to them in any of the primitive tissues of the body. Amongst the productions of the latter kind, Laennec arranged *tubercles*, *scirrhus*, the *encephaloid*, *cerebriiform*, or (as we more frequently call it) the *medullary tumour*, and *melanosis*. Notwithstanding all, or several of these abnormal elementary modifications of disease may exist in tumours, vaguely called cancerous, yet, as M. Bégin well observes, and M. Laennec admits it himself, it is particularly to *scirrhus* and *cerebriiform*, or *medullary* formations, that the term cancer is applied. In this article, I shall exclude from consideration *tubercles*, which British pathologists never regard as cancerous, but generally as a form of scrofulous disease. Neither shall I enter, at present, into the subject of *melanosis*, which, though sometimes regarded as a species of cancer, as, for instance, by M. Alibert, who terms it *cancer mélané* (see *Annales Nat.* t. ii.

1617, 4to.), will admit very advantageously of separate consideration: (See *Melanosis*.) According to Professor Carswell, carcinoma does not admit of a precise definition, but it may be said to consist in the formation or deposition of a peculiar substance which presents a great variety of consistence, form, and colour; frequently assumes a definite arrangement, and possesses a vascular organisation of its own; gives rise to the gradual destruction or transformation of the tissues in which it is situated; affects simultaneously or successively a greater or lesser number of organs; and has a remarkable re-productive tendency. Both *scirrhus* and *medullary cancer*, have long been looked upon as *malignant diseases*, though not with that discrimination and precision of meaning, which the valuable remarks of Mr. Travers are likely to establish. This gentleman considers carcinoma 'as a genus of the order "malignant diseases;" and agrees with Laennec, Carswell, and other eminent modern pathologists, in enumerating two species of it; the *scirrhus* and *medullary*. It is to incurableness from causes not local, and consequently the disposition to appear in more than one part at the same time, or to reappear when the first affected part has been freely removed, that Mr. Travers applies the term malignity. But if, from any local cause, a sore will not heal, or becomes gangrenous; if, by the extension of the ulcerative process, blood-vessels are opened, and fatal hemorrhage ensues; if, by the profuseness of a secretion, the patient dies exhausted; if, by the incessant irritation of the nervous system, or the morbid actions set up in vital organs under a protracted symptomatic fever, life is extinguished; the circumstances of the disease, viewed with reference to the above definition of malignity, would not imply that its nature was malignant. (See *Med. Chir. Trans.* vol. xv. p. 198.)

Dr. Carswell founds the essential character of heterologous formations, of which scirrhus and medullary cancer are examples, on the presence of a substance, which does not enter into the healthy composition of the body; and, under the generic term of *carcinoma*, he comprehends *scirrhus* (*scirrhus*) and *medullary cancer* (*cephaloma*), with their varieties. His reasons for arranging these diseases together are the following:—1. They often present, in the early period of their formation, certain characters common to all of them, however much they may differ from each other in the subsequent periods. 2. They all terminate in the gradual destruction or transformation of the tissues which they affect. 3. They have all a tendency to affect several organs in the same individual. 4. They all possess, though in various degrees, the same reproductive character. (See *Carswell's Illustrations of the Elem. Forms of Diseases*, Fasc. 2.)

But though the varieties of *scirrhus* and *cephaloma*, as they are named by Dr. Carswell, resemble one another in the foregoing respects, they present differences which this pathologist refers to two states of the heterologous deposit, to which they owe their origin. In *scirrhus*, the deposit has little or no tendency to become organised. Its form and arrangement appear to be determined chiefly by external circumstances; and its production and increase are entirely dependent upon the nutritive function of the organ in which it is contained. In *cephaloma*, the deposit has a greater or lesser tendency to become organised; and, although it may at first assume a determinate

form and arrangement, in consequence of the influence of external circumstances, it possesses in itself properties, by means of which its subsequent arrangement and development are effected; independent of the nutritive function of the organ in which it is formed, except in so far as the materials of its growth may be derived from this source." (Carswell, *Op. cit.*)

With respect to the varieties of *scirrhus*, when the heterologous deposit is collected in numerous points in the form of a hard, grey, semitransparent substance, intersected by a dull white or pale straw-coloured fibrous, or condensed cellular tissue, it is denominated *scirrhus*. When it assumes a regularly lobulated arrangement, so as to represent an appearance similar to a section of the pancreas, it forms what was called by Abernethy *pancreatic sarcoma*, but is better named by M. Bégia *pancreatic scirrhus*; the term sarcoma being strongly objected to by some pathologists, amongst whom I know is Sir Astley Cooper. Again, as Dr. Carswell observes, the heterologous deposit may be uniformly disseminated throughout the texture of an organ, which it converts into a solid substance, resembling raw or boiled pork, and named by the French *tumeur lardée*, or *lardaceous tumor*. Lastly, when it presents the appearance of firm jelly, and is collected into masses of greater or less bulk in a multitude of cells, it is the *matière colloïde* of Laennec, the cancer *gélutiforme*, or, aréolaire of M. Cruveilhier. (See *Carswell's Illustrations of the Elem. Forms of Disease*, Fasc. 2.)

M. Laennec entertained the belief, which is not at present adopted, that every heterologous deposit, like those of *scirrhus* and cerebriform cancer, having nothing analogous to them amongst the primitive textures of the system, necessarily and invariably had two stages; one of *crudity*, the other of *softening*. The mistake on these points is, that the heterologous deposit does not always soften after a certain period, though it sometimes does so partially.

In the period of crudity, *scirrhus* is represented by Laennec as a substance sometimes perfectly white, but in other instances, bluish, or greyish, slightly transparent, and whose consistence is such, that dividing it with a scalpel usually causes a rattling sound, the consistence varying, however, in different examples, from that of the skin of pork nearly to that of cartilage. The *scirrhus* substance is ordinarily homogeneous, but divided into masses, which are again subdivided into lobules, united by a dense cellular tissue, whose arrangement, though exceedingly diversified, appeared to Laennec to exhibit a kind of regularity, and to resemble that of the cells of a honeycomb. In some cases, the fibrous tissue, intersecting the *scirrhus* substance, presents a reticulated arrangement, in some, an arborescent distribution; and, in others, an appearance, as if it radiated from a central point in every direction around. Some *scirrhi*, when laid open, are fancied to look very much like the substance of a turnip.

When a section is made of a *scirrhus* in its first stage, we find, according to Mr. Travers's description, "a tough, inorganisable, and pretty compact mass, of a white and yellow brown colour, smooth, and moistened by a slightly unctuous fluid; its consistence is not uniform, being hard in the centre, so as to form a nucleus. The circumference is defined by the termination of red vessels, forming

a vascular boundary." On maceration, "the texture opens, so as to bring into view concentric areolæ, having their interstices filled by a white granular matter, which may be picked out from the meshes. These areolæ are crossed by faint white lines, at irregular intervals, in the direction of radii from a centre, visible to the naked eye, and very conspicuous under a magnifier, giving the section some analogy to that of a lemon. In the second stage, when inflammatory action commences, and is announced by shoots of pain, the relative firmness of the centre and circumference of the tubercle becomes reversed, the centre being pulpy or broken, while the circumference retains its firmness. The surrounding parts are now found to have lost their natural elasticity by condensation of texture, and partake of the firmness and weight of the *scirrhus*, giving considerable apparent increase of volume to the tumour, which is now less defined at its margin, and, in fact, of a compound character." One particular opinion entertained by Mr. Travers is, that the dense opaque white lines, traversing the tumour in the direction of radii, and diminishing in density as they proceed outward, are not the production of the disease, but the septa, which divide and support the lobules of which the gland is composed, in an opaque and thickened state. (See *Med. Chir. Trans.* vol. xv. p. 208.) The correctness of this view seems rendered doubtful by the fact, that the radiating white lines are met with wherever the *scirrhus* formation is met with, whether in a gland or not; and sometimes shoot into the surrounding textures beyond the limits of the part originally attacked.

Notwithstanding the essential difference between *scirrhus* and cephaloma seems to Dr. Carswell to consist in the former having little or no tendency, the latter a greater or lesser tendency, to become organised, it is sometimes impossible to draw a distinct line of separation between them; for, the heterologous deposit, when first formed, and, indeed, frequently for a considerable time after its formation, does not furnish any signs, which show that it will or will not become organised. 1. The heterologous substance may exist in the form of *scirrhus*, *pancreatic sarcoma*, or the *lardaceous tissue*, without presenting any trace of organisation; the textures which it invades being gradually destroyed by its presence, and both ultimately converted into a soft, granular, pulpy, or liquid mass, of the colour or consistence of cream or milk. 2. The heterologous deposit may exist under the same forms, but change into mammary, or medullary sarcoma, becoming more or less soft and vascular, and frequently terminating in hemorrhage by the rupture of its vessels, or in the state commonly, but improperly, termed fungus hæmatodes. According to Dr. Carswell, numerous examples might be given of *scirrhus*, medullary sarcoma, and fungus hæmatodes, originating in the same morbid state, and passing successively from the one into the other in the order here specified. Indeed, all the varieties, both of *scirrhus* and cephaloma, are frequently met with, not only in different organs of the same individual, but even in a single organ. (See *Carswell's Illustrations of the Elem. Forms of Disease*, Fasc. 2.) A testis, which I lately removed in the North London Hospital, exhibited, in some places, fine specimens of mammary sarcoma; while, in others, its consistence was cerebriform, or medullary. Sir Astley Cooper once mentioned to

in a case, in which he removed a diseased breast, the substance of which corresponded to scirrhus; a return of disease took place, and the tumour was then of the medullary kind. A true scirrhus texture of an unmixed form is rare in young persons. The examples, in which it presents itself, in combination with medullary cancer, are principally noticed in individuals who have passed the middle period of life. Several of the varieties of both species of carcinoma appear to Dr. Carswell to differ materially from one another with regard to the comparative rapidity of their development, as well as their reproductive tendency; a fact of considerable practical importance. In both these respects, the pancreatic differs from the lardaceous, the lardaceous from the mammary; and the mammary from the medullary cancer. The first often remaining stationary for months or years; the last frequently acquiring its maximum of bulk in a few weeks, and when removed, being sometimes reproduced with a degree of rapidity which is never observed in any of the other varieties. Generally, the more the varieties of scirrhus, and medullary cancer partake of the characters of cellular, cellular-fibrous, and fibrous tissues, *ceteris paribus*, the less rapid are they in their growth, and the less is their tendency to be reproduced. (See Carswell's *Illustrations*, &c. Fasc. ii.)

If the disease be examined at the earliest period of its formation, while the heterologous substance has not effaced the particular texture of the part in which it is contained, the researches of Dr. Carswell prove, that the morbid substance becomes manifest to our senses, either as a production of nutrition or of secretion. "In the former case (says he) it is deposited in the same manner as the nutritive element of the blood enters into the molecular structure, and assumes the form and arrangement of the tissue or organ into which it is thus introduced. In the latter, it makes its appearance on a free surface, after the manner of natural secretions, as on serous surfaces in general."

Another interesting fact in relation to cancer is, that the heterologous substance is sometimes found within the vessels. According to M. Andral, solid fibrine in the blood-vessels sometimes constitutes in organs whitish masses, similar to cancerous tumours. In the body of a middle-aged man he found one of the lungs full of masses of this description. The middle ramifications of the pulmonary artery were gorged with solid matter, of a dirty white colour, reddish at some points, and at others liquid, and like greyish bouillie. On being attentively examined, it seemed to M. Andral to be nothing more than solid blood, reduced to elementary fibrine, with a little of the colouring matter at some points, and here and there in a state of fluidity. M. Andral traced a similar matter in the smallest vessels, as far as he was able to follow them, and he was convinced that the whitish masses, with which the lung was studded, instead of being a degeneration of the organ, or an accidental production in it, really consisted of small vessels filled with solid fibrine, more or less destitute of colouring matter. M. Andral likewise ascertained that cancerous masses are sometimes met with in the ramifications of the vena portæ. He noticed the same thing in the kidney: a fibrinous concretion, of a dirty white colour, was found occupying the renal vein, to the interior of which it was adherent; and it extended into the ramifications of the vessel, so that it

could be traced into the smallest branches, and into parts of the kidney, where previously to the dissection, only white or pale red masses had been seen, which Luennec would have termed the encephaloid (medullary) matter in a state of crudity. M. Velpeau, who had observed similar facts, was led to infer that cancer may be primarily developed in the blood. But instead of adopting this conclusion, M. Bégin prefers the view entertained by M. Andral, in which a certain change of the fibrine of the blood is conceived to have an important share in the formation of some cancerous productions. (See *Dict. de Med. et de Chir. Pratique*, t. iv. p. 42.) As Professor Carswell remarks, the presence of the heterologous substance, which constitutes the several varieties of both species of carcinoma in the blood, is a circumstance of great importance; and unless it be clearly demonstrated to arise in consequence of a modification of the blood itself, we should find it impossible to explain many of the phenomena which it presents, more especially those which accompany its formation in the molecular structure of organs, and on the free surface of membranes. The following facts are regarded by Dr. Carswell as furnishing strong evidence, that the formation of this substance takes place in the blood, whether it be found in this fluid alone, or in other parts of the body at the same time: The presence of this substance, 1. in the vessels, which ramify in carcinomatous tumours, or in their immediate vicinity. — 2. In the vessels of a portion, or of the whole of an organ; to the former of which this substance is exclusively confined, and can be traced from the trunks into the branches and capillaries. — 3. In vessels having no direct communication with an organ affected with the same disease; as, for example, when it is confined to a small extent of the vena portæ; and lastly, in blood which has been effused into the cellular tissue, and on the surface of organs.

Dr. Carswell further observes, that the divisions of the vascular system, in which the carcinomatous substance has been observed, are the venous and capillary; and that in large veins, such as the vena portæ and its branches, the emulgent vein, &c., it may present the lardaceous, mammary, medullary, or hamatoid characters, all in the same venous trunk.

The formation of these varieties of carcinoma in the blood is a curious and particularly interesting fact, more especially as bearing upon the long-disputed question, whether cancer is a local or a constitutional disease. Dr. Carswell believes that when the disease takes place in the intimate structure, or on the free surface of organs, its material element is separated from the blood, and deposited under a variety of circumstances which modify its form, bulk, colour, and consistence. He cannot, therefore, imitate some pathologists, who regard the seat of the two principal varieties of carcinoma, as limited to any one tissue, or who refer its origin to any modification of structure, or special organisation. And, with respect to the cystic origin of carcinoma, as suggested by Dr. Hodgkin (See *Med. Chir. Trans.* vol. xv. p. 292.); he remarks, that the presence of cysts in the liver, walls of the stomach, lungs, kidneys, brain, lymphatic glands, spleen and blood, is not to be detected at any period of the development of carcinoma, and, therefore, when they do occur in other organs, as the ovaries, testes, mammae, &c., they must be

regarded as a mere coincidence, or as a consequence of the disease, and not as a cause, or necessary condition of it. (See *Carswell's Illustrations of the Elem. Forms of Disease*, Fasc. 2.) The latter conclusion, I believe, has long been the prevailing one. We find it adopted by Home, Abernethy, and Travers. The latter remarks:—"Within the wall of the tubercle, one or more cysts, containing a dark yellow, or coffee-brown fluid, are sometimes met with, but are often not present." (See *Med. Chir. Trans.* vol. xv. p. 209.)

Cruveilhier regards all organic transformations and degenerations as exclusively the result of the deposition of morbid products in the cellular element of organs, and he believes that their *tissus propres* are incapable of undergoing any organic lesion, except hypertrophy and atrophy. But this view has been proved by Dr. Carswell to be incorrect, who shows that, in the liver and stomach, carcinoma can be distinctly seen to form in the molecular structure, or proper tissue.

The form assumed by the carcinomatous matter seems to Dr. Carswell to be determined, in a great measure, by external circumstances. The globular shape mostly occurs in organs possessing uniform density, and in parts submitted on all sides to equal pressure. On natural and accidental serous surfaces, although the deposit may be at first globular, it frequently becomes pyriform, either on account of the mode of its attachment, or of less resistance being made to its growth, in one direction than another. It assumes a fungiform shape when placed in circumstances facilitating its lateral, or retarding its anterior development, as when it meets with a dense unyielding substance during its progress, or having pierced the skin, is subjected to pressure. When accumulated in separate portions of the cellular tissue into rounded masses, grouped together, and included within a common capsule, it generally presents a lobulated appearance, and, in the sub-mucous tissue in particular, it frequently exhibits the cauliflower or mulberry appearance. (See *Carswell's Illustrations*, &c.)

This eminent pathologist next notices the *stratiform* arrangement of carcinomatous matter, as principally met with in the subserous cellular tissue, and frequently in the form of thin circular patches, varying from the breadth of a pin's head to an inch or more. The *ramiform* arrangement and modifications of it seem to him to depend upon the carcinomatous matter being contained in the veins, lymphatics, or lacteals.

With respect to *bulk*, Dr. Carswell explains, that the quantity of carcinomatous matter deposited in the molecular structure or on the free surface of organs is extremely various, but perhaps never so great in the former as in the latter. In the liver, it may vary from the size of a pin's head to that of an orange. In more yielding organs, as the lungs, testes, and even the mammae, it may equal in bulk the head of an infant, or of an adult, as exemplified in a coat preserved at University College, London; and, in the intermuscular and subcutaneous cellular tissue, its bulk is sometimes still more considerable.

Dr. Carswell very properly draws the attention of his reader to the influence of pressure in promoting or retarding the development of carcinomatous tumours. While their progress outwards is resisted by an unyielding fibrous membrane, they often remain for a considerable time nearly

stationary; but, directly this obstacle is removed, they acquire a rapid increase of bulk, and as soon as the skin ulcerates, they often protrude in the shape of enormous fungi.

The carcinomatous swellings, which attain a very considerable size, are not those of a scirrhus, but of a medullary texture. In fact, as Dr. Carswell observes, the latter possess within themselves the power of increasing to an almost unlimited extent. It is to the vascular organisation of such tumours, that the rapidity of their growth, and their frequently great bulk, are to be attributed. A boy came to the North London Hospital with a medullary tumour about the size of an orange, situated over the lower costa of the scapula: in ten days, it occupied the whole of the axilla, reaching partly over its anterior margin, as well as very deeply into it.

I have already alluded to Laennec's doctrine, that the consistence of cancer varies, and that it is greater in the early than the late stage. The term *scirrhus*, implying induration, is commonly employed to express the early, or occult stage of cancer; while a softer condition of the part, or tumour, is frequently conceived to indicate a more advanced period of the disease. But, as Dr. Carswell remarks, the degree of consistence of carcinomatous formations is not an invariable character of a particular stage of their development; for, when first perceptible, they may be as hard as cartilage, soft as brain, or fluid as cream; or they may become soft or fluid, after having remained for a certain time in a state of hardness.

The variety in the consistence of carcinomatous formations is ascribed by Dr. Carswell to the following circumstances:—1. The nature of the organ in which the carcinomatous deposit is contained.—2. The elementary composition of the deposit.—3. The subsequent changes, occurring either in the deposit itself, or the tissues with which it is in contact.

According to the analysis of scirrhus and medullary deposits, published by Lobstein (*Traité de Anat. Pathol.*), seventy-two grains of scirrhus breast contained—

Albumen . . .	2 grs.
Gelatine . . .	20
Fibrine . . .	20
Fluid fatty matter . . .	10
Water . . .	20
	—
	72

Seventy grains of scirrhus uterus contained—

Gelatine . . .	15 grs.
Fibrine . . .	10
Fatty matter . . .	10
Water . . .	35
	—
	70

In the early stage of medullary cancer, the tumour contained a greater quantity of gelatine than albumen; and in the more advanced stage, when the carcinomatous matter was of the consistence of soft brain, the albumen was much more abundant than the gelatine. This statement is worthy of attention, now that medullary tumours are frequently termed *albuminous*.

According to the important researches of Professor Carswell, when we examine anatomically a mass of carcinomatous matter contained in a large

vein, or situated on the surface of a serous membrane, in loose cellular tissue, or on the surface of a scire, or cicatrix, we find it composed of the following elements in various proportions, viz. carcinomatous matter, cellular, fibrous, and serous tissues, and blood-vessels. The carcinomatous matter almost always forms by far the greater bulk of the disease. If its consistence be considerable, it presents a uniform, granular, or radiated arrangement; if soft, a lobulated one. The cellular tissue is often in small quantity, and so fine as not to be perceptible till the carcinomatous matter has been separated from it by pressure, or maceration. The carcinomatous matter is inclosed in it, and separated by it into granules, lobules, &c. These it intersects in various directions, and it serves to conduct the vessels which administer to the nutrition and growth of the disease. The fibrous tissue is less frequently an element of carcinoma on the surfaces of organs; but the serous is often present, either rendering the carcinomatous matter encysted, or forming cysts in it of various sizes filled with gelatinous, albuminous, or other fluid. When carcinomatous matter is deposited in the molecular structure of organs, the quantity of cellular and fibrous tissues, intersecting it in various directions, is sometimes very considerable. (See *Carswell's Illustrations of the Elementary Forms of Disease*, p. 3.)

In true scirrhus the traces of vascularity are very faint; but, in medullary cancer, the adventitious membranes possess a high degree of vascularity. The vessels ramifying in them are not only numerous but large. By some they have been considered principally arterial; by others, venous. Dr. Hodgkin is not able to decide to which class of vessels they are most nearly allied. These newly formed vessels, though large and numerous, are extremely weak and tender, and derive little or no support from the structure by which they are surrounded. Hence, they are liable to give way at numerous points, whence proceed those frequent and extensive hemorrhages, which have led to the disease, being sometimes named fungus hæmatodes. (See *Hodgkin*, in *Med. Chir. Trans.* vol. xv. p. 334.) According to Dr. Carswell, the vessels of cephaloma, or medullary cancer, vary in diameter from the breadth of a hair to that of a line, and present that peculiarity of distribution, always more or less conspicuous in newly formed vessels, namely, the ramifications, of which they are composed, communicate with a common trunk at its opposite extremities, in the same manner as the hepatic and abdominal divisions of the vena portæ do with the trunk of this vessel. They are frequently varicous, and seem to Dr. Carswell to partake more of the venous than the arterial character. He describes them as formed apart from the vascular system of the surrounding tissues, and constituting the proper circulation of cephaloma. "The communication, which exists between these vessels and those of the organ in which the cephalomatous substance is contained, is frequently very imperfect; a circumstance which, together with the delicacy of their structure, renders them extremely liable to congestion and rupture. The most minute divisions of these vessels terminate by penicillated extremities in the carcinomatous matter, where they communicate with veins and arteries belonging to the affected organ. The latter vessels, which may be said to form the collateral circulation of cephaloma, are seldom so conspicuous

as the former; but there are cases in which they appear to constitute the greater part of the vascular structure of the disease." The branches, seen in scirrhus, or scirrhoma, are only those of the vessels of neighbouring tissues, which have become enclosed within the heterologous substance. (See *Carswell's Illustrations of the Elementary Forms of Disease*, p. 3.)

Nerves have never been detected in any of the varieties of carcinoma as a new formation; but they are sometimes included within agglomerated tumours, or even in a single tumour that has happened to form in a situation through which they pass. (*Id.*) Dr. Hodgkin is not aware that even a single nervous fibril has ever been discovered in the essential part of the adventitious growth. (See *Med. Chir. Trans.* vol. xv. p. 336.) But, though the substance of medullary cancer is not supplied with nerves, the nerves may become the seat of the disease. This has often been noticed in the optic nerves. (See *Wardrop on Fungus Hæmatodes*.) M. Jules Cloquet records an instance in which a cancerous tumour was situated in the great sciatic nerve, immediately below the quadratus muscle. At some points, it was very firm; at others, soft; while, in particular parts of it, there was an obscure feel of fluctuation. Its colour was a brownish red, and its surface streaked with turgid capillary vessels. Some of the posterior filaments of the sciatic nerve passed behind the tumour, and were separated from one another on a level with it, but without any perceptible change in their organization; all the others were lost in, and confounded with, the adventitious growth, which consisted of the scirrhus and cerebriform matters blended together, and presenting a marbled appearance. (See *Jules Cloquet, Pathologie Chir.* p. 187. 4to. Paris, 1831.)

Mr. Caesar Hawkins concurs with the observations made by Sir Astley Cooper, M. Andral, and Professor Carswell, that cancer and encephaloid tumours are allied to one another, so that the two structures may be found together, or a tumour of one kind, removed from a part, may be followed in the same place by another of the opposite kind. "Even the local cancer of the scrotum may be succeeded by fungus hæmatodes; for a case of chimney sweeper's cancer has been published by Mr. Langstaff, which was operated upon, and the patient died of fungus hæmatodes of the os innominatum, lumbar glands, and liver." (See *London Med. Gaz.*, Aug. 1834, p. 681.) I have heard of several other cases confirming the truth of this observation; and one I saw myself, in a patient of the Bloomsbury Dispensary.

Mr. Hawkins justly observes, that some parts are more liable to one form of cancer than another. Thus scirrhus is common in the breast, but fungus hæmatodes (medullary cancer) rare; while the latter disease is frequent in the testicle, and the scirrhus variety of cancer rarely seen in it. Fungus hæmatodes of a muscle, or other soft texture, runs a different course from the same disease in a bone; and cancer is modified, according as it occurs in the breast, stomach, or uterus. In the skin, particularly, a considerable difference is observed in its appearance, progress, and degree of malignancy, from cancer of other parts; and even different parts of the skin are, in some respects, differently affected. (*Hawkins, Op.*, et. vol. cit. p. 683.)

EXTERNAL CHARACTERS OF SCIRRHUS.

It was a remark made by Sir Everard Home, that when the disease originates by a small portion of the glandular structure of the breast becoming hard, it may be readily distinguished by the hard part never having been perfectly circumscribed, and giving more the feel of a knot in the gland itself, than of a substance distinct from it. The disease begins at a small spot, and extends from it in all directions, like rays from a centre. This is one feature distinguishing this disease from many others, which, at their first attack, involve a considerable portion, if not the whole, of the part in which they occur. Abernethy conceived, that though a true scirrhous might be checked, it could not be made to recede by the treatment which lessens other swellings. On this point, however, he was not positive; for other surgeons had informed him that diseases, which eventually proved to be cancerous, had been considerably lessened by local treatment. It is to be recollected, however, that some tumours, which end in cancer, are not from the first of this nature: consequently, in their earlier stages, they may yield in a certain degree to local applications, but completely resist them after the cancerous deposit has begun. Still we have the authority of Young, Recamier, Carswell, and others, for the fact, that the growth of cancer may be retarded by methodical pressure, and sometimes the disease even cured. Perhaps, therefore, to assert, that a scirrhous swelling is absolutely incapable of any diminution, would not be correct. We lately had a woman in the North London Hospital, whose breast I removed on account of a true scirrhous. The disease unfortunately returned, in the form of hard tubercles in the skin, as well as induration of the glands of the axilla, and above the clavicle. Now, in this instance, the hard masses in the skin were observed to be much smaller at some periods than others. A scirrhous tumour is sometimes surrounded by more or less inflammation of the adjacent textures, and, upon the subsidence of it, the swelling will of course appear lessened. Notwithstanding these circumstances, the backwardness of a scirrhous swelling to be dispersed or diminished may be set down, without risk of inaccuracy, as one of its most confirmed features.

Another character of scirrhous is to involve the contiguous textures in the same diseased action. The skin, the cellular tissue, the muscles, the periosteum, &c. all become implicated, sooner or later, if they are in the vicinity of scirrhous cancer. In this respect, Abernethy recognised one difference of it from medullary cancer, which is propagated along the absorbent system, while the parts immediately in contact with the enlarged glands do not generally assume the same diseased action.

As a scirrhous tumour increases, it generally, though not constantly, becomes unequal upon its surface, so that this inequality has been considered characteristic of the disease. The circumstances influencing the shape of the carcinomatous deposit, according to Professor Carswell's views, I have already explained: they prove, that the mere shape of the swelling is not a criterion of its nature.

It is pointed out the error of dwelling too much on lancinating pain, as a test of a scirrhous tumour: first, because it does not prevail in every

case, or in every stage of cases, in which it does occur; and, secondly, because it is a symptom attending other tumours which are unlike scirrhous in structure. (See *Abernethy's Surgical Works*, vol. ii. p. 69, &c.) M. Bégin agrees with Abernethy, that lancinating pain is by no means a characteristic sign of cancer; and it seems to him only to take place under circumstances, where the disease is situated in an organ, which is penetrated or surrounded by a greater or lesser number of nerves, derived from the medulla spinalis, and suffering irritation. This happens especially in cancer of the breast, face, limbs, and neck of the womb. As for cancer (medullary?) of the liver, kidneys, spleen, and lungs, it is alleged by M. Bégin scarcely ever to produce any lancinating pain, except when the disease has extended beyond the parenchymatous structure. (See *Dict. de Med. et de Chir. Pratiques*, t. iv. p. 484.) The fact of scirrhous tumours being often unaccompanied by such pain as is now so familiarly known, that I shall merely add the evidence of Mr. Travers, on this interesting point. "Not unfrequently (says he) the scirrhous tumour is perfectly inert, from the period of its formation to the close of life, undergoing very slight, if any, increase, and giving, when mental apprehension is appeased, no trouble to the subject of it. A lady, now under my observation, has been many years so situated, enjoying uninterrupted health, though considerably above 70 years of age. The tumour is of the size of a hen's egg, and has the genuine scirrhous character. She takes sarsaparilla as a beverage, and the probability is, that, what in no degree affects her health, will not eventually shorten her life." (See *Med. Chir. Trans.* vol. xv. p. 214.)

Scirrhous tumours are mostly developed slowly, without any perceptible increase in the temperature of the part, unless the textures, amongst which the cancerous deposit lies, happen to be the seat of inflammation. As for the heterologous substance itself, M. Bégin correctly regards it as a kind of foreign body which may mechanically irritate the organs and textures, in or amongst which it is placed, or more or less seriously impede their functions, so that when these are of first-rate importance in the economy, the result is inevitably fatal.

A scirrhous swelling rarely, or I may say never, acquires the magnitude, which the generality of other swellings are disposed to attain. According to Sir Astley Cooper, it usually increases from the size of a marble until it acquires two or three inches in diameter; "for it rarely happens, that the true scirrhous tubercle increases to a very considerable bulk; and this circumstance is one of its criteria." (*Lectures, &c.* vol. ii. p. 177.) Many scirrhi are even attended with a diminution or atrophy of the part. The pressure of the heterologous deposit on the surrounding textures fully explains their occasional removal and annihilation.

By some writers, unacquainted with the pathological anatomy of scirrhous, it has been asserted, that tumour is not an essential character of the disease. Now this observation is only correct in a certain sense. "It is true (says Sir Charles Bell) that there is not always an increase of the dimensions of the whole breast: on the contrary, true carcinoma is often accompanied with a contraction and diminution of the general bulk. But what is true

of the breast or mamma, is not true of the tumour; for, the proper structure of the gland either shrinks or is compressed; and sometimes the surrounding fat is diminished by absorption, so that the whole mass is less than the natural breast, or than what the breast was before the commencement of the disease. But still the diseased part is properly a tumour; there we see an increased mass, a preternatural growth, or new matter, corresponding to the old definition, *morbosum augmentum*. But further, and in respect to the adipous membrane, the fat is not always diminished in carcinoma mammae, but sometimes quite the contrary; and this difference in it will sometimes produce a variety in the external character, when there is none in the disease actually, or in the internal structure. Sometimes from the diminution of fat, the irregular tuberculated structure of this disease will be apparent to the eye, and to the touch; while, in another patient, the breast will be large, full, and smooth, only marked more than naturally with large blue veins, and having an ulcer like a hole dug in the centre of the breast." (See *Med. Chir. Trans.* vol. xii, p. 220.)

A truly scirrhus tumour of the breast, capable of changing into open cancerous ulceration, and of a certain size, is described by Sir Everard Home, as hard, heavy, and closely connected with the mammary gland, and, when moved, the whole gland moves along with it. When, indeed, all the following characters are present, no doubt can exist about the nature of the disease: an early puckering of the integuments; a dull brown, or leaden-coloured appearance of them; a knotted uneven feel of the swelling; occasional darting pains in it; an early fixed attachment of it to the skin above, and pectoral muscle underneath; and a retraction of the nipple. According to Sir Charles Bell, it is the ligamentous bands which produce the retraction of the nipple, by extending between its ducts, and destroying its spongy texture. (See *Med. Chir. Trans.* vol. xii, p. 233.)

Mr. Travers's description of the external characters of scirrhus is one of the best which I am acquainted with. "Hardness (says he), with increase of weight, inelasticity or toughness in some cases, knotty or craggy induration in others. Circumscription and mobility beneath the skin in its earliest stage, but not to such a degree in the subjacent bed as to allow of the fingers passing beneath the tumour and turning its edge upwards. Next, i. e. in the second stage, close adhesion to the tegument, and such incorporation with the glandular organ, in which it is seated, as to have no mobility but that of the gland itself upon the parts beneath. The adhesion of the skin either stretches, or partially retracts and puckers it, according to the smooth or unequal surface of the tumour, or to the close or loose attachment and particular conformation of the integument at the spot, as, for example, next the nipple, and at a distance from it; or beneath the mucous membrane of the pylorus, or rectum, and the common integument of the body. Third stage: contraction and diminution by pressure of volume in the gland as the tumour increases. A abrupt projection of one large coloured tubercle; sometimes of several smaller tubercles, or nodules. Irreducibility of volume and hardness by topics or medicine. Transient pains, which have been hitherto obscure and occasional, now more distinct and frequent, like the pricking of a

sharp instrument, with a sense of heat, or burning. Dusky or livid red colour of the skin, with resplendent tension. Excoriation or cracking of the skin at the summit or base of the tubercles, and fungous elevations, with ichorous and sanious oozing. Neither of these signs is individually diagnostic." (See *Med. Chir. Trans.* vol. xv, p. 205.) To continue the same gentleman's description, the ulcerative process at length opens the tumour, where the cracked and livid integument, previously exuding a sanious ichor, is most prominent, and the external opening is sometimes enlarged by a partial sloughing of the integument. Suppuration now takes place in the surrounding cellular membrane, and, as granulations spring up luxuriantly from the sides, the centre of the tumour gapes, and becomes a cavity more or less considerable. The granulations have a spongy or fungoid character, and are so elevated and broadly everted, as to give the appearance of additional depth and breadth to the sore. "As the sloughing process enlarges and deepens the centre, the disease becomes exceedingly offensive; and although granulations continue sprouting circumferentially at the same time, they have not the power of maintaining their vitality. It is in vain that we attempt to preserve the ulcer from foulness and fetor, by detergent applications; we can render it clean, but, in a day or two, the newly cleansed surface ulcerates afresh, instead of advancing towards cicatrisation" (*Travers, in Med. Chir. Trans.*, vol. xv, p. 211.) He adds, that in scirrhus it is not suppuration which, as in serofulous and other tumours, brings the disease to the surface; nor does the skin ulcerate until after the scirrhus. "Encompassed by a dense wall, the centre breaks up by ulceration, constituting the state of occult cancer. Indeed, the scirrhus is seldom removed so early as to be found with its nucleus unbroken." (P. 213.) This observation agrees with that of Laennec, respecting the softening process, who only erred in representing it as invariably taking place.

Mr. Abernethy describes the diseased skin, covering a scirrhus tumour of the breast, as generally ulcerating before the swelling has attained any great magnitude: a large chasm is then produced in its substance, partly by a sloughing, and partly by an ulcerative process. Sometimes, when cells contained in the tumour are by this means laid open, their contents, which are pulpy matter of different degrees of consistence, and various colours, fall out, and an excoriating ichor ensues from their sides. This discharge takes place with a celerity which would almost lead to the belief, that it can hardly result from the process of secretion. Afterwards an attempt at reparation is made. New flesh is formed, constituting a fungus of peculiar hardness. This even occasionally cicatrises. But, though the actions of the disease are thus mitigated—though they may be, for some time, indolent and stationary—they never cease, nor does the part ever become healthy.

In the meanwhile, the disease extends through the medium of the absorbent vessels. Their glands become affected, at a considerable distance from the original tumour. The progress of carcinoma, in an absorbent gland, is the same as that which has been already described. The disease is communicated from one gland to another, so that after all the axillary glands are affected, those which

lie under the collar-bone, at the lower part of the neck, and upper part of the chest, become disordered. Occasionally, a gland, or two, become diseased higher up in the neck, and apparently out of the course, which the absorbed fluids would take. As the disease continues, the absorbent glands, in the course of the internal mammary vessels, become affected. In the advanced stage, small tumours, similar in structure to the original disease, form at some distance, so as to make a kind of irregular circle round it.

The strongest constitutions now sink under the pain and irritation which the disease creates, aggravated by the obstruction, which it occasions to the function of absorption in those parts, to which the vessels leading to the diseased glands belong. Towards the conclusion of the disease, the patient is generally affected with difficulty of breathing, and a cough. (See *Abernethy's Surgical Works*, vol. ii. p. 72, &c.)

The general condition of the patient is excellently described by Sir Charles Bell: — After noticing the hectic fever which preys upon her, he observes, the countenance is pale and anxious, with a slight leaden hue; the features have become pinched, the lips and nostrils slightly livid; the pulse is frequent; the pains are severe. In the hard tumours, the pain is stinging, or sharp; in the exposed surface, it is burning and sore. Pains, like those of rheumatism, extend over the body, especially to the back and lower part of the spine, the hips and shoulders, &c. Successively the glands of the axilla, and those above the clavicle, become diseased. Severe pains shoot down the arm of the affected side; it swells in an alarming degree, and lies immovable. At length, there is nausea and weakness of digestion. A tickling cough distresses her. Severe stitches strike through the side; the pulse becomes rapid and fluttering; the surface cadaverous; the breathing anxious; and so she sinks." (*Med. Chir. Trans.* vol. xii. p. 223.)

One of the most deplorable effects, occasionally resulting from cancer, is so great a fragility of the bones, that those of the limbs are broken by the most trifling causes, as merely turning in bed, &c. Sir Astley Cooper mentions several examples of this fact. In the collection at St. Thomas's Hospital is the thigh-bone of a Mrs. Edge, which broke on her merely rising in bed; and also the thigh-bone of another cancerous patient, that was fractured by her turning in bed. (*Lectures*, &c. vol. ii. p. 184.) I have seen several instances of this fact myself. A female patient was in the North London Hospital under Mr. Liston with a cancerous breast, and a humerus, which broke spontaneously. She had also had some other bone fractured in the same way, and, what deserves attention, the union had taken place very well. In the museum of University College is a thigh-bone, which gave way in a coachman as he was turning in bed, while he was labouring under cancer of the bladder. (See *Med. Chir. Trans.* vol. 17.) Other cases are recorded by surgical writers. (See *Frangilitas Ossium*.) It seems that the scirrhous substance is deposited in the structure of the bones, as the sternum of Mrs. Edge, above mentioned, fully illustrates; and in the museum at St. Thomas's are two curious specimens of diseased spine, in which much of the bone is absorbed, and scirrhous tubercles are deposited in the spaces produced by absorption. In University College Museum is a

portion of the skull, containing a similar deposit, in lieu of osseous matter: it was taken from a woman, who died of a cancer of the breast.

In the above species of carcinoma described by Mr. Abernethy, the part is peculiarly hard, and rarely attains considerable magnitude. He admits, however, that there are varieties, and speaks of another case, in which the integuments sometimes remain pale and pliant; "and a surgeon who first sees the breast in this state, may doubt whether the disease be actual cancer or common sarcoma. The substance of the tumour is also much less hard than in the specimen first described; yet it is more compact and weighty than most other diseases of the same bulk, which are not carcinomatous. If the history of the disease accords with that of carcinoma; that is to say, if it began in a small district, and regularly and unabatingly attained its present magnitude; if the surface of the tumour be unequal, having produced in various parts roundish projecting knobs, the disease will almost invariably be found to be carcinoma. The skin will soon adhere to one or more of these prominences; it will ulcerate and expose the subjacent parts; and the future progress of the disease will accord to that of the harder and smaller specimen," except that the absorbents are much less liable to be affected.

The edges of a cancerous ulcer are hard, ragged, and unequal, very painful, and reversed in different ways, being sometimes turned upwards and backwards, and, on other occasions, inwards. The whole surface of the sore is commonly unequal: in some parts there are considerable risings, whilst, in others, there are deep excavations. The discharge, for the most part, is a thin, dark-coloured, fetid ichor; and is often possessed of such a degree of acrimony, as to excoriate, and even destroy, the neighbouring parts. In the more advanced stages of the disease, a good deal of blood is often lost from the ulcerated vessels. A burning heat is universally felt over the ulcerated surface; and, this is the most tormenting symptom, that attends the disorder. Those shooting, lancinating pains, which are sometimes very distressing in the occult state of the complaint, become now a great deal more so. (*B. Bell*.)

According to Sir Charles Bell, scirrhus of the breast belongs to that period of life when the uterine functions cease. Menstruation becomes irregular, both in respect to time and quantity. Long intervals occur, after which the discharge is profuse, with unusual disturbance of the general system. The mamma, in particular, sympathizes with the condition of the uterus; pains shoot through it, and it swells, and when the general fulness and tension subside, a partial hardness, an indurated lump, is left, with irregular margins, which mix with the substance of the breast. The hardness extends, until the whole gland is unusually firm, the disease becoming at the same time tuberculated, or knobby and irregular. The veins enlarge, and assume a deep blue colour. In the meantime, the strength declines, and the patient becomes emaciated. The nipple is now not only drawn in and incapable of erection, but retracted in comparison with the irregular convexity of the mamma. In a later stage, the skin is puckered and tucked in. These parts now firmly adhere to the subjacent mass, and sometimes there is bleed-

ing from the nipple; in which case, the axillary glands are affected early.

The disease may begin very differently. A small hard tumour is felt deeply seated in the mamma. It is difficult to distinguish whether or not it is a part of the proper gland. It becomes painful, approaches the surface, becomes attached to the mamma and to the skin, and is gradually incorporated with them. The skin becomes discoloured, the surface moist, and the patient is apprehensive of the occurrence of a sore. At length the part does ulcerate, and begins to discharge. The bottom of the sore is foul and sloughy; the smell is offensive; and the constitution sympathizes with the state of the sore. The whole gland is now hard, and adherent to the pectoral muscle. The edges of the sore are particularly hard, and present a dark red, glazed appearance. They are not everted, and curling; but rather depressed under the general convexity of the tumour. This will certainly be the appearance in a fat woman. The chasm is deep, with solid, abrupt, sharp edges. In proportion as its depth increases, the surrounding hardness extends, and the whole breast feels of a stony hardness.

Cancer of the breast sometimes assumes another form, which is also well described by Sir C. Bell: although the disease commences in the mamma, it rather propagates itself by extending its peculiar structure to the cutaneous glandular texture. Around the nipple, tubercles are felt in the skin, which extend to the skin of the breast, neck, and shoulders, and soon become painful. At first, they assume a high red colour; then, a yellowish transparency in the centre. They do not suppurate and break; but change into corroding ulceration.

It is a form of the same disease, says Sir C. Bell, when the breast presents a tumour elevated, tuberculated, and remarkably firm, without any elasticity, but, on the contrary, fixed to the side, and presenting one consolidated mass. The surface is granular, and of a deep, or rather dark red colour, with a bluish cast, somewhat like the colour of a peach. This tumour ulcerates, and sloughs, and bleeds profusely. The disease is propagated by tubercles under the skin, towards the sternum and clavicles; and it is a case soon accompanied with effusion in the chest. (C. Bell, in *Med. Chir. Trans.* vol. xii. p. 216. 220.)

On dissection, Sir Astley Cooper observes, that the breast is one solid mass like cartilage, with very little vascularity except at its edges, and internally fibrous. When the breast has acquired any magnitude, he says, there is generally an opening in it, in which case it has the appearance internally of being worm-eaten, and spongy. In the situation of the ulceration, it is very vascular, and bloody serum is met with. The absorbent glands put on the same character as the scirrhus breast. The cellular membrane, skin, and muscles are also affected. Sometimes the diseased glands above the clavicæ press upon the thoracic duct, and thus interrupt the transmission of chyle into the blood. Hence, the appetite is sometimes voracious, though the patient is rapidly wasting. In the chest, on the same side as the disease, hydrothorax prevails, and the absorbents on the pleura are in a morbid state, and small white spots, like pins' heads, are visible. Traces of scirrhus disorder Sir Astley Cooper likewise represents as occasionally existing in the liver, uterus, &c.

CAUSES OF CANCER.

By some of the old writers the causes of cancer were referred to the presence of worms, which destroyed the parts, and produced all the local mischief. Strange as this doctrine may appear, one very analogous to it was adopted by the late Dr. Adams. (*Obs. on Morbid Poisons.*) When hydatids found their way into a solid substance, he supposed that the effect would be cancer; and he conjectured, that the success of an operation would depend, in a great measure, upon these animals being confined in a common cyst, for then they could be entirely removed; whereas, if they were unconnected, some of the smaller ones would be likely to remain. The absurdity of this doctrine, however, and the eccentric reasoning by which it is supported, make it quite unnecessary here to fatigue the reader with a particular explanation of it. Though hydatids are occasionally found in tumours, which have been called cancerous, they are not found often enough to make any part of the character of the disease; and they are met with in cases, in which there is not the least vestige of such disorder.

After cancer had continued some time, it was formerly believed that the matter was absorbed into the blood, and the whole system contaminated. Hence, was explained the fatal and rapid relapses after an apparent cure. To this view, my friend Mr. Travers decidedly inclines. However, the effects of absorption are supposed by others to be confined to the lymphatic glands, which intervene betwixt the sore and the heart; for, beyond these, it is said, that the absorbed matter is changed in its properties. (*J. Burns on Inflammation*, vol. ii.)

The disease is frequently imputed to blows, pressure, and other accidental injuries; but other circumstances are always concerned, which have more influence than the accidental violence. "Although (as Sir Astley Cooper remarks) the disease operates on some particular part of the body, it is always preceded by a state of constitution which has excited it. He who looks at this disease in the light merely of a local affection, takes but a narrow view of it. A blow, or a bruise, inflicted on a healthy person, would be followed by common inflammation only, which would lead to the removal of the matter effused. But, if a blow were received on the breast when the constitution was disposed to the formation of scirrhus tubercle, it would be the cause of a particular action being excited in the part injured, and might lay the foundation of this complaint." Yet the formation of scirrhus tubercle does not entirely depend on constitutional derangement; there must be also a peculiar action excited in the part." In order to prove that the disease must depend on constitutional derangement and an altered action in the part unitedly, Sir Astley observes, that, if a scirrhus be cut into, all the horrors of cancer will be the result of the injury; but if the cut be made in the healthy parts around the disease, no cancerous ulceration follows, and the wound heals. In short, he argues that the disease is the effect of a specific action in the part, preceded by a disposition in the constitution to its production.

In the breast, cancer frequently commences without any previous accidental injury of the part; a fact tending to establish the correctness of such writers as represent the disease to be of a constitu-

tional nature. In these cases, there is always an irregularity, or disappearance of the menses; and the affection of the mamma may be supposed to depend on sympathy between it and the uterus. Certain it is, that cancer is very frequent about the time of life, when the menstrual discharge ceases.

It is a commonly received opinion, that cancer is an hereditary disease, or observed to prevail a good deal in particular families. Sir Astley Cooper has known it occur in three sisters. (*Lectures, &c.* vol. ii. p. 186.) Sir Everard Home has endeavoured to reconcile this to the doctrine of the disease being at first entirely of a local nature; circumstances which seem incompatible. "It is now universally admitted (says he) that children take after their parents in the general structure of their bodies, and therefore will be more or less liable to have the different solids of which they are composed disturbed by the same causes; and when a violence of any kind is committed upon them, it may be productive of the same diseases. In some families, the venereal disease shall always appear in the form of gonorrhœa [?]; in others again, rarely or never in that form, but, in that of chancre [?]. Strictures in the urethra are common in some families: they have taken place in a father, and all his sons, from very slight causes; such, indeed, as would not have produced the disease in others. Yet stricture cannot be called hereditary, because it is a local complaint arising from a local inflammation, differing in different people, according to the natural irritability of the parts which are affected. In this way, and this only, can cancer run in families, and be an hereditary disease," &c. (*Obs. on Cancer*, p. 150.) The observations, which this gentleman published respecting cancer, are valuable; but, I am doubtful about the correctness of one term, which is frequently met with in his work, and that of several other modern writers, viz. *cancerous poison*. At all events, I am not at present acquainted with any facts which satisfactorily demonstrate the existence of such virus. In support of the belief in the existence of a cancerous virus, it has been observed, however, "that we scarcely ever see glands diseased out of the course which the absorbed matter would naturally take, though they are affected in this manner in diseases, which can be propagated by irritation." (*Abernethy's Surg. Works*, vol. ii. on Tumours, p. 75.)

But, on the other hand, attempts have been made by Biett, Dupuytren, and Alibert, to propagate the disease by inoculation, but always without any result in proof of the existence of a virus. The fact of the substance of cancer being often found within the blood-vessels, the same heterologous matter as is deposited out of them, sufficiently proves to my mind, that the disease is constitutional, and depends upon a process, by which the adventitious substance is formed in, or from, the blood.

Cancer is most common in elderly persons; but, according to some writers, no age is exempt from the disease. Mr. J. Burns has seen it distinctly marked, and attended with a fatal event, in children of five years old: he mentions two instances of the eye being affected in such subjects; though, from the observations of Mr. Wardrop, we may now reasonably suspect, that these examples were really cases of fungus hæmatodes. An instance, in which a cancerous disease of the

breast began at the age of fifteen, is related by Sir E. Home. (*Obs. on Cancer, &c.* p. 50.)

Sir Astley Cooper has frequently seen the disease at all ages between thirty and seventy. He does not recollect more than two cases, in which the nature of the tumour was decidedly scirrhus, in persons under thirty years of age. He has seen one case in a patient aged ninety-three; another in an individual of eighty-six; and he has removed an ulcerated scirrhus from a person seventy-three years old, who got well. According to Sir Astley's experience, the disease most frequently occurs about the age of fifty. The tumours met with in women under thirty, and often called scirrhi, he says, are only simple chronic enlargements, not disposed to malignant action, and not requiring removal. (*Lectures, &c.* vol. ii. p. 185.)

Age makes a great difference in the whole class of carcinomatous tumours; and as Sir C. Bell has remarked, the same disease, distinguishable by obvious signs, will run its course rapidly, and with every symptom aggravated, in a woman of forty-five, while it will remain stationary for years in a woman of sixty or seventy. (*Med. Chir. Trans.* vol. xii. p. 216.) Sir Astley Cooper also states, that, when it occurs in very advanced age, it is slow in its progress, and does not in general shorten life. (*Lectures, &c.* p. 185.)

According to Sir Astley Cooper, married women who bear no children, and single women, are more subject to this complaint than such as have large families. He thinks it very probable, that the natural change, which the breast undergoes in the secretion of milk, has some power in preventing this disease. But he admits, that the circumstance of a woman having borne children is not a perfect security against the complaint; and he knew one individual with this disease, who had been pregnant seventeen times.

His experience confirms a remark, made by other writers, that grief and mental anxiety seem frequently to have a great share in the production of scirrhus of the breast.

TREATMENT OF CANCER.

Cancers have sometimes been supposed to be a general disorder of the system; sometimes merely local affections. This is a point of much importance in practice; for if cancers are originally only local affections, no objection can be made to extirpating them. They who think, that cancer is a constitutional disease, will have much less confidence in the operation, which they may even regard as useless, perhaps hurtful, inasmuch as it may convert a scirrhus into an open cancer, or bring on the affection in some other part.

Some practitioners, however, reject the doctrine of cancer depending on constitutional causes; and Sir E. Home's sentiments, in opposition to it, have been laid before the reader. When cancer breaks out again in the same part, after the performance of an operation, it is often owing to some portion of the disease having been blameably left behind, or to the operation having been put off too long. How likely it is, that some of the cancerous disease may be left unremoved by the operator, is obvious on considering the manner in which the white bands, resembling ligament, shoot into the surrounding fat; and that even the fibres of the muscles, beneath a cancerous disease, are frequently affected. At the same time, it must be

allowed, that the disease is sometimes, to all appearances, so freely and completely removed, that its recurrence may be imputed, perhaps with equal probability, to the continued operation of the same unknown cause, which originally produced the first cancerous mischief. Sir Astley Cooper, and many other very experienced men, both of the past and present time, consider cancer as decidedly a complaint connected with a peculiar state of the constitution. But, if this be true, it may be asked, how can any cure be expected from the removal of the part, as the continued operation of the same constitutional causes must occasion a relapse? And so they sometimes do, no doubt, independently of the accident of any portion of the disease not being completely removed with the knife. However, experience proves, that the operation frequently effects a radical cure, and no other organ is afterwards attacked; which is analogous to what is seen after the amputation of a scrofulous limb; a case in which frequently no other part is afterwards attacked, though the constitution is unsound.

From the description, which Sir Astley Cooper has given of the dissection of persons destroyed by scirrhus, it must be inferred, not only that the disease is constitutional, but that the hope of radically curing it, either by medicines or an operation, must very often fail in advanced cases. He says, that a scirrhus in the breast is generally accompanied by several smaller tumors of the same character in different parts of the glandular structure. He notices the deposition of the scirrhus matter in the axillary glands, and those above the clavicle. On the left side, he says, the latter sometimes press upon the termination of the thoracic duct. According to his observations, the glands behind the cartilages of the ribs, when the disease is on the sternal side of the nipple, are generally diseased. The axillary glands on the other side of the body he has also seen in the same state. The lungs are often found inflamed, and adherent to the pleura; serum is effused in the chest; and the pleura costalis studded with scirrhus tubercles. He also describes the liver, uterus, ovaries, and bones, as participating in the morbid changes. (See *Lectures*, &c. p. 182. vol. ii.) In addition to all these facts, we are to remember the occasional presence of scirrhus matter in the blood-vessels themselves. Under such circumstances, the inutility of any treatment must be obvious.

Until late years, the accounts, given of the results of operations for cancers, were so unpromising, that they deterred many patients from undergoing a timely operation; which, for cancerous complaints, is the only remedy with which we are as yet acquainted, entitled to any confidence. As Mr. B. Bell remarks, the great authority of Dr. Alexander Monro must have had no inconsiderable influence even with practitioners, in making them much more backward in undertaking the extirpation of cancers than they otherwise would have been. "Of near sixty cancers," says he, "which I have been present at the extirpation of, only four patients remained free of the disease, at the end of two years: three of these lucky people had occult cancers in the breast, and the fourth had an ulcerated cancer on the lip." (*Edin. Med. Essays*, vol. v.) Dr. Monro also observes that in those, in whom he saw the disease relapse, it was always

more violent, and made a quicker progress, than it commonly did in others on whom no operation had been performed. Hence he questions, "whether ought cancerous tumours to be extirpated, or ought the palliative method only to be followed?" and, upon the whole, he concludes against their extirpation, except in such as are of the occult kind, in young healthy people, and have been occasioned by bruises, or other external causes.

More modern experience, however, has afforded a very different result, and given rather more encouragement to the early performance of an operation, and even to making an attempt to cut away the disease, in every instance, both of the occult, and ulcerated kind, when such a measure can be so executed as not to leave a particle of the cancerous mischief behind.

Mr. Hill, in 1772, published some valuable remarks on the present subject. At this period, he had extirpated from different parts of the body eighty-eight genuine cancers, which were all ulcerated, except four; and all the patients, except two, recovered of the operation. Of the first forty-five cases, one only proved unsuccessful; in three more, the cancer broke out again in different parts; and, in a fifth, there were threatenings of some tumours, at a distance from the original disease. These tumours, however, did not appear till three years after the operation; and the woman was carried off by a fever before they had made any progress. All the rest of the forty-five continued well as long as they lived; or are so, says Mr. Hill, at this day. One of them survived the operation above thirty years; and fifteen were then alive, although the last of them was cured in March, 1761.

Of the next thirty-three, one lived only four months; and, in five more, the disease broke out afresh, after having been once healed. The reason why, out of forty-five cases, only four or five proved unsuccessful, and six, out of thirty-three, was as follows: "The extraordinary success I met with (says Mr. Hill), made cancerous patients resort to me from all corners of the country, several of whom, after delaying till there was little probability of a cure by extirpation, or any other means, forced me to perform the operation contrary both to my judgment and inclination."

Upon a survey, in April, 1764, made with a view to publication, the numbers stood thus:—Total cured, of different ages, from eighty downwards, sixty-three; of whom there were then living thirty-nine. In twenty-eight of that number, the operation had been performed more than two years before; and, in eleven, it had been done in the course of the last two years. So that, upon the whole, after thirty years' practice, thirty-nine, of sixty-three patients, were alive and sound; which gives Mr. Hill occasion to observe, that the different patients lived as long, after the extirpation of the cancers, as, according to the bills of mortality, they would have done, had they never had any cancers, or undergone any operation.

The remaining twenty-five, which complete the eighty-eight, were cured since the year 1764. Twenty-two of these had been cured at least two years; and some of them, it may be remarked, were seventy, and one ninety years old.

In the year 1770, the sum of the whole stood thus:—Of eighty-eight cancers, extirpated at least two years before: not cured, two; broke out

breast, nine; threatened with a relapse, one; in all, twelve, which is less than a seventh part of the whole number. At that time, there were about forty patients alive and sound, whose cancers had been extirpated above two years before.

Mr. B. Bell, who was present at many of these cases, bears witness to Mr. Hill's accuracy; and states, that "from these and many other authenticated facts, which, if necessary, might be adduced, of the success attending the extirpation of cancers, there is, it is presumed, great reasons for considering the disease in general as a local complaint, not originally connected with any disorder of the system." With respect to Mr. Bell's opinion, that a general cancerous taint seldom, or perhaps never, occurs, but in consequence of the cancerous virus being absorbed into the constitution from some local affection, much doubt attends even this supposition, though the practical inference from it is what cannot be found fault with, viz. in every case of real cancer, or rather in such scirrhuses, as, from their nature, are known generally to terminate in cancer, we should have recourse to extirpation as early as possible; "and if this were done soon after the appearance of such affections, or before the formation of matter takes place, their return would probably be a very rare occurrence." (*System of Surgery*, vol. vii.)

Sir Astley Cooper admits, that the operation is followed by a return of the disease in many cases, the average number of which, however, he does not state, though he says that they do not amount to one fourth.

How often is the operation determined upon, because the nipple is retracted, and true cancer thereby announced! Yet, says Sir Charles Bell, with reference to the cause of this change, as previously explained, "it is quite clear, that if the nipple be fully retracted, and if this has been evident for any considerable time, the operation has been too long deferred." (*Med. Chir. Trans.* vol. xii. p. 223.)

Sir Astley Cooper is adverse to the performance of the operation when dyspnoea is present; for he has known patients die in two or three days, who had been operated upon while labouring under that symptom. On examination after death, water was found in their chests, and tubercles in the pleura.

The same experienced surgeon gives it as his opinion, that a breast should never be removed, unless the patient has undergone a course of alterative medicines, as compound calomel pills and the compound decoction of sarsaparilla, or (what he prefers) the infusion of gentian with soda and rhubarb. Thus he thinks the constitution may be improved, and the danger of a relapse diminished.

After comparing the different accounts of success given by Monro and Hill, well might Richter say: "*Inter omnes diacris, de uno eodemque morbo hoc mihi fuit dubitari jere potest.*" (*Obs. Chir. fasc. 3.*)

MEDICINES AND PLANS WHICH HAVE BEEN TRIED FOR THE CURE OF SCIRRHUS AND CANCER.

It is a contested point, whether a truly cancerous disease is susceptible of any process by which a spontaneous cure can be effected. It appears certain, however, that a violent inflammation, and its abating, may sometimes accomplish

an entire separation of a cancerous affection; and that the sore left behind may then heal. Facts confirming this observation are occasionally exemplified where caustic is used, and accidental inflammations have led to the same fortunate result, as we may be convinced of by examples recorded by Sir Everard Home, Richerand, &c. The latter writer, adverting to the effort which nature sometimes makes to rid herself of the disease by the inflammation and bursting of the tumour, takes the opportunity to relate the following case:—"A woman, aged forty-eight, of a strong constitution, was admitted into the hospital of St. Louis, with a cancerous tumour of the right breast. The swelling, after becoming softer, and affected with lancinating pains, was attacked with an inflammation, which extended to the skin of the part, and all the adjacent cellular membrane. The whole of the swelling mortified, and was detached. A large sore, of healthy appearance, remained after this loss of substance, and healed in two months. (*Nosographie. Chir. t. i. p. 381. edit. 2.*)

I once attended a woman who died of cancer of the uterus, and in the same room was her mother, all the forepart of whose chest was in a most mutilated state from the effects of sloughing, by which, at different periods, she had been freed from cancers of both her breasts. Baron Dupuytren believed that it was particularly when the cancerous mass was encysted, that the whole of it was capable of being destroyed by gangrene, and the patient completely cured. (See *Journ. Hebdomad. de Med. t. iv. p. 38.*) Many years ago, Mr. Cliné had a patient in St. Thomas's Hospital, in whom the sloughing process went on to such an extent, under a linseed poultice, that the ulcer afterwards healed soundly. "I have seen (says Mr. Travers), more than one case, in which extensive cicatrices of ulcers existed, with much puckering and stretching of the skin of the chest, and no vestige of the breast remained. In one of these, the patient, a lady in Berkshire, resisted the pressing advice of a consultation of London surgeons to allow the extirpation of the tumour many years since. She has been in the constant habit of taking the medicine there prescribed, the extract of hemlock, almost *ad libitum*. She is still a stout healthy looking person, as formerly, and attributes her cure to the medicine. (See *Med. Chir. Trans.* vol. xv. p. 213.)

In general, however, inflammation renders things worse, instead of better, and by converting occult cancers into ulcerated ones, hastens the patient's death, or at all events renders the cure more difficult, and forbids any attempts, which, on such a principle, might be made for his relief.

Of the general remedies, narcotics, as common opium, belladonna, &c. have been employed with most hope.

Cicuta, or conium maculatum, owed its reputation to the experimenting talent of Storck, who has written several treatises on it. According to him, cicuta possesses very evident powers over cancer, and has cured a great many cases; but, in less prejudiced hands, it has not been found successful; and even in many of the instances, adduced by Baron Storck of its utility, it is by no means proved that the disease was really cancer. The public have now little or no reliance on this medicine, as a means of relieving cancer. Mr. J. Burns declares, that, in cancerous ulceration, he

never knew hemlock produce even temporary melioration. (See *CONSUM.*)

Belladonna was highly recommended by Lam-bert. During its use, he kept the bowels open with clysters, administered every second day. The dose should be, at first, a grain of the dried leaves, made into a pill. The quantity may be gradually increased to that of ten or twelve grains. The extract is now frequently exhibited, the dose being at first one grain, and afterwards increased by degrees to five. The reputation of *belladonna* has not been supported by any decided success in cases of true cancer.

Hyosciamus has often been tried, and was held in great estimation by the ancients. Mr. J. Burns employed it occasionally, but with little effect. The common dose, at first, is three grains of the extract.

Aconitum has also been given; and, as it is a powerful and dangerous narcotic, a patient usually begins with only half of a grain of the extract night and morning. *Solanum dulcamara*, *Paris quadrifolia*, *phytolacca*, &c. have also been recommended; but they are now hardly ever employed, which is a sufficient proof of their inefficacy. Mr. J. Burns tried the hydro-sulphuret of ammonia; and Richter prescribed the *laurus cerasus*, without success.

Digitalis lessens vascular action, and may act on *schirri*, like abstinence, bleeding, &c. It has, however, no specific virtue in curing cancerous diseases.

Opium is seldom employed with the intention of curing cancer, although probably it has just as much power of this kind as other narcotics which have been more frequently used. For the purpose of lessening the pain of cancerous diseases, it is very freely prescribed.

Tonics sometimes improve the general health; but they never produce any specific effect on the local disease.

Justamond thought arsenic a specific for cancers. Further experience has not, however, confirmed the truth of this opinion, though there are practitioners, who continue to think highly of the efficacy of this mineral in certain forms of disease which have sometimes been classed with cancer. It cures numerous ill-looking sores on the face, lips, and tongue, and is one of the best remedies for lupus. Arsenical powder and paste, employed with considerable success by Dupuytren, as external applications, in the treatment of inveterate ulcers of the lips, nose, and other parts, are noticed in the article *ARSENIC*. The powder I have tried in some cases, in the North London Hospital, and found its effects correspond to Dupuytren's account. Mr. Hill even thinks, that arsenic will, "in a great majority of cases, retard the progress of the true scirrhus tumour, and often prevent its becoming cancer. In some, it has appeared to dissipate such swellings completely." (See *Edin. Med. and Surgical Journ.* vol. vi. p. 58.)

Mercury, in conjunction with decoctions of guaiacum, sassa-parilla, &c. has been recommended, but, as Mr. J. Burns remarks, no fact is more certainly ascertained, than that mercury always exasperates the disease, especially when in the ulcerated state.

Muriate of barites at present retains no character as a remedy for cancer.

Carbonate of iron was particularly recommended by Mr. Carmichael. Besides the carbonate of iron, he sometimes prescribed the tartrate of iron and potass, and the phosphate, oxyphosphate, and suboxyphosphate of the metal. Some constitutions can bear these preparations only in small quantities; they affect most patients with constipation, and many with headach and dyspnœa. Mr. Carmichael has seldom given less than thirty grains, in divided doses, in a day, or exceeded sixty. He prefers the suboxyphosphate for internal use, and states, that it answers best in small doses, frequently repeated. It should be blended with white of egg, have a little pure fixed alkali added, and then be made into pills with powdered liquorice. Aloe is recommended for the removal of costiveness. When half a grain is combined with a pill, containing four grains of carbonate of iron, and taken thrice a day, the constipation will be obviated. When the internal use of iron brings on headach, difficult respiration, a quick, sometimes full pulse, which is also generally hard and wiry, excessive languor, lassitude, &c. the iron is to be left off, and four grains of camphor given every fifth hour.

At the same time, that preparations of iron were internally administered, Mr. Carmichael employed externally, for ulcerated cancers, the carbonate, phosphate, oxyphosphate, and arseniate of iron, blended with water, to the consistence of a thin paste, which was applied once every twenty-four hours. To occult cancers, the same gentleman applied a solution of the sulphate of iron, \mathfrak{ss} . to \mathfrak{lj} . of water. The acetate of iron, diluted with eight or ten times its weight of water, was also used. These lotions were put on the part affected by means of folded linen, wet in them, and covered with a piece of oiled silk to prevent injury of the clothes. (See *An Essay on the Effects of the Carbonate and other Preparations of Iron upon Cancer*, &c. 2d ed. 8vo. Dublin, 1808.)

Many remedies have acquired celebrity in cases of cancer, because very bad and malignant diseases, only supposed to be cancers, have got well, under their use. Such is probably the case with the carbonate of iron.

The only mode of treatment which Mr. Pearson ever saw do any particular benefit to cancer, was that of keeping the patient on a diet, barely sufficient for the support of life, such as barley-water alone, tea, &c. A milk diet has also been recommended.

With respect to the effects of a very low diet, Sir Astley Cooper protests strongly against the plan: if the patient be already weak, he says, you will thus render her still weaker, and soon bring her to the grave: in proportion as the strength declines, the pulse is quickened. He further declares, that we possess no medicine, which has any specific power over the disease, though the state of the constitution may sometimes be improved by Plummer's pills given at bedtime, and the following draught in the day: *R* Infus. Gentian. \mathfrak{ss} .s. tinct. columbæ \mathfrak{ss} . Ammon. carbon. gr. v. Sodæ Carbon. \mathfrak{ss} .s. Misce. Climate he also regards as having no particular effect on scirrhus disease. Sir Astley Cooper only sanctions the use of steel medicines, when the uterine secretion is defective. In such cases, he recommends the compound calomel pill at night, and the following draught twice a day: *R* Vin. ferri \mathfrak{ss} . Ammon. Carbon.

gr. viij. Aq. Ment. Vir. ℥j. Tinct. Cardam. c. ℥ss. He also approves of anodynes for the relief of the suffering; as the tinct. opii, the liquor opii sedativus, or the black drop, combined with the camphor mixture, and a little of the spir. ætheris comp. One of his patients derived much relief from the following: pill: R. Ext. Stramonii gr. ½ Camph. gr. ij. M. ft. Pil. Bis. terve in die sumend. (See *Lectures*, &c. vol. ii. p. 193.)

The old surgeons dressed cancerous sores with narcotic applications. Vesalius used cloths dipped in the juice of the solanum; whilst others employed it mixed with oil of roses, and preparations of lead and antimony. Others had recourse to hyosciamus, or hemlock poultices, which in many cases, as Mr. J. Burns observes, have abated pain, and diminished fetor; but this is all which can reasonably be expected. He thinks carrot poultices better than those of hemlock, as they produce as much ease, and more powerfully diminish the fetor.

Sir Astley Cooper has no confidence in the utility of evaporating lotions. Wurm applications he also represents as improper. The dressing, which he mostly prefers for scirrhi, is a plaster, made by blending ℥j. of the extract of belladonna with ℥j. of soap cerate. When inflammation is present, he does not object to the use of leeches. All local applications, as well as internal medicines, he considers merely as palliatives.

The fetor of cancers having been thought to resemble that of the sulphuret of potash (liver of sulphur), and the oxygenated muriatic acid being the best agent for decomposing and destroying such smell, it has been recommended as an application to cancerous sores. It may correct the fetor, but it will never accomplish a cure. Carbonic acid has been said not only to correct the fetor, but, in some instances, completely to cure the disease. It was long ago proposed, says Mr. J. Burns, by Peyrilhe, and was again brought forward by Dr. Ewart. Experience, however, has not shown that the efficacy of carbonic acid, in cases of cancer, is very great. Fourcroy remarks: "After the first applications, the cancerous sore appears to assume a more favourable aspect; the sanies, which flows from it, becomes whiter, thicker, and purer, and the flesh has a redder and fresher colour; but these flattering appearances are deceitful, nor do they continue long, for the sore speedily returns to its former state, and its progress goes on as before the application." The method of applying carbonic acid was by means of a bladder, the mouth of which fastened round the sore with adhesive plaster. The air was introduced by a pipe, inserted at the other end. Sometimes the fermenting poultice is employed. That iodine commonly fails, is now universally admitted, and this even in very large doses. (See *Paper by Dr. Buchanan, of Glasgow, in Lond. Med. Gaz. of Oct. 1836*.)

Tar ointment, gastric juice, absorbent powders, &c. have been tried; but, without any evident good. (See *J. Burns on Inflammation*, vol. ii.)

Mr. Fearon rejected all internal remedies, as inefficient in the treatment of cancer, and, in the early stages of the complaint, recommended a method of practice, founded on his idea of the inflammatory nature of the disease. "In the beginning of scirrhus affections of the breast and testis, the mode I have adopted of taking away blood, is by leeches repeatedly applied to the parts.

In this course, however, I have often been interrupted by the topical inflammation produced by these animals around the parts where they fastened. In delicate female habits, I have often lost a week, before I could proceed to the re-application of them. When the symptoms lead me to suspect the stomach, uterus, or any of the viscera, to be so affected, that the complaint either is, or most probably, soon will become cancerous, I then have recourse to general bleedings. But whether topical or general, perseverance for a sufficient length of time is necessary. Though the pulse never indicated such practice, yet the patients have not suffered by repeated bleedings; on the contrary, when they passed a certain time without losing blood, they felt a return of their symptoms, and, of their own accord, desired to be bled again. To this plan of repeated bleedings, I joined a milk and vegetable diet, avoiding wine, spirits, and fermented liquors." Mr. Fearon used also to keep the belly open, and employ saturnine applications.

Methodical compression was first recommended and practised in this country, as a means of curing cancer, by Young; and the same practice was afterwards put to the test of experience in the Middlesex Hospital; from which institution the report of Sir Charles Bell tends to prove, that compression, applied either to scirrhus or to ulcerated cancer, is decidedly hurtful. MM. Breschet and Ferrus also came to the same conclusion. (See *Dict. de Méd.* 1822.) The principal advocate for it, at present, is M. Recamier, who attributes the failures of it in the Middlesex Hospital to its not having been applied in a suitable manner, nor modified according to the stages of the disease. M. Recamier combines likewise the administration of hemlock with a very low diet, without which, he observes, that the latter medicine produces scarcely any effect. (See *Recherches sur le Traitement du Cancer par la Compression, Simple ou Combinée*, 8vo. 2 tomes, Paris, 1829.) I lately tried Recamier's plan in a case of scirrhus in the North London Hospital; but it seemed only to accelerate the conversion of the disease into open cancer.

From the preceding accounts we may infer, that no reliance is to be placed on any known remedy, or plan, in cases of real scirrhi and ulcerated cancers. The operation is the only rational chance of getting rid of the disease; and to waste time, so as to allow the disorder to increase in a serious degree, merely for the sake of trying various unpromising medicines, is conduct unworthy of a wise surgeon's imitation.*

Perhaps, in the early stage, it may be right to make trial of arsenic, conium, preparations of iron, or those of iodine, and of friction, with the ointment of the hydriodate of potash. In this country the ointment employed varies in strength from ℥j. to ℥ss of the hydriodate to each ounce of lard. Graef is alleged to have succeeded in bringing about an absorption of the whole of the diseased breast, by applying an ointment composed of ℥j. of hydriodate of potash, and ℥ij. of lard. Mr. Hill, of Chester, has recorded one case very favourable to trials of iodine. The cancer was in the ulcerated state. He dressed it with an ointment consisting of ℥j. of the hydriodate to ℥j. of lard; and gave the patient internally thirty drops at a time of a solution of thirty-six grains of the hydriodate in an ounce of distilled water. The result was such amendment of the disease, that a cure was confidently ex-

pected; but, in the end, the ulcer resumed its former dimensions and malignant character. (See *Edin. Med. Journ.* No. 87. p. 283.)

Upon the whole, the operation is the most likely means of getting rid of cancerous diseases. It is always admissible when every particle of the disease can be removed by it; when the absorbent glands are unaffected; and the constitution is not too far deranged. Even open cancers, if they can be entirely cut away, may yet admit of it.

The removal of cancerous disorders, even in the slightest and most trivial cases, should always be effected with the scalpel, in preference to caustic; the use of which, though it may sometimes succeed by producing a complete destruction of the diseased parts, causes severe agony, and, in the event of its not acting sufficiently on all the diseased parts, often renders the complaint more aggravated, and kills the patient in a very short space of time.

In cases of cancer, the irritation, generally occasioned by every application of the caustic kind, together with the pain and inflammation which commonly ensue, are strong objections to the practice. Plunkett's remedy, which is chiefly arsenic, is equally objectionable. Nor can we at once so certainly extirpate every atom of cancerous mischief with any caustic, as we can with the knife; for, with this, we immediately gain an ocular inspection of the surface surrounding the disease, so as to see and feel whether the disordered parts are completely removed, or whether any portion of the disorder requires a further employment of the instrument. With respect to the pain, that of caustics is infinitely greater, more intolerable, and more tedious, than that occasioned by the knife. When caustic also fails in destroying every particle of the disease at once, it almost always tends to enlarge, in a very rapid way, the original boundaries of the mischief. For an account of the method of removing schirri and ulcerated cancers, see MAMMA, REMOVAL OF.

An escharotic, which has been of late strongly recommended for cancerous affections, is the chloride of zinc, employed in the form of paste. On this subject my friend Mr. Crosse, of Norwich, observes, "It can of course only avail when the disease is still local; but the cases related by Drs. Canquoin, Ure, and Rieffrey, many of which occurred under the eye of most able surgeons, prove that this escharotic destroys the scirrhous tumour, speedily, leaving an ulcerated surface, which often readily heals; and, moreover, it induces no danger from absorption, which is a recommendation not possessed by the arsenical paste." The cuticle being first removed by a blister, the phagedenic paste is applied, composed of one part of chloride of zinc, and two of sulphate of lime. (See *Ure*, in *Lond. Med. Gaz.* vol. xviii. p. 287.; *Canquoin*, *Mém. sur un Nouveau Mode de Traitement des Affections Cancéreuses*, Paris, 1835; and *Rieffrey*, *New Treatment of Malignant Diseases and Cancer*, Lond. 1836.) This writer states, that the paste not only destroys the tumour, but purifies the surrounding atmosphere. He uses the chloride of zinc mixed with different proportions of flour, and has applied it to a tumour on the inside of the mouth, and also to the os uteri, with a good result. (See also *J. G. Crosse*, in *Prov. Med. Trans.* vol. v. p. 25.)

Dr. Ure, in some observations on lupus, recently published, communicates the following particulars respecting the chloride of zinc:—"The prepara-

tion of the chloride, which I proposed and introduced into practice in this country, differs in a most important feature from that originally employed by M. Canquoin. The wheaten flour, prescribed in the French formula, is apt to envelope the chloride in a glutinous dough, which blunts its power, or, at any rate, tends to confine its action to the particles on the surface of the paste; but the anhydrous gypsum of my formula, while it can exercise no chemical action upon the chloride, forms a porous medium, through which the whole of the particles of the deliquescent chloride may transude upon the morbid albuminous tissue, with the effect of decomposing, or destroying it, with certainty, to any definite depth. This preparation of mine has been adopted in several of the London Hospitals, and has been found to be unfailing in its escharotic powers." (See *Lond. Med. Gaz.* Dec. 3. 1836.) The action of the chloride, and also of the nitrate of zinc upon albumen, and their consequences, in relation to the albumen of cancer, are discoveries to which this gentleman lays claim. (See *Zinc*.)

Justamond's Account of the Methods pursued in the Treatment of Cancerous and Scirrhous disorders, 8vo. Lond. 1780; also *Surgical Tracts*, &c. 8vo. Lond. 1789. *James Hill*, Cases in Surgery, 8vo. Edin. 1772. *J. Storck*, An Essay on the Medical Nature of Hemlock, &c. 8vo. Lond. 1760. *Sir John Hill*, Plain and Useful Directions for those who are afflicted with Cancers, 2d ed. 8vo. Lond. *A. Zuffarini*, Storia di due Mammelle Demolite nella di cui Scirroza sostanza sono stati trovati nove Aghi, 8vo. Venez. 1761. *C. Petrus*, Diss. sistens historiam rationem mamme cancerose, sanguinem menstruum fundentis, methodo simpliciori sanate. (Frank. Del. Op. 10.) *W. Beckett*, New Discoveries, relating to the Cure of Cancers, wherein a method of dissolving cancerous substance is recommended, &c. 8vo. Lond. 1711. *J. Burrows*, Practice: Essay on Cancers, 8vo. Lond. 1767. *J. Andrieux*, Obs. upon a Treatise on the Virtues of Hemlock, in the Cure of Cancers, written by Dr. Storck, of Vienna, wherein the Doctor's Cases in favour of that vegetable are proved insufficient. 8vo. Lond. 1761. *E. Acutius*, Cases of Cancer; with Obs. on the Use of Carbonate of Lime, 8vo. Newcastle, 1802. *Fearon* on Cancers, with an Account of a new and successful Method of operating, particularly in Cancers of the Breast, or Testicle, 8vo. Lond. 1786. *A. Crawford*, Experiments on the Matter of Cancer, 8vo. Lond. 1790. *Adams* on Cancerous Breasts, 8vo. Lond. 1801; and on Morbid Poisons, 2d ed. 1807. *Medical Museum*, vol. i. *Med. Trans.* vol. i. *Gooch's* Med. Obs. vol. iii. *G. L. Bayle*, Sur le Cancer, 8vo. Paris, 1812. *Pract. Obs.* on Cancer, by *J. Howard*, 8vo. Lond. 1811. *J. P. Roux*, Mémoire renfermant quelques Vues Générales sur le Cancer, in *Œuvres Chir. de Desault*, par *Bichat*, t. iii. p. 406. &c. Paris, 1803. *Lambe's* Inquiry into the Origin and Cure of Constitutional Diseases, 8vo. Lond. 1805; and Reports of the Effects of a peculiar Regimen in Cancerous Complaints, 8vo. Lond. 1815. *Baillie's* Morbid Anatomy of some of the most important Parts of the Human Body. The Queries of the Society for Investigating the Nature and Cure of Cancer may be seen in the *Edin. Med. and Surgical Journal*, vol. ii. p. 382, &c. *Dict. des Sciences Méd. art. Cancer*. *Alibert*, Nosol. Natuella, t. i. fol. Paris, 1817. *Wardrop* on Fungous Hematomas, in which may be seen an interesting comparative View of this last Affection and Cancer, 8vo. 1809. *Dennan's* Obs. on Cancer, 8vo. Lond. 1810. *Carmichael's* Essay on the Effects of Carbonate and other Preparations of Iron upon Cancers, 2d ed. 8vo. Dublin, 1809. *W. Thomas*, Commentaries on the Treatment of Scirrhous Cancer, 8vo. Lond. 1805, 1817. *S. Young*, Inquiry into the Nature, &c. of Cancer, 8vo. Lond. 1805. Also Minutes of Cases of Cancer and Cancerous Tendency, 8vo. Lond. 1816; also further Reports of Cases treated by the New Mode of Pressure, 8vo. Lond. 1818. *J. Pearson*, Practical Obs. on Cancerous Complaints; with an Account of some Diseases, which have been confounded with Cancer; also Critical Remarks on some of the Operations performed in Cancerous Cases, 8vo. Lond. 1798. *Adeney's* Surgical Works, vol. ii. Lond. 1811. *J. Hodgkin*, A Practical Explanation of Cancer in the Breast, 8vo. Lond. 1815. *Sir E. Home*, Obs. on Cancer, comprehended under *C. Bell* on the Varieties of Diseases, in *Med. Chir. Trans.* vol. xii. Lond. 1822. *Sir J. Cooper's* Lectures, vol. ii. 1825. Also Illustrations of the Diseases of the Breast, Lond. 1829. &c. *Hill*, in *Edin. Med. Journ.* No. 87. *Dr. Hodgkin*, On the Anatomical Characters of some Adventitious Structures; *Med. Chir. Trans.* vol. xv. p. 228.

Benj. Travers, Obs. on the Local Diseases termed Malignant; *Med. Chir. Trans.* vol. xv. p. 195. 230.; also vol. xvii. p. 306. *J. A. Recamier*, Recherches sur le Traitement du Cancer par Compression, 2 vols. 8vo. Paris, 1829. *A. Ure*, M.D., in *Lond. Med. Gaz.* vol. xviii. p. 287. *Casus Haquius*, in *Lond. Med. Gaz.* for Aug. 1834. *Andral*, Précis d'Anat. Pathol. t. i. p. 501, &c. 8vo. Paris, 1829. *T. J. Bégin*, art. Cancer, in *Dict. de Med. et de Chir. Pratiques*, 8vo. Paris, 1830. *J. Cruveilhier*, Anat. Pathol. Paris, 1829. *Rob. Carswell*, M.D., Illustrations of the Elementary Forms of Disease, p. 2, 3. Lond. 1833. fol.

CANCER SCROTI. CHIMNEY-SWEEPERS' CANCER. (See SCROTUM.)

CANCRUM ORIS. A deep, foul, irregular, fetid ulcer, with jagged edges, on the inside of the lips and cheeks, attended with a copious flow of offensive saliva. It is a perfect specimen of phagedenic ulceration, and in its worst forms not unlike hospital gangrene, as I have seen several deplorable instances of. It also resembles the ulceration and sloughing in the mouth, produced by mercury. The gangrenous inflammation of the pudenda of children is of a similar character. (See *Kinderkrank.*, in *Med. Chir. Trans.* vol. vii.)

The disease is rarely seen in adults; but most commonly in children from the age of eighteen months to that of six or seven years. The gums, as well as the lips and cheeks, are sometimes affected, in which circumstance the teeth are generally carious and loose. The ulceration is occasionally attended with abscesses, which burst either through the cheek, lip, or just below the jaw. Exfoliations are not unfrequent, and, when the disease is neglected, extensive sloughing sometimes happens.

According to Dr. Cuming, in most instances, the ulceration, commencing in the gums, extends to the lips and cheek, but sometimes it begins in the mucous membrane of the lips or cheek, and thence extends to the gums. This disease is set down by Dr. Cuming as most frequently making its attack during the period of the first dentition, though often met with in children between three and seven years of age.

"When the disease occurs in infants on the breast, it is generally attended with a purplish and spongy appearance of the gums and roof of the mouth; and the ulceration, which lays bare the necks of the teeth, both externally and internally, is of a greenish, or ash-colour, and very much disposed to bleed. The salivary discharge is increased, the tongue is white; the mouth feels hot; the bowels are for the most part confined; and the child in general labours under a greater or less degree of fever." (See *Dublin Hospital Reports*, vol. iv. p. 331.) Dr. Cuming has not seen this form of the disease, previously to the irruption of the four superior incisors, but he has frequently seen it when the child had only six or eight teeth; and he has constantly observed, that, when it occurs thus early, it is the upper gum that is first and principally attacked. This appears, to Dr. Cuming, the mildest and most manageable form of the disease; and he describes it as rarely attended with sloughing.

The second variety, noticed by Dr. Cuming, occurs in children between the ages of twenty months and seven years. The ulceration generally begins in the gums; whence it extends to the lips or cheek. Sometimes it is of an acute, sometimes of a chronic nature, and attended accordingly with more or less sloughing. In the very worst forms, however, though the sloughing is considerable, the

ulceration is always predominant. (Op. et vol. cit. p. 341.)

The third variety described by Dr. Cuming is, at first, confined principally to the cheek or lips. It begins with ulceration of their membrane, which is soon followed by that hard, red, shining, and circumscribed swelling, which, if the disease be not arrested, will speedily pass into gangrene. In this variety, gangrene predominates over ulceration; and the constitutional disturbance resulting from it may prove fatal.

Living in a marshy situation, want of wholesome food, and inattention to cleanliness, are conducive to this disorder, which is often met with in houses where children are crowded together. One of the worst cases, however, which I have ever seen, was in a child of an opulent family in Essex. The complaint is sometimes suspected to be contagious.

The first, or mildest form, is well known generally to admit of being cured by purgatives, aided by some of the applications presently specified.

In the second form, Dr. Cuming, after clearing out the bowels with a brisk cathartic, confides chiefly in an alternative of mild mercurials with aperients. The local applications preferred by him, are the black wash, and a dilute solution of muriatic acid in honey. When the ulcerated surface is in contact with carious, or loose teeth, these should be removed. Dr. Cuming tried the liquor arsenicalis and cold salt water bath, without advantage.

In the third variety, where gangrene is predominant, the disease mostly proves fatal. Dr. Cuming has employed various local applications, such as the mineral acids, dilute and pure, the oxymel aruginis, the butter of antimony, solution of the nitrate of silver, the black wash, &c., but mostly without any good effect. I have likewise tried all these applications in vain, as well as solutions of the chloride of soda of different strength. With such external means, cinchona, sulphate of quinine, carbonate of ammoniac, opium and wine, have been prescribed; yet, for the most part, unavailingly. (See *Cuming*, in *Dub. Hosp. Reports*, vol. iv. p. 343. 345.)

The treatment recommended by Dense, consisted in administering muriatic acid internally, using it as an application to the disease; giving the patient a nourishing diet, with jelly, wine, &c., and occasionally prescribing an emetic.

In the worst form of the disease, I have found the concentrated nitric acid one of the most useful applications, especially when assisted with the internal exhibition of sulphate of quinine and dilute sulphuric acid.

Mr. Pearson extracted diseased teeth and loose pieces of bone; directed a milk and vegetable diet, with a prudent quantity of fermented liquors; and prescribed bark, sarsaparilla, and elm bark with sulphuric acid. The best applications seemed to him to be diluted mineral acids; burnt alum; the decoctum cinchonæ, with sulphate of zinc; tincture of myrrh; lime-water, with spirit of wine, &c. (See *Pearson's Principles of Surgery*, ed. 2. p. 287.)

CANTHARIDES. Spanish, or French flies, with which the common blistering plaster is made. In surgery, the tincture of cantharides is sometimes prescribed in incontinence of urine, gleet, &c. It is occasionally added to stimulating liniments, to

increase their effect. Cantharides, applied to the skin, or taken into the stomach, have a peculiar tendency to act upon the urinary organs, and especially to irritate and inflame the neck of the bladder, and occasion strangury. In children, these effects are particularly frequent. In 1810, Robiquet announced the discovery of a new principle, to which the active properties of the blistering beetles are referrible, and to which Professor Thomson, of Glasgow, gave the name of cantharidin. (See *BLISTERS*.)

CAPÉLINA (from *capelin*, a woman's hat, French). A double-headed roller, the middle of which is applied to the occiput. After two or three circles, the rollers intersect each other upon the forehead and occiput; then one being reflected over the vertex to the forehead, the other is continued in a circular track. They next cross each other upon the forehead, after which the first head is carried back obliquely towards the occiput, and reflected by the side of the other. The last is continued in a circular direction; but the first is brought again over the sagittal suture, backward and forward, and so continued, till the whole head is covered.* By the ancients, this bandage was sometimes applied in cases of hydrocephalus: it has no advantage, however, and is now hardly ever used.

CAPILLARY FISSURE. A very minute crack in the skull. The term came into use from its presenting the appearance of a hair.

CAPISTRUM. (See *BANDAGE*.)

CARBUNCLE (from *carbo*, a burning coal), is divided into the *benign* and *malignant* kinds, or into what are termed by French pathologists *anthrax* and *charbon*, examples of which last are afforded, in what is sometimes termed the *malignant pustule*, and in the carbuncle of plague, called therefore *pestilential*. Fortunately, all cases met with in England correspond to the anthrax of Dupuytren; for no opportunities of remarking the *pestilential carbuncle* have occurred in England since the deploable periods of 1665 and 1666.

Besides the diffuse forms of gangrene and sphacelus of the subcutaneous cellular tissue, there is likewise "a circumscribed form, which is observed in furunculus, carbuncle, or anthrax." The great accumulation of blood, and the still greater and rapid effusion of serosity, which takes place in these circumscribed acute inflammatory affections, produce a state of extreme induration of the cellular tissue, a greater or lesser portion of which, being thus as if strangulated, dies from want of nutrition, becomes separated from the living parts, and is expelled in the form of a grey or straw-coloured spongy or pulpy mass, through an opening made in the skin by a similar process, by ulceration, or a surgical operation." (See *Carswell's Illustrations of the Elementary Forms of Disease*, p. 7.)

Anthrax, or common carbuncle, resembles a boil (see *FURUNCULUS*), in being attended with gangrene of the subcutaneous cellular tissue, and, if one high authority can be credited, of certain processes of that texture within the skin. (Dupuytren, *Clin. Chir.* vol. iv. p. 109.) It is remarkable for constituting a circumscribed dark red, or livid swelling, accompanied by burning heat, stiffness, and for soreness in the part; and, occurring most frequently in parts of the body, where the skin is thickest, and abounds most in

those processes of cellular tissue which are described by Dupuytren as extending between its areolæ. Thus, the nape of the neck, the back, the spaces over the scapulae, the sides of the chest, and the nates, are the ordinary situations of anthrax.

Anthrax differs from a boil, not only in being of more considerable size, but in being usually single, and bursting by several small apertures; whereas several boils frequently form together, or occur in succession, and when one of these tumours bursts, it does so by a single opening in its apex. The skin, which covers the anthrax, and especially what lies over its centre, is of a deeper and more livid red colour, than what is seen over a boil. The mortified cellular tissue is deeper and more extensive in anthrax, than a boil, in which it forms only a central nucleus, or *core*. The surface of the tumour is flatter than that of a boil, which always rises in a conical shape above the level of the skin, while its base does not penetrate so deeply as that of a carbuncle, which is a great deal broader than the more superficial part of the tumour. It is the nature of anthrax to produce gangrene and disorganisation of the subcutaneous cellular tissue, and sometimes a destruction of even the subjacent muscles, and deeper textures, the mass of dead parts constituting frequently a slough of a lightish colour, portions of which, mixing with the discharge, sometimes communicate to it an appearance, compared by Sir Astley Cooper to that of flour and water. Sometimes, however, the matter is bloody and sanguine. Boils chiefly occur in children, and young plethoric persons; the anthrax is mostly seen in subjects beyond the middle period of life, whose constitutions have been seriously impaired by intemperance, or other causes.

The occurrence of anthrax on the limbs is uncommon. Mr. Hunter, however, had seen the disease so situated: I have met with examples of it on the occiput, side of the neck, in various parts of the back, and on the nates.

Anthrax, or common carbuncle, is essentially different from the malignant pustule, so frequent in some of the southern parts of Europe (see *Larrey, Mem. de Chir. Militaire*, t. i. p. 104, &c.), in not being contagious. It differs also from pestilential and malignant carbuncle (the *charbon*, of French pathologists), in the same important respect. (See Dupuytren, *Clin. Chir.* t. iv. p. 113.) This latter also regards the malignant pustule and pestilential carbuncle as essentially gangrenous diseases, whereas simple anthrax seems to him to be so merely from strangulation of the processes of cellular tissue extending into the structure of the true skin. The correctness of this statement seems to be rather doubtful; because there can be no carbuncular disease, whether benign or malignant, without a gangrenous disorganisation of the cellular tissue, and the influence of constitutional causes. This is certain; but, whether constriction of the inflamed tissues, as alleged by Dupuytren, be the principal cause of gangrene, is a point which is far less clear. We find, indeed, that it is the character of carbuncular inflammations, first to produce a sloughing of the cellular tissue, even where this may not be covered by any dense unyielding part; though occasionally it afterwards destroys the textures down to the vertebrae or scapulae themselves. The gangrene, I should say, is independent of the constriction and confinement of the textures.

affected. The first symptoms are great heat and violent pain in some part of the body, on which arise one or several vesications, attended with great itching and a burning heat; below which a circumscribed, but very deep-seated and extremely hard tumour may be felt.

Anthrax, or common carbuncle, sometimes appears in persons affected with typhoid symptoms, in which case it is attended with great weight and stiffness of the adjacent parts; the patient is restless and pale, the tongue white, or of a deep red, and moist; the pulse low, urine sometimes pale, sometimes very turbid, with all the other symptoms, in an exaggerated degree, which attend typhoid fevers. The patient often complains much of his head, either from pain or giddiness. Sometimes, he is drowsy; at other times, he cannot get the least sleep. Occasionally, he is delirious. The case is also apt to be attended with chilliness or rigors, and profuse perspirations. The patient is sometimes costive, sometimes afflicted with a profusion of stools; he generally complains of loss of appetite, nausea, and vomiting; takes but little nourishment; complains of difficulty of breathing, and is extremely low, with palpitations of the heart, and sometimes faintness. (See *Bromfield's Obs.* vol. i. p. 122.)

The progress of carbuncles to the gangrenous state is generally quick. Their size is various: they have been known to be as large as a plate. Considerable local pain and induration always attend the disease. The skin, indeed, has a peculiar feel, like that of brown. As the complaint advances, several little vesicles arise, and under these apertures generally form in the tumour, through which a greenish, bloody, fetid, irritating matter is discharged. The internal sloughing is often extensive, even when no sign of mortification can be outwardly discovered.

The degree of peril may generally be estimated by the magnitude and situation of the tumour, the age of the patient, and the state of his constitution. Carbuncles on the head are often fatal.

With regard to the local treatment, the principal thing is to make an early and free incision into the tumour, so as to allow the sloughs and matter to escape. If the carbuncle be large, a crucial incision is mostly preferred, because the compact mass of disorganised cellular tissue will be long in getting completely out, unless the opening be made very free. The extremities of each cut should go two or three lines beyond the boundaries of the disease. (See *Dupuytren, Clin. Chir.* t. iv. p. 112.)

As much of the contents as possible should at once be pressed out, and the part covered with a poultice. Until the tumour is opened, no applications are more proper than an emollient poultice; but after an incision has been made, the poultice should be made rather stimulating; like that composed of oatmeal and port wine, the common fermenting poultice, or a linseed one, with which a proportion of Peruvian balsam is blended. Fomentations also afford considerable relief, both before and after an opening has been made. As the discharge is exceedingly fetid, a fresh poultice is necessary two or three times a day. Poultices are to be continued, till all the sloughs have separated, and the cavity becomes clean, after which the ulcer may be dressed with red precipitate ointment. Peruvian balsam, or a solution of nitrate of silver, 10 grs.

to the ounce of water. Dupuytren, after opening the tumour sometimes continued the poultice, and, in other instances, employed gently stimulating dressings. When the carbuncle is situated on the posterior part of the trunk, the patient should not lie on his back; for then the skin would slough, notwithstanding the incision. (See *Dupuytren, Clin. Chir.* t. iv. p. 113.)

The manner in which the disease is protracted, by not making a proper opening in due time, cannot be too strongly impressed upon the mind of every practitioner, and it may justly be regarded as a frequent reason of the fatal terminations of numerous cases. Mr. Bromfield long ago forcibly inculcated the necessity of making a timely opening for the discharge of the sloughs; for, says he, "in case you rely on the opening made by nature, the thin matter only will be discharged, the sloughy membranes will remain, and the orifice close up." (See vol. i. p. 128.)

It was formerly not an uncommon custom to remove the most prominent portions of carbuncles with the knife, or to destroy them with the actual and potential cauteries. Many foreign surgeons are partial to the hot iron, the employment of which was sanctioned by Pouteau. (See his *Œuvres Posthumes.*) Even now they sometimes touch the apex of the swelling with muriate of antimony, or the actual cautery, especially when the pain is excessively severe; and the practice is alleged to be the most expeditious mode of relief. However, Dupuytren makes a distinction between anthrax and malignant carbuncles, observing that the proper cure for the former is an incision, but for the latter, the actual or potential cautery. In America, emollient poultices are continued until vesications appear, openings form, and a bloody serum begins to be discharged: the surface of the tumour is then freely covered with caustic vegetable alkali, which of course produces a good deal of pain, but this soon subsides, and the severe burning agony, peculiar to the complaint is now quite removed. It was Dr. Physick who first explained the proper period for the application; without which knowledge, Professor Gibson says, much mischief has resulted from ill-timed incisions, and the actual and potential cauteries. (*Institutes of Surgery*, vol. i. p. 52.)

With respect to the constitutional treatment, the continental surgeons, in the beginning of the case, before a slough has formed, usually prescribe gentle diaphoretic drinks, containing a sufficient quantity of tartar of antimony to open the bowels. After this stage, they have immediate recourse to tonics and cordials. It should always be remembered, that the disease is for the most part met with in bad constitutions, and in persons who are weak and irritable. Hence, bleeding is rarely allowable. Bark, sulphate of quinine, camphor, wine, opium, æther, and the regulation of the bowels, with calomel and other means, are the internal medicines most commonly needed. The diluted sulphuric acid is highly proper, as well as aromatics and a nourishing diet. As the pain is severe, opium is essential. The constitutional treatment is analogous to that of mortification. (See *MONIFICATION.*)

I once attended an elderly man who had a carbuncle, as broad as a dinner-plate, over the scapula: he died of phlebitis, with abscesses in various organs, and in two or three of the large joints.

Ant. Toss, De Anthrace seu Carbunculo Tractatus. 170. Venetis, 1776 This tract, notwithstanding its antiquity, contains useful precepts. *Bromfield's Chir. Cases and Obs.* vol. i. *Hunter on the Blood, Inflammation, &c.* *Richter's Anfangsgr. der Wundarzn.* b. i. *Doyen, Traité des Maladies Chir.* t. ii. p. 50, &c. *Physick's Case of Carbuncle, with Remarks on the Use of Caustic in that Disease, in the Philadelphia Journ. of the Med. and Physical Sciences,* vol. ii. p. 172. *W. Gibson's Institutes and Practice of Surgery,* vol. i. p. 50, &c. Philadelphia, 1824. *Darbyshire, Chiquette Chir.* t. iv. p. 109, 8vo. Paris, 1834. *Rob. Carnwell's Illustrations of the Elementary Forms of Disease; Fasc. on Mortification.*

CARCINOMA (from *καρκίνος*, a crab). See CANCER.

CARIES (from *καίω*, to abrade). Caries is a disease of the bones, supposed to be very analogous to ulceration of the soft parts; and this comparison is one of great antiquity, having been made by Galen. However, by the generality of the ancients, caries was not discriminated from necrosis.

It was from the surgeons of the eighteenth century, that more correct opinions were derived respecting caries. Until that period, writers had done little more than mention the complaint and the methods of treating it. Some new light was thrown upon the subject by J. L. Petit, in his remarks upon exostosis and caries. (*Mal. des Os*, t. ii. chap. xvi. p. 27.) But as he only spoke of the disorder as one of the terminations of exostosis, he has not entered far into the consideration of it. The best observations on caries were first made by Dr. A. Monro, *primus*. (*Edin. Med. Essays*, vol. v. art. 25.) This memoir contains the earliest correct ideas of *dry caries*, or *necrosis*, which is rightly compared to mortification of the soft parts, and named *gangrenous caries*.

The bones, like other parts of the body, are composed of arteries, veins, absorbent vessels, nerves, and a cellular texture; they are endued with vitality; they are nourished, they grow, waste, are repaired, and undergo various mutations according to the age of the individual; and they are subject to diseases analogous to those of the soft parts. To the phosphate of lime, which is more or less abundantly distributed in their texture, they owe all their solidity; and, perhaps, it is to the same inorganic substance that the difference in their vital properties and in their diseases, from those of the rest of the body, is to be referred. In fact, this particular organisation and inferior vitality of the bones, are generally supposed to account for the small number, peculiar character, and generally slow progress of their diseases. (*Dict. des Sciences Méd.* t. iv. p. 80.)

Bones of a spongy texture are more frequently attacked by caries than such as are compact. Hence, the vertebrae; astragalus, and other bones of the tarsus; those of the carpus; the sternum; the bones of the pelvis, and the heads of the long bones, are often affected; and the bones of young persons are unquestionably more frequently the seat of caries than those of old subjects.

But though the soft and spongy bones are most subject to caries, they sometimes suffer a degree of injury sufficient to produce the death of a portion of their texture. Thus in a case, where a musket-ball had struck the head of the tibia, a sequestrum was found in it, with a cloaca leading down to it. (*Liston, in Edin. Med. and Surg. Journ.* No. lxxviii. p. 50.) In the fine plates of Weidmann, and the cases recorded by him, the same fact, as the effect of disease, was long ago illustrated.

According to the observations of Mr. Syme, when caries occurs in the tables of the skull, or the cylindrical bones, it is uniformly preceded by a morbid expansion of the compact structure into a state resembling that which naturally belongs to those, where the disease usually resides. He notices that the shafts of bones, and especially that of the tibia, are frequently enlarged and thickened, in consequence of chronic inflammation, and at the same time loosened in their texture, so as to present nearly the same appearance as that of the spongy articulating extremities. "In bones so altered, caries occasionally occurs, or, I should rather say, a condition resembling caries, since it differs from this disease in one important feature, viz *incurribleness*. I have hardly ever known this pseudo-caries resist the local application of blisters, and internal use of oxymuriate of mercury; and I have felt very uncomfortable in seeing extensive incisions, rasping, trephining, actual canteries, &c. employed ineffectually to cure complaints admitting of such easy remedy." (*See Edin. Med. and Surg. Journ.* vol. xxxi. p. 257.)

In necrosis, the bone is entirely deprived of life: in caries, the vital principle exists; but a morbid action is going on, whereby the texture of the bone is altered, and rendered softer and lighter than natural. But, though these disorders are essentially different from each other, they frequently occur together in the same part, as Weidmann, Liston, and others have correctly explained. In syphilis, this fact is often exemplified, the degree of necrosis predominating over that of caries.

In the most common species of caries, a loose, fungous flesh grows out of the interstices, formed on the surface of the diseased bone, and bleeds from the slightest causes; while, in the soft parts, a sinus generally leads down to the caries, and emits a fetid, dark-coloured sanies. These symptoms, however, as well as the tendency in the accompanying ulcer or sinus to produce large fungous granulations, are more constant in cases of necrosis than in those of caries, some of which may remain a considerable time unattended with any outward sore, abscess, or sinus, as is illustrated in caries produced by various diseases of the joints. And, indeed, particular forms of caries (if they deserve that name) are rarely accompanied with suppuration; a fact to which I shall again advert.

"The absorption of bone, like that of soft parts (says Dr. Thomson), may be distinguished into interstitial, progressive, and ulcerative. We have ample proofs of the interstitial absorption, or that which is daily, hourly, and unceasingly taking place from every part of the substance of bone, in the deposition and removal of phosphate of lime, that has been tinged with madder. If too much earth be removed, the quantity of animal matter will be relatively increased, and a disposition given to softness of the bones — a state, which exists in the bones of children in the disease called the rickets, and in the bones of older people, in that denominated *mollities ossium*, or the rickets of grown people.

"I have already had occasion to mention the effects of the progressive absorption of bone, as manifested in the progress of aneurisms and other tumours of the skin; but the formation of pus is by no means a necessary, constant, or even fre-

quent attendant on the progressive absorption in bone. Hydatids in the brains of sheep, tumours growing from the *pia* or *dura mater* in the human body (see *DURA MATER*), or aneurism seated over the cranium, or within the cavity of the chest, are often the cause of the whole substance of a bone being removed, layer after layer, by progressive absorption, without the formation of a single particle of pus. (See *ANEURISM*.) This state of the bone has often been confounded, but improperly, with that state of the bone which arises from ulcerative absorption, the state which is properly denominated caries, and in which one or more solutions of continuity may be produced upon the surface, or in the substance of the bones. The ulcerations, occasioned in bones by the venereal disease, afford by far the best marked examples of the effects and appearances of ulcerative absorption, or caries in bones," &c. (See *Thomson's Lectures on Inflammation*, p. 389.)

The prominent feature both of ulceration and caries, is loss of substance through absorption. But, as Mr. Mayo properly observes, "caries is something more than mere absorption. When an aneurism of the aorta presses against the sternum, or the vertebrae, the bones are gradually eaten through; they are partially absorbed; but they are not carious. When, however, the face is attacked with lupus, and the ulcer, spreading in depth and breadth, reaches the bones, and they become excavated simultaneously with the soft parts in the enlarging ulcer, the osseous tissue is not only absorbed, but truly carious. In caries, absorption is preceded by a change in the bone, which (with very few and doubtful exceptions) has a well marked inflammatory character. The same condition exists during the progress of the absorption. There is further present an imperfect restorative action, which is shown in the more or less partial growth of unwholesome granulations from the ulcerated surface. Of these changes, the inflamed condition of the bone is the primary and most important; the absorption is secondary and accidental. Absorption may be prevented by subduing the inflammation; or may, after having begun, be arrested, and the crop of unwholesome granulations converted into a healthy restorative growth, if the case is of such a nature as to allow of the suppression of the inflammatory or specific action." (See *Outlines of Human Pathology*, p. 36.)

Caries has been divided into several kinds, according to the nature of its causes: 1. Caries from external causes; 2. From constitutional disease, in which cases, besides local remedies, it is necessary to employ such medicines as are calculated to obviate the particular affection of the system, whence the diseased state of the bone has originated.

Mr. Mayo enumerates four kinds of caries: 1. *Simple*. When, in a person of sound constitution, a state of unwholesome and protracted inflammation is set up in a bone, through some accidental local cause. 2. *Syphilitic*. When a disposition to a specific periosteal inflammation is produced by lues. 3. *Strumous*. When the scrofulous diathesis gives origin to caries. 4. *Malignant*. When the bones are absorbed in the spread of malignant ulcers. (See *Outlines of Human Pathology*, p. 36.)

But many circumstances, in relation to the

varieties of caries, yet lie in obscurity. If, as a modern writer remarks, the situation of the bones, the nature of their organisation, and the slowness of their diseases, would let an attentive observer trace the formation, development, and progress of caries, no doubt there would be noticed a diversity in its symptoms, corresponding to its different species; and, probably, it would be found, that a venereal or scrofulous caries would vary in its origin and progress, as much from a caries arising from a purely local cause, as a venereal or scrofulous ulcer differs from the kind of ulceration that follows a common abscess. (*Dict. des Sciences Méd.* t. iv. p. 84.) The *worm-eaten* caries, as it has been termed, which penetrates the whole substance of a bone, and gives it an appearance as if it had been bored in hundreds of places, is a very different affection from some other forms of the disease, whether superficial, or extending to the deeper texture of the bone.

Around the carious part, there is always a deposit of new osseous matter, in the form of tubercles, extending to a considerable distance, and greatly increasing the thickness of the bone. The new bone, on superficial inspection, appears rough and porous, the pores being for the transmission of blood-vessels.

Mr. Syme regards the distinction of caries into the *dry*, *moist*, *worm-eaten*, &c. only as the result of the confusion of caries with other morbid states of the osseous tissue. The *dry* is in reality necrosis, as already noticed. A carious bone, after maceration, according to Mr. Syme, looks as if it had been burned; being harder, whiter, and more brittle than usual, and always attended with more or less excavation, so as to expose the cellular structure. It resembles a piece of loaf sugar, that has been partially dissolved by momentary immersion in hot water. According to Mr. Mayo, syphilitic caries begins with inflammation of the periosteum, and "does not lead to much enlargement of the bone. The bones commonly attacked are those, which, lying near the surface, are obnoxious to cold: the tibia, for instance, the ulna, the clavicle, the cranial bones. The swelling, by which syphilitic caries first manifests itself, is called a node. It is an inflammation, either confined to the periosteum, or involving at most the cortex of the bone. The periosteum becomes thickened, and is exquisitely painful. If the integuments are divided down to the bone at this period, a thick, viscid, glary matter, like honey, is often found in the cells of the periosteum, &c. The surface of the bone now gradually enlarges, or is thrown up in particles of porous bone, either furrowed by longitudinal grooves, or spongy and sieve-like, riddled with innumerable minute holes." The outer table of the skull in venereal caries, generally has the appearance of being worm-eaten. Mr. Mayo adds, that, while the caries is making progress, the integuments inflame; and matter forms below the skin, which afterwards ulcerates. The skin before breaking has a livid colour; and afterwards the skin around the ulcer has the same hue. The edges of the sore are commonly a little raised; its outline uneven, and the granulations irregular, and covered by a viscid ash-coloured secretion. A probe readily passes through the soft and gritty texture of the caries. The co-existence of ulcerated fauces and squamous eruption, or other disease of the skin, generally leaves no doubt of the

nature of the caries. Sometimes, however, the latter exists alone. (See *Mayo's Outline of Human Pathology*, p. 40.)

Mr. Mayo is unacquainted with any essential difference in the appearance of carious bones in different forms of scrofula, and in the parallel cases dependent upon lues. "Less pain, less periosteal inflammation, and a smaller extent of surface attack, the absence of other symptoms, and the general physical appearance of the patient (he adds), afford a strong presumption of the scrofulous origin of the disease." (*Op. cit.* p. 41.)

The instances of malignant caries, adduced by Mr. Mayo, are those from lupus and cancer. (*Op. cit.* p. 48.)

Mr. Syme regards the distinction of caries into the dry, moist, worm-eaten, &c. only as the result of the confusion of caries with other morbid states of the osseous tissue. The dry is in reality necrosis, as already noticed. A carious bone, after maceration, according to Mr. Syme, looks as if it had been burned; being harder, whiter, and more brittle than usual, and always attended with more or less excavation, so as to expose the cellular structure. It resembles a piece of loaf sugar, that has been partially dissolved by momentary immersion in hot water. (See *Edin. Med. and Surg. Journ.* vol. xxxi. p. 257., and *Syme's Principles of Surgery*, p. 171. ed. 2. 8vo. Edinb. 1837.)

Abscesses, situated in the vicinity of bones, are frequently thought to be the cause both of necrosis and caries. This was the ancient doctrine, and it has found various advocates in modern times, especially Mr. Liston. (See *Edin. Med. and Surg. Journ.* vol. xx. p. 52.) Hence, the rule to open such abscesses at an early period, in order to prevent the bone from being affected. If some abscesses, like those which form over the anterior surface of the tibia and mastoid process of the temporal bone, be frequently attended either with caries or necrosis, the latter is mostly the cause, and not the effect, of the suppuration. Pus, which is a bland, unctuous, inodorous fluid, never attacks the soft parts, with which it is in contact, until its qualities are changed by exposure to the air. When an abscess forms in the anterior part of the parietes of the abdomen, the peritoneum of that part, naturally a thin membrane, instead of being destroyed, becomes thick, and strong enough to resist the extension of the abscess towards the cavity of the abdomen. So also, when an abscess is formed over a bone, not originally diseased, or hurt by the same causes which produced the abscess, and not injured by being kept exposed, or by astringent or scharotic applications, neither caries, nor necrosis, is likely to happen. On the contrary, the periosteum, like the peritoneum, becomes thickened, and granulations are formed over it. In the opinion of Mr. Syme, caries cannot, like necrosis, be induced directly by the effect of violence. It depends, he says, upon a peculiar morbid action, which is probably in all cases preceded by inflammation. "Many people think, that pressure, such as that of an aneurism, causes absorption of bone, and gives rise to an appearance, which might be mistaken for caries by an inexperienced, or careless observer, but could never for a moment impose upon any one acquainted with the distinctive characters of the disease. The surface, exposed by simple absorption, differs in no respect from that which would have appeared if the excavation had

been effected by violence. We do not here perceive the hardness, whiteness, and brittleness of caries; neither is there any matter secreted from it; and so soon as the caries is removed, the disease ceases. The effect of pressure in causing absorption without inducing caries, is well seen in those common cases of necrosis, where internal exfoliation occurs, and the confined pus makes a way for its escape, since the sides of these passages, so produced, the cloaca, as they are called, are in no respect carious, or unfit for healthy action. Deep-seated collections of matter ought to be evacuated early to relieve the patient from pain, or prevent extension of the fluid, but no apprehension need be entertained of caries being produced by its pressure." (*Syme*, vol. cit. p. 258.)

But, though Mr. Syme believes, that inflammation generally, if not always, precedes caries, he represents this consequence as not invariably following inflammation, or even suppuration. "In cases of compound fracture, amputation, excision of joints, &c., we every day see bone suppurate and granulate in the most satisfactory manner. We observe the same thing occasionally in joints, which become ankylosed after being the seat of abscess." At the same time, Mr. Syme is of opinion, that suppuration of bone, which either takes place spontaneously, or in consequence of slight external injury, is very frequently followed by caries, much more so, than when it results from a wound, which does not heal by the first intention.

Mr. Syme has found that caries seldom affects the bone to a great depth. "Thus, we often see an articulating extremity carious over its whole external surface, and sound in the centre. At other times, we find it hollowed out into a cavity, the surface of which is carious, while the external shell is sound. The very limited extent of the disease often contrasts remarkably with the extreme obstinacy and severity of the symptoms. Thus, there is in my possession a thigh-bone, which I took from the body of a woman, who had laboured under caries of the trochanter major for thirteen years; yet the whole disease may be covered by the point of a finger, and is not thicker than a sixpence." (*Syme*, in *Edin. Med. Journ.* vol. xxx. p. 257.)

The venereal disease is sometimes a cause of caries; sometimes of necrosis; frequently of both affections together; and, in other instances, of exostosis. When it attacks the bones of the nose, its destructive effects arise partly from necrosis, and partly from caries, and the face is sadly disfigured. The bones of the palate are sometimes altered in the same manner; but, on other occasions, the effect upon them is chiefly necrosis.

In cases of cancer of the breast, the sternum and ribs are sometimes found carious. I believe, that, in such cases, the disease of the bones has nothing in its own nature entitling it to be regarded as cancerous. It is a mere effect of the original disorder; and if the carious bone could be removed together with every particle of the disease of the soft parts, a cure would probably follow. Or, supposing the carious bone were the only portion of the disease left, it is conceivable that the cure might yet end in a cure. At the same time it is proper to recollect, what has been mentioned in the article CANCER, that Sir Astley Cooper refers in his Lectures to some bones, taken from cancerous

subjects, where a scirrhus substance has been deposited in their structure.

Caries, arising from syphilis, most commonly affects the tibia, ulna, clavicle, cranium, ossa nasi, ossa palati, and sternum; and, I believe, is often complicated with a greater or less degree of necrosis. Scrofulous caries of the vertebrae is known by peculiar symptoms, among which a paralysis of the inferior extremities, and lumpier abscesses, are the most remarkable. Caries paribus, caries from an external or a local internal cause, is less dangerous than that, which proceeds from a constitutional disease, particularly when the latter is difficult of cure. Caries of the spongy part of bones is more difficult to cure than a similar affection of their compact parts. Caries of the carpal and tarsal bones is particularly obstinate. These bones being in close contact, the affection cannot easily be prevented from spreading from one to the other. If excision, or extraction of them be impracticable, amputation is often the only means of cure. The same is frequently the case, when the spongy heads of the long bones, forming the large joints, become carious. Even this mode of relief is not practicable when the head of the bone lies very deeply, like that of the os femoris.

Caries from scrofula, the most frequent case, is more difficult of cure than that from syphilis and scurvy; for some efficacious remedies against the latter diseases are known, but scrofula cannot be said to be much within the reach of medicine. The prognosis is less favourable in old than young subjects; and much depends on the extent of the disease, the patient's strength, and the state of the soft parts.

When caries arises from constitutional disease, internal remedies are of course indicated. Thus hydriodate of potash, sarsaparilla, tonics, and sudorific medicines, have a tendency to cure (perhaps even more frequently than mercury) caries from syphilis; while vegetable diet and acids cure both scurvy and the caries dependent on it.

According to writers, the indications in the treatment of caries are, either to produce a change in the action of the diseased portion of bone, whereby it may regain a healthy state, or to destroy it altogether.

In the caries from constitutional causes, the first object seems to be brought about by the operation of such remedies as remove the original disease, and, I should much doubt, whether, in these cases, any very active local treatment is necessary, or free from objection. Of course this remark is meant to apply only to examples, in which we possess some medicine or plan, which is known to be a tolerably sure remedy for the general disease. This is not the case in caries from scrofula, and here issues, blisters, friction, with other local means, are unquestionably advantageous. (See JOINTS, and VERTEBRAE.) But surgeons have proceeded further; and not content with issues, blisters, fomentations, &c. as means for quickening the action of the diseased bone, they have commonly recommended applying directly to it the strongest stimulants, as the tincture of aloes or myrrh, a solution of the argemum nitratum, the acetic acid, or diluted muriatic or nitric acid. The actual and potential cauteries, and cutting instruments, have also been employed.

On the Continent and particularly in France, the plan of touching carious parts of bones with

the actual cautery, after bringing them fairly into view by the previous use of the knife, is still pursued. It is thought, that the burning iron acts by changing the caries into a necrosis, irritating the subjacent sound parts, and exciting that action of the vessels, by which the dead or diseased part of the bones must be thrown off. Such is the doctrine inculcated by Boyer, and such is the practice sanctioned by other surgeons of the present day.

Mr. Hey succeeded in cutting away a carious part of the tibia. He began the operation by dissecting off the granulations of flesh, which had arisen from the bone, and then sawed out, by means of a circular-headed saw, a wedge of the tibia, two inches in length. The removal of this portion, brought into view a caries of the cancelli, almost as extensive as the piece already removed. With different trephines, suited to the breadth of the caries, Mr. Hey removed the diseased cancelli of the bone, quite through to the opposite lamel. As the caries extended in various directions, it was not possible to remove the whole of it with a trephine, without removing also a large portion of the sound part of the bone, which Mr. Hey wished to avoid. By the assistance, therefore, of a strong sharp-pointed knife, he pursued the caries in every direction until every part was taken away, which had an unsound appearance. The wound was simply dressed with dry lint; the whole surface was speedily covered with good granulations; and a complete cure was obtained, without any exfoliation.

Mr. Hey concludes this subject as follows: "I have treated some other cases of caries of the tibia in the same manner, and with equal success. Where the extent of the caries is not so great as to prevent a complete removal of the morbid part, this method is extremely useful, and far superior to the use of the potential or actual cautery.

"The trephine is not wanted where the cancelli of the bone are not affected with the caries. The diseased parts of the lamella may be removed with gouges or small chisels. Granulations of flesh will then arise from the sound parts of the bone, and become united with the integuments, which ought to be preserved as far as is possible." (*Pract. Obs. on Surgery.*)

Mr. Syme also regards excision as the best method of destroying carious bone, since (he says) "more can be done by the gouge or cutting pliers, in a few seconds, than by the actual cautery in as many weeks, or months;" but he strongly objects to the application of the cautery to the bone after the excision of the carious part. (*Edin. Med. Journ.* vol. xxxi. p. 260.) On this point, every judicious surgeon must, I think, agree with him.

Dr. Nicol, surgeon to the Northern Infirmary of Inverness, has published the result of his experience in caries; and he finds that, when excision is not practicable, the next most effectual treatment consists in applying nitrate of silver to the carious part, and exhibiting the compound decoction of sarsaparilla. (*See Edin. Med. and Sn Journ.* No. xciv.)

In the treatment of caries, particularly of that form of it which accompanies white swellings, Mr. Liston considers ointments and poultices as unlikely to be productive of much good. In the first or inflammatory stage, he praises topical bleeding, practised with moderation, and followed

by issues, sinapisms, blisters, or the antimonial ointment. However, he thinks the most effectual remedy is the moxa. "In all deep-seated pains of the joints (says Mr. Liston) this remedy affords the most speedy and complete relief, at the expense but of a trifling pain, of no long duration. The pain does not appear to be greater, than that arising from the formation of an eschar by potass, or any other of the potential cauterics, and lasts only during the time of the application, whilst the violent pain does not subside, perhaps, for twelve hours after the employment of the potass."

(*Edin. Med. and Surg. Journ.* No. lxxviii. p. 54.)

When caries is fairly established, and the integuments have given way, the same author represents the indications to be either the immediate removal of the diseased bone, or the employment of means calculated to make it be thrown off by the constitution. "The first indication (he says) is to be accomplished, by the proper use of trephines, perforators, gouges, gravers, scoops, saws, and forceps of different kinds, for dividing, or extracting; the second, by cauterics, actual or potential. In general, a combination of both is required."

"In caries of the long bones, it becomes in general necessary to enlarge the opening through the outer lamella, by the application of the trephine, and perhaps by the use of a small saw, or cutting forceps, so as to connect the different perforations, and thus obtain access to the diseased cancelli. The scoop, or graver, will answer well for the rest of the work. In most instances the actual cautery is next applied very freely, by which means the whole of the diseased surface will be thrown off, and healthy granulations fill up the breach." (*Op. cit.* p. 56.)

In the Medico-Chirurgical Trans. cases have been recorded by Mr. Dunn and Mr. A. C. Hutchinson, in which several of the tarsal bones in a state of caries were cut out, and the foot preserved. The same practice seems to be followed by Mr. Liston, with the addition of the cautery. He observes, that when the disease is seated in one of the tarsal, or carpal bones, and entirely limited to it, its simple removal will be sufficient. But when one is quite destroyed, and the surfaces of others with which it is articulated are affected, these surfaces must also be cut out, and the operation finished by the free application of the cautery. The principle which Mr. Liston lays down is, that the cautery is indispensable, whenever the cancellated texture of a bone is encroached upon. The knife for such operations, he says, should have a strong sharp point and edge, with a thick back and firm handle. A scoop, graver, or gouge, and strong pliers, with some pairs of cutting forceps, will (with the cauterics for such cases as require them) complete the apparatus. The bone-forceps, with the cutting edges in a line with the handles, as used by Mr. Liston for some years, are strongly commended, more especially when the metacarpal or metatarsal bones are to be in part removed. In these operations Mr. Liston has never found saws of the least use; and in several trials of the chain saw, which he witnessed, it either broke, or got so wedged, that great difficulty was experienced in disengaging it and bringing the operation to a conclusion. He does not approve of the half-headed trephine, because the bone must be de-

nuded much higher than where the division is to be made, in order to let the centre-pin be fixed. The annular saw, he also disapproves of, on account of the extensive division of the integuments, which its use requires. He does not enter into any particular reasons against Illey's saws, which have been found so useful by other practitioners; and the rotation saw lately invented by Professor Thal, of Copenhagen, is mentioned, but its merits not examined. "In short, whatever some surgeons would execute with a saw in the operations under consideration, Mr. Liston would perform with his bone-forceps, or cutting pliers, and other means. The facts which he has reported, show clearly enough, that the forceps used by him, is a very efficient instrument; and it is no slight circumstance in its favour, that Baron Dupuytren strongly commends it, and has publicly used it. (*Liston, in Edin. Med. and Surg. Journ.* No. lxxviii.) I have also tried it in the North London Hospital with great advantage."

(See *J. L. Petit, Traité des Mal. des Os.* Paris, 1741. *A. Monro in Edin. Med. Essays*, vol. 6. *H. Coleman, De Necrosi Ossium*, Francof. 1793. *Callisen, Systema Chirurgiæ Medicinæ*, vol. 1. p. 493. *Jager, Traité des Maladies Chir.* t. iii. p. 353, et seq. Paris, 1811. *Diet. des Sciences Méd.* t. iv. p. 74, &c. *J. Wilson, on the Structure, Physiology, and Diseases of the Bones*, &c. p. 253, 8vo. Lond. 1820. *L. H. Nassmann, De Rite Cognoscendis et Curandis Nudatione*, Carls. et Necrosi Ossium. *N. B. Liston, Essay on Caries*, in *Edin. Med. and Surg. Journ.* No. 78. *B. Bell, on Diseases of the Bones*, chap. 2. 12mo. Edinb. 1828. *Herbert Mayo's Outlines of Human Pathology*, sect. vii. p. 36. 8vo. Lond. 1835.

CARTILAGES, ULCERATION OF. See JOINTS.

CASTRATION. The operation of removing a testicle. For an account of the cases rendering this measure necessary, see *TESTICLE, DISEASES OF*. The manner of operating is as follows:—The patient being laid on a table of convenient height, the first incision should begin, as nearly as possible, opposite to the abdominal ring, and be continued at least to the bottom of the scrotum.

The manner of beginning this incision is differently described by writers; some of them advising that the skin be held up by an assistant; others, that the knife be used perpendicularly in this as in other parts. The latter mode is generally preferred by English surgeons. The length of the division is a more important consideration. A small wound will indeed serve to lay bare the spermatic chord; but it will not permit the operator to do what is necessary afterwards with dexterity or facility; and as the scrotum must, either at first or at last, be divided nearly to the bottom, it had better be done at first.

Dupuytren recommends it to be carried also a little further, in the direction backwards. "In scirrhus cases (says he), not only is the testicle affected, but often a portion of the spermatic chord. It is therefore for the purpose of following up the diseased parts, that the incision is extended up to the abdominal ring. It is carried down the whole length of the organ, in order that this may be removed entire from the scrotum; for, if the opening were only two or three inches long, the testis could not be easily drawn out, and the dissection would be extremely painful. The intention of prolonging the incision backwards is not less obvious; if this were not attended to, the scrotum would retract, and form a sac, in which the pus would accumulate." (*See Dupuytren, Clin. Chir.* t. i. p. 91.)

The spermatic chord is next to be laid bare by another incision. If the external pudendal artery is divided, the bleeding from it may be checked by an assistant putting his finger on it. The spermatic chord having been detached from its surrounding connections, the operator, instead of putting a ligature round it, which is an excessively painful proceeding, should first transfix it with a tenaculum, so as to hinder its retraction within the abdominal ring; then divide it just below the tenaculum with the scalpel; and next tie the arteries of the chord as separately as possible from the rest of it. This plan, which has long been adopted by the best surgeons in London, was also preferred by Dupuytren. (See *Clin. Chir.* t. i. p. 94.) Then the testicle is to be dissected out from its connection with the scrotum: the loose texture of the connecting cellular substance, the previous separation of the testicle from the spermatic chord, and the help of an assistant to hold up the lips of the wound, will enable the surgeon to do this with great facility, particularly if he takes hold of the chord, and draws the testicle outward by means of it. As Dupuytren directs, all the cellular tissue around the testicle and chord, the tunica vaginalis, and even the cremaster, should be taken away. Before the chord is cut, it should be carefully examined, lest the incision be made so low, as to leave some of the disease behind. (See *Dupuytren, Clin. Chir.* t. i. p. 92.) In dissecting out a large testis, care must be taken not to wound the urethra, corpora cavernosa, nor the testis of the opposite side.

Mr. S. Sharp once castrated a man whose testicle weighed above three pounds; and some of the vessels were so varicose and dilated, as nearly to equal the size of the humeral artery. (*Operations of Surgery*, chap. x.)

Desault first divides the chord, and, holding its upper end between the index finger and thumb of his left hand, he then takes up the arteries with a pair of forceps, and they are immediately tied by an assistant. (*Ouvres Chir. par Bichat*, t. ii.) The spermatic artery will be found in the anterior part of the chord; and as soon as this vessel has been tied, the surgeon is to secure another, which accompanies the vas deferens, the latter not being carefully excluded from the ligature. (See *Sir A. Cooper's Lecture*, &c. vol. ii. p. 161.)

The spermatic artery, and any scrotal vessel which require to be taken up, should be tied with fine silk ligatures, as recommended by my friend Mr. Lawrence. (See *Med. Chir. Trans.* vol. vi. p. 197.)

Pott used to fill the cavity of the wound with lint, but Desault and all the modern surgeons of this country bring the edges of the wound together, and endeavour to heal as much of it as possible by the first intention.

The plan of dressing, adopted by Mr. Lawrence, consists in retaining the edges of the skin together with two or three sutures, and then applying a narrow strip of simple dressing. A folded cloth, kept constantly damp, is also laid over the wound. (*Med. Chir. Trans.* vol. vi. loc. cit.) Sir A. Cooper also employs two sutures: one, opposite the end of the chord; the other, at the mid-point between the first suture and the termination of the incision. (*Lectures*, &c. vol. ii. p. 161.)

The main reasons, stated by M. Roux, for not bringing the wound together, are that secondary hemorrhage cannot be well guarded against, except by filling the part with charpie; that the redundancy and looseness of the skin render it difficult to keep its edges in exact contact, without removing a portion of it, and using sutures, which are objectionable; and that suppuration cannot commonly be prevented, because there is a large quantity of loose cellular substance in the wound, which substance readily suppurates. (*Parallèle de la Chirurgie Angloise avec la Chirurgie Française*, &c. p. 119, &c.) By applying cold water and gentle compression to the part, I believe, however, such hemorrhage may generally be averted, and the union of the wound materially expedited. As a judicious writer observes:—"In the London hospitals, complete union by the first intention is seldom or never accomplished: yet, by attempting it, the wound is much diminished, and the cure of it rarely delayed later than three or four weeks; whereas the wound, when stuffed with lint, is usually not healed in less than seven or eight weeks." (See *Sketches of the Medical Schools of Paris*, by J. Cross, p. 144.)

After castration, the edges of the scrotum separate and become inverted, so that, if brought together, only the skin covering them is in apposition. Hence, as Dupuytren has explained, one reason for sutures, with which he imitated English surgeons in endeavouring to unite as much of the wound as he could. (See *Clin. Chir.* t. i. p. 94.)

Sometimes, one or more vessels begin to bleed soon after the patient is in bed, although they effused no blood just after the removal of the testicle. Keeping the dressings and scrotum continually wet with the cold saturnine lotion very often suffices for the prevention and suppression of such hemorrhage: if not, the wound must be opened again, and the vessels tied.

J. L. Petit made some useful remarks on this operation. The vessels of the scrotum, says he, are not the only ones, which may be the source of hemorrhage. Anatomists know, that the septum which divides this part into two cavities, is furnished with an artery, that is not considerable, but which becomes materially enlarged in the case of a sarcocele or other tumour. It is sometimes so considerable, that it causes a bleeding, which makes a surgeon, who has had no previous opportunity of seeing the occurrence, exceedingly uneasy. Such hemorrhage, says Petit, may be easily suppressed with a ligature; and he assures us, that he has seen a surgeon dress the patient three times, without ever suspecting that the bleeding, for which the applications were a third time removed, proceeded from this artery. (*Maladies Chir.* t. ii. p. 524, 525.)

The same experienced surgeon also acquaints us, that he has more than once extricated from trouble persons, who knew not how to stop the bleeding after the operation. He has seen some of them take off the dressings several times without discovering the wounded vessel. As they imagined, that the only hemorrhage which could follow castration must be from the spermatic artery, they contented themselves with examining the ligature on the chord, and increasing the compression, in order to stop the bleeding; but finding their attempts fail, they were compelled to

seek assistance. On being sent for, M. Petit found, that the blood did not issue from the chord, but from a small artery under the skin, at the inferior angle of the wound. He easily stopped the hemorrhage, and explained, not only that the chord had no share in the accident, but that it is generally suspected without foundation.

In general, after the removal of a diseased testis, there is more risk of bleeding from the vessels of the scrotum than those of the chord. I have never seen hemorrhage from the spermatic artery give trouble after the operation, but have often known surgeons obliged to take off the dressings on account of bleeding in the scrotum. I believe the most likely way of avoiding this disagreeable occurrence is to ignite Mr. Tyrell, "always to allow the patient to become warm in bed before the dressing is completed," for, until this period, it is not known what vessels in the scrotum will bleed. (See *Sir A. Cooper's Lectures*, &c. vol. ii. p. 161.)

When the diseased testicle is exceedingly large, or a part of the scrotum is diseased, the surgeon should take care to remove the redundant or morbid portion of the skin, by including the piece, which he designs to take away, within two long elliptical incisions, which are to meet at the upper and lower parts of the swelling. In this manner, as Mr. Samuel Sharp has observed, the hemorrhage will be much less, the operation greatly shortened, the sloughing of the distended skin prevented, and the recurrence of cancerous disease rendered less likely. (See *Treatise of the Operations*, chnp. x.)

Mr. Lawrence concurs with M. de la Faye in thinking it best always to remove a large piece of the scrotum with the testicle, by which means the surface of the wound is lessened. (See *Med. Chir. Trans.* vol. vi. p. 196.) Sir Astley Cooper approves of the practice when inflammation has rendered the testicle adherent to the scrotum, as being preferable to a tedious and painful dissection for the separation of the parts. (See *Lectures*, &c. vol. ii. p. 160.)

If the tumour be of a pyriform figure, perfectly smooth and equal in its surface, and free from pain, notwithstanding the degree of hardness may be great, and the surgeon may, in his own opinion, be clear, that the tumour is not produced by fluid, but is a true scirrhus, it is an excellent rule to make a small opening through the scrotum into the fore part of the tunica vaginalis, previously to the commencement of the operation, as recommended by Mr. Pott, so that if the case be one of serum or blood, its nature may be ascertained, and perhaps the testicle saved. "My reason for giving this advice (says Pott) is, that I was once so deceived by every apparent circumstance of a true, equal, indolent scirrhus, that I removed a testicle, which proved upon examination to be so little diseased, that, had I pierced it with a trocar previous to the operation, I could, and certainly should, have preserved it." J. Cloquet has seen castration performed in two instances of simple hydrocele, accompanied with great tension, but presenting no transparency nor manifest fluctuation. (*Pathologie Chir.* p. 45.)

The best way is to make a small opening with a lancet or knife; and not to introduce a trocar in the manner advised by Pott, because it would be highly censurable to injure the testicle, and put the

patient to unnecessary pain, even though that organ might be found diseased, and to require removal.

The agony of tying the chord is immensely increased by including the vas deferens; and, as no good results from so doing, the practice should be renounced in every part of the world, as it long has been in this metropolis.

Cases are recorded, in which the inclusion of the whole of the spermatic chord appears to have occasioned severe and perilous consequences, and these in so great a degree, that it was found necessary to cut and remove the ligature. Sometimes, says Petit, patients on whom castration has been performed, suffer more or less acute pain in the kidneys. The suffering often becomes insupportable and highly dangerous, the belly being swelled, tense, and painful; the patient being affected with syncope, and affections of the heart, sometimes with vomiting, and a retention of urine. Lastly, a universal inflammation of the belly, and a violent fever, accompanied with delirium, are occasionally the fatal consequences of this operation. Petit was required to visit a patient, who had been in this deplorable state for twenty-four hours, after having suffered castration, and this distinguished surgeon could impute the sudden and violent symptoms to nothing except the ligature on the spermatic chord; consequently, he advised the ligature to be removed. The patient received some slight relief from this step; and, after having been bled twice within a short space of time, he found himself a great deal better; but, as the dressings became wet with blood, apprehension of bleeding began to be entertained. Petit, therefore, had recourse to moderate compression of the chord. No hemorrhage ensued; the case afterwards went on well; and the patient recovered sooner than was expected. (*Traité des Maladies Chir.* t. ii. p. 527, 528.)

In the operation of removing a testicle, one caution seems particularly necessary, viz. if the chord should be at all enlarged, the surgeon ought carefully to examine, whether the augmentation of its size may not be owing to a portion of intestine, or omentum, that is contained within it. (*Sabatier, Médecine Opératoire*, t. i. p. 332. édit. 1.) In one case of extirpation of the testicle, "after the operation was completed, and the wound dressed, the patient being seized with a fit of coughing, to the astonishment and dismay of the surgeon, the dressings were forced off by a protrusion of several convolutions of small intestines: from this, it was proved that the patient had had a hernia; but, the diseased enlargement of the testicle had acted as a truss, and prevented the rupture from coming down." (See *Operative Surgery*, by Sir C. Bell, vol. i. p. 226., also p. 224.)

Another circumstance merits attention: when there are reasons which oblige us to divide the chord high up, and this part has not been tied before such division is made, it may be drawn up by the cremaster within the abdominal ring, and some difficulty may be experienced in securing the spermatic arteries. Sir C. Bell saw this happen twice, and the patients lost their lives from hemorrhage. Hence, when it is necessary to cut through the chord near the ring, it is best always to transfix it with a tenaculum first, as above

recommended. However, were the chord to happen in any instance to be drawn up within the ring, a surgeon would be guilty of most supine neglect to let the patient die of bleeding; for, as Sir C. Bell has remarked, we may follow the chord with perfect safety, even to the origin of the cremaster, which pulls it up, if attention be paid to the course of the chord, obliquely upward and outward, within the inguinal canal. Mr. Cline was present at the removal of a testicle, after which the chord could not be found; he therefore slit up the inguinal canal, and brought it into view again. In order to avoid this inconvenience, Sir Astley Cooper approves of the practice of passing a temporary ligature through the chord, as soon as it has been exposed. (See *Lectures, &c.* vol. ii. p. 61.) Either this expedient, or that of the tenaculum, is unquestionably prudent.

A few years ago, the operation for a bubonocoele was performed, and as the testicle was found diseased, the surgeon made a complete division of the spermatic chord, tied the spermatic arteries, and then left the testicle in its natural situation. After a time, the absorbents had diminished the part to a very small inconsiderable tumour. (*H. Reinhold, in Journ. der Pract. Heilkunde von C. W. Hufeland und K. Nimby, 1812, 24tes stueck, p. 112.*) This case merits attention, because it is the first instance, I believe, in which such practice was ever tried. Subsequently, the following work was published: — *Nouvelle Méthode de traiter le Sarcocoele, sans avoir recours à l'Écaupation du Testicule; par C. Th. Maunoir, 8vo. Genève, 1820.* The new plan consists in dividing and tying the spermatic arteries, and leaving the rest of the chord and the testis undisturbed. Instead of this plan, another has been proposed, which consists in merely removing an inch or two of the vas deferens from the chord. I do not find that these methods have yet been established.

When disease, not merely an cedematous swelling, extends far up the chord, Pott considered castration as too late. In such cases Lisfranc has seen Dubois pull down the chord and then divide it, and Baron Dupuytren cut up the inguinal canal to the internal ring; but all the patients died. (*C. Avelin, Operative Surgery, p. 103. Lond. 1823.*)

In one instance, I removed a testis for medullary disease, and observed in the part of the chord removed little white bodies, like millet seeds in size and This led me to apprehend a relapse, but the patient has continued well for some years. In the North London Hospital, I removed another testis, for the same kind of disease; but I fear that the patient will ultimately die of another medullary tumour in the abdomen.

See *Sharp's Operations of Surgery, chap. x. Pott on the Hydrocele, &c. Sabatier, De la Méd. Opér. tom. i. Bertrandi, Traité des Opér. de Chirurgie, chap. xi. Coeuras Chir. de Desault, par Bichat, tom. ii. p. 445. Larrey, Mém. de Chirurgie Militaire, tom. iii. p. 427. &c. John Pearson on Cancerous Complaints. J. L. Petit, Traité des Maladies Chir. tom. ii. p. 619, &c. Sir C. Bell's Operative Surgery, vol. i. Roux, Parallèle de la Chirurgie Angloise avec la Chirurgie Française. p. 119, &c. Laurence, in Med. Chir. Trans. vol. vi. p. 196, 197. Sketches of the Medical Schools of Paris, by J. Green (1794), p. 139, &c. Sir A. Cooper's Lectures on the Principles and Practice of Surgery, vol. ii. p. 159, 8vo. Lond. 1825. Baron Dupuytren, Leçons Orales de Clinique Chir. t. iv. p. 102, &c. 8vo. Paris, 1834. A. L. M. F. &c. Nouveaux Élém. de Méd. Opérat. t. iii. p. 537. 8vo. Paris, 1832. J. F. Malg. &c. Manuel de Méd. Opérat. p. 61.*

CATAPLASMA ACETI. Made by mixing a sufficient quantity of vinegar with either oatmeal, linseed meal, or bread crumb. When linseed is employed, it is best to add a little oatmeal or bread crumb, in order to keep the poultice from becoming hard. The vinegar poultice is generally applied cold, and is principally used in cases of bruises and sprains.

CATAPLASMA ACETOSÆ. *Sorrel Poultice.* R *Acetosæ* ℥j. To be beaten in a mortar into a pulp.

CATAPLASMA ALUMINIS. Made by stirring the whites of two eggs with a bit of alum, till they are coagulated. In cases of chronic and purulent ophthalmia it has been applied to the eye, between two bits of rag; and it has been praised as a good application to chilblains which are not broken.

CATAPLASMA BYNES. (*Malt.*) R *Farina Bynes, Spuma Cerivisæ, q. s.* This is applied to gangrenous and ill-conditioned extending sores. It operates as a gentle stimulus, and as a corrector of fetid effluvia.

CATAPLASMA CARBONIS. Made by mixing powdered charcoal with linseed meal and warm water, and applied to improve the condition of several kinds of unhealthy sores.

CATAPLASMA CERIVISÆ. Made by stirring some oatmeal, or linseed meal, in strong beer grounds. It is used in the same cases as the Cataplasma Fermenti, and Cataplasma Bynes.

CATAPLASMA CONTI. R *Herbæ circutæ esfoliatæ* ℥ij. *Aqua fontana* ℥ij. To be boiled till only a pint remains, when as much linseed meal as necessary is to be added.

Hemlock poultice is an application for cancerous, scrofulous, and other ill-conditioned ulcers, frequently producing a great diminution of the pain of such diseases, and improving their appearance. Justamond preferred the fresh herb bruised. A solution of the extract is sometimes added to a bread and water poultice.

CATAPLASMA DAUCI. Some bruise the carrots in a mortar into a pulp; while others first boil them. Carrot poultice is employed as an application to ulcerated cancers, scrofulous sores, and various inveterate ulcers.

CATAPLASMA DIGITALIS. Made by mixing linseed meal with a decoction of the leaves of the plant. It is adapted to the same cases as the Cicuta poultice.

CATAPLASMA FARINACEUM. The bread and milk poultice, made by putting some slices of bread-crumbs in milk, and letting them gently simmer over the fire in a saucepan, till they are properly softened. The mass is then to be mixed and stirred about with a spoon, and spread on linen.

CATAPLASMA FERMENTI. *Fermenting Poultice.* R *Farina Tritici, ℥j. Cerevisia Spuma, Yest dicta, ℥ss.* These are to be mixed together and exposed to a moderate heat till the effervescence begins. In cases of sloughing, and many ill-conditioned ulcers, this is an application of great repute.

CATAPLASMA LINI. *Linseed Poultice.* R *Farina Lini* ℥ss. *Aq. Fermentis* ℥iiss. The powder is to be gradually sprinkled into the hot water, while they are quickly blended together with a spoon.

This is one of the best and most convenient of all the emollient poultices for common cases, and

it has nearly superseded that of bread and milk, which was formerly much more frequently employed.

Mr. Hunter speaks in the following terms, of the linseed poultice, and its uses:—

"Poultices are commonly made *too thin*; by which means the least pressure, or their own gravity, removes them from the part: they should be thick enough to support a certain form when applied.

"They are generally made of *stale* bread and milk. This composition, in general, makes *too brittle* an application; it breaks easily into different portions from the least motion, and often leaves some part of the wound uncovered, which is frustrating the first intention.

"The poultice, which makes the best application, and continues most nearly the same between each dressing, is that formed of the meal of linsced; it is made at once, and when applied it keeps always in one mass.

"The kind of wound to which the above application is best adapted, is one made in a sound part, which we intend shall heal by granulation. The same application is equally proper when parts are deprived of life, and consequently will slough. It is therefore the very best dressing for a *gunshot* wound, and probably for most *lacerated wounds*; for *lint*, applied to a part that is to throw off a *slough*, will often be retained till that slough is separated, which will be for eight, ten, or more days."

CATAPLASMA MURIATIS SODE. R Pulvis Lini, Mica Punis, aa. partes aequales. Aq. Soda Muriatæ q. s. This is used for diminishing serofulous tumours and glands. When it excites too much irritation in the skin, a linseed poultice may be substituted for it until this state has subsided.

CATAPLASMA PLUMBI SUBACETATIS.

R Liquoris Plumbi Subacetatis drach. j.

Aque distillatæ lib. j.

Micæ punis q. s. — Misce.

Practitioners, who place much confidence in the virtues of lead, externally applied, often use this poultice either in a warm or cold state.

CATAPLASMA QUERCUS MARINI.

This is prepared by bruising a quantity of the marine plant commonly called *sea tang*. The poultice, thus made, has been occasionally applied to serofulous abscesses, glandular swellings, and diseased joints. I rarely hear of its being employed at the present day.

CATARACT. (From καταράσσει, to confound or disturb; because the disease confounds or destroys vision. Γλαύκωμα ἢ πύρρην, *Gutta opaca*. *Naffusio*. *Der Graue Staar*.) Is usually defined to be a weakness or impediment of sight, produced by opacity of the crystalline lens, or its capsule. Professor Beer applies the term to every perceptible obstacle to vision, situated in the posterior chamber, between the vitreous humour and the uvea. (*Lehre von den Augenkrankheiten*, b. ii. p. 279. 8vo. Wien, 1817.)

A cataract is also described as a partial or general opacity, of the crystalline lens, of its capsule, or of the fluid of Morgagni, with a corresponding diminution of sight. "The most striking circumstances observable in cataract (says Mr. Lawrence), are an opaque body placed behind, or even filling up the pupil, and the impaired state of vision which

is the result of that change. In both these respects it agrees, in its incipient stage, with glaucoma and some forms of amaurosis; but as the treatment is essentially different in these several affections, it is necessary to discriminate them accurately. In incipient cataract, we can do little or nothing; we must wait until the opacity has become complete, before we perform an operation; but active measures must be resorted to in the earliest stage of amaurosis: if we should leave the case to itself under the supposition of its being cataract, loss of sight would be inevitable and irremediable." (See *Lawrence on Dis. of the Eye*, p. 397.)

Hippocrates and the ancient Greeks described the cataract as a disease of the crystalline lens, under the name of γλαύκωμα; but no sooner had Galen promulgated the doctrine of the lens being the immediate organ of sight, than the correct opinion of the ancient founder of medicine began to decline, and, for many ages afterwards, had no influence in practice. In fact, the seat of the cataract was entirely forgotten till about 1656, when first Lasnier, and, afterwards Borel, Bonetus, Blegny, Geoffroi, &c., revived the truth, which had been so long extinct; and they and a few others believed that the disease was situated in the crystalline lens. The bulk of practitioners, however, remained ignorant of this fact even as late as the beginning of the eighteenth century, when the several publications of Maitre-Jan, Brisseau, St. Ives, and Heister, combined to render the truth universally known. In 1708, M. Mery, who had hitherto joined in the belief, that the cataract was not a disease of the lens, communicated to the Academy of Sciences, a memoir, in which he acknowledges the correctness of the statement made by Brisseau and Maitre-Jan, that vision can take place without the assistance of the crystalline lens; and he recommended a clergyman who had a cataract to have the lens extracted, which was successfully done by M. Petit.

A cataract, even in its highest degree, does not always produce complete blindness. For the most part, its formation takes place slowly; the cases in which it originates quickly being but few, and those, in which it is suddenly produced in a complete form, still more unusual.

When a cataract is slowly formed: 1. All objects, especially white ones, seem to the patient to be covered by a thin smutty or dusty cloud, which is generally perceived before any opacity is visible in the pupil. 2. The decline of vision bears an exact proportion to the increasing opacity distinguishable behind the pupil. 3. In most cases, the opacity is first discerned behind the pupil, most plainly also at the central point; the instances in which it first presents itself at the edge of the pupil being less frequent. 4. In eyes with a light-coloured iris, the greater progress a cataract makes, the more clearly can one perceive at the edge of the pupil a blackish ring, which partly arises from the shadow of the iris falling on the cataract, but chiefly from the dark-coloured pupillary edge of the iris, which, in a clear pupil, cannot be seen, but now that a greyish surface lies behind it, is rendered very manifest. (See *Beer's Lehre*, &c. vol. ii. p. 281.) This blackish ring is perfectly evident in cases of soft cataracts, and arises from the back of the pupillary edge of the iris being pushed forward by the size of the lens. But if the dilatation be increased to its full extent by the application of the extract of belladonna, an internal blacker circle

will be seen to surround the turbid part behind the iris, and the patient sees better for a short time. (*Guthrie's Operative Surgery of the Eye*, p. 197.) The account given of this black circle by Mr. Middlemore differs from that of the latter writer:—"When the cataract is of a light colour (says he) and is not in immediate contact with the iris, a black ring may be seen upon its surface, which will vary in breadth according to the distance at which the anterior capsule may be placed from the iris, and in intensity and distinctness, in proportion to the intensity of the colour of the cataract. This black ring is merely a shadow from the neural aspect of the iris (the uvea), thrown upon the light-coloured surface which is situated near to it, and is always less in the diameter of its inner circle than the pupil. It is, of course, much broader, and more distinctly seen in hard than in soft cataract, presuming the colour of both to be the same, and is not noticed at all, when, from the peculiar softness of the opaque lens, it is in close contact with the iris. It is scarcely to be observed when the cataract is of an unusually deep or dark brown colour." (See *Middlemore on Dis. of the Eye*, vol. ii. p. 77.) 5. As a cataract generally begins at the central point behind the pupil, such objects as are placed directly in front of the eye, are most difficultly seen, even in the early stage of the disease; but those which are laterally placed, especially when the light is not too strong, and of course the pupil a good deal dilated, can yet be seen tolerably well. 6. Hence, when the opacity, at the central point behind the pupil, is at all considerable, the patient is completely blind in a strong light, while, on the contrary, in a moderately dark room, a degree of vision is yet enjoyed. When the opacity is not far advanced, the eyesight may be improved for a short time, by the patient's turning his back to the light. Belladonna, by increasing the size of the pupil, is of service, and by means of it, "the patient may be conducted, with comparative comfort, through that stage of the disease which intervenes between a moderate defect of vision and the period of the operation. I know (continues Mr. Middlemore) that some surgeons object to its continued use; they say, that its prolonged employment induces a torpid state of the retina, the susceptibility of which becomes permanently diminished under its influence; but, although it has been used under my observation in these and other cases very extensively, and for a long period, I do not remember to have witnessed a single instance, tending in the slightest degree to confirm this opinion." (See *Middlemore on Dis. of the Eye*, vol. ii. p. 77.) 7. Persons with incipient cataracts derive palliative aid from the use of convex glasses, because objects are magnified by them; but they only answer while the opacity is inconsiderable. 8. To such patients the flame of a candle seems to be enveloped in a whitish misty halo, which always becomes broader, the further the patient is from the light. "A candle or street lamp seems expanded into a large globe of weaker light; it looks, to use the phrase of a countryman at the Glasgow Eye Infirmary, as if every lamp was as big as a corn-sieve." (See *Mackenzie on Dis. of the Eye*, p. 673.) When the cataract is far advanced, the flame of the candle cannot be seen, and the patient can only indicate the place near which the light is, or say whether it is close, or at a distance. 9. A cataract which forms slowly,

produces, in the course of its progress, no change in the mobility of the iris; and if this effect sometimes takes place when the disease is completely developed, the nature of the case is now so manifest, that no surgeon is in any danger of mistaking the complaint for amaurosis.

The characteristic appearances of amaurosis are entirely different. 1. The opacity, perceptible behind the pupil, is at a considerable distance from this opening, as may be best seen when the eye is viewed sideways. 2. The opacity is somewhat concave. 3. Its colour inclines rather to a greenish or reddish cast, than to grey, or a milk and water colour, which last, according to Dr. Mackenzie, incipient cataract always exhibits. (*Op. cit.* p. 674.) 4. The decline of the eyesight is not at all in a ratio to the degree of opacity, for the patient may be almost blind, though there may be only a slight greenish discolouration of the pupil, very inadequate to account for the injury of vision. 5. The pupil is more or less dilated; the iris sluggish or motionless, its pupillary edge not exactly circular, sometimes angular. 6. Even the cornea itself, is not quite so clear and transparent as in the natural state. 7. The temporary increase or diminution of blindness, so common in patients with incomplete amaurosis, never depends, as in those with cataracts, upon the degree of dilatation of the pupil, but upon causes, which tend either to depress, or excite the system, or upon the degree of light. In general, where vision begins to fail from diminished sensibility of the retina, the patient courts a strong light, and when he attempts to read by candle-light, he brings the book as close as he can to the candle. His period of most distinct vision is noonday, when objects are most brilliantly illuminated by the sun. This is the very time when the cataract patient sees worst. (See *Mackenzie on Dis. of the Eye*, p. 673.) 8. The halo, which amaurotic patients perceive around the flame of a candle is not like a whitish cloud, but has all the hues of the rainbow: indeed, the flame itself presents these colours, and when the patient goes to some distance from it, it generally seems split, or the rays are scattered like those of a star. 9. At no period of the complaint are spectacles of any service, in enabling the patient to see better. In general, objects situated to one side, cannot be seen more plainly, than those which are directly in front of the eye. (See *Beer's Lehre von den Augenkr.* b. ii. pp. 281—284.) To this statement, however, there are exceptions; for, in some instances, where the sensibility of the retina is beginning to diminish, or even where amaurosis is advanced, the patients see objects placed to one side, better than such as are directly before the eye. (See *Mackenzie on Dis. of the Eye*, p. 673.; *Hey, in Med. Obs. and Inq.* vol. v. p. 27. 8vo. Lond. 1776.) 10. The sight is not temporarily improved by the application of belladonna. (See *Guthrie's Operative Surgery of the Eye*, p. 212.)

For the difference between cataract and glaucoma, see GLAUCOMA.

In doubtful cases, the nature of the affection is sometimes elucidated by its history. Cataract forms without any uneasiness in the eye or head, or any disturbance of the health. Glaucoma and amaurosis are often preceded and accompanied by various uneasy sensations, and functional disorder. (See *Lawrence on Dis. of the Eye*, p. 339.)

A positive opinion on the existence of cataract should never be given, without dilating the pupil with belladonna, so as to bring the whole field of disease into view. "It is important also to observe the degree of celerity with which the pupil yields to the influence of belladonna. If the retina is sound, in half an hour the pupil is generally widely dilated; in an amaurotic eye, there is often very little dilatation, at the end of twenty-four hours." (See *Markensie on Dis. of the Eye*, p. 677.) The extract of belladonna, dissolved in water to the consistence of cream, may be rubbed on the forehead and eyebrow; or a little more diluted, may be dropped into the eye. Under its influence (says another writer), the pupil becomes fully dilated, "in the course of an hour or two; or if otherwise, the application may be repeated once or twice in the day, for further examination on the subsequent morning. The pupil will now be either fully dilated, or the points of its adherence will be clearly demonstrated, by their remaining fixed, whilst the rest of the pupil yields, the salient points being thereby exposed; or the pupil will remain permanently fixed, showing the attachment of the whole internal surface to the capsule of the lens; or it will remain immovable, whilst the distance between it and the opacity can be distinctly perceived to be as great, or even greater, than natural; the iris inclining backwards, under which circumstances it will in general be tremulous. These parts, as well as the surface of the lens, should now be examined with a magnifying glass." (See *Guthrie on Extraction of the Cataract*, p. 3.) In speaking of the advantages of dilating the pupil with belladonna, stramonium, or hyosciamus, another modern writer remarks:—"This will enable us to detect the characters of the opaque lens, as regards its colour, its consistence, and the seat and extent of the opacity much better than where we have not this advantage; and it will also assist us in ascertaining the true state of the retina; and, as regards the iris, whether or not it has acquired any morbid adhesions, and, if any, their nature, their seat, and extent, and also (what is of great moment) how far the pupil retains the capacity of being dilated by artificial means. (See *Middlemore on Dis. of the Eye*, vol. ii. p. 73.)

The obstacle to vision, situated in the posterior chamber, between the vitreous humour and the uvea, and making what is termed a cataract, may be either within the limit of the capsule of the lens, or between the anterior layer of that capsule and the uvea. The first case is the *genuine*; the second, the *spurious*, cataract.

A genuine cataract, when a primary disease, and unattended from the first with other morbid effects in the eye, is mostly a single independent affection; on the contrary, as the spurious cataract is generally the consequence of internal ophthalmia, it is generally combined with a partial opacity of the anterior layer of the capsule, and, of course, with a genuine cataract.

The first variety of genuine cataract noticed by Beer, is the *lenticular*; it always begins in the centre or nucleus of the lens, mostly presenting a dull yellowish grey colour, which is somewhat deeper at the centre, than at the margin of the pupil; a character retained even when the disease is in its most complete stage. If the lenticular cataract is hard or firm, "the opacity has a greyish appearance, with more or less of the yellowish brown, or

amber tint towards the centre. In the firm and darker-coloured portion, it resembles wax slightly softened by heat; the circumference is lighter-coloured and softer, being about the consistence of soft jelly. The more we see of the amber colour, and the deeper the tint, the harder is the cataract; the greyer its appearance, the softer is the consistence." The central portion is firmer than the rest. In a few instances, the lens has been of a dark brown, or mahogany colour, and hard throughout. An ordinary firm cataract presents the consistence of wax. The firm cataract, with the amber tint in the middle, gradually shaded off into grey, is the ordinary form of the complaint in advancing age. (*Lawrence, Op. cit.* p. 399.) It always forms slowly; and except when the iris is too dark-coloured, it is more or less attended with a blackish ring at the edge of the pupil, which ring becomes plainer as the disease advances. It never causes any alteration in the expansion or contraction of the iris; nor does it even in its highest degree deprive the patient of all power of vision, who in shady places, or when the pupil is artificially dilated with hyosciamus or belladonna, is often capable of distinguishing pretty well many objects, which are placed laterally with respect to the eye. A lenticular cataract is usually at some distance from the uvea, so that the extent of the posterior chamber is manifest, while the opacity presents more or less of a convex appearance, and never that of very white cloudy specks. Frequently the lenticular cataract is unattended with any change in the capsule, or the liquor of Morgagni. In most cases of senile cataract, not preceded by inflammation, the capsule is said to remain transparent. (*Travers's Synopsis of the Diseases of the Eye*, p. 207. 8vo. Lond. 1820.)

The second species of genuine cataract, noticed by Beer, is the *capsular*. The disease seldom commences in the centre of the pupil, and usually arises at its margin in the form of distinct, white, shining points, streaks, or specks; its colour, therefore, is always very light, and never altogether uniform, even when the disease is completely formed. The dotted or mottled appearance of this cataract, is also particularly noticed by Mr. Travers. (*Synopsis of the Diseases of the Eye*, p. 207.) The blackish ring, which, when the iris is light-coloured, is even more evident in this than the lenticular cataract, is here not owing to the shadow of the iris, but to its dark border; for this cataract is too near the iris for any shadow to be formed. This observation, however, is somewhat at variance with what Mr. Travers has remarked; for when a transparent circumference can be seen on dilating the pupil with belladonna, he has never found the capsule opaque; and he believes, that the black rim may be considered as the diagnostic mark of the transparency of the capsule. But, when the opacity of the lens is diffused, this sign is of course absent. (*Med. Chir. Trans.* vol. iv. p. 288.) The disease has some effect on the motions of the iris, at least their quickness. A capsular cataract never remains long the only affection, but is followed by disease of the lens itself; a fact, says Beer, which cannot surprise us, when we consider, that it is through the medium of the capsule, that the particles of the lens are incessantly undergoing the changes of removal and reproduction.

The *capsular cataract* is subdivided by Beer

into the *anterior*; the *posterior*; and the *capsular cataract*, in which both the front and back portions of the capsule are opaque.

The *anterior capsular cataract*, which is not at all unfrequent, does not continue long in this form after it has attained a high degree; but, according to Beer, becomes combined with an opacity, and, according to Mr. Travers, with a slow absorption of the lens itself. (*Synopsis*, &c. p. 207.) "When the capsule is completely opaque (says Mr. Travers), we can hardly judge of the texture of the lens." But, in such examples, "the lens is commonly diminished in bulk; it undergoes a waste after the opacity of the capsule, so as in process of time to become a membranous cataract. Thus I conceive to be owing to the obliteration of the vessels of the capsule, from which those of the lens are derived. When the capsular opacity is congenital, it is either purely capsular, or only a very small piece of lens remains. When the capsule turns opaque from injury, the lens is soon greatly reduced in bulk, as appears from the falling in or concavity of the iris, which loses its support, and is demonstrated in the operation. This observation renders the operation with the needle appropriate to the cataract, in which the capsule is opaque, in cases which are not very recent." (*Med. Chir. Trans.* vol. iv. p. 286.) In the *anterior capsular cataract*, according to Mr. Guthrie, the lens does not generally undergo any diminution, but, for the most part, an enlargement, in consequence of becoming opaque and soft. But he admits, that the reverse is frequently the case in infants, only a small portion of the lens being left, and the rest of the contents of the capsule fluid. (See *Operative Surgery of the Eye*, p. 233.) The *anterior capsular cataract* may be known by its light grey, and in some places, completely chalk-white colour, intersected by shining mother-of-pearl like streaks and spots. As the capsule is at the same time thicker than natural, the posterior chamber is lessened, and the cataract is not unfrequently close to the uvea, especially when the lens has also completely lost its transparency. In this stage, the movements of the iris are likewise rendered less quick, and the shadow at the margin of the pupil is entirely absent. Hence, vision is not only hurt, but quite impeded, in regard to any correct sensation of light, whether the patient be in a light, or shady situation; and frequently a faint light is completely invisible to him.

The *posterior capsular cataract* belongs to the rarer forms of the disease of the eye; but, says Beer, when it happens, the lens always participates in the opacity much more quickly, than occurs in the *anterior capsular cataract*. Hence, the disease can never be observed up to its perfect development. Respecting the state of the lens, some difference prevails between the statement of Beer and that of Mr. Travers: the latter gentleman informs us, that where the opacity of the posterior capsule is met with, which he agrees with Beer in considering as very rare, the lens and anterior capsule are usually transparent; "and when this is not the case, and the cataract escapes with a posterior fold of opaque capsule, it is always accompanied with a considerable discharge of vitreous humour." (*Synopsis of the Diseases of the Eye*, p. 209.) And, in speaking of the opacity of the posterior capsule, in another work, he informs us, that he has not observed, that, in this case, the lens undergoes any diminu-

tion. (*Med. Chir. Trans.* vol. iv. p. 286.) Like the *anterior capsular cataract*, it is denoted by a whitish-grey, unequal, variegated colour; but no light coloured, chalk-white spots and streaks are ever discernible, which, while the lens retains its transparency, may be owing to the distance of the cataract from the pupil. However, the opacity situated behind the pupil, always seems concave, when the eye is inspected, not from before, but from every side of it. While the posterior half of the capsule is not completely opaque, the lens is not materially affected; the eyesight is only more or less weakened; and sometimes, especially with the aid of a magnifying glass, a tolerable degree of vision is enjoyed, notwithstanding the considerable opacity behind the pupil. This species of cataract has not itself any influence over the motions of the iris, and after the lens becomes opaque it is not softened.

Though the *perfect capsular cataract* is not the rarest species of genuine cataract, it cannot be said to be very common. In addition to the symptoms of the *anterior capsular cataract*, the iris is nearly motionless, the cataract lying close to that organ; the posterior chamber for the same reason is effaced; and an inexperienced surgeon might suppose the anterior portion of the capsule were adherent to the uvea, unless he convinced himself of the contrary by producing an artificial dilatation of the pupil, with hyosciamus or belladonna. Sometimes the iris even seems thrust out by this large cataract, towards the cornea, in a convex form; and the patient can only perceive the strongest kinds of light. Though such is the statement of Beer, I concur with Mr. Guthrie in regarding the above characters, which may attend any large soft cataract as well as the complete capsular one, as by no means a demonstration of the existence of the latter. (*Operative Surgery of the Eye*, p. 235.)

The existence of *perfect capsular cataract* cannot be easily ascertained; for, if the anterior portion of the membrane be opaque, it will prevent us from knowing whether the posterior be so or not. (See *Lawrence on Diseases of the Eye*, p. 494.)

When any portion of the capsule is left behind after operations with the needle, and becomes opaque, the case is termed a *secondary membranous, or capsular cataract*.

The third species of genuine cataract is the *cataracta Morgagniana*, which some term the milk cataract, and others confound with the purulent cataract. It is one of the rarest forms of the disease; so rare, indeed, that it is often regarded as purely hypothetical. (*Synopsis of Diseases of the Eye*, p. 208; also, *Lawrence, Op. cit.* p. 402.) The following is the form of a disease described by Beer, under this name; it proceeds from a total conversion of the lens into a milky fluid, or thin jelly, frequently attended with a complete capsular cataract. Its origin is said to be always quick, and an immediate effect of chemical injuries of the eye. The following are the symptoms of the case, while it is uncomplicated with disease of the lens and capsule; a state which can never continue long. Though the colour is milk-white, it is delicate and thin, like that of diluted milk. The whole pupil seems cloudy; but whenever the eyeball moves suddenly and violently, or the eyelid is rubbed over the eye, the opaque substances

change their shape and position. The posterior chamber is nearly annihilated, which may be owing to the quantity of fluid, or gelatinous substance collected. While the lens and capsule are not materially changed, the sight suffers only a diminution, though it is very cloudy, and small objects cannot be distinguished at all. When, however, the lens and capsule become opaque, vision is quite abolished, a certain power of knowing light from darkness only remaining. Not unfrequently, says Beer, when the lens itself is in a dissolved state, the capsule is partially opaque, the eye is kept quiet for a few minutes, and the patient stands or sits in an upright posture, two rows of opaque matter can be plainly seen; the upper being the least white of the two; the lower presenting a chalky whiteness. However, as soon as the patient suddenly or violently moves his eye or head, or the eyelid is rubbed over the eye, both these rows of opaque matter disappear, and the colour of the opacity behind the pupil again seems uniform.

The fourth species of genuine cataract, described by Beer, is the *capsulo-lenticular cataract*, to which, as it is of large size, he conceives the liquor of Morgagni in an altered state may likewise often contribute. It is by no means uncommon, and attended with the following characteristic symptoms:—The colour of the opacity, close to the uvea, is partly chalk-white, partly like that of mother-of-pearl, and, in many places, both these colours can be evidently seen disposed one over the other, that of mother-of-pearl, however, being always most superficial. Exposure of the eye to the most vivid light scarcely causes any motion of the iris, but the pupil is circular, without any angles in it. After the application of the extract of henbane or belladonna, the iris contracts again exceedingly slowly, and the pupil is long in returning to its former diameter. Besides the obliteration of the posterior chamber, the anterior one itself is mostly diminished, in consequence of the iris being pushed towards the cornea by the very large size of the cataract, and hence the sensation of light is indistinct.

The capsulo-lenticular cataract is not unfrequently the consequence of a slow inflammatory process in the iris, the lens and its capsule; and hence, several varieties of this case, and its not unfrequent combination with a spurious cataract; all which different modifications, says Beer, should be correctly understood previously to an operation, in order to form a just prognosis of its event, and to know what method of operating ought to be adopted.

Of these varieties, the first is the *capsulo-lenticular cataract*, conjoined with slight depositions of new matter upon the anterior capsule of the lens. These after-formations upon the front layers of the capsule, as Beer calls them, put on very different appearances, and accordingly receive various appellations. For instance, the *marbled capsulo-lenticular cataract*, when the chalk-white new-formed substances upon the anterior layer of the capsule are so arranged as to resemble the variegated appearance of marble. The *window or lattice capsulo-lenticular cataract*, when the new-deposited substances cross each other, leaving darker-coloured interspaces. The *stellated capsulo-lenticular cataract*, when the new matter runs in concentric streaks towards

the middle of the pupil. The *central capsulo-lenticular cataract*, when a single, elevated, white, shining point is formed on the anterior capsule, while the rest of this membrane is tolerably clear, and the lens not completely opaque. The *dotted capsulo-lenticular cataract*, when the front layer of the capsule presents several distinct unconnected depositions on its surface. The *half-ataract*, or *cataracta capsulo-lenticularis dimidiata*, when one half of the front layer of the capsule is covered with a white deposit. In all these, and some other examples, says Beer, the lens is found to be converted to its very nucleus into a gelatinous, or milky substance.

The second variety of the capsulo-lenticular cataract, pointed out by Beer, is the *encysted*, indicated by its snow-white colour; sometimes lying so close to the uvea, as to push the iris forward towards the cornea; and, at other times, appearing to be at a distance from the uvea. These circumstances, as Beer remarks, almost always depend upon the position of the head; for when this is inclined forwards, the cataract readily assumes a globular form, and projects considerably towards the anterior chamber. Frequently, this variety of the capsulo-lenticular cataract constitutes the kind of case, to which the epithets, *tremulous* or *shaking*, and *swimming* or *floating*, are applied. According to Beer, the reason of such unsteadiness in the cataract is owing to the broken, or very slight connection of the capsule of the lens with the neighbouring textures. The same author had never seen any case of this kind, which had not been preceded by a violent concussion of the eye, or adjacent part of the head. Both layers of the capsule are opaque, and sometimes considerably thickened. The third variety of the capsulo-lenticular cataract, described by Beer, is the *pyramidal*, or *conical*, which is one of the rarer forms of the disease, and always brought on by violent internal inflammation of the eye, especially affecting the lens, its capsule, and the iris. It may be known by a white, almost shining, conical, more or less projecting new-formed substance, which grows from the centre of the anterior layer of the capsule, and is almost in close contact with the pupillary margin of the iris. Hence, the iris is always quite motionless, and the pupil angular. Sometimes this growth from the capsule extends itself so far into the anterior chamber, as nearly to touch the inner surface of the cornea, and sometimes actually to adhere firmly to it; a circumstance, says Beer, which is very constant in the conical staphyloma of the cornea, though not discoverable till the operation is performed. The power of discerning light is feeble and indistinct, and sometimes entirely abolished. Mr Guthrie regards this case as an advanced degree of the disease described by Beer, under the name of *lymph-ataract*: it ought, indeed, to be classed as a *spurious cataract*. (See *Guthrie's Operative Surgery of the Eye*, p. 246.)

The fourth variety of the capsulo-lenticular cataract is the *siliqueuse*. Though principally met with in young children, it is not one of the most uncommon affections in adults, and, in the former, it is often falsely regarded as a congenital complaint. When this cataract is extracted either from children, or grown-up persons, Beer says, that the dried shrivelled capsule is always found round the equally dry nucleus of the lens,

like a husk, or shell. In children, however, he says, that the nucleus of the lens is often scarcely perceptible, while, in adults, it is always of considerable size; and this may be the reason, why this cataract in children does not present so bright a yellow-white colour, as it does in grown-up persons. In infants, in which it is frequently seen in the first weeks of their existence, it is manifestly produced by a slow and neglected inflammation of the lens and its capsule, arising from too strong light. In adults, the inflammation, exciting this form of cataract, is always owing to external violence; yet Beer supposes, that a considerable diminution of cohesion between the capsule and the adjacent textures must likewise have a principal share in bringing on the disease, which, in grown-up persons, is constantly preceded by a concussion of the eyeball, from the cut of a whip, the lash of a horse's tail, &c. Professor Schmidt had never seen this kind of cataract, except in boys and girls, who in their early childhood had been afflicted with convulsions; and hence, he thought, that the cause of the disease was owing to a partial loosening of the capsule from its natural connections by the violence of the convulsive paroxysms. (*Abhandlung über Nachstar und Iritis nach Staar-Operationen*. Wien, 1801, 4to.) However, Beer assures us, that he has seen infants, scarcely two months old, affected with this cataract, which had not been preceded or followed by any convulsions; while a much larger number of children with the same kind of cataract had fallen under his notice, where more or less severe blows on the head had been received. With respect to the convulsions, spoken of by Schmidt, he also questions, whether they and the cataract might not be owing to the same cause, viz. the preceding inflammation within the eye. In children, says Beer, this form of cataract may be known by its light-grey, whitish, though seldom very white, colour; its diminutive size, and considerable distance from the uvea; and by the freedom with which the iris moves when no adhesions exist at any points between this organ and the cataract, as occasionally happens; a proof of the previous inflammation of the capsule, lens, and neighbouring textures. The eyesight is never quite impeded, but only much diminished. On the contrary, in adults, this cataract invariably presents a dazzling white hue, and only a few points of it are of a smutty yellowish-white colour, whence the case has been sometimes termed the *gypsum-cataract*. It is not convex, but rather flat; it does not approach the iris; and when free from adhesions to the uvea, which are more likely to happen in adults, it has no effect on the motion of the iris. Vision is generally entirely lost, with the exception of the power of discerning the light, and even this faculty is sometimes destroyed, in consequence of the previous violence done to the eye, whereby not merely the lens and its capsule, but also the retina, have suffered.

According to Beer, one of the rarest varieties of the *capsulo-lenticular cataract* is that accompanied with a cyst of purulent matter. It is indicated by a deep lemon colour, very slow motion of the iris, manifest abolition of the posterior chamber, slight convexity of the iris, trivial perception of light, and the weak unhealthy

constitution of the patient. This purulent cyst, which sometimes contains a very fetid matter, and was therefore called by Schieferli the *putrid cataract*, (*Theoretisch-Praktische Abhandlung über den Grauen Staar*, 8vo. Jena, and Leipz. 1797.), may sometimes be taken out, without being broken, together with the whole capsule of the lens, with the aid of the forceps, or cataract tenaculum, as was first correctly remarked by Professor Schmidt. In one single example, Beer found the cyst of matter between the lens and the anterior portion of its capsule. Mr. Travers has likewise seen an example of supuration within the capsule, which projected through the pupil in a globular form, and was filled with pus. The case happened in a lad, and had been preceded by a severe blow on the eye. (*Synopsis of the Diseases of the Eye*, p. 206.)

The sixth, and a rare variety of the *capsulo-lenticular cataract*, mentioned by Beer, is that described by the French under the name of *cataracte barée*, the *bar-cataract*, and by Schmidt under the appellation of the *cataract with a girth or zone*. The case, says Beer, is one of the least frequent. The diagnosis is easy; for behind the diminished, more or less angular pupil, the cataract can be plainly seen, to which is attached, either in a more or less perpendicular, or horizontal direction, a chalk-white, generally very shining, and thickish kind of bar, or girth, which is closely adherent at both its extremities to the pupillary margin of the uvea, and sometime reaches, but often only on one side, more or less towards the ciliary processes. The iris is therefore completely motionless, the uvea not being merely adherent to the substance forming what is termed the *bar* or *girth*, but, also, closely connected with the whole front portion of the capsule. The perception of light is either very indistinct, or quite lost, and, not unfrequently, the globe of the eye is somewhat smaller than natural. Beer says, that he has never met with this variety of cataract, except after violent internal inflammation of the eye. He describes the substance, composing the *bar* or *girth*, as being of various consistence, and sometimes firm and almost cartilaginous. In two cataracts of this sort, which he extracted from a boy twelve years of age, he found the *bar*, strictly speaking, ossified, and the capsule, which was nearly cartilaginous, was adherent to a very small firm nucleus of the lens, though they were yet capable of separation. In a dead subject, Beer also examined such a cataract, in which the outer end of the *bar* scarcely extended to the greater ring of the uvea, but the inner end reached over the ciliary processes to the ciliary ligament, from which latter part it was inseparable. (*Lehrs von den Augentr.* b. ii. p. 302.)

OF SPURIOUS CATARACTS.

The most frequent, according to Beer, is what he names the *lymph-cataract*. It is, without exception, the effect of an inflammation, which is chiefly situated in the iris, the lens, and its capsule. Hence, it is frequently combined with a genuine cataract. The nature of the disease may be known from the patient's account, that the present blindness has been preceded by a painful tedious affection of his eye and head; and from an examin-

ation of the eye itself, in which the pupil will be found more or less diminished and angular; the iris either perfectly motionless, or nearly so; the eyesight, and even sometimes the perception of light more, or less impeded, or lost, and this not merely in proportion to the quantity of lymph observable immediately behind the pupil, but also in proportion to other morbid effects produced in the organ of inflammation. Lastly, the surgeon may notice, directly behind the pupil, a plastic lymph, either in the form of a delicate kind of network, or of a thick web of a snow-white colour. Sometimes, in this variety of spurious cataract, though very little coagulating lymph appears upon the anterior portion of the capsule of the lens, and what is effused, as well as the lens itself, is almost clear and transparent, yet the eyesight is considerably impaired, and, on more careful examination of the pupil, something of a dark-brown colour is perceived, which often projects, at several points behind the pupillary edge of the iris, a good way towards the centre of the pupil. In this substance one may discern, with a good magnifying glass, new vessels extending from those of the uvea, and formed by the previous inflammation; by means of which vessels, this mass, and the delicate layer of lymph, are connected with the capsule of the lens. According to Beer's sentiments, it is only the real lymph-cataract which rightly deserves the epithet *membranous*, which is sometimes wrongly applied to the *capsular cataract*; for, says he, *the lymph-cataract alone consists of an adventitious membrane formed by inflammation, of a web of plastic lymph, which may be very thin and semi-transparent, while the lens and its capsule are nearly quite clear, though the patient may be almost or completely blind, when the effects of the inflammation have extended to the choroids and retina.*

The spurious purulent cataract is much less frequent than the lymph-cataract. In neglected cases of hypopium (*see this word*), where the pupil is already quite covered with pus, the greater part of the effused matter is sometimes absorbed, and the pupil can be seen again; but, immediately behind it, a quantity of coagulating lymph can be discerned, as in the lymph-cataract, sometimes even projecting partly into the anterior chamber, but blended with particles of purulent matter, so as to give it a light-yellowish tinge, and a clustered appearance. The pupil is always diminished, adherent to the morbid substance, and angular; the motionless iris projects towards the cornea; and not only the eyesight, but even the perception of light, are completely lost, or the latter at least much diminished.

A rare variety of spurious cataract described by Beer, is the *blood-cataract*. Either from some considerable injury of the eye, a large quantity of blood is extravasated in the chambers, and slowly absorbed during the ophthalmia caused by the violence, a part of it, however, remaining in the posterior chamber in the form of small clots, encysted in the lymph which was effused during the inflammation; or else, in the course of a more tedious and neglected case of hypopium, blood is effused in the chambers of the eye, and, not mixing with the pus, still continues in the same form behind the pupil, after the matter has been absorbed. In the first example, this cataract looks like a reddish web, interwoven with silvery streaks or threads; the pupil, though angular, is seldom contracted;

the iris nearly or quite motionless; and not only is the light clearly distinguished, but a partial degree of vision sometimes retained. On the contrary, in the second instance, the opacity behind the pupil is very dense, white, studded with reddish or brownish points, or specks, having a clustered appearance, and frequently projecting through the pupil into the anterior chamber; while the pupil itself is very small, and angular, the iris quite incapable of motion, and generally either no perception of light remains, or only a very confined, indeterminate sensation of it. Beer says, that this cataract may easily be mistaken for lymph, and that its difference can only be made out with a good magnifying glass.

The dendritic cataract of Schmidt, the *arborescent cataract* of Richter, or the *choroid cataract*, as Beer observes, is not one of the least frequent of the spurious cataracts, and is invariably the consequence of a violent concussion of the globe of the eye, with, or without a wound, whereby a portion of the tapetum of the uvea is loosened; and becomes placed upon the anterior layer of the capsule, more or less resembling in its appearance the arborescent form of the stone termed a dendritis. Immediately after such a concussion of the eyeball, the patient complains of a serious diminution and confusion of vision. Whoever examines the eye only superficially, will certainly not discern the pieces of the tapetum lying upon the yet perfectly transparent capsule of the lens; for the most careful inspection will be necessary for the purpose, and sometimes the aid of a magnifying glass will be requisite. But, as the lens and its capsule are mostly at the same time loosened from their connexions, they likewise generally become deprived of their transparency, and, as soon as this has happened, the displaced portion of the tapetum can be readily seen. When inflammation ensues, the flakes of the tapetum become closely adherent to the front layer of the capsule of the lens, and even the pupillary edge of the uvea acquires the same kind of connection, so that the perception of light is diminished. But, says Beer, when inflammation follows, the pupillary margin of the uvea remains free, the iris is perfectly moveable, the light clearly distinguishable, though the lens and its capsule be entirely opaque, and sometimes the flakes of the tapetum, resembling the arborescent *streaks* of the dendritis, alter in shape, size, and position, but never completely disappear, though they may not closely adhere to the capsule. (*Lehre von den Augenkr.* b. ii. p. 303. 309.)

Another classification of cataracts, which is of great importance to an operator, is founded upon their consistence; for this makes not only a great difference in the prognosis, but also in the choice of a method of operating.

When the opaque lens is either more indurated than in the natural state, or retains a tolerable degree of firmness, the case is termed a *firm* or *hard cataract*. When the substance of the lens seems to be converted into a whitish or other kind of fluid lodged in the capsule, the case is denominated a *milky* or *fluid cataract*. When the opaque lens is of a middling consistence, neither hard, nor fluid, but about as consistent as a thick jelly or curds, the case is named a *soft* or *caseous cataract*. When the anterior, or posterior, layer of the crystalline capsule becomes opaque, after the lens itself has been removed from this little membran-

often very faint, and sometimes entirely lost, for the preternatural adhesion is always the consequence of previous internal ophthalmia, which, besides occasioning opacity of the lens and its capsule, readily produces other serious effects upon the retina, the choroid coat, and vitreous humour, perfectly adequate to account for the loss of sight, and the incapacity of distinguishing the rays of light. When the anterior layer of the capsule is adherent only at a single point to the uvea, the extent of the adhesion may be readily ascertained by artificially dilating the pupil with hyosciamus or belladonna: and the information, thus obtained, will have great weight in the selection of a method of operating. (*Beer, loco cit.*)

Some other local complications of cataract are so obvious, that they cannot fail to be understood; as, for instance, its combination with an adhesion of the iris to the cornea (*synchia anterior*), with closure of the pupil, unattended by any adhesion of the uvea to the anterior capsule of the lens (*synchia posterior*); as in watchmakers, and hysterical or hypochondriacal subjects, the complications with atrophy, hydrophthalmia, cirsophthalmia specks and scars upon the cornea, pterygium, and various forms of ophthalmia.

According to Beer, the combination of cataract with glaucoma is also readily made out by any body who has once seen the case; for the cataract always presents a greenish and sometimes quite a sea-green colour; it is of prodigious size, so as to project through the pupil towards the cornea; the colour of the iris is more or less changed, nearly in the same manner as after iritis; the iris is perfectly motionless; the pupil very much expanded and drawn into angles, for the most part towards the canthi; the lesser circle of the iris is no where visible, because it lies concealed under the far-projecting soft cataract; the light cannot be perceived, though the blinded patient is frequently conscious of false luminous appearances within the eye (*photopsia*), and, lastly, the case is invariably accompanied with more or less of a varicose state of the blood-vessels of the eye. The origin of this sort of cataract is constantly attended with severe obstinate headach.

There are, says Beer, two other local complications, which are much more difficult to learn before an operation. The first is a cataract combined with a dissolution of the vitreous humour (*synchysis*), the diagnosis of which, indeed, when the affection prevails in a considerable degree, is tolerably easy, as the cataract trembles, and the iris always swings backwards and forwards upon the slightest motion of the eyeball; the globe itself is somewhat affected with atrophy; the eye is quite spoiled, and feels flaccid and unresisting; the sclerótica, immediately around the cornea, is bluish as in infants; and the perception of light is uncertain. On the other hand, when the synchysis is not far advanced, the only symptoms are a suspicious softness of the eyeball, and a swinging of the iris, when the eye is suddenly or violently moved.

The other complication of cataract, sometimes very difficult to detect previously to an operation, is amaurosis. When, indeed, the pupil is extraordinarily large, the iris nearly or quite motionless, and the patient cannot distinguish day from night, and, of course, not the least glimmer of light, no great powers of divination are required to predict with certainty, that no operation will restore the

eyesight, which is abolished not by the cataract, but by the existing amaurosis. On the other hand, when the motions of the iris are nearly as free as in the natural state, the pupil as small as it usually is in a given degree of light, the patient capable of judging accurately of the strength of the light, and yet the cataract conjoined with amaurosis, which, with the exception of the faculty of perceiving the light, completely impedes vision, it is then only by a careful inquiry into the history of the disease, that certain circumstances, attending the origin of the cataract, and indicating in some measure the prevalence of amaurosis, can be traced. Sometimes, in consequence of one eye being affected with amaurosis, and not with cataract, a reasonable suspicion may be entertained, that the eye with cataract is also amaurotic; yet, says Beer, in such a case, nothing certain can be known before an operation is done.

He considers the general complications of cataract to be as numerous as the diseases of the constitution itself, or as the affections of other organs, besides the eye; but, the most common are scrofula, gout, syphilis, psora, old ulcers of the leg, and an unhealthy constitution.

CAUSES, PROGNOSIS, &c.

Old age may be regarded as one of the predisposing causes of cataract, inasmuch as the disease is most frequent in advanced life. Of 500 cataract patients, treated by Dr. Fabini, 268 were males, and 232 females. The ages of these individuals were as follows:—

From	1 to 10	years	14
	11 to 20		16
	21 to 30		18
	31 to 40		18
	41 to 50		51
	51 to 60		102
	61 to 70		172
	71 and upwards		109
			<hr/> 500

(See Mackenzie on Dis. of the Eye, p. 679.; and Gräfe and Walther's Journ. vol. xiv. p. 445. Berlin, 1830.) This table may afford a tolerably correct view of the comparative frequency of cataract at different ages.

It was the doctrine of Wenzel, that persons, much exposed to strong fires, and above the age of 40, were more liable to cataracts than other individuals.

Beer assents to the general correctness of the opinion, that old age is conducive to cataracts, since the disease is most frequently observed in old persons. Yet, says he, that age, nay, a very great age, cannot be deemed a regular cause of cataract, is clear from the circumstance of many very old, and even decrepit, individuals being able, with the aid of spectacles, to read the smallest print; and it would seem that other causes, besides old age, are essential to the production of cataracts; as, for instance, immoderate exertion of the eye during youth, particularly in such employments as expose the organ to a strong reflected light. (*Lehre von den Augenkr. b. ii. p. 325.*) And according to the same author, one of the most important, though least noticed, causes promoting the formation of cataract, is allowing a strong light

suddenly to enter the eyes of a new-born or very young delicate infant, the consequence of which is, that cataracts form more or less quickly with inflammation of the capsule and lens, or remain for life incomplete, as is the case in the central capsulo-lenticular cataract.

Frequently (says a modern writer) the cataract "proceeds from an hereditary disposition, which has existed for several successive generations; while, in other cases, it attacks several members of the same family, without any disposition of this kind being recognisable in their progenitors. Among others, Janin mentions a whole family of six persons, who laboured under this disease." (*Obs. sur l'Œil*, p. 149.) Richter extracted the cataract from a patient, whose father and grandfather had been affected with the same malady, and in whose son, at that period, it had begun to manifest itself. He adds, that he had seen three children, all born of the same parents, who acquired cataracts at the age of three years. (*On the different Kinds of Cataract*, p. 3.) "During my apprenticeship with the late Mr. Hill, of Barnstable, I was present, when he operated on two brothers, and a sister, all of whom were adults, and who stated, that three of four others of their family were affected with symptoms not unlike those which they had experienced at the commencement of the complaint. I myself recently operated on two gentlemen advanced in years, who informed me, that they had a brother on his return from India, who was similarly affected." (See *Adam's Pract. Obs. on Ectropium, Artificial Pupil, and Cataract*, p. 101. London, 1812.) Beer speaks of families in which the children all became afflicted with cataracts at a certain age; cases, says he, where an operation, though done by the most skillful practitioner, hardly ever succeeds. (*Lehre von den Augenkr.* b. ii. p. 331.)

The dust of lime is supposed to be conducive to the disease, cataracts being said to be frequent amongst the workmen in lime-pits and kilns. In such cases, I conceive that the cataract has mostly been the result of inflammation.

Wounds of the eye, where the weapon has pierced the capsule and the lens, and especially violent concussions of the fore part of the globe of the eye, though no wound may exist, are in general followed by a cataract, as an immediate consequence. This is the case, says Beer, even when no inflammation arises from the injury, the cataract often occurring in a few hours, and in so considerable a degree as not to admit of being mistaken.

The cause of cataract, thus rapidly produced, must depend, in Beer's opinion, upon the complete separation of the lens from its connections with the capsule, and not unfrequently in part upon the detachment of the capsule itself from the neighbouring textures; for, in such cases, this membrane also gradually becomes opaque.

In the opinion of Delpech, Demours, Wendt, and Walther, the opacity of the lens, termed cataract, is equivalent to its death. That its original structure must be entirely disorganised and destroyed where the cataract is soft, or fluid, must be perfectly manifest. To the view adopted by the preceding writers Mr. Middlemore, inclines. "Parts (says he) may be discoloured, and may still retain their usual degree of vitality, and their proper grade of organisation; for instance, a serous membrane may be rendered opaque, or the colour of the iris may

be changed by inflammation, and yet we do not say, that either the one or the other of these textures has lost its vitality, when merely so altered; but I suspect that, when the crystalline lens has become opaque, it ceases to be a living part of the animal machine. The occurrence of cataract in very aged persons, and of congenital cataract, the hereditary predisposition to cataract in some families, and the proneness of the lens to become opaque from slight injury, strongly dispose me to this opinion. If common senile cataract be not caused by death of the lens; if this explanation of its opacity be rejected; we are totally at a loss to explain its frequent occurrence in aged persons. It is evidently not produced in them by inflammation; for it takes place first—it is perceived—in the centre of the lens: it occurs in old feeble persons, and is unattended by pain, or by any morbid effect in the other parts of the eye, which can with propriety be referred to inflammation." (*On Dis. of the Eye*, vol. ii. p. 62.) On this point I should say, that there is evidence rather of disorganisation, or of alteration of texture, or of new deposit in the lens, than of actual death of it. When other textures lose their transparency slowly and insidiously without inflammation, is it usual to refer such change to loss of vitality? On this part of the subject, I consider the observations of Dr. Mackenzie judicious. The most frequent kind of cataract (says he) is that which occurs in old age, independently of inflammation, or injury. We ascribe this variety of cataract to a defective nutrition, gradual decay, or marasmus of the lens. But, in fact, we are unacquainted with the proximate cause of this sort of cataract. It ends not merely in an opacity, but in a peculiar change, which, by some, has been compared to a coagulation, and, by others, to a necrosis, and which is entirely wanting in the glaucomatous state of the lens. The lens also loses its natural adhesion to the internal surface of the capsule, and, in some cases, an effusion of fluid takes place between them.

"Next in point of frequency is cataract from injuries. These rupturing the capsule, will admit the aqueous humour into contact with the lens. Even the smallest puncture of the capsule will induce lenticular cataract. If the rupture of the capsule is considerable, in four and twenty hours, we sometimes see the lens opaque, an effect attributed to the coagulating influence of the aqueous humour, but which is more probably owing to inflammation excited in the lens. Should the rupture of the capsule remain open, the whole lens may dissolve in the aqueous humour, be absorbed, and thus the pupil become clear. In this case, opaque portions of the capsule often remain visible, although, by the dissolution of the lens, a considerable share of vision is restored.

"If the wound of the capsule closes, the dissolution of the lens ceases, the cicatrix of the capsule assumes a chalk-white appearance, and thus a capsulo-lenticular cataract is formed. It has been conjectured, that the capsule is occasionally ruptured in the tetanic state of the eyes, which attends the convulsions of young children, so that the aqueous humour being admitted within the capsule, the lens becomes opaque. In some cases, a blow on the eye, without any penetration of its tunics, ruptures the capsule; while, in others, cataract, generally attended by amaurosis, follows a blow, without any apparent rupture or dislocation.

"Inflammation is in some cases the proximate cause of cataract. Indeed, anterior and posterior capsular cataracts may be compared to specks of the cornea; while, in some instances, the lens also from long continued inflammation, becomes opaque, dissolves into a milk-like fluid, or even suppurates. Ossification of the lens and its capsule is another termination of inflammation of these parts." Iritis is sometimes followed by opacity of the capsule and lens. (See *Mackenzie on Dis. of the Eye*, p. 677.)

Dr. Mackenzie has met with a greater number of stocking-weavers affected with cataract, than of any other trade. The disease in them was often attended with amaurosis. "Looking intensely at an object in motion, which their occupation requires, is probably the cause of their eyes becoming diseased." According to the same authority, the inhabitants of volcanic countries, as Naples and Sicily, are very subject to cataract. (*Op. cit.* p. 679.) Respecting his statement, that wine and spirituous liquors promote its occurrence, I may observe, that the disease does not appear to be particularly frequent among the drunken classes of society in London.

In this country, no faith is put in the notions, respecting the constitutional influence of rheumatism, gout, scrofula, syphilis, &c. in the production of cataracts, except where such general disorders directly excite inflammation of the eye, and opacity of the lens or its capsule is brought on as a consequence of such inflammation. Indeed, Mr. Guthrie maintains, that scrofulous inflammation is rarely propagated to the interior of the eye, and that strumous subjects are not more subject to cataract than other individuals; an opinion in which I perfectly coincide. He also remarks, that there is no evidence of syphilitic patients being particularly liable to cataracts, and thus, even when they have suffered severely and frequently. In short, he absolutely denies the power of this and other constitutional diseases to promote the formation of an opacity of the lens and its capsule, unless inflammation of the eye be excited by them. (See *Operative Surgery of the Eye*, p. 191.)

Cataracts are said to have been cured in venereal patients, while under a course of mercury. Probably, however, many such cases might have been mere opacities of the cornea, or, at most, only transient opacities of the capsule, or depositions of lymph in the posterior chamber, the consequence of existing or previous inflammation. Wenzel placed no reliance whatever on the power of any remedies to dissipate a cataract, and, as he had remarked their inefficacy in numerous instances, he felt authorised in declaring, that internal remedies, either of the mercurial or any other kind, are inadequate to the cure of this disorder; and equally so, whether the opacity be in the crystalline lens, or in the capsule, whether incipient or advanced.

Although Ware coincided with Wenzel and Beer, in regard to the uncertainty of all known medicines to dissipate an opacity, either in the lens, or its capsule, or even to prevent the progress of such opacity, when once begun, yet, according to his observations, the powers of nature are often sufficient to accomplish these purposes. The opacities, in particular, which are produced by external violence, he had repeatedly seen dissipated in a short space of time, when no other parts of the eye had been hurt. In such cases, the crystalline

lens is generally absorbed, as is proved by the benefit, which is afterwards derived from very convex glasses. In some of these cases, though the crystalline had been dissolved, the greater part of the capsule remained opaque, and the light was transmitted to the retina only through a small aperture, which had become transparent in its centre. Instances are also recorded, in which cataracts, formed without any violence, have been suddenly dissipated in consequence of an accidental blow on the eye. The remedies, which Ware found more effectual than others, were the application to the eye itself of one or two drops of ether, once or twice, in the course of the day, and occasionally rubbing the eye, over the lid, with the point of the finger, first moistened with a weak volatile or mercurial liniment. While Mr. Guthrie admits, that opacities perceptible behind the iris, have been cured under a course of medicine, he considers such events very rare, and to have been accomplished only when the opacity arose from slight depositions in the capsule, the result of simple inflammation, rather than from any affection of the crystalline itself. A haziness of the capsule, caused by the extension of inflammation of the iris to it, he says, may almost always be relieved under the treatment proper for the cure of iritis; but, he does not believe, that an opacity of the lens, distinctly discerned to be such, has ever been removed by medicine. He expresses his decided opinion, that if any lenticular cataracts have really been cured, they were caused by external violence, and disappeared in consequence of their dissolution in the aqueous humour, and the action of the absorbents, the opacity of the lens having been the result of a rupture of its capsule. Ware, who at one time supposed that incipient cataracts might be cured by spirituous applications, and particularly the sulphuric ether, latterly abandoned the opinion; and it would seem from a note in the third edition of his book on the cataract, that the cases he published in the first and second, and as proceeding from an external injury, were of the latter description. (*Operative Surgery of the Eye*, p. 250.) In short, the operation is now regarded as the only means, affording any rational hope of restoring the eyesight of patients afflicted with cataracts. Speaking of genuine cataracts, Mr. Lawrence delivers his belief, that no external nor internal medicines, with which we are at present acquainted, can alter the condition of the opaque lens and capsule. General or local measures may occasionally alleviate particular symptoms, or remove concomitant affections; but they have absolutely no influence on the cataract. (*On Dis. of the Eye*, p. 411.) Another experienced and well-informed writer on this subject joins in the belief, that most of the alleged cures have in all probability, been either instances of mere fibrinous effusions on the surface of the capsule, or else cases of ruptured capsule, in which the removal of the opaque lens has been effected by the solvent power of the aqueous humour; while, on other occasions, it is scarcely to be doubted, that no affection of the lens, or its capsule existed; but, that glaucoma, with incipient amaurosis, was mistaken for cataract, and submitted to certain modes of treatment, which, not unfrequently prove efficacious in restoring to a certain degree the sensibility of the retina. (See *Mackenzie on Dis. of the Eye*, p. 698. ed. 2.) The late Mr.

Ware has been the only practitioner, who has attempted the cure of cataract by local stimulants. M. Gondret employs electricity, galvanism, and ammoniacal collyria; and cauterisation of the forehead either with the actual cautery, or an ointment composed of a highly concentrated solution of ammonia. M. Magendie regards the utility of this practice as depending upon its stimulating the fifth nerve, the influence of which is so essentially concerned in the nutrition of the eye, that, when divided, the cornea becomes opaque, and the humours are transformed into a substance resembling curd. Cataract being often suspected to arise from defective nutrition of the lens, some imperfection of the nerve, it is conceived, may be concerned. Here the question arises, were M. Gondret's cases true, or spurious cataracts? Dr. Mackenzie expresses his suspicion, that most of them were of the latter kind. (*Op. cit.* p. 699.)

Notwithstanding the perfection to which the operation, with all its different modifications, really has been brought, its performance will not always re-establish vision; nay, says Beer, it is frequently counterindicated; and even in favourable cases, the result is exposed to many contingencies.

When the operation is done apparently under favourable circumstances, and its event is unexpectedly very incomplete, or quite unsuccessful, surgeons in vain ascribe the failure to the particular method of operating, which they have hitherto adopted, and uselessly abandon it for another; because none of these methods, including that which is preferred, brought to the highest state of perfection possible, can be applicable to all cataracts. But, says Beer, the reason of the ill success is generally rather owing to the operation not having been indicated, or to a mode of operating, not well calculated for the particular case, having been selected. He ridicules the idea of adhering exclusively to any one plan of operating, and whenever the question was put to him, "What is your plan?" he answered, that his custom was to operate in the manner which appeared to him the best adapted to each particular case about which he was consulted. A surgeon should be able to distinguish, first, the cases of cataract, in which an operation may be done with the best chance of success, secondly, the examples, in which the prognosis is more or less doubtful; and, lastly, the cases, in which there is a great probability, or an absolute certainty, of the operation failing, in which last circumstance the practice is prohibited.

According to Beer, the result of an operation will probably be favourable:—1. When the cataract is a genuine local complaint, perfectly free from every species of complication. 2. When the conformation of the eye and surrounding parts is such, as to allow whatever method of operating may be most advantageous for the particular case, to be done without difficulty. 3. When the patient is intelligent enough to behave himself in a manner, which will not disturb the precision and safety of the requisite proceedings in the operation, or the subsequent treatment. 4. When the operator not only possesses all requisite medical and surgical knowledge in general, but is capable of judging correctly, what method of operating suits the particular case; and when besides he has derived from nature and acquirement such mental

and corporeal qualities, as are essential to a skilful operator on the eye; viz. an acute eyesight, a steady, but light, skilful hand, except for mechanical artifice in general; long, pliant fingers; a delicate touch; a certain tenderness in the scientific treatment of this particular organ; complete fearlessness; invincible presence of mind; and proper circumspection. 5. When the requisite instruments are not too complicated; but well adapted to the purpose, and in right order. 6. When the domestic condition of the patient is such as not to occasion any particular disadvantages during or after the operation. Yet, says Beer, even with this fortunate combination of circumstances, uniform success must not be expected; for a patient, whose sight is quite prevented by this disease, and who, previously to its origin, was already far-sighted, will be still more so after the removal of the diseased lens, and, in order to see distinctly the most common objects which are near, he will be obliged constantly to employ suitable glasses. An individual of this description, though the operation be done with great success, is apt not to be satisfied. But such patients as were short-sighted previously to the formation of their cataracts, are more pleased with the restoration of vision; as, before the operation, their eyesight was much less than what it is now, and in general they can lay aside the glasses, which they formerly made use of, without having occasion for any others. Lastly, as Beer remarks, although patients, who, before the origin of their cataracts, were neither far nor short-sighted, are sensible of the important benefit of an operation, inasmuch as they now plainly discern all objects again, yet they are usually obliged to employ spectacles in reading, writing, or doing any kind of fine work.

On the other hand, the result of an operation Beer considers always more or less doubtful:—1. When the cataract is only locally complicated, as, for instance, with pterygium, which may not form any absolute reason against the experiment. 2. When the conformation of the eye and surrounding parts causes several hinderances to the operator; as is the case, when the eye is small, and deep in the orbit, and the fissure of the eyelids very narrow. 3. When the patient is either very obstinate, rough-mannered, particularly timid, or badly fed. 4. When the surgeon knows how to operate only in one way, in which, perhaps, he has also not had sufficient experience, and when possibly he is also deficient in the qualities specified above, as essential to a good operator on the eyes. 5. When the instruments are bad. 6. When, in the patient's domestic affairs, there are any circumstances, which cannot be removed, and are likely to have a bad effect upon the operation, as an unwholesome, damp room, great uncleanness, &c. 7. When the origin of the cataract was attended with repeated, or tedious headach, though this may have subsided a long while. 8. When the patient is particularly subject to catarrhal and rheumatic complaints, especially affecting the eyes. 9. When the patient has often had, or still labours under, an attack of erysipelas, notwithstanding the parts inflamed be remote from the eye. 10. When the patient's skin is peculiarly irritable. 11. When in his childhood, or youth, he has been frequently afflicted with convulsions, or epileptic fits, though these complaints may have ceased many years. 12. When there is the least tendency to certain

constitutional diseases, scrofula, gout, syphilis, &c. Gout, however, does not always make an operation fail, as we learn from Mr. Travers, who, in three cases, extracted the cataract from gouty subjects, and, though a smart attack of the disease followed the operation, the eyes were unaffected and the sight was well recovered. (*Synopsis of the Diseases of the Eye*, p. 297.) 13. When the patient's habit is bad, though not affected with any definite disorder. 14. When the patient in his youth has often been troubled with attacks of ophthalmia. 15. When he cannot perceive the different degrees of light, and correctly describe them, while nothing to account for this state can be detected in the eye itself. 16. The result of an operation is always very doubtful, when there is the slightest tendency to hysteria, or hypochondriasis. 17. When the patient is subject to violent mental emotions, mania, &c. 18. When the eye to be operated upon can still discern things, however feebly, a state, which generally produces an involuntary resistance to the necessary measures in the operation. 19. When the cataract is the consequence of a wound, though free from complication. 20. When the patient is in the state of pregnancy. 21. When one eye has been already destroyed by supuration. 22. And, lastly, when one eye has already been operated upon without success, by a man whose professional judgment, skill, and caution, are unquestionable.

In almost every case of congenital cataract in a child, under eight years of age, where the capacity to distinguish the different degrees of light is possessed, and where the eye is, in other respects, healthy and perfectly formed, the prognosis, with reference to the probable result of an operation, will be favourable. (*Richard Middlemore on Dis. of the Eye*, vol. ii. p. 68.)

According to Beer, the result of the operation will be more or less unfavourable:—1. When the patient is affected with gutta, or acne rosacea, not the effect of hard drinking, but rather of scurvy. 2. When evident traces of some general disease of the constitution are present. 3. When the patient has been ill, and is only yet convalescent. 4. When any other disease, though not constitutional, is present. 5. When the cataract is adherent for a considerable extent to the uvea, or an incurable, though not very severe chronic inflammatory affection of the eyelids, or eyeball, prevails, as, for instance, an habitual inflammation of the Meibomian glands; ectropium of the lower eyelid, the remains of a pannus; or, a strong aversion to light.

Lastly, as Beer observes, every operation must fail, when the cataract is manifestly joined with complete amaurosis, a dissolution of the vitreous humour, dropsy, or atrophy of the eye, some species of ophthalmia, glaucoma, or a general varicose affection of the blood-vessels of the eye.

The capacity of distinguishing light from darkness, and, in a shady place, where the pupil is not too much contracted, of perceiving bright colours and the shadows of objects, is, as Scarpa has particularly noticed, a very important desideratum in every case, selected for operation.

The power of distinguishing light from darkness is even more satisfactory than motion of the iris. I have met with several cases of complete gutta serena, in both eyes, in which there was the freest contraction and dilatation of the pupils. Had such

patients been also afflicted with cataract (a complication by no means unfrequent), and a surgeon, induced by the moveable state of the iris, had undertaken an operation, it must of course have proved unavailing, since the rays of light could only have been transmitted to an insensible retina. Richter and Wenzel make mention of these peculiarities, and the latter refers the phenomenon to the iris deriving its nerves wholly from the lenticular ganglion, while the immediate organ of sight is constituted entirely by another distinct nerve. Hence, motion of the iris is not an infallible criterion, as authors have stated (*Wathen*), that the retina is endued with sensibility. Mr. Lucas attended, in conjunction with Hey and Jones, five children of a clergyman at Leaven, near Beverley, who were all born blind. He writes, "None of them can distinguish light from darkness; and although the pupil is, in common, neither too much dilated nor contracted, and has motions, yet these do not seem to depend upon the usual causes, but are irregular." (*Med. Obs. and Inq.* vol. vi.)

The reciprocal sympathy between the two organs of sight is so active, that no one, solicitous to acquire either physiological or pathological knowledge respecting them, ought, for a moment, to forget it. Hence, in the examination of cataracts, it is of the highest importance to keep one eye entirely secluded from the light, while the surgeon is investigating the state of the iris in the other; for the impression of the rays of light upon one eye, sensible to this stimulus, is known to be often sufficient to produce corresponding motions of the iris in the opposite one, although in the state of perfect amaurosis. It is now well established, that the action of the iris is not exclusively sympathetic with the impression of light upon the retina of the eye, to which it belongs. The action of the iris may depend, indeed, first, upon the direct agency of light upon its irritable and contractile texture; secondly, upon the stimulus of light upon the retina; or, thirdly, upon a sympathy with the iris of the opposite eye. In investigating the state of the retina in several forms of disease, these three influences over the action of the iris should be remembered. (*See Middlemore on Dis. of the Eye*, vol. ii. p. 79.) In other examples of cataract, the pupil may be quite motionless, and yet sight shall be restored after the performance of an operation. (*Wenzel*.) There are two circumstances, however, which may prevent us from ascertaining, whether the retina is sensible to light or not:—The first is, a circular adhesion of the crystalline capsule to the iris: here Richter thought, that some opinion might be formed of the nature of this case, by observing the distance between the cataract and pupil; inferring, that when the space between the pupil and opaque lens was inconsiderable, such an adhesion had happened; and, when the cataract did not seem particularly close to the pupil, and yet the patient could not discern light from darkness, that it was complicated with amaurosis. The second circumstance, sometimes utterly preventing the ingress of any light to the healthy retina, is the round bulky form of the cataract.

But although the power of distinguishing light from darkness is more satisfactory than motion of the iris, it is not an unequivocal test of the retina being perfectly free from disease. While amau-

rosis is incomplete, the patient can yet distinguish light and the shadows of objects. Dilatation of the pupil is, also, a deceitful criterion of the complication of this disease with the cataract. When the cataract is large, or adherent to the iris, the pupil is frequently much dilated, though the optic nerve may be natural and sound: the pupil often continues quite undilated in a perfect gutta serena. (Richter.)

From all this it must be manifest, 1st, That the irregularity and inconstancy of the symptoms of amaurosis, together with the possibility of particular states of the cataract rendering the patient utterly unconscious of the stimulus of light, make it necessary for the surgeon to be particularly attentive to the appearance and to the history of the origin and progress of the disease, in order to understand the real condition of certain causes. 2dly, That, when the patient can distinguish light from darkness, though the iris may be motionless, there is good ground for trying an operation. Possibly, in this circumstance, an incipient amaurosis may exist; but the chance of the defect of the iris arising from other causes; the certainty, that the opaque body must be removed from the axis of sight (even if the disease of the retina be cured), ere sight can be restored, and the improbability that an operation to cure the cataract will render the other complaint at all less remediable, fully justify the attempt. Frequently, the patient has a fully formed cataract in one eye, which presents the signs of amaurosis, while an incipient cataract, or one as much advanced, exists in the other, which, at present, is free from these symptoms: in this case (says Mr. Travers), the cataract of the latter should be removed, without delay. (*Synopsis*, &c. p. 314.)

The concurrent testimony of almost all writers upon the subject tends to prove, that the restoration of sight has sometimes been effected in the most hopeless cases; and I am, therefore, of opinion with Mr. Lucas that, in all doubtful cases, an operation should be tried as a remedy by no means violent or hazardous. (*Med. Obs. and Inquiries*, vol. vi. p. 257.)

I shall conclude this part of the subject with annexing the sentiment of Mr. Travers, viz. that it would be incorrect to say, that the operation is undvisable in all cases of cataract, in which the patient has no sense of light; for it is possible, that the density of the lens may be such as absolutely to exclude the light, and that the motions of the iris may be therefore suspended; or from some degree of the pressure of the lens, or adhesion of the vena to the capsule, that the pupil may be undilated, and the circumference of the lens permanently covered. But, undoubtedly, says Mr. Travers, a case of this description is unpromising. "A strong sense of light, by which at least to know the direction in which it enters the apartment, to be sensible of its falling on the eye, and of a shade, as the hand for example, intercepting it, with a corresponding freedom of motion of the pupil, is the most favourable state for the operation." (*Synopsis of the Diseases of the Eye*, p. 315.)

As it not unfrequently happens that cataracts, produced by external violence, spontaneously disappear, (Pott, Hey, Ware, &c.) the operation should never be too hastily recommended for them.

Respecting the question, whether an operation ought to be done, when only one eye is affected

with cataract, and the other is sound, some difference of opinion prevails.

One reason assigned by the condemnners of this practice, viz. that one eye is sufficient for the necessities of life, is but of a frivolous description; but another, that the patient would never be able to see distinctly after the operation, by reason of the difference of the focus in the eyes, is one of true importance and well deserving investigation. To prove that success does sometimes attend the practice of couching, an extraction, when only one eye is affected with a cataract, I refer to a case reported by Maître-Jan. (*Traité des Maladies de l'Œil*, édit. Paris, 1741. 12mo. *Obs. sur une Cataracte laiteuse*, p. 196.)

Also to Baron Weizel, who was in the habit of extracting cataracts with some success when only one eye was affected with the disease, as may be learned by referring to the cases here specified. (Cases 6. 13. 16. 19. 22. 25. 29. 30. 31. 34. &c. *Treatise on the Cataract*.)

Richter was formerly convinced, that the advice not to operate, when there is a cataract only in one eye, ought, for several reasons, to be disregarded; he reminds us of the wonderful consent between the eyes, so that one is seldom diseased without the other, sooner or later, falling into the same state; and hence he questions, whether it may not be possible to prevent the loss of the sound eye by a timely operation. *An non curari possit jactura integri oculi tempestive extrahendo cataractum prius?* (*Obs. Chir.* fascic. 1.) He adverts to the remarkable case related by St. Ives, where a man was wounded in the right eye by a small shot, and, shortly afterwards, had a cataract in it, he then gradually became blind in the left, but soon recovered his sight in it after the cataract had been extracted from the right one. Here let us notice, that St. Ives (*Maladies des Yeux*, chap. xv. art. 3.) makes no mention of any confusion in vision, in consequence of the different refracting powers of the two eyes in question. From some modern publications, indeed, it would appear that, in a few instances, an incipient cataract in one eye has actually disappeared of itself, after the operation had been performed for a complete one in the other. (*Carmichael in Med. and Physical Journ.* vol. xix.; and *Stearns, in Edin. Med. and Surg. Journ.* No. lxxvii. p. 521.) This is a circumstance which is urged by the latter gentleman, not only as a strong reason for disregarding the common opinion, that a cataract should never be operated upon while the other eye enjoys useful vision, but as a powerful motive for doing the operation even at an early period, so that, if there be no cataract in the other eye, the operation may be the means of preventing its formation, or, if it be already beginning, the chance of its dispersal by the effect of the removal of the other cataract may be taken. In the *Medical and Physical Journ.* for May, 1808, is also an ingenious paper, defending the practice of operating when only one eye is affected. Another reason assigned by Richter, (*Obs. Chirurg.* fascic. 1.) for disregarding the above precept, is, that in waiting until a cataract forms in the other eye, the existing one, which is at this moment, perhaps, in the most favourable state for the operation, may soon change so much for the worse (for instance, it may contract such adhesions to the iris) as either to destroy all prospect of relief, or, at most, afford but a very precarious and discouraging

one. The length of time necessary to wait is also uncertain and tedious. I once saw a man in St. Bartholomew's Hospital who had had a cataract in one eye fifteen years, during all which time the other continued quite sound; and another case of twenty years' standing has lately been communicated to me. It is right to state that Richter latterly inculcated a contrary opinion to what he formerly espoused, and observed that the patient not only does not see better with the two eyes after the operation, than with one before it; but he frequently sees more confusedly, because the eye that has been operated on cannot see well without the aid of a glass, which, perhaps, the sound one does not require. (*Anfangsgründe der Wundarzn. Dritter. b. iii. p. 199.*)

Warner's objection is similar to that specified by Richter: he writes, "The eye, from which the crystalline lens is removed, cannot be restored to a degree of perfection at all equal to that of the sound eye, without the assistance of a convex glass." (*Description of the Human Eye, and its Diseases, p. 85.*) But is not the power of using both eyes at the same time, even with the inconvenience of being necessitated to employ a glass for the purpose, preferable to being blind of one? The cases quoted, at all events prove, that confusion in vision is not always the result of the practice: whether the fact is concordant with the modern theory of vision, is entirely another consideration. If it should be found incompatible with it, we must infer, that our knowledge of optics still continues imperfect: not that such well attested examples as some alluded to are unworthy of belief.

For some decided information on the foregoing interesting question, I have referred to Beer; but he seems not to have entered into its consideration at all. The only instance, in which he approaches the subject is, when he notices the custom of covering the eye, which yet possesses more or less vision, when the other alone has a cataract in a fit state for an operation: (*Lehre von den Augenkr. b. ii. p. 351.*)

My experienced friend, Mr. Lawrence, also joins in the belief, that the practice is not productive of advantage.

Mr. Guthrie even declares, that he has met with several "cases in which great inconvenience was sustained from the confusion of vision caused by a successful operation;" and, in one instance, the patient actually wished him to destroy the sight gained by the operation. He therefore joins in the opinion, that the operation should not be attempted on one eye while the other is sound. (*Operative Surgery of the Eye, p. 258.*)

On the same side of the question is Dr. Mackenzie, who remarks that, under these circumstances, delay is the usual practice. "Were it established (says he) that cataract might be produced sympathetically, there could be no doubt of the propriety of removing a single cataract, even when not the slightest appearance of the disease could be detected in the opposite eye; but the fact is not established. The cataract of old people generally attacks both eyes within the period of a few months; but, in middle life, we often meet with it in one eye, the other having continued unaffected for many years." (*On Dis. of the Eye, p. 700. ed. 2.*)

On the other hand, however, we have the evidence of Dr. Andrew Smith, a gentleman whose observations appear to be deduced from considerable experience in the ophthalmic hospital at Chat-

ham. He admits, that a slight degree of double vision does occur for a short time after the lens has been extracted. In cases where the lens was broken up, however, this casual imperfection did not occur; as, before the lens was absorbed, the eye became accustomed to its privation. "The following (says he) were the remarks I made on the cases, in which extraction was performed:—Three saw objects double when the bandage was first removed, and for nearly twenty-four hours; and then singly. Two saw double for about three hours; and one of them, two days afterwards, upon being surprised, and opening his eyelids suddenly, experienced for a few seconds the same imperfection. A sixth saw constantly double for four days, and after that as distinctly as ever he did; and the other three cases, as above remarked, always single." (*Edin. Med. and Surgical Journ. No. lxxiv. p. 14.*) On the whole, I consider this question, which is a very important one in practice, by no means decidedly settled; and, as far as the evidence of various writers upon it extends, I think those who are in favour of operating upon a cataract, though the other eye is sound, have the best of the argument.

When there is a fully formed cataract in one eye, and vision is retained in the other, Mr. Travers thinks the postponement of the operation wrong. "I am satisfied (says he) that the cataractous eye, if it becomes the subject of an accidental inflammation, is strongly disposed to go into amaurosis; and further, that the retina loses its vigour by the permanent exclusion of light. I speak from repeated observation of the fact. The objection to the operation on the ground of inconvenience, arising from the difference of focus of the two eyes, when one only is the subject of disease, is trivial, and a consideration altogether subordinate; such a defect may always be remedied by glasses properly adjusted." In several cases of amaurosis ensuing upon cataract, I have been disposed to regard the change in consistence and volume of the lens, as productive of a destroying inflammation; in others, of a partial absorption of the vitreous humour." (*Synopsis of Diseases of the Eye, p. 313.*)

On the other hand, Mr. Middlemore contends, that there is no evidence to prove that, when the sight of one eye is destroyed, the opposite organ becomes impaired or amaurotic in consequence. "Persons (says he) who were born with one eye only, persons who, in early life, have had collapse of one eye-ball after an attack of ophthalmia; persons who are affected with congenital or traumatic amaurosis; or cataract of one eye only, very often retain the sight in the opposite organ to a late period of life." (*See Middlemore on Dis. of the Eye, vol. ii. p. 114.*) This author seems to regard an operation for a single cataract as only right on young females, to whom personal appearance is an argument of some weight.

When there are cataracts in both eyes, some authors are of opinion that there is no reason why one should not be operated upon immediately after the other. As, however, the inflammation is likely to be more severe, *ceteris paribus*, when both eyes are operated upon at the same time, Scarpa, who gives the preference to the needle, disapproves of this mode of proceeding, and assures us, that, in patients with cataracts in both eyes, his experience had taught him, that it is better to wait till one eye is well, before any attempt is made upon the other. (*Saggio di Osservazioni, &c. p. 255.*)

On this point the following is Beer's sentiment :— When cataracts are completely formed in both eyes, the patient willing, and every thing promises a favourable result, both eyes may be operated upon at the same time. On the contrary, when any circumstances are present, which render the event of the operation very doubtful, it is most advisable to make the attempt only on one eye, even though the patient absolutely wish more to be done, so that if the first operation should fail, but the complication of this cataract afterwards change considerably to the advantage of the patient, one eye would still be left for a second more favourable attempt. (*Lehre von den Augenkr.* b. ii. p. 350.)

If division of the cataract is the operation to be performed, Dr. Mackenzie approves of operating on both eyes at the same time; if extraction, then he deems it best to await the result of the operation on one eye before touching the other. "Double extraction (says he) decidedly exposes the eyes to greater risk of inflammation." (*On Dis. of the Eye*, p. 700. ed. 2.)

Some years ago it was the common doctrine that no operation should be undertaken for a cataract before the patient had attained the age of docility and reason, and, in a point of view abstractedly surgical, there can be no doubt of the rectitude of such advice; but when it is further considered how essential sight is to the acquirement of education; that youth is the condition best adapted for this indispensable pursuit; that when the child's head is steadily fixed, the needle admits of being employed; that, with the aid of an assistant, this object can most effectually be accomplished; that, when the operation is delayed, the cataract may acquire adhesions; that persons have not only had cataracts successfully depressed or broken at a very early age, but, with the assistance of a *speculum oculi*, have even had them extracted (see Ware's note, p. 90. of *Wenzel's Treatise*), which is universally acknowledged to be a far more difficult process; and that the pupil of the eye, in a young subject, is nearly as large as in an adult (*Warner's Description of the Human Eye and its Diseases*, p. 34.); I cannot help thinking, with Mr. Lucas, that, after a child is old enough to bear an operation, the attempt to cure a cataract with the needle may be proper at any age. Surgeons do not refuse to operate for the hare lip as early as two years of age, or even earlier; they do not wait for docility and reason in the patient to make him manageable, and sensible of the propriety of submitting quietly to the performance of the operation; they render him tractable by force, and thus they wisely succeed in making, perhaps with more certainty than reliance upon the fortitude of any human being would afford, a very precise incision, such as the nature of the operation demands: and why should they refuse to attempt the cure of cataracts in children, when the motives are more urgent, and it is equally in the power of art to substitute means quite as effectual as docility and reason in surgical patients? What experienced operator would trust to these qualitics, when he undertakes any grand operation, even on the most rational and firm adult? (*Critical Reflections on the Cataract*, 1805.)

The propriety of operating on the cataracts of children seems now firmly fixed on the basis of experience. The needle may be successfully employed on children of the most tender age. The

late Mr. Saunders, surgeon to the London Infirmary for Diseases of the Eye, had the principal share in promoting the adoption of this important improvement. His practice confirmed what reason had long ago made probable; and the judgment, tenderness, and skill with which he operated on the eyes of infants, as well as those of adults, were followed by a degree of success which had never been previously witnessed, and which infused quite a new spirit into this most interesting branch of surgery. Subjects from eighteen months to four years old, received most benefit from Mr. Saunders's operations; and, if any intermediate time be selected, Dr. Farre is inclined to recommend the age of two years. "The parts have then attained a degree of resistance which enables the surgeon to operate with greater precision than at an earlier period; yet, the capsule has not become so tough and flexible as it does at a later period, after the lens has been more completely absorbed.

"But this is not the greatest, although a considerable advantage of an early operation; for, in cases in which the patient has no perception of external objects, the muscles acquire such an inveterate habit of rolling the eye, that, for a very long time after the pupil has been cleared by an operation, no voluntary effort can control this irregular motion, nor direct the eye to objects with sufficient precision for the purpose of distinct and useful vision. The retina, too, by a law common to all the structures of an animal body, for want of being exercised, fades in power. Its sensibility, in many of the cases, cured at the ages of four years, and under, could not be surpassed in children who had enjoyed vision from birth; but, at eight years, or even earlier, the sense was evidently less active; at twelve, it was still more dull; and from the age of fifteen and upwards it was generally very imperfect, and sometimes the mere perception of light remained. But these observations do not apply to those congenital cataracts in which only the centre of the lens and capsule is opaque, the circumference being transparent; for, in those, the retina is exercised by a perception, although an imperfect one, of external objects, the motions of the muscles which direct the globe are associated, and an absorption of the lens does not take place: therefore in this variety of the disease, the argument in favour of an early operation, is not so much a medical as a moral one—it is preferable for the purposes of education and enjoyment." (*Saunders on Diseases of the Eye*, p. 153. 155.)

Besides Mr. Saunders, several other surgeons of the present day have become zealous advocates for operating upon the cataracts of children. Even Mr. Ware, before his death, strongly recommended the use of the needle in the congenital cataract of infants and children. The late Mr. Gibson of Manchester likewise urged the propriety of couching young subjects, and fixed on the age of six months as preferable to that of two years. "Whatever objections (says he) have been urged against the safe and effectual use of the couching-needle in infants, have always appeared to me so slight, and so easily surmountable, that, without inquiring particularly into the real state of the question, I have long concluded that the same motives which would induce an operator to couch a cataract at any period of adult life, would equally lead him to perform that operation at any earlier period, when a cataract existed. Acting upon this presumption,

I have operated upon children of all ages for ten years past." (See *Edin. Med. and Surg. Journal*, vol. vii. p. 394.)

Mr. Gibson's paper being dated June, 1811, we are of course given to understand that he pursued this practice from the year 1801; he says, "If an operator cannot depend upon his management of the eye, so as to render it steady by the introduction of the couching-needle, he can avail himself of the assistance of a speculum to restrain its motions.

"The following observations will apply principally to infants under twenty months old:—The advantages which an operator possesses in operating upon a child of this age, as compared with a child of three years old or upwards, are important. An infant is not conscious of the operation intended: it is free from the fears created by imagination, and can oppose very feeble resistance to the means employed to secure it with steadiness. At an early age it has not acquired the power of retracting the eye deep in the socket, so that the operator has always a good prospect of introducing the couching-needle with ease, by watching a proper opportunity. The eye has not, at this time, acquired the unsteady rolling motion which, after a few years, is so common and remarkable in children born blind, or reduced to that state soon after birth. So that this impediment to the easy introduction of the needle does not exist in infants a few months old. The operator also has it in his power to administer a dose of opium, sufficient to render the steps necessary to expose the eye, almost entirely disregarded by his patient. With respect to the state of the eye itself, but, particularly that of the cataract, this is more favourable for the operation, than at any future period of life. *In infants, the cataract is generally fluid*, and merely requires the free rupture of its containing capsule, which is in that case generally opaque. The capsule, however, is tender, and easily removed by the needle, so as to leave an aperture sufficiently large for the admission of light. The milky fluid which escapes from the capsule is soon removed by absorption. If, on the other hand (says Mr. Gibson), the cataract should be soft, it is generally of so pulpy a softness, that the free laceration of the anterior part of its capsule, and the consequent admission of the aqueous humour, ensure its speedy dissolution and disappearance, without the necessity of a second operation. Should the cataract happen to be hard, there will be no more difficulty in depressing it, than in an adult.

"The advantages which an operator will possess when he attempts the removal of a cataract in a child of a few months old, are peculiar to that period. In proportion as the age of the patient advances, until he arrives at the age of discretion, and can estimate, in some measure, the value of sight, by feeling its loss, the difficulties opposed to the use of the couching-needle increase. His fears of the operation, the unsteadiness of the eye, and his power of retracting it within the orbit, present considerable, but not insuperable, obstacles; such, however, as every surgeon would willingly dispense with, if he had it in his power.

"Before an operation, at an early age, is recommended, the practitioner ought (as at any other age) to ascertain, that the cataract is not complicated with a defective state of the retina, or with a complete amaurosis. Such cases are by no

means uncommon. Some years ago, I recollect to have seen five or six children, the families of two sisters, who were all totally blind, and in an idiotic state, with cataracts accompanied by amaurosis." (*Gibson, Op. et loco cit.*)

I find also in this paper some arguments which are repeated in Mr. Saunders's work:—"Few practitioners at all conversant with cases of blindness from birth, will deny that it is highly probable that the eye may lose a considerable part of its original powers, from the mere circumstance of its having so long remained a passive organ. Hence, probably, it happens, that, in some cases of congenital cataract, the only benefit conferred on the patient by an operation, is that of enabling him to find his way in an awkward manner, and to discriminate the more vivid colours. Such patients have never been able to discern small objects, or to judge, in any useful degree, of figure or magnitude: I am well aware, however," says Mr. Gibson, "that, in some rare instances, such a defective state of the eye exists from birth.

"Another circumstance, which must have attracted the attention of oculists, is, that, in a few years, the eye of a patient born blind acquires a restless and rolling motion, which is at length so firmly established by habit, that he has little control over it. This motion unfortunately continues, for a considerable time, after sight has been restored to such a person, and is a very material obstacle to the early attainment of a knowledge of the objects of vision. He cannot fix his eye steadily upon one point for a moment, and the inconvenience which arises from this unsteadiness, is, to such a person occasionally as great a bar to the distinct view of an object, as the unsteady motion of the same object would be to one whose vision is perfect. This inconvenience any one can appreciate, and, as far as I know, it is completely avoided by restoring sight at an early age." As a motive for operating on infants, Mr. Gibson also comments on the loss of those years which ought to be spent in education. (See *Edin. Med. and Surgical Journal*, vol. vii. p. 394, 400.)

With reference to the results of Saunders's operations, Dr. Farre, informs us, that the sensibility of the eye, "in many of the cases cured at the ages of four years and under, could not be surpassed in children who had enjoyed vision from birth; but, at eight years, or even earlier, the sense was evidently less active; at twelve, it was still more dull; and, from the age of fifteen and upwards, it was generally very imperfect, and sometimes the mere perception of light remained." (See *Saunders on Dis. of the Eye*, p. 154.) In a case which I lately attended with Mr. Alexander, and Mr. Buinbridge of Tooting, the latter fact was unfortunately exemplified after extraction of the lens. The patient was a young woman, aged eighteen, who had congenital cataracts. Dr. Mackenzie is also an advocate for operating in infancy, if possible, before teething commences. (*On Dis. of the Eye*, ed. 2. p. 702.) Mr. Lawrence has operated, with perfect success, on infants of six weeks, but considers the age of two months as generally early enough. He has always operated in the first year, where he has had the choice. (*On Dis. of the Eye*, p. 51.)

Mr. Guthrie considers the period of dentition an unseasonable one for the operation; but excepting the time of this process, if the child be healthy, he thinks it qualified for the attempt at any age,

reckoning from that of six months: and that, "even if the operation be delayed until the end of the third or fourth year, little or no inconvenience is found to arise from it." (*Operative Surgery of the Eye*, p. 362.)

When once it is decided to operate upon a cataract, the sooner the operation is done, in general, the better; because the anxiety of the patient increases, every day, nay, every hour. When the operation is deferred for a few days, the greatest caution must be used not to let him expose himself to any causes likely to bring on catarrhal or rheumatic complaints. (Beer, b. ii. p. 344.) The following advice, delivered by Mr. Lawrence, with respect to preparation of the patient for operation, seems judicious:—After recommending the operation not to be performed if the tongue is foul, he observes, "No fermented liquors, and generally no animal food should be taken for a week, or fortnight previously; and the bowels should be evacuated by some mild aperient, every other day during this time: they should also be well cleared on the morning of the operation. These remarks will apply to all cases; and generally speaking this is the only preparation necessary. Some patients, however, require other preparatory measures; in plethoric subjects, and such as manifest great determination of blood to the head, direct depletion is necessary. In robust persons, in those about the middle period of life, it will be necessary to resort to venesection; and, if the pulse were full, and the patient young and strong, it might be advisable to take blood freely and repeatedly before operating. In general, it is sufficient to take some blood on the morning of the operation. In those of a plethoric habit, with symptoms of determination to the head, we must practise active depletion; and this is occasionally necessary, even in old persons." (*Laurence on Dis. of the Eye*, p. 415.) If the bowels are disordered, tongue foul, and appetite lost, a dose of calomel, every second, or third night, followed by salts and senna next morning, ought to be given, three, or four times. "Even if the patient appears to be in perfect health, three or four saline purges ought to be administered at proper intervals, and a strict antiphlogistic plan of diet followed, for at least eight or ten days." (*Mackenzie, Op. cit.* p. 701.)

Mr. Middlemore states, that he has repeatedly operated for cataracts upon very gouty persons, with almost uniform success. His plan is to place an issue in the arm, about a week prior to the operation, to select proper weather for the operation, and to take care that no fit of gout is expected to occur about the time of its performance. In this particular case, he also prefers operating upon both eyes at the same period. (*On Dis. of the Eye*, vol. ii. p. 120.) If a fit of gout is impending, or is supposed to be likely to occur, it should be allowed to pass over before the operation is performed. Or, if the patient has a strong determination of blood to the head, he should be cupped, a few days before the operation is attempted, in addition to the bleeding recommended by Mr. Guthrie on the evening preceding the operation. (*On the Certainty of Extraction*, p. 71.)

OF THE VARIOUS OPERATIONS FOR CATARACT.

Four different operations are practised for the cure of cataracts, viz. one termed *couching*, or *de-*

pression, of which the method called, *reclination*, is a modification: second, named *extraction*: a third, in which the lens is neither extracted nor depressed, but after the needle has been introduced into the eye in the same manner as for depression, the lens is disturbed, or divided, and left in its place to be removed by absorption. This method is frequently termed the operation by *solution*, or *absorption*, which, however, is not altogether an unobjectionable phrase, because these processes are also concerned as a means of restoring vision after keratonyxis: and a fourth, denominated *keratonyxis*, which consists in puncturing the cornea with a needle, the point of which is to be conveyed through the pupil, so as to reach the cataract, which is to be gently broken into fragments. In particular cases, as Beer observes, each of these modes has manifest advantages over the others; but no single method will ever be exclusively preferred by any man of experience and judgment. In every operation for a cataract, the position of the patient, assistants, and surgeon, is of great importance. In order to enable the assistant, who stands behind the patient, to be conveniently near the head of the latter, Beer prefers letting the patient sit on a stool which has no back. However, some surgeons have been in favour of employing a chair, which is completely perpendicular. When the left eye is to be operated upon, the same assistant is to apply his right hand under the patient's chin, and press the head of the latter against his breast, at the same time that he inclines it and himself more or less forward towards the operator, who sits upon rather a high stool, in front of the patient. In this country, a music-stool is commonly preferred, the height of which can be regulated in a moment, by simply turning the seat round to the right, or left, whereby the screw, with which it is connected, is made to rise, or descend, as may be found most desirable. The same assistant then places his left hand flat upon the left side of the patient's forehead, with the points of the fore and middle fingers somewhat under the edge of the upper eyelid; and, with the forefinger, he is now to raise the edge of this eyelid as much as possible, following that finger immediately with the middle one, so as to fix the eyelid with greater certainty. The ends of these fingers, however, must be so applied, as not to touch the globe of the eye in the slightest manner, much less make any pressure upon it; yet so that the upper part of the eyeball and cornea may be gently resisted by them, when the eye rolls upwards away from the instrument about to be introduced, whereby this position, which is extremely inconvenient to the operator, may be immediately rectified. The patient should also sit opposite a clear window, so that a sufficient light may fall obliquely upon the eyes, without any rays being reflected to the cornea, and becoming a hindrance to the operator. Nor should light from any other quarter be ever allowed to fall upon the eyes. The surgeon should sit in front of the patient, whose head ought to be directly opposite the operator's breast, whereby the latter will be enabled to see from above, with the greatest correctness, every thing in the eye during the operation, and will not be under the necessity of raising his arms too considerably. Supposing it to be the left eye, which is to be operated upon, he next effectually draws down the lower eyelid with

the left forefinger, the end of which must be placed over the edge of the eyelid towards the globe of the eye. The middle finger is then to be applied in a similar way over the caruncula lachrymalis. The operator now takes in his right hand the requisite instrument for the operation, viz. the needle or knife, which is to be held, like a pen, between the thumb and the fore and middle fingers. By this particular arrangement of the fingers of the assistant and operator, which, indeed, is partly ineffectual where the fissure of the eyelids is very narrow, and the eyeball is diminutive and sunk in the orbit, the restless eye of the timid patient is fixed; for a point of the finger is disposed on every side, to which the eye can possibly turn away from the instrument about to be introduced, and when the cornea is gently touched with the extremity of the finger, the wrong position which the eye is about to take, is immediately prevented. This method of fixing the eye, says Beer, is not merely indispensable for young operators, but is the only perfectly unobjectionable one, which can be employed on this delicate organ, since all mechanical inventions for this purpose, like the speculum oculi, which keeps the eye steady, by considerable pressure, or other contrivances, like Rumpell's instrument, which does the same thing by means of a short pointed instrument attached to a kind of thimble, and with which the sclerotic is pierced and held motionless, are found to be worse than useless. The only specula, now ever employed, are those of Pöller and Adams. The first is a bent silver wire; the latter, a thick piece of silver, with a concave edge. They are also merely used for fixing the upper eyelid, without making any kind of pressure on the eye itself. In certain cases, where the muscles of the eye and eyelids are affected with spasm, or the eye diminutive, and sunk in the orbit, these instruments prove serviceable. In young subjects, they materially facilitate the operation.

Mr. Alexander, whose great skill in operations on the eye is universally acknowledged, employs no assistant for raising the upper eyelid, or fixing the eye which objects he accomplishes himself; and, in Germany, this independent mode of proceeding has been particularly commended by Barth. (*Etwas über die Ausziehung des grauen Staars, für den gewöhnlichen Operateur*. 8vo., Wien, 1797.) Mr. Alexander, however, mostly divides the upper segment of the cornea.

Richter recommends the chair, on which the patient sits to have a high back, against which the head can be firmly supported, and which ought to be perpendicular, in order that the head may not be too distant from the surgeon's breast. (*See Anfangsgr. der Wundarzt.* b. iii. p. 207.)

The plan of supporting the patient's head rather upon the back of the chair, on which he sits, than upon an assistant's breast, was also preferred by Bischoff; because the least motion of the assistant, even that necessarily occasioned by respiration, cannot fail to be disadvantageous.

OF COUCHING, OR DEPRESSION OF THE CATARACT, AND RECLINATION.

The operation of couching was once supposed to consist altogether in removing the opaque lens ~~from the axis of vision~~, by means of a needle with a ~~hook~~ for the purpose; but it is well known

to be frequently effectual on another principle, even when the nature and consistence of the cataract do not admit of the depression of the opaque body. Experience fully proves, that the diseased lens, when broken and disturbed with the needle, and especially when freely exposed to the contact of the aqueous humor by a proper laceration of its capsule, is gradually dissolved and removed by the action of the absorbents.

Indeed, couching now means a variety of operations; for, it comprehends not merely the depression of the cataract, not simply its displacement in any direction whatsoever, not only the breaking of it piecemeal, and the pushing of the fragments into the aqueous humor; but likewise the mere disturbance of the opaque body, whereby its absorption is sometimes effected, without any kind of depression, or displacement of it at all with the needle. When, therefore, the merits of couching are investigated, it is necessary to define precisely what modification of it is meant, and for what particular kind of case its application is designed; for, no surgeon of the present day would confine himself exclusively to one method of operating; and as Mr. Guthrie has remarked, "In considering the advantages, or disadvantages, from any or all of the different operations for cataract, it is absolutely necessary to recollect, that no individual operation is applicable to every species of the disease; that each kind requires an operation for its relief or cure, sometimes of a particular nature, and differing essentially from that which is found most advantageous in another. To collect then all the objections, which can be urged against any of the operations, from a consideration of every case of cataract, to which it is and is not applicable, is merely to confuse the subject, and has generally been done for the purpose of recommending some particular mode of proceeding, rather than to regulate these operations, by the general principles of surgery." (*Operative Surgery of the Eye*, p. 365.) In this respect, the doctrines of Pott, Callisen, Hey, Scarpa, and Dupuytren, are undoubtedly wrong, though their sentiments are blended with many valuable and important truths. Beer, who is by no means a great advocate for depression, admits its utility in particular cases. It is easily comprehensible, says he, that, in this way, a firm and large cataract either cannot be removed without injuring the retina, and the attachment of the corpus ciliare to the vitreous humor, or not far enough to prevent the opaque body from rising again at the first opportunity. Hence, the former complaint about the frequent return of the cataract, and other ill consequences, unappeasable vomiting, suddenly produced amaurosis, and severe inflammation, &c. But, while Beer acknowledges the frequency of these ill effects of depression, he condemns the universal rejection of it, attempted at the present day, and the unlimited substitution for it of reclination, which consists in applying the needle in a certain manner to the anterior surface of the cataract, and depressing the opaque body into the vitreous humor, in such a way that the front surface of the cataract is now the upper one, its back surface the lower one, its upper edge backwards, and its lower edge forwards; a change, which Beer says, cannot be made without an extensive destruction of the cells of the vitreous humor. Hence, with few exceptions, this author

thinks the common mode of depression should be preferred. (*Lehre von den Augenkr.* b. ii. p. 352.) And, in this sentiment, he is joined by Mr. Travers, who remarks, that the real objection to couching is the breaking up of the fine texture of the globe of the eye, by the forcible depression of the lens. "Whether it be depressed edgeways or breadthways, makes no difference in the result; it must still occupy a breach in the cells of the vitreous humor, and must derange and disorder that delicate texture, and those connected with it. A slow insidious inflammation, marked by a gradual development of the symptoms of disgorging, viz. congestion of vessels, turbid humors, flaccid tunics, and palsied iris, is too often the consequence. The sight, instead of improving, when the immediate effects of the injury are passed away, remains habitually weak and dim, or declines and fades altogether. The advocates for reclinatation seem to forget, that the principle, which is the same in both operations, is the real ground of objection. As to the position of the lens, I suspect less mischief is done by the old method of depression, as less force is required to break a space for the vertical, than the horizontal lens, provided the depression be carried to no greater extent, than is necessary to clear the inferior border of the pupil." (*Synopsis of the Diseases of the Eye*, p. 318.)

The cases, suited to depression and reclinatation, seem to Mr. Middlemore to be those, in which the lens is firm and not particularly large, and where, for various reasons, we cannot with propriety perform, or are unwilling to perform, the operation of extraction. (See *Middlemore on Dis. of the Eye*, vol. ii. p. 157.)

The form of couching-needles should vary according to the object designed to be effected in the operation. The needle, used by the late Mr. Hey, that recommended by Scarpa, and another employed by Beer, are the principal ones.

The length of Mr. Hey's needle is somewhat less than an inch. It is round, except near the point, where it is made flat by grinding two opposite sides. The flat part is ground gradually thinner to the extremity of the needle, which is semicircular, and ought to be made as sharp as a lancet. The flat part extends in length, about an eighth of an inch, and its sides are parallel. From the part where the needle ceases to be flat, its diameter gradually increases towards the handle. The flat part is one-fourth of an inch in diameter. The part which is nearest the handle, is one-twentieth of an inch. The handle, which is three inches and a half in length, is made of light wood, stained black. It is octagonal, and has a little ivory inlaid in the two sides which correspond with the edges of the needle.

Mr. Hey asserts, that his needle will pass through the sclerotic coat with ease; depress a firm cataract readily, and break down the texture of one that is soft. "If the operator finds it of use to bring the point of the needle into the anterior chamber of the eye (which is often the case), he may do this with the greatest safety, for the edges of the needle will not wound the iris. In short, if the operator, in the use of this needle, does but attend properly to the motion of its point, he will do no avoidable injury to the eye, and this caution becomes the less embarrassing, as the point does not project beyond that part of the

needle by which the depression is made, the extreme part of the needle being used for this purpose." (See *Hey's Pract. Obs. in Surgery*.)

Scarpa employed a very slender needle, possessing sufficient firmness to enter the eye without hazard of breaking, and having a point which is slightly curved. The curved extremity of the needle is flat upon its dorsum, or convexity; sharp at its edges; and has a concavity constructed with two oblique surfaces forming in the middle a gentle eminence that is continued along to the very point of the instrument; there is a mark on that side of the handle which corresponds to the convexity of the point. The surgeons of the Leeds Infirmary have had one advantage in the needle, which they have used in imitation of Baron Hilmer; I mean, having it made of no greater length than the purposes of the operation demand. A couching-needle is sufficiently long when it does not exceed, at most, an inch in length; this affords the operator a greater command over the motions of the point, and enables him to judge more accurately, how far it has penetrated the globe of the eye, before he has an opportunity of seeing it through the pupil. When Scarpa's needle is preferred, it should therefore be of no greater length than the operation requires. The needle, here described, will penetrate the sclerotic coat as readily as any straight one of the same diameter, and by reason of its slenderness, will impair the internal structure of the eye less in its movements, than common couching-needles. When cautiously pushed in a transverse direction, till its point has reached the upper part of the opaque lens, it becomes situated with its convexity towards the iris, and its point in the opposite direction; and, upon the least pressure being made with its convex surface, it removes the cataract a little downward, by which a space is afforded at the upper part of the pupil between the cataract and ciliary processes, through which the instrument may be safely conveyed in front of the opaque body and its capsule, which it is prudent to lacerate in the operation. In cases of caseous, bulky, and membranous cataracts, the soft pulp of the crystalline may be most readily divided and broken piecemeal by the edges of its curved extremity; and the front layer of the capsule lacerated into numerous membranous flakes which, by turning the point of the instrument towards the pupil, may be as easily pushed through this aperture into the anterior chamber, where Scarpa finds absorption takes place more quickly, than behind the pupil.

Beer, and many other skilful operators, give the preference to a straight spear-pointed or lance-shaped needle, with cutting edges. Mr. Middlemore prefers this construction, but with the point slightly curved, the neck round, and the surface broad enough to act upon the lens in depression, or reclinatation. (See *Middlemore on Diseases of the Eye*, vol. ii. p. 158.) Scarpa's needle, made quite straight, is an eligible instrument; and Beer's small spear-pointed needle, which is sold at almost every shop for surgical instruments, deserves all the reputation which it possesses.

As Mr. Travers has observed, in all cases of operation with the needle, the employment of a solution of the extract of belladonna in an equal part of distilled water, is a point of the first importance. "The space, included between the

eyebrow and lash, should be thickly painted with the solution once, or oftener, in the twenty-four hours, and this varnish should be preserved moist for a period of half an hour, in order to admit of its absorption. The frequency of the application must be determined by its effect upon the pupil. The preternatural dilatation should not be permanently maintained; for, if it be, the pupil will in all probability be misshapen," after the use of the belladonna has been suspended, and the iris recovered its power. (*Synopsis of the Diseases of the Eye*, p. 322.)

Many operators apply the moistened extract of belladonna to the eyebrow on the evening before, and on the morning of the operation; and, if necessary, also a solution of it to the surface of the eye. (See *Middlemore*, vol. ii. p. 159.) The upper eyelid is to be raised and held steadily against the superciliary ridge by means of the index and middle fingers of the assistant, who stands behind the patient and supports his head, while the operator draws down the lower eyelid himself with the fore and middle fingers of the hand, not engaged with the needle. Supposing the eye about to be operated upon, is the left, the surgeon's fingers, employed for depressing the lower lid, should project a little beyond the margin of the tarsus; the index finger being situated, towards the external canthus, and the middle one towards the caruncula lachrymalis, so that the movements of the eyeball upwards and inwards may be controlled.

The couching-needle (if the curved one be used) is to be held with its convexity forward, its point backward, and its handle parallel to the patient's temple. The surgeon, having directed the patient to turn the eye towards the nose, is to introduce the instrument boldly through the sclerotic coat, at the distance of at least one line and a half from the margin of the cornea, for fear of injuring the ciliary processes. Most authors advise the puncture to be made at about one line, and some even at the minute distance of 1-16th of an inch (*Hæp*) from the union of the cornea with the sclerotic; but as the ciliary processes ought invariably to be avoided, the propriety of puncturing the globe of the eye, one line and half, or two, from the margin of the cornea, as advised by Petit, Platner, Bertrandi, Beer, &c. is probably the best practice. However, Mr. Middlemore prefers one line from the cornea, in order to avoid the ciliary processes, and not a greater distance, lest he should wound the retina. (*On Dis. of the Eye*, vol. ii. p. 162.)

Nor is it a matter of indifference, at what height the needle is introduced, if it be desirable to avoid, as much as possible, effusion of blood in the operation. Anatomy reveals to us, that the long ciliary artery pursues its course to the iris, along the middle of the external convexity of the eyeball, between the sclerotic and choroid coats; and hence, in order to avoid this vessel, it is prudent to introduce the instrument one line below the transverse diameter of the pupil, as Dudell, Guntz, Bertrandi, Beer, Scarpa, &c. have directed. If the couching-needle were introduced higher than the track of the long ciliary artery, it would be inconvenient for the depression of the cataract.

The exact place, where the point of the needle should next be guided, is, no doubt, between the

cataract and ciliary processes, in front of the opaque lens, and its capsule; but as I conceive the attempt to hit this delicate invisible mark borders upon impossibility, and, perhaps, in the common manner of bringing the needle from the posterior chamber to the upper edge of the lens, is never effected without injuring those processes, as Mr. Guthrie positively asserts (*Operative Surgery of the Eye*, p. 270.), I cannot refrain from expressing my dissent to the common method of passing a couching-needle at once in front of the cataract. On the contrary, it seems safer to direct the extremity of the instrument immediately over the opaque lens, and, in the first instance, to depress it a little downward, by means of the flat surface of the needle, in order to make room for the safe conveyance of the instrument between the cataract and corpus ciliare, in front of the diseased crystalline and its capsule; taking care, in this latter step of the operation, to keep the marked side of the handle forward, by which means the point of the needle will be in an opposite direction to the iris, and will come into contact with the diseased body, and the membrane-binding it down in the fossula of the vitreous humour. When this has been done, and the case is a firm cataract, the instrument will be visible through the pupil. Scarpa now pushes its point trans-versely, as near as possible the margin of the lens, on the side next the internal angle of the eye, taking strict care to keep it continually turned backward. He then inclines the handle of the instrument towards himself, whereby its point is directed through the capsule, into the substance of the opaque lens; and, on making a movement of the needle, describing the segment of a circle, at the same instant inclining it downward and backward, he lacerates the former, and conveys it, in the generality of cases, with the latter, deeply into the vitreous humour. Perhaps, the greatest inconvenience of Scarpa's method is that likely to arise from passing the point of the needle into a firm cataract, whereby the opaque body may become fixed on the end of the instrument, and follow it when it is withdrawn instead of remaining below the pupil. Indeed Mr. Guthrie considers it a point of great importance in this operation never to pierce the lens, and that this rule should even be followed, "if necessary, at the expense of the ciliary processes," of which, he thinks, the principal utility terminates with the removal of the lens. (*Operative Surgery of the Eye*, p. 271.) To me, who prefer Scarpa's manner of depressing the cataract a little in the first instance, so as to make room for the passage of the needle between it and the ciliary processes into the posterior chamber, the necessity of even wounding those processes, for the purpose of avoiding to pierce the lens, seems hardly conceivable. At the same time, I believe with Mr. Guthrie, that, in the common practice of moving the needle from the posterior chamber to the upper part of the cataract, the ciliary processes must suffer more or less injury.

Beer, as I have explained, gives the preference to a spear-pointed straight needle, one flat surface of which, at the period of its first introduction into the eye, is turned upwards; the other, downwards; one edge, directed towards the nasal, the other, towards the temporal canthus, and the point towards the centre of the eyeball. Beer prefers this mode of proceeding, in order to avoid moving the

lens too soon out of its natural situation, whereby the subsequent manœuvres of depression or re-clination, he thinks, would be rendered very uncertain and incomplete. He also recommends the surgeon to support his hand in some measure on the patient's cheek, by means of the little finger, so as to have it in his power to check the too sudden and deep entrance of the instrument into the eye, liable to happen when the broadest part of the spear-point has passed through the sclerótica. (*Lehre*, &c. b. ii. p. 354.)

It happened, unfortunately for the credit of the operation of depression, that Petit admonished surgeons to beware of wounding the anterior layer of the crystalline capsule: he had an idea, that, when this caution was observed, the vitreous humour would afterwards fill up the space previously occupied by the lens, and that thus the refracting powers of the eye might become as strong as in the natural state, and the necessity for using spectacles be considerably obviated. But, we are now apprised, that leaving this very membrane, from which Petit anticipated such great utility, even were it practicable to leave it constantly uninjured in its natural situation, would be one of the worst inculcations that could possibly be established: for, in many cases, where extraction proves fruitless; in some, where depression fails; the want of success is owing to a subsequent opacity of the crystalline capsule; in short, blindness is reproduced by the secondary membranous cataract. It seems more than probable, that, in some of the instances, where the opaque lens has been said to have risen again, nothing more has happened than the disease in question. Therefore, notwithstanding the whole capsule in the majority of cases, may be depressed with the lens out of the axis of vision, as it is not a constant occurrence, I cannot too strongly enforce the propriety of extirpating, as it were, every source and seat of the cataract in the same operation; and, in imitation of the celebrated Scarpa, who is entitled to the honour of having first pointed out the great importance of this practice, I shall presume to recommend, as a general rule in couching, always to lacerate the front layer of the capsule, whether in an opaque or transparent state.

The capsule of the lens may retain its usual transparency, while the lens itself is in an opaque state. In this case, an inexperienced operator might, from the blackness of the pupil, suppose, not only that he had removed the lens, but also the capsule from the axis of sight; and, having depressed the cataract, he might unintentionally leave this membrane entire in its natural situation. Therefore, if there should be any reason for suspecting, that the anterior layer of the capsule has escaped laceration; if, in other words, the resistance made to moving the convexity of the instrument forward, towards the pupil, should give rise to such a suspicion; for the sake of removing all doubt, it is proper to communicate to the needle a gentle rotatory motion, by which its point will be turned forward, and disengaged, through the transparent capsule, opposite the pupil: then, by repeating a few movements downward and backward, it will be so freely rent with the needle, as to occasion no future trouble.

Beer divides both the operations of couching and re-clination into three stages: the first is that in which the needle is introduced into the eye;

the second, that in which it is passed into the posterior chamber, and placed across the anterior surface of the cataract; and the third, that in which the depression, or re-clination of the cataract is accomplished.

If a straight, slender, spear-pointed needle be used, and the second stage of the operation be completed by the introduction of the extremity of the instrument into the posterior chamber (which I particularly recommended to be done in the manner directed by Scarpa), then, according to the directions given by Professor Beer, when depression is indicated, the needle is to be immediately carried to the uppermost part of the cataract, with its point directed somewhat obliquely downwards; and with that surface, which, in the first instance, was applied to the front of the lens, now placed upon its superior edge; then the opaque body is to be pushed rather obliquely, downwards and outwards, so far below the pupil, that it can no longer be distinguished. After this has been done, the needle is to be gently raised, in order to see whether the cataract will continue depressed; and, if it be found to do so, the needle is to be withdrawn in the same direction in which it was introduced.

On the other hand, says Beer, when re-clination is to be practised, the needle, after being applied to the front surface of the cataract, is not to be moved further out of the position of the second stage of the operation, but its handle is merely to be raised diagonally forwards, whereby the cataract will be pressed downwards and outwards to the bottom of the vitreous humour, and turned in the manner already specified. Beer has delivered what appears to me one valuable piece of advice for operators on the eye with the needle: whether depression, or re-clination, is to be done, says he, a surgeon can only use this instrument without injurious consequences on the principle of a lever; and every attempt to press with the whole length of the instrument, is not only ineffectual with respect to the progress of the operation, but so hurtful to the eye, that bad effects must follow, as may be readily conceived, when it is recollected how violently the ciliary nerves must be stretched.

As for the modifications of the manœuvres, rendered necessary by the varieties of cataracts, they are (says Beer) so unimportant in all cases of depression, that a young operator will easily understand them himself. But, things are far otherwise in the practice of re-clination; for, when the cataract is a completely formed *capsulo-lenticular cataract*, and the opaque capsule is so thin as to be torn during the turning of the lens, the latter body will, indeed be placed in the intended position at the bottom of the eye, but the capsule itself, which has merely been lacerated, must form a secondary cataract, unless the surgeon, with a sharp double-edged needle, immediately divide it in every direction, and remove it as far as possible from the pupil. When, during re-clination, a *softish lens*, or one which is *pulpy* to its very nucleus, breaks into several pieces, it is necessary, in order not to have afterwards a considerable secondary lenticular cataract, to put the larger fragments separately in a state of re-clination, while the smaller ones may either be depressed, or (if the pupil be not too much contracted) they may be pushed into the anterior chamber, where they will soon be absorbed. When the cataract is *partially adherent to the uvea*, Beer recommends an endeavour to be

first made, with the edge of the needle (which is to be introduced flat between the cataract and the uvea, above or below the adhesion) to separate the adherent parts before the attempt at reclinacion is made. Should it be a cataract, which always rises again as soon as the needle is taken from it, though the instrument has not pierced it at all, the case is termed the *elastic cataract*, in which the lens is not only firmly adherent to its own capsule, but this also to the *membrana hyaloides*. Here Beer thinks, that the best plan is first to carry the needle to the uppermost point of the posterior surface of the lens, and by means of perpendicular movements of the cutting part of the instrument, to endeavour completely to loosen this preternatural adhesion of the cataract to the vitreous humour, when reclinacion may be tried again, and will perhaps succeed. But, says Beer, when the continual rising of the cataract is caused by the operator's running the needle into it, the instrument must either be withdrawn far enough out of the eye to let it be again properly brought into the posterior chamber, when reclinacion may be effectually repeated; or if the cataract be firmly fixed on the needle at the bottom of the eye, the instrument should not be raised again, but, previously to being withdrawn, it should be rotated a couple of times on its axis, whereby the pierced lens will be more easily disengaged from the needle, and at last continue depressed. (*Lehre von den Augenkr.* b. ii. p. 356—358.)

In addition to Beer's directions for couching and reclinacion, the following observations seem to me to merit attention:—

When the case is a *fluid or milky* cataract, the operator frequently finds, that, on passing the point of the couching-needle through the anterior layer of the capsule, its white milky content, instantly flow out: and, spreading like a cloud over the two chambers of the aqueous humour, completely conceal the pupil, the iris, and the instrument from his view; who, however, ought never to be discouraged at this event. Although it seems to me most prudent, to postpone the completion of operations with the needle, in the example of blood concealing the pupil, in the first step of couching, and not to renew any attempt before the aqueous humour has recovered its transparency I am inclined to adopt this sentiment, chiefly because the species of cataract is, in this circumstance, generally unknown to the operator, consequently he must be absolutely incapable of employing that method of couching, which the peculiarities of the case may demand. Speaking of this case, however, Beer says, "The surgeon must hasten the completion of extraction or reclinacion, though possibly the operation may not always admit of being continued; or if gone on with, it must be done, as it were, blindfold." (*Lehre, &c.* b. ii. p. 361.) When a milky fluid blends itself with the aqueous humour, and prevents the surgeon from seeing the iris and pupil, this event is itself a source of information to him, inasmuch as it gives him a perfect insight into the nature of the cataract which he is treating, and instructs him what method of operating it is his duty to adopt. The surgeon, guided by his anatomical knowledge of the eye, should make the curved point of the needle describe the segment of a circle, from the inner towards the outer canthus, and in a direction backward, as if he had to

depress a firm cataract. (*Scarpa.*) Thus he will succeed in lacerating, as much as is necessary, the anterior layer of the capsule, upon which, in a great measure, the perfect success of the operation depends; and, not only in the milky, but almost every other species of cataract.

The extravasation of the milky fluid in the chambers of the aqueous humour, spontaneously disappears very soon after the operation, and leaves the pupil of its accustomed transparency. "In twelve cases of a dissolved lens, on which I have operated," says Latta, "the dissolution was so complete, that, on entering the needle into the capsule of the lens, the whole was mixed with the aqueous humour, and all that could be done was to destroy the capsule as completely as possible, that all the milky matter might be evacuated. In ten of these cases, vision was almost completely restored in four weeks from the operation." Mr. Pott, in treating of this circumstance, viz. the effusion of the fluid contents of the capsule into the aqueous humour, observes that, so far from being an unlucky one, and preventive of success, it proves, on the contrary, productive of all the benefit which can be derived from the most successful depression or extraction, as he has often and often seen.

When the cataract is of a *soft or caseous* description, the particles of which it is composed will frequently elude all efforts made with the needle to depress them, and will continue behind the pupil in the axis of vision. This has been adduced as one instance that baffles the efficacy of couching, and may really seem, to the inexperienced, an unfortunate circumstance. It often happens in the operation of extraction, that fragments of opaque matter are unavoidably overlooked and left behind; yet Richter confesses, that such matter is frequently removed by the absorbents. Supposing a caseous cataract were not sufficiently broken and disturbed in the first operation, and that, consequently, the absorbents did not completely remove it, such a state might possibly require a re-application of the instrument; but this does not generally occur, and is the worst that can happen. It is quite impossible to determine *a priori*, what effect will result from the most trivial disturbance of a cataract; its entire absorption may, in some instances, follow, while, in others, a repetition of the operation becomes necessary for the restoration of sight. Even where the whole firm lens has reascended behind the pupil, as Latta and Hey confirm, the absorbents have superseded the necessity for couching again. The disappearance of the opaque particles of cataracts was, in all times and in all ages, a fact of such conspicuousness, that, as appears from the authority of Barbette and others, it was recorded, even previously to the discovery of the system of lymphatic vessels in the body. Indeed, the modern observations of Scarpa and others, so strongly corroborate the account, which I have given, of the vigorous action of the absorbents, in the two chambers of the aqueous humour, and, particularly, in the anterior one, that, from the moment the case is discovered to be a soft or caseous cataract, it seems quite unnecessary to make any further attempt to depress it into the vitreous humour. Mr. Pott sometimes, in this circumstance, made no attempt of this kind, but contented himself with a free laceration of the capsule, and,

after turning the needle round and round, between his finger and thumb, within the body of the crystalline, left all the parts in their natural situation, where he hardly ever knew them fail of dissolving so entirely, as not to leave the smallest vestige of a cataract. This eminent surgeon even practised occasionally what Beer sanctions, and Scarpa so strongly recommends, at this day; for he sometimes pushed the firm part of such cataracts through the pupil into the anterior chamber, where it always disappeared, without producing the least inconvenience: we must, at the same time, add, that he thought this method wrong, not on account of its inefficacy, but an apprehension that it would be apt to produce an irregularity of the pupil, one of the worst inconveniences attending the operation of extraction. But the deformity of the pupil, after extraction, seems to proceed either from an actual laceration of the iris, or a forcible distention of the pupil, by the passage of large cataracts through it, a kind of cause that would not be present in pushing the broken portions of a cataract into the anterior chamber. Hence, it does not seem warrantable to reject this very efficacious plan of treatment. It is well deserving of notice, that Mr. Hey, who has several times seen the whole opaque nucleus and very frequently small opaque portions fall into the anterior chamber, makes this remark:—"Indeed, if the cataract could, in all cases, be brought into the anterior chamber of the eye, without injury to the iris, it would be the best method of performing the operation." What the same author also observes, in the subsequent part of his work, is strikingly corroborative of the efficacy of Scarpa's practice. The practice of the Italian professor consists, in lacerating the anterior portion of the crystalline capsule, to the extent of the diameter of the pupil, in a moderately dilated state; in breaking the pappy substance of the diseased lens piecemeal; and in pushing the fragments through the pupil, into the anterior chamber, where they are gradually absorbed.

One great advantage of couching, insisted upon by Scarpa, depends upon its generally removing the capsule, at the same time with the lens, from the passage of the rays of light to the retina. Sometimes, however, this desirable event, by which the patient is extricated from the danger of a *secondary membranous cataract*, does not take place. What most frequently constitutes the *secondary membranous cataract*, is the anterior half of the capsule, which not having been removed, or sufficiently broken, in a previous operation, continues more or less entire in its natural situation, afterwards becomes opaque, and thus impedes the free transmission of the rays of light to the seat of vision. Sometimes the *secondary membranous cataract* presents itself beyond the pupil, in the form of membranous flakes, apparently floating in the aqueous humour, and shutting up the pupil: at other times, it appears in the form of triangular membranes, with their bases affixed to the *membrana hyaloidea*, and their points directed towards the centre of the pupil. When there is only a minute membranous flake suspended in the posterior chamber, Scarpa thinks it by no means necessary for the patient to submit to another operation; vision is tolerably perfect, and, in time, the small particle of opaque matter will spontaneously disappear. But when the se-

condary membranous cataract consists of a collection of opaque fragments of the capsule, accumulated so as either in a great degree or entirely to close the pupil; or when the disease consists of the whole anterior half of the opaque capsule, neglected in a prior operation, and continuing adherent in its natural situation, it is indispensable to operate again; for, although, in the first case, there may be good reason to hope, that the collection of membranous fragments might, in time, disappear, yet it would be unjustifiable to detain the patient for weeks and months in a state of anxiety and blindness, when a safe and simple operation would restore him, in a very short space of time, to the enjoyment of this most useful of the senses. In the second case, says Scarpa, it is absolutely indispensable: for while the capsule remains adherent to its natural connections, the opacity seldom disappears, and may even expand over a larger portion of the pupil. He advises the operation to be performed as follows:—When the aperture in the iris is obstructed by a collection of membranous flakes, detached from the *membrana hyaloidea*, the curved needle should be introduced, with the usual precaution of keeping its convexity forward, its point backward, until arrived behind the mass of opaque matter; the surgeon is then to turn the point of the needle towards the pupil, and is to push through this opening regularly one after another, all the opaque particles into the anterior chamber, where, as we have before noticed, absorption seems to be carried on more vigorously than behind the pupil. All endeavours to depress them into the vitreous humour, Scarpa has found to be in vain; for scarcely is the couching-needle withdrawn when they all reappear at the pupil, as if (to use his own phrase) carried thither by a current; but, when forced into the anterior chamber, besides being incapable of blocking up the pupil, they lie, without inconvenience, at the bottom of that cavity, and in a few weeks are entirely absorbed.

When the *secondary membranous cataract* consists of the whole anterior layer of the crystalline capsule, or of several portions of it connected with the *membrana hyaloidea*, Scarpa, after cautiously turning the point of the needle towards the pupil, pierces the opaque capsule: or, if there be any interspace, he passes the point of the instrument through it; then, having turned it again backward, he conveys it, as near as possible, to the attachment of the membranous cataract, and after piercing the capsule, or each portion of it successively, and sometimes carefully rolling the handle of the instrument between his finger and thumb, so as to twist the capsule round its extremity, he thus breaks the cataract, as far as it is practicable, at every point of its circumference. The portions of membrane, by this means separated from their adhesions, are next cautiously pushed, with the point of the couching-needle turned forward, through the pupil, into the anterior chamber. In these manoeuvres, the operator must use the utmost caution not to injure the iris and ciliary processes; for upon this circumstance depends the avoidance of bad symptoms after the operation, notwithstanding its duration may be long, and the necessary movements of the needle frequently repeated. If a part of the membranous cataract be found adherent to the iris (a compli-

cation, that will be indicated when, upon moving it, backward or downward with the needle, the pupil alters its shape, and, from being circular, becomes of an oval, or irregular figure), even more caution is required than in the foregoing case, so as to make repeated, but delicate movements of the needle, to separate the membranous opacity, without injuring the iris. Beer's mode of proceeding in such a case, I have already described.

Scarpa does not deem it necessary to vary the plan of operating above explained, if occasionally the cataract be formed of the posterior layer of the capsule. And, according to this author, the same plan also succeeds in those rare instances, where the substance itself of the crystalline wastes, and is almost completely absorbed, leaving the capsule opaque, and including, at most, only a small nucleus, not larger than a pin's head. Scarpa terms it the *primary membranous cataract*, and describes it as being met with in children, or young people under the age of twenty; as being characterised by a certain transparency, and similitude to a cobweb; by a whitish opaque point, either at its centre or circumference; and, by a streaked and reticulated appearance: he adds, that whosoever attempts to depress such a cataract is baffled, as it re-appears behind the pupil, soon after the operation: he recommends breaking it freely with the curved spear of the couching-needle, and pushing its fragments into the anterior chamber, where they are gradually absorbed in the course of about three weeks.

No other topical application is generally requisite, after the operation, but a small compress of fine linen upon each eye; and the patient ought to be kept in a quiet, moderately darkened room. On the following morning, a dose of some mild purgative salt, such as the sulphate of soda, or magnesia, may usually be administered, with advantage. When the inflammation exceeds the ordinary bounds, then the treatment applicable to ititis becomes proper. (See *Ophthalmy*.)

Beer remarks, that although, after extraction, very cautious trials of the sight are indispensable, they are by no means proper after depression or reclination; for the action of the muscles of the eye, in the inspection of objects at various distances is very liable to make the opaque body rise again. Hence, as soon as the pupil is clear, Beer recommends covering both eyes (even when one only has been operated upon) with a plaster, and simple linen compress, which last is to be fastened on the forehead with a common bandage. The same experienced operator also enjoins perfect quietude of the body and head for some days. The patient, he says, may either lie in bed, or sit in an arm-chair, as may be most agreeable, care being taken to avoid all sudden motions. The most proper food for the patient is such as is easily digested, not too nutritious, and does not require much mastication. Every thing must be avoided, which has a tendency to excite inflammation in the eye. On the third or fourth day, the eye should be opened, and afterwards be merely protected by a green silk eye-screen, which should also be gradually dispensed with. The patient should be careful to do whatever is agreeable to the eye, which has been operated upon, and as carefully avoid every thing which irritates it, or causes a disagreeable sensation in

it, a difficulty of opening the eyelids, or keeping them open, a discharge of tears, or a redness of the white of the eye, &c.

Of the thrombus under the conjunctiva, sometimes caused by the prick of the needle, and of the readily bleeding granulations which occasionally shoot up at the puncture, I need not here particularly speak. For relieving the obstinate vomiting, sometimes excited by injury of the ciliary nerves, or that of the retina, Beer recommends castor, musk, and opium, except when the eye is in a state of inflammation, in which circumstance, antiphlogistic treatment is preferable. Such vomiting, Beer joins other writers in believing, is often produced by a firm lens being depressed too far, so as to injure the retina; a case, however, which is usually combined with a suddenly produced, complete, or incomplete amaurosis. Here, unless the position of the lens can be changed by a sudden movement of the head, the above class of medicines will be of no use. This kind of amaurosis may also take place, without any vomiting, and, as Beer has had opportunities of remarking, it will not always subside, even though the cataract be made to rise again. The same amaurotic affection may also result from the surgeon hurting the retina by pushing the needle too deeply against this membrane. According to Beer, the ophthalmia, liable to happen in these cases, as well as after extraction and keratonyxis, is always most severe in the iris and neighbouring textures. (*Von den Augenkr. b. ii. p. 361—363.*)

I cannot help remarking how judicious it is never to attempt too much at one time in any mode of couching. It happens in this, as in most other branches of operative surgery, that celerity is too often mistaken for skill: the operator should not only be slow and deliberate in achieving his purpose; he should be taught to consider, that the repetition of couching may, like the puncture of a vein, be safely and advantageously put in practice again and again; and with far greater security than if, for the sake of appearing expeditious, or avoiding the temporary semblance of failure, a bolder use of the couching-needle should be made, than the delicate structure of the eye warrants. We read, in Mr. Hey's *Practical Observations on Surgery*, that he couched one eye seven times, before perfect success was obtained; had he been less patient, and endeavoured to effect by one or two rough applications of the instrument, what he achieved by seven efforts of a gentler description, it is highly probable, that the structure of the eye would have been so impaired, as well as the consequent ophthalmia so violent, as to have utterly prevented the restoration of sight.

All the various methods of couching having now been described, I subjoin the sentiments of Beer, respecting the circumstances, by which the choice of depression, or reclination, ought to be regulated. According to this author, when the cataract is very firm, or moderately so, with a scabrous surface, or the case is what has been already described under the name of *encysted cataract*, or when the cataract consists of any tough membrane, both depression and reclination can only be a palliative remedy; for, says he, none of these cataracts after the operation can be dissolved and absorbed, but must remain in

the eye, as a foreign unorganised body, ready at every opportunity to rise again, and partially or completely blind the patient anew. Beer assures us, that he has carefully examined the eyes of persons after death, on whom depression or re-clination had been practised, in some instances, years previously; but, in almost all the examples, the lens was found firm and undissolved, or at most only diminished, with or without its capsule. Membranous cataracts were very trivially lessened; though they had quite lost their rough consistence, and were changed into a firmish white mass. In a living person, Beer says, he saw an instance, in which a cataract rose again after it had been depressed by Hilmer thirty years previously: it was small, angular, and, when the pupil was dilated, it floated from one chamber of the eye into the other. When extracted, which was done with complete success, it was found to be almost ossified. In 1805, Beer extracted from a woman, forty years of age, a very large, hard, yellowish-white lenticular cataract, which had been in the anterior chamber twenty-six years. The lens had been thus displaced by a blow received on the eye from the branch of a tree. Nor has Beer ever yet seen a case, in which a cataract of a semi-firm consistence was dissolved and absorbed. (*Von den Augenkr.* b. ii. p. 363.) In old subjects, absorption is excessively languid, and the lens often very hard. Dupuytren, who admits these facts as arguments against the use of needles, states that he had seen examples, where the lens, after it had been displaced, more than two years, was completely unchanged. Yet, in many old persons, extraction is rendered difficult by the sunk state of the eye, and the prominence of the border of the orbit. (See *Clin. Chir.* t. i. p. 45.) Had Beer confined his statements to what happens to certain cataracts, on which depression or re-clination, strictly so called, had been practised, I should have been disposed to accede to the general assertion, respecting the great length of time which a firm or tough capsular cataract remains in the vitreous humour, undissolved and unabsorbed. But, if he mean, that the same thing is generally the case with cataracts broken piecemeal, and placed in the aqueous humour, we know, that such a representation is contradicted by the experience of an infinite number of the highest authorities in surgery. Nay, notwithstanding the case adduced of a bony lens having remained in the aqueous humor twenty-six years, I am disposed to think, that Beer himself does not intend to question the absorption of the fragments of cataracts in the aqueous humour, particularly as at p. 357. b. ii. he sanctions pushing the fragments of semi-firm cataracts through the pupil into the anterior chamber, where, he confesses, that they are soon absorbed.

Beer thinks, that, in general, depression and re-clination are indicated only in cases, in which extraction is absolutely impracticable, or attended with too great difficulty, as will be better understood when this operation is considered. As examples of this kind, Beer specifies an extensive adhesion of the iris to the cornea; a very flat cornea, and, of course, so small an anterior chamber, that an incision of proper size in the cornea cannot be made; a broad arcus senilis; an habitually contracted pupil (incapable of being artificially dilated); an eye much sunk in the orbit, with a small fissure between the eyelids; eyes

affected with incessant convulsive motions; a partial adhesion of the cataract to the uvea; unappeasable timidity in the patient; and an impossibility of managing him during and after the operation, in consequence of his childhood or stupidity. Amongst the circumstances, enumerated by Mr. Middlemore as rendering the operation of depression, or re-clination more advantageous than extraction, is an emaciated feeble condition of the patient, which, if the latter operation were performed, might interfere with the union of the wound in the cornea, and be followed by ulceration, sloughing, and staphyloma of that texture. (See *Middlemore on Dis. of the Eye*; vol. ii. p. 111.) The same gentleman also expresses his opinion, that in certain examples of hard cataract, where extraction cannot be performed with propriety, re-clination is generally preferable, to depression, because not so likely to be followed by a rising of the lens again, or to cause pressure on the retina. He adds, indeed, direct depression of the lens beneath the pupil is very seldom practised now, as it is in a great measure superseded by extraction and re-clination. (p. 112.)

With regard to the question whether depression or re-clination should be preferred, Beer is of opinion, that the first method is indicated only when the dimensions of the cataract are small, and, consequently, when there is room enough for it to be placed below the pupil without the ciliary processes being torn from the annulus ciliaris. Such cases are the *dry siliquose cataract* (the *primary membranous cataract*, of Scarpa), when perfectly free from adhesions to the uvea; the *true lenticular secondary cataract*, produced by the small but firm fragments of the lens having been left, or risen again; and the genuine *secondary membranous or capsular cataract*. On the other hand, re-clination is to be preferred, when, together with the above objections to extraction, the surgeon has to deal with a fully formed, very *hard lenticular or capsulo-lenticular cataract*; or with a case of the latter kind, complicated with partial adhesions to the uvea; or when the case is a *secondary capsular cataract*, similarly circumstanced; a *secondary cataract of lymph*; a *gypsum cataract*; or there is reason to apprehend a considerable tendency in the blood-vessels of the interior of the eye to become varicose. (*Lehre von den Augenkr.* b. ii. p. 365.)

The manner of operating with the needle upon the congenital cataracts of children will be hereafter explained.

The operation, most frequently performed in the United States, is that of passing the needle of Adams, Scarpa, Saunders, or Hey through the sclerotic, immediately behind the iris, and then lacerating the capsule, or the lens itself, and permitting the aqueous humour to act upon it, either by pressing the fragments of the lens through the pupil into the anterior chamber, or, where this is impracticable, leaving them *in situ*. One of the most successful operators in the United States, is Dr. John Harper, of Baltimore, and he seldom adopts any other operation, than this, which he repeats, as often as necessary, on the same eye. In the case of a young lady, Dr. Reese performed it on both eyes at once, and to promote absorption gave her the blue pill: in three weeks, her vision was restored, although she had been blind twelve years. Depression seems to have but few advo-

cates in the United States; nor is extraction often preferred there, even for hard cataracts. (See *Reese*, in *Amer. ed. of this Dict.*)

EXTRACTION OF THE CATARACT.

From some passages in the works of Rhazes, Haly, and Avicenna, specified by Mr. Guthrie, it is sufficiently clear, that the practice of opening the cornea for the removal of cataracts was not unknown to the ancients. Rhazes says, that about the end of the first century, Antyllus opened the cornea, and drew the cataract out of the eye with a fine needle, in which practice he was followed by Lathyrion. However, while doubts were entertained, respecting the true seat of the cataract, it is hardly to be supposed, that this mode of treatment could have been frequently adopted; but, as soon as it was fully proved, that the true cataract was an opacity of the crystalline lens; that the loss of sight would not be occasioned by the removal of this body, that the cornea might be divided without danger; and that the aqueous humour would be quickly regenerated; the mode of cure, by extracting the cataract out of the eye, would naturally present itself. (*Wenzel*.)

Freitag is perhaps the first in modern times who made an attempt to extract the cataract. This was about the close of the 17th century. After him, Lotterius, of Turin, performed the operation. But nobody has so strong a claim as M. David to the honour of bringing the merits of the practice before the public; and he not only adopted it himself, but published the first good description of it. (*Sur une Nouvelle Methode de guérir le Cataracte par l'Extraction du Cristallin*, 1747. *Also Mémoires de l'Acad. Royale de Chirurgie*, t. ii. 4to. 1753.) Two cases in which the cataract had accidentally slipped through the pupil into the anterior chamber, whence they were extracted in the years 1707 and 1708 by Mory and Petit, as related by St. Ives, seem to have had considerable influence in bringing about the regular performance of this method of removing the cataract; for, they served as an encouragement to David, by whom the practice was completely established. The operation was afterwards brought considerably nearer to perfection by the ingenuity and industry of Wenzel. (*Brannalla Instrumentarium Chir. Austriacum*, 1762, p. 71.)

Indeed, with the valuable instructions, which Ware and Beer have still more recently furnished, the extraction of the cataract may now be regarded as brought to the highest state of improvement. According to Beer, it admits of division into three stages, the first of which, as in depression and reclination, is the most important; because, unless it be performed exactly as it ought to be, the operation would be very liable to fail, and it is exceedingly difficult to make amends for any fault committed in this early part of the proceedings. The first stage consists in making an effectual incision in the cornea with a suitable knife. The dividing the anterior layer of the capsule, says Beer, should not be merely done with a blunt instrument, but by a two-edged lancet-pointed needle, as possible, annihilated. In the expulsion of the cataract from the eye is effected either by the well-regulated action of the eyeball itself, or by the assistance of art.

But, as Beer remarks, they who have learned the manner of effectually and skilfully cutting the cornea, will frequently have the pleasure to find the two last stages beneficially converted into one, and the operation in general soon and expeditiously completed. (*Von den Augenkr.* b. ii. p. 366.)

On the evening, prior to the operation, and also the next morning, belladonna should be applied to the eyebrow, to produce an expansion of the pupil. This is much better, than dropping the solution of belladonna into the eyes, which has a tendency to render them irritable, and sometimes, in spite of every precaution, a little of the belladonna may remain in the folds of the conjunctiva, and insinuate itself between the edges of the incision in the cornea. The dilatation of the pupil will lessen the risk of the iris being wounded, and will enable the operator to pass the knife with greater certainty and celerity across the anterior chamber. When the pupil is small on the morning of the operation, Mr. Middlemore drops a strong solution of extract of hyoscinus (one drachm to an ounce of water) into the eyes, as suggested by Huxley and Wshart. By the agency of these drops, the pupil becomes largely dilated, with much less pain than follows the use of belladonna drops. (*See Middlemore on Dis. of the Eye*, vol. 2, p. 128.)

The knives, used by Richter, Wenzel, Ware, and Beer, are all of them more or less different; but, they agree in the common quality of completely filling up the wound, as it is extended, so that none of the aqueous humour can escape before the division of the cornea is finished.

Wenzel's knife resembles the common lancet employed in bleeding, excepting that its blade is a little longer, and not quite so broad. Its edges are straight, and the blade is an inch and a half (eighteen lines) long, and a quarter of an inch (three lines) broad in the widest part of it, which is at the base. From this part it gradually becomes narrower towards the point; so that the breadth of a quarter of an inch extends only to the space of about one-third of an inch from the base; and, for the space of half an inch from the point, it is no more than one-eighth of an inch broad.

The knife employed by the late Mr. Ware, is, in regard to its dimensions, not unlike that employed by Wenzel. The principal difference is, that it is less spear-pointed; in consequence of which, when this latter instrument has transfixed the cornea, its lower or cutting edge will sooner pass below the inferior margin of the pupil, than the knife used by Wenzel. On this account, Mr. Ware believed, that the iris would be less likely to be entangled under the knife which he recommended, than under Wenzel's, when the instrument begins to cut its way downwards, and the aqueous humour is discharged. Mr. Ware particularly advises great care to be taken to let the knife increase gradually in thickness from the point to the handle; by which means, if it be conducted steadily through the cornea, it will be next to an impossibility, that any part of the aqueous humour can escape, before the section is begun downwards; and, consequently, during this time, the cornea will preserve its due convexity. But if the blade should not increase in thickness from the point, or if it be incurvated much in its back or edge, the aqueous humour

will unavoidably escape, before the puncture is completed; and the iris, being brought under the edge of the knife, will be in great danger of being wounded by it. One of the best cataract knives is that employed by Beer. A double cataract knife is used by Jaeger. "It is composed of a Beer's blade affixed to a handle; a smaller blade, of the same form, having its flat side in contact with the other knife; and a button screw. When not in use, the second blade is situated within the outline of the first, with which the cornea is transixed. It is introduced in the same way as Beer's knife, not parallel, but nearly perpendicular to the cornea, and afterwards carried across the eye, exactly like the single knife, with the posterior surface of the fixed blade parallel to the iris, at the usual distance from the junction of the cornea with the scleroticum. When the point of the greater knife has transixed the cornea at the inner side, pressure is made on the button-head of the smaller blade, which slides in a groove in the upper part of the handle, with the thumb, with which it is pushed steadily forward, whilst the greater blade keeps the ball firmly fixed, and thus the section of the cornea is completed," &c. (See *Loudon's Short Inquiry into the Principal Causes of the Unsuccessful Termination of Extraction*, &c. 1826.) Amongst the advantages imputed to Jaeger's knife are those of not injuring parts at the inner angle; of not making the incision too small for the extraction of the lens, and of less of the aqueous humour being discharged previously to the iris being out of danger. Baron Graefe uses also a knife of his own invention, the end of which is a little curved, so that when it has passed through the cornea, it is calculated to draw the eye in any desirable direction more surely. The sentiments of Richter, Scarpa, Beer, and others, about the position of the patient in the operation, and the mode of fixing the eye, have been already noticed in a foregoing section.

The operator is to sit in front of the patient, but upon a considerably higher stool, or chair than the latter, as already explained, and his legs are to be placed on each side of the patient, and his right foot sufficiently raised by a stool for his elbow to rest upon his knee, whilst the knife is on a level with the patient's eye. (See *Guthrie's Operative Surgery of the Eye*, p. 295.)

When the right eye is to be operated upon, and the operation is to be done according to the preceding directions, the surgeon must of course use his left hand: but if he be not an ambidexter, "the patient must be placed on his back on a table, or on a mattress, or a firm bedstead with a head, so that the operator can stand behind without inconvenience. The head being supported on a cushion, the operator raises the upper eyelid himself, and fixes the eyeball, whilst an assistant depresses the lower lid, if necessary. The incision is then to be made with the same precaution, as in the other method, the knife being held with its edges towards the thumb, and the little finger towards the temple, instead of the cheek. The division of the cornea upwards in this manner is the operation generally preferred by Mr. Alexander for both eyes, when not specially contraindicated." (*Guthrie*, p. 318.) In an operation which I lately saw this gentleman perform, he stood behind a kind of easy chair, on the upper part of the back of which he kept the head steadily

supported while he divided the upper segment of the cornea. As a general rule, Mr. Guthrie thinks that the operation of extraction should always be done upwards, and this regulates the position of the patient and surgeon. The former, he observes, should be seated in an arm-chair, the back of which should be low enough to support the head when gently inclined backwards. (*On the Certainty, &c. of Extraction*, p. 9.) For the operation on the right eye, Mr. Guthrie recommends the surgeon to place himself behind the patient, and observes, that he will usually find it necessary to stand on a stool, in order to raise himself to such a height that he may readily lean over, and have his hands in that position which is most convenient to him. The patient's head being a little inclined backwards, and duly supported by the cushion, or back of the chair, the surgeon, leaning over from behind, brings the two forefingers of the left hand over the forehead gently down on the eyelid, and raises it up tenderly, so as to fix it against the upper edge of the orbit, and to retain it there perfectly with the end of the index finger only. He should be able to do this, and also to make a little pressure on the eyeball, in order to fix it at the moment the incision is begun. As soon as the index finger, is in this position, the second finger moves the upper and lowers the under lid, fixing it against the edge of the orbit below. "The left eye may be opened, and fixed in a similar manner: or the surgeon, standing before the patient, raises the upper lid with the side of the forefinger of the left hand, and depresses the under lid with the thumb, the hand being over the nose." (*Guthrie*, *Op. cit.*, p. 9.) This gentleman prefers leaving the other eye uncovered.

When the patient is placed in the sitting posture, and syncope occurs, the completion of the operation may be prevented. Dupuytren used to place his patients in bed. The recumbent position is thus spoken of by Ware. "It appears to me (says he) that the surgeon will perform the operation with more composure, if the patient be laid on a table, than if he be seated in a chair; but, except in infants, this is not indispensable, if the patient's steadiness can be depended upon," (p. 372.) Another writer observes, that, if the patient be placed in the recumbent posture, the head is prevented from receding, and the operator can rest his elbow upon the table, support his arm upon the patient's chest, and his hand upon his cheek. (*Middlemore on Dis. of the Eye*, vol. ii. p. 130.) This gentleman follows the most common plan of covering the eye, which is about to be operated upon, with a roller or some light bandage.

The danger likely to arise from undue pressure, Mr. Ware observes, can only take place after the instrument has made an opening in the eye; but the pressure ought to be removed the instant the knife is carried through the cornea, and before any attempt is made to divide this tunic downwards. To understand this subject better, however, the reader should know, that Mr. Ware divided the incision of the cornea into two distinct processes; the first of which may be called *punctation*, and the second *section*. So long as the knife fills up the aperture, in which it is inserted, that is, until it has passed through both sides of the cornea, and its extremity has advanced some way beyond this tunic, the aqueous humour cannot be dis-

charged, and pressure may be continued with safety. The punctation of the cornea being completed, the purpose of pressure is fully answered: and, if such pressure be continued, when the section of the cornea begins, instead of being useful, it will be hurtful. Mr. Ware recommends the cornea to be cut in the following way:—

The operator is to place the fore and middle fingers of the left hand upon the tunica conjunctiva, just below, and a little on the inside of the cornea. At the same time, the assistant, who supports the head, is to apply one, or, if the eye projects sufficiently, two of his fingers upon the conjunctiva, a little on the inside and above the cornea. The fingers of the operator and assistant, thus opposed to each other, will fix the eye, and prevent the lids from closing. The point of the knife is to enter the outside of the cornea, a little above its transverse diameter, and just before its connection with the sclerotica. Thus introduced, it is to be pushed on slowly, but steadily, without the least intermission, and in a straight direction, with its blade parallel to the iris, so as to pierce the cornea towards the inner angle of the eye, on the side opposite to that which it first entered, and till about one-third part of it is seen to emerge beyond the inner margin of the cornea. When the knife has reached so far, the punctation is completed. The broad part of the blade is now between the cornea and the iris, and its cutting edge below the pupil, which of course is out of all danger of being wounded. As every degree of pressure must now be taken off the eyeball, the fingers, both of the operator and his assistant, are instantly to be removed from this part, and shifted to the eyelids. These are to be kept asunder by gently pressing them against the edges of the orbit; and the eye is to be left entirely to the guidance of the knife, by which, says Mr. Ware, it may be raised, depressed, or drawn to either side, as may be found necessary. The aqueous humour being now partly, if not entirely evacuated, and the cornea of course rendered flaccid, the edge of the blade is to be pressed slowly downward, till it has cut its way out, and separated a little more than half the cornea from the sclerotic, following the semi-circular direction, marked out by the attachment of the one to the other. (Ware.)

In the eyes of some persons, the iris is so convex, that it is almost impossible to complete the section of the cornea, without entangling the iris under the edge of the knife, unless the cornea be gently rubbed downward with the finger; one of the most important directions, according to Mr. Ware, in Wenzel's whole book. However, it is alleged by Mr. Guthrie that the iris will not be disentangled unless something more be done, and this is to raise the eye, or to draw it as were, out from the orbit, whilst the cornea is pressed flat against the blade of the knife. (*On the Certainty, &c. of Extraction*, p. 23.)

If the edge of the knife should incline too much forward, and its direction be not altered, the incision in the cornea will be too small, and terminate almost opposite the pupil. In this case there will be great difficulty in extracting the cataract, and the cicatrix afterwards may obstruct sight. If, on the contrary, the edge of the instrument be inclined too much backward, and its direction be not changed, the incision will approach too near the part where the iris and sclerotic unite, and

there will be great danger of wounding them. These accidents may be prevented by gently rolling the instrument between the fingers, until the blade takes the proper direction. (Wenzel.)

The late Mr. Ware had seen operators, through a fear of wounding the iris, introduce and bring out the instrument at a considerable distance before the union of the cornea and sclerotic; in consequence of which the incision from one side of the cornea to the other was made too small for the easy extraction of the cataract, although, from above downward, it was fully large enough for this purpose. Mr. Ware also sometimes observed, that though the punctation of the cornea, from side to side, had been properly conducted, and its section afterwards, to all appearance, effectually completed; yet, on account of the frictions, employed to disengage the iris from the edge of the instrument, the knife, in cutting downward, was carried between the layers of the cornea, and, consequently, though the incision appeared, externally, to be of its proper size, internally it was much too small for the cataract to be easily extracted. In this case, the incision must be enlarged, by means of a pair of curved blunt-pointed scissors, which should be introduced at the part where the knife first entered the cornea. (Ware.)

Beer subdivides the first stage of this operation into four, each of which, he says, claims the utmost attention, if it be wished to make the incision in the cornea in every respect proper: the first is the introduction of the knife through the cornea into the anterior chamber; the second is directing the knife towards the place where its point is to be brought out again; the third is bringing out the point, and guiding the knife in continuing the incision in the cornea; and the fourth is the finishing of that incision. As Beer states, a completely well-made incision in the cornea, must, in the first place, be of sufficient size, to let the cataract escape from the eye without the slightest impediment, and it will be large enough, if care be taken to open one-half of the cornea near its edge. Secondly, It must be of a proper shape, its margin not being triangular, nor notched, but evenly rounded. In general, says Beer, no greater disadvantage can happen, than that of having too small an incision in the cornea; for even when the cataract is pressed out of such an opening, portions of it are always left behind, which afterwards cannot be extracted without trouble; and though the sight may be at the moment restored, it will be fortunate, if the eye be not afterwards spoiled by the effects of inflammation. When the incision is triangular, or notched, its edges cannot be put smoothly together so as to be healed by the first intention, which, however, is highly necessary, and the consequence is a white ugly scar, which is slowly produced with inflammation, and forms a greater or lesser permanent impediment to vision downwards, though the patient be capable of seeing the smallest objects, which are straight before him.

According to Beer, when the knife is to be introduced, its point should enter the cornea, about one-eighth of a line from its edge, and one-fourth of a line above its transverse diameter, directed obliquely towards the iris, with its edge turned downwards, by which means the point will pass immediately into the anterior chamber. As soon as it has arrived there, which is indicated partly by its bright extremity being seen within

the space in question, and partly by the *tactus eruditus*, such a direction is to be given to it, that its point may project from the place of its entrance nearly in a direct line towards the intended place of its exit out of the cornea, but a little higher; while the posterior surface of the blade is to be conveyed across the anterior chamber exactly parallel to the iris. The knife is to be cautiously pushed on, neither too quickly, nor too slowly, with its point continually directed somewhat upwards above the part, where it is to pass out again, until the point arrives near the inner edge of the cornea; but, in the transverse passage of the knife, its edge should not be suffered either to go nearer to, or further from, the iris, as every turn of the blade backwards, or forwards, opens the upper angle of the wound, when the aqueous humour immediately escapes, and the iris not only falls close against the posterior surface of the blade, but, sometimes even under the edge, so as to throw the young operator into the greatest embarrassment. If the point of the knife has now been favourably brought out, the surgeon is to continue to push it on, without pressing it downwards, or making a sawing motion with it, until the last stage of the operation, viz. that in which the incision is finished. However, as soon as the point of the knife has passed out of the cornea, and reached the inner canthus, attention must be paid, first, to that part of the blade which is yet in the anterior chamber, so that the iris may not fall under its edge, and the knife may not take an erroneous direction. Secondly, to the point of the knife, which continually projects more and more, so that the inner canthus may not be wounded, which accident, though trivial in itself, would make the unprepared patient suddenly and involuntarily draw back his head. The only way of preventing this injury, says Beer, is regularly to incline the handle more backwards and downwards, in proportion as the point passes further out of the anterior chamber. Thirdly, At the period when the last piece of the cornea is to be cut, the knife should be pushed on very slowly, for otherwise the lens, and with it a part of the vitreous humour, may be discharged, as now the muscles of the eye are acting, and compressing this organ with the greatest force, and in old persons especially, the loose conjunctiva, after the cornea is cut through, comes against the knife, and is apt to be wounded. At the time when the operator finishes the incision in the cornea, the assistant is to let the upper eyelid cover the eye, and a few seconds are to be allowed for the patient to recover from his fright.

In the second stage of the operation, Beer directs the assistant again steadily to hold the patient's head in the same manner, as during the cutting of the cornea; but, the upper eyelid, he says, must be carefully and effectually raised, without touching the eyeball in the least, or letting the ends of the fingers project beyond the edge of the tarsus. The operator is to depress the lower eyelid with his forefinger, which is not to be removed away from the eye, but gently applied to the lower part of it with the intervention of the eyelid, by which means the cataract-lance, or capsule-needle, may be more readily and easily introduced under the flap of the cornea into the pupil, while the eye pressure, and the projection of the cataract, thereby produced, considerably enlarge the pupil, and facilitate the proper division of the capsule.

In order to complete the latter object, the surgeon introduces one of the sharp edges of the capsule-needle, with the point directed towards the inner canthus, between the cornea and the iris, the wound in the former of these membranes being opened as little as possible, lest the atmospheric air enter the eye; a circumstance of which Beer entertains great apprehension. After the capsule-needle has been cautiously passed to the inferior margin of the pupil, its lower sharp edge is to be applied to the capsule of the lens with its point directly upwards, and one of its flat surfaces towards the inner, and the other towards the outer canthus. The operator is now strictly to cut through the capsule, by making, at small distances from one another, repeated perpendicular strokes with the edge of the needle. Then the handle of the instrument is to be half turned round on its axis, and similar strokes are to be made with its edge in a somewhat oblique direction, by which means the anterior layer of the capsule will be cut into many squarish fragments; some of which, in the third stage of the operation, are taken out of the eye together with the cataract, and the risk of a secondary cataract of the anterior layer of the capsule is in a great measure removed. When the capsule-needle has done its business, it is to be withdrawn from the eye in the same position in which it was introduced, and the second stage of the operation is thus finished. (*Beer, b. ii. p. 369.*)

I believe no better instructions than the foregoing can be delivered, respecting the most advantageous method of dividing the capsule. They are infinitely better than those given by Wenzel and Ware. As soon as the point of the cornea-knife had arrived opposite the pupil, Wenzel used to incline it gently backward, and thus puncture the capsule.

For dividing the capsule after the division of the cornea, Wenzel and his father used to employ a flat needle, one-twelfth of an inch in diameter, having its cutting extremity a little incurvated. This needle, which they advised to be made of sealed gold, in order that its pliability may allow the operator to bend it in different directions, as occasion requires, is fixed in a handle, two inches and a half in length, and similar to that of the cornea-knife. At the other extremity of the same handle a small curette, or scoop, is fixed, made of sealed gold, which is of use for extracting the cataract.

The late Mr. Ware's method of opening the capsule will be hereafter noticed.

When the incision in the cornea has been completed, and the capsule effectually divided, the cataract, as Beer observes, advances into the pupil immediately behind the capsule-needle, and, if there be the least action in the eye itself, it is generally at once discharged. Under these very favourable circumstances, however, it sometimes happens, that a portion of the gelatinous or scabrous surface of the cataract is detached at the margin of the pupil, as the opaque body is passing out, and, therefore, in the second stage of the operation, Beer recommends having David's scoop always ready, which is to be substituted for the capsule-needle, and employed for preventing the loose fragments from falling back into the posterior chamber in the following manner: — As soon as the operator remarks, that, in the passage of the cataract out of the pupil, a portion of it will be scraped off by the edge of that opening, he should

introduce the scoop at the lower and outer edge of the cataract upwards, between the cornea and the iris, so as to be able to keep the part of the cataract, which is ready to break off, close up behind the rest of it, and bring the whole out of the eye.

But says Beer, when the third stage of the operation, viz. the removal of the cataract from the eye, cannot be so readily accomplished; a circumstance, not always owing to an imperfection in the incision in the cornea, or in the division of the capsule, but sometimes proceeding from a want of proper action in the eye itself; the operator, if he feels convinced that the fault does not lie in the first or second stage of the operation (in which case, it would be necessary to endeavour to rectify what is wrong), should assist in promoting the discharge of the cataract. There are two manners of doing this, and it is not a matter of indifference which is selected; for, the second should be adopted only when the first will not answer. Hence, says Beer, the operator like a skilful accoucheur, must first trust to the action of the organ itself, which he should in a certain degree excite, and not proceed immediately to the use of a scoop, hook, or forceps. The eye is to be suffered to turn quickly a few times upwards, and in general, during these movements, the surgeon will perceive, that the lower edge of the cataract advances further through the pupil, and, at length, slips out of the eye, without the aid of instruments. If, at this period, a portion of the cataract were found to be likely to break off, the employment of Daviel's scoop, in the way already explained, would be proper. Or the other hand, if during the protracted movements of the eye upwards, this organ evince little energy of its own, the cataract will not enter the pupil, or scarcely do so, much less pass out of the eye, and the operator is under the necessity of resorting to manual assistance, and with the end of the finger, used for keeping the lower eyelid depressed, he is gently to press the lid against the lower part of the eyeball. Such pressure should be gradually increased until the greatest diameter of the cataract has passed into the pupil, at which moment, the pressure must not be discontinued, before the cataract is completely out of the eye, which object may be promoted by supporting the lower part of the lens with Daviel's scoop, and then the pressure is to be diminished in the same gradual way in which it has been previously augmented. Immediately the cataract is completely out of the eye, and the surgeon has paid due attention to the removal of any fragments left behind, the assistant is to let the upper eyelid descend, the patient is to be desired to keep both his eyes shut and perfectly still, and his head and eyes are to be covered with a clean white piece of linen, so that the effect of the light may be moderated.

When the patient has recovered from the alarm, which, according to Beer, the passage of the cataract outwards, especially when it is large and firm, always produces in a greater or lesser degree, he is to be placed with his back towards the window, and the linen is to be raised a little from the eye, which is to be very slowly opened, while the other eye, which has not been operated upon, is to be kept well covered. Beer says, that the patient should then be shown some objects, not of a shining or very bright description, at different dis-

tances; and, if he is able to see them plainly, the surgeon may proceed to apply the dressings without delay.

Beer confesses, that, if possible, it would be better to dispense altogether with making any trials of the power of the eye, which has just been operated upon, because such attempts must tend to increase the subsequent inflammation in the organ; yet he is of opinion, that these trials of the eyesight are necessary after extraction of the cataract. First, Because the capability of seeing immediately is a thing always expected by the patient and his friends, and leaving them in ignorance on this point would keep up an anxiety likely to have a bad effect in rendering the ophthalmia more severe. Secondly, Beer urges, as a stronger motive for the custom, the circumstance of the patient seeing, when his eye is first opened, all, even the smallest objects, though he suddenly loses the faculty of distinguishing them at all, or sees them very obscurely; and, now, if he be half turned with his face towards the window, one will find in the pupil, which directly after the passage of the cataract was perfectly clear, some soft or firm fragments of the lens, which are first dislodged from within the capsule by the variations in the eye, produced by the inspection of different objects at different distances, and which, without these trials of vision, would be long in being loosened by the aqueous humour, and might form a secondary lenticular cataract; which will not now be the case, as the surgeon can and ought at once to remove them. (*Lehre von den Augenkr.* b. ii. p. 373.)

The preceding mode of operating, as Beer observes, will not answer for every case of cataract, adapted to extraction; the plan sometimes requires to be modified according to circumstances. Thus, according to the same writer, when the eye is very prominent, and particularly when at the same time the fissure of the eyelids is extremely narrow, the incision in the cornea must not be made horizontally, but obliquely outwards; for otherwise the edge of the lower eyelid will retard the healing of the wound, and an ugly cicatrix, more or less injurious to the eyesight, be the consequence.

When the cataract is of middling consistence, neither very hard, nor soft, Beer assures us, that the attempt ought to be made to extract the cataract and the capsule together, (*Methode den grauen Star Sammt der Kapsel auszuziehen*, &c. Wein, 1799.) In such a case, he says, the experiment will mostly succeed, if properly conducted, and, if it should not, it causes not the slightest detriment to the eye, nor the least obstacle to the effectual completion of the operation. The capsule-needle is to be introduced into the pupil, as in the second stage of the operation, and its point is then to be slowly pushed, as far as its greatest diameter; into the centre of the lens, so that one surface of the needle may be upwards, the other downwards, one of its cutting edges turned towards the inner canthus, the other towards the outer one. And now the needle, with the impaled cataract is to have sudden, but short perpendicular jerks communicated to it, by which means, the upper and lower connections of the capsule with the neighbouring textures will be in part loosened. The needle is next to be suddenly moved, without withdrawing it from the cataract, so that one of its flat surfaces may face the inner canthus, the other, the

outer one; and one of its edges may be turned upwards, the other downwards; and then the short sudden jerks of the needle in the horizontal direction may be repeated for the purpose of breaking, as much as possible, the lateral connections of the capsule. Lastly, The capsule-needle is to be quickly withdrawn from the eye, when it is mostly followed by the lens and the capsule, or the cataract comes away fixed on the point of the instrument, at which moment the pupil becomes perfectly clear and black. When the cataract does not follow the removal of the needle, the surgeon is to proceed with the usual cautions to the third stage of the operation. Great as the advantage would always be of extracting the cataract together with its capsule, it is plain, that the attempt is not practicable when the case is a hard lenticular cataract; because the capsule-needle cannot be effectually introduced into the body of such a lens, situated upon the yielding vitreous humour. Nor would the plan answer, if the cataract were very soft, as the movements of the needle in it could have no effect in breaking the connections of the capsule. Mr. Lawrence has often expressed to me his decided opinion, that the foregoing method will rarely succeed, and ought not to be attempted; which is also Mr. Guthrie's judgment. (*Operative Surgery of the Eye*, p. 308.)

In the case described by Beer under the name of *encysted cataract*, the capsule must not be opened; but after the cornea has been divided, if the cataract does not escape of itself at this moment from the eye, the operator must immediately introduce the small cataract-tanniculum, with its point turned downwards, between the cornea and the iris, into the pupil. The cataract should then be firmly taken hold of with the hook, and slowly and steadily drawn out of the eye with its thick, tough capsule. Beer says, that extraction should be performed in the same way in the dry-siliqueous capsulo-lenticular cataract of children and adults, except that in all these cases, a fine, elastic, sharp, silver, or golden spatula, fixed at the lower part of David's curette or scoop, should be ready at hand to assist in separating the cataract from the vitreous humour, immediately the opaque substance is disposed to pass out of the eye. Also in the completely fluid cataract, when the capsule is partially opaque and thickened, a circumstance easily known by appearances, the same mode of extraction must be attempted. But, if the hook should tear its way out, and the capsule empty itself, the extraction must be performed altogether with the forceps. The latter instrument is to be cautiously introduced, in the same manner as the capsule-needle, into the pupil, one of the largest and thickest portions of the capsule is then to be taken hold of, and suddenly drawn out towards the opposite side, by which means generally the whole anterior layer, and sometimes also the posterior layer of the capsule will be detached, and the pupil immediately cleared. On the contrary, in what Beer has called the *bar-cataract*, which, he says, is seldom fit for an operation, as soon as the cornea has been opened, the bar must first be separated, by means of the capsule-needle, from the uvea, in whatever way is found most practicable, and then it is to be extracted with the small cataract-tanniculum, or forceps, when this has been done, the cataract itself must be taken out of the

eye in the same manner as the encysted cataract. (B. ii. p. 377.)

When extraction has been completed, the next object is to dress the eye: while the patient turns thus upwards, the lower eyelid is to be drawn downwards with the forefinger, and steadily held so, until the patient has shut his eye as much as possible.

Mr. Ware found, that a dossil of lint, steeped in plain water, or brandy and water, and covered with the spermaceti or saturnine cerate, and removed once every day, is the most easy and convenient dressing that can be applied after the operation. The cerate over the lint prevents the latter, when impregnated with the discharge, from becoming stiff, and irritating the lids. Mr. Ware thought the mode of applying the compress and bandage over the eye, a circumstance of no small importance; because, if too loose, the dressings are very apt to slip off, and, consequently, to press unequally and injuriously on the eye; and if too tight, the undue pressure will excite pain and inflammation, and even force out some of the vitreous humour. Mr. Ware's compress is made of soft linen, folded, two or three times, wide enough to cover both eyes, and sufficiently long to extend from the upper part of the forehead to the lower part of the nose. This he pins at the top of the patient's nightcap; and its lower part, which is divided in the middle, to allow the nose to come through it, he lays loosely over the eyes. The bandage, also made of old linen, and as broad as six fingers, he carries round the head over the compress, and pins to the side of the nightcap moderately tight. A slip of linen is afterwards carried under the chin, and pinned at each end to the side of the bandage, so as to prevent it from slipping upwards. (Ware.) Mr. Guthrie recommends an elastic network nightcap, which fits the head closely, and a piece of roller to be fastened by its middle to the centre of the cap behind. "A small piece of lint, on which some ung. ceteacei has been spread, is to be applied over the closed eyelids, a compress of fine linen is to be placed over it, and another over the opposite eye, when each end of the roller is to be brought forwards, made to secure the compress of its own side, and then passed over to the other." (*Operative Surgery of the Eye*, p. 314.)

Beer recommends the patient to lie upon his back, with his head not too low, and in a chamber which is not too light, and to remain in this way at least until the wound in the cornea is closed. As during the first two days after the operation, the doubled piece of linen, which Beer places over the eye, is repeatedly wet through with the discharged aqueous humour, it is to be changed several times a day. He also enjoins the observance of every thing which has been already pointed out as proper after depression and re-elimination; and, in particular, while the wound in the cornea is not firmly healed, and the eye cannot be kept open, the patient must refrain from taking snuff and smoking tobacco. According to the same author, no thoughts should be entertained of opening the eye again, till two or three days after the discharge of the aqueous humour completely ceased; a circumstance always by slight prickings in the eye itself, by a though not very severe, pain, attending it

of that fluid from the inner canthus, and in irritable, nervous, debilitated subjects, even by the sensation of transient luminous appearances. Therefore, Beer says, the eye should seldom be opened before the fifth or sixth day. When this is first done, the light should be very moderate, and the patient placed with his back towards it, all unnecessary lateral light being kept from the eye by the linen attached to the forehead, while the daily trials of the newly recovered powers of the eye should be made with the utmost caution. On the 8th, 9th, or, at latest, on the 10th day, Beer recommends leaving the eye open, but screened above by a green eye-shade, in a half-darkened chamber; and the patient is afterwards to be treated, until his eye is perfectly well, according to the rules already laid down as proper to be observed after couching. And, especially when the patient has had cataracts in both eyes, Beer thinks it as well to apprise him, in order to prevent unnecessary alarm, that, upon first going out into the open air, particularly in the evening, he will be for some moments almost blinded, and then begin to see again, but every object will now appear covered with a white, shining circle, which at length goes off; though, in the open air, it will sometimes continue for several days. (B. ii. p. 380.)

A few hours after the operation, Mr. Guthrie always bleeds the patient, whether pain come on, or not; and if it continue, or afterwards take place, he repeats the evacuation. In another few hours, if no amendment occur, he has recourse even to a third bleeding. For the first twenty-four hours, he does not wish the patient to be disturbed with purgative medicines, so as to produce any risk of the edges of the cornea being displaced; but, after this period, he exhibits saline aperients, and, when much inflammation is expected, he prescribes calomel, combined with opiate confection; and, if the inflammation continue, he gives two grains of calomel with $\frac{1}{4}$ or $\frac{1}{2}$ of a grain of opium, three or four times in the course of twenty-four hours, so as to affect the system, and prevent the bad consequences of the inflammation of the iris and internal parts of the eye. (See Guthrie's *Operative Surgery of the Eye*, pp. 315, 316.)

On the morning after the operation, Mr. Guthrie gently frees the eyelid from any moisture, and replaces the light compress and bandage. "The occurrence of a discharge of tears, and particularly hot ones, marks some degree of inflammation, which must be immediately arrested, especially if the eyelid swells. This is only to be done by the abstraction of blood, in the first instance, from the arm, and locally afterwards by cupping, or leeches."

The late Mr. Ware published an inquiry into causes preventing the success of extraction.

The first, which he considers, is making the incision through the cornea too small. In this circumstance, a degree of violence will be required to bring the cataract through the wound, and, if the cataract be not altered in its figure, the wound will be forcibly dilated, and the edge of the iris compressed between the cornea and the cataract. In this way, either some of its fibres may be kept turgid, or it may be otherwise so much injured as to excite a considerable degree of inflammation, and, in the end, a closure of the pupil.

This accident may arise from the operator's cutting the cornea, without being able to see exactly the position of this membrane, in consequence of the eye having turned inward, owing to its not being properly fixed. The fault may also proceed from the incision having been begun below the transverse diameter of the cornea. In this manner, nine-sixteenths, or rather more than half of the circumference of this membrane, will not be divided; which extent the incision ought always to occupy, in order to allow the cataract to be extracted with facility.

When however the cornea is remarkably flat, and the iris projects unusually forward in the anterior chamber, Mr. Ware recommends including only one third of the cornea in the first incision, and afterwards enlarging the aperture, on the outer side, by means of curved scissors.

Taking care to fix the eye in Mr. Ware's way, as represented by this author as being of great consequence in hindering the wound in the cornea from being made too small.

Whenever the wound in the cornea is made too small, it should always be enlarged before proceeding further in the operation; and, according to Mr. Ware, this can be best accomplished with a pair of curved blunt-pointed scissors, on the outer side of the cornea, where the knife has made its entrance.

For doing this, Beer recommends the use of David's scissors, which are to be introduced with their concavity towards the operator, and their point directed towards the pupil. Beer also introduces the point of the inner blade into the middle of the wound of the cornea, under the flap already made, and passes it somewhat higher than the place to which it is necessary to enlarge the incision. Then he first conveys the instrument to the inner or outer angle of the wound, where the dilatation is to be made, keeping the blade, which is within the cornea, not parallel to the iris, but in an oblique position with respect to it, for otherwise the best scissors will fail to make a clear division. The scissors also must not be opened more than is absolutely necessary, and they should be very quickly shut, and in such a manner, that the outer blade ought only to move towards that within the cornea, lest the eye suffer injury. Beer says that it is hardly ever necessary to enlarge the incision in the cornea at both its angles; and, in these cases, he confesses, that all idea of shaping the wound altogether as it ought to be, must be renounced. (*Lehre von den Augenkr.* b. ii. p. 382.) As already explained, Jaeger uses a double knife, with which it is alleged the incision in the cornea may always be made of due size. (See London's *Short Inquiry*, &c. 1826.)

Wounding the iris with the cornea-knife, the effect of which injury seems to Mr. Guthrie to have been much exaggerated, is the second accident which Mr. Ware considers. The principal cause seems to him to be a discharge of the aqueous humour, before the knife has passed through the cornea low enough to hinder the lower part of the iris, which forms the inferior rim of the pupil, from getting beneath the edge of the instrument. According to Mr. Ware, the escape of the aqueous humour may be owing to some inaccuracy in the shape of the knife, or unsteadiness in introducing it. The falling of the lower part of the iris under the edge of the knife, he believes,

cannot always be prevented, by the utmost skill or precaution of the operator. Happily, however, says he, we have been taught, that the iris may be reinstated, after it has been thus displaced, and without suffering any injury, by making gentle frictions on the cornea with the point of the finger. With these frictions, as I have already mentioned, Mr. Guthrie adopts the expedient of drawing forwards the eye from the orbit, and pressing the cornea flat upon the blade, as an essential thing to make the iris recede.

By unsteadiness in passing the knife, Mr. Ware means, that the knife may not only be suffered to make a punctuation through this tunic, but, that its edge may, at the same time, be unintentionally pressed downward, so as to make an incision likewise; in consequence of which downward motion of the knife, an aperture must unavoidably be left in the cornea, through which the aqueous humour will escape. If the cornea-knife increase through its whole length, both in width and thickness, and if it be merely pushed through the cornea, no space will be left, through which any fluid can escape.

According to Beer, the escape of the aqueous humour, as the knife passes across the anterior chamber, may happen with or without any fault on the part of the operator, and the iris fall not merely against the posterior surface of the knife, but even project under its edge, and over its back. When this happens, Beer joins Ware in recommending the end of the middle finger, situated at the inner canthus, to be gently pressed without delay upon that part of the cornea which is in front of the knife; and, at the moment when this is done, the iris will recede from the edge of the instrument; and the operator, by being very quick, may proceed again without any risk of injuring that part of the eye. But, if the iris should be found to project again above and below the knife immediately the point of the finger is removed from the cornea, such removal should not be made, and the knife be boldly pushed on until its point pierces the other side of the cornea; or, if the point has already passed some way out of the cornea towards the inner canthus, the blade is to be pushed on so far, that no protrusion of the iris is possible. For, says Beer, while the finger continues to make gentle pressure upon the cornea, the iris will not fall under the knife. Should the eye chance to withdraw itself from the knife, after this has penetrated the anterior chamber, — a circumstance which may easily happen in restless timid patients, — the greater part or the whole of the aqueous humour is immediately discharged, and the iris comes in contact with the empty cornea. In this case, Beer says, that the operator should find out the wound with another knife; and with a wriggling motion of the instrument, conduct it between the iris and the cornea, twisting and turning the point about until it has successfully passed beyond the external, then beyond the inner pupillary margin of the iris, and has finally come out of the cornea again. Now the incision in the cornea may be properly finished, in doing which, it is always necessary to keep the middle finger applied to this membrane, in consequence of the disposition of the iris to fall against the knife. Beer mentions it as a curious fact, that most of the patients, who are restless and unmanageable at the first introduction of the knife, and who them-

selves cause the disagreeable occurrence now spoken of, are, on the contrary, very quiet during the foregoing manoeuvres. (*Lehrvon. den Augenkr.* b. ii. p. 381.)

The third accident, noticed by Mr. Ware, is the escape of the vitreous humour. The common cause of this occurrence is the undue application of pressure. It may take place, either when the incision is made through the cornea, or at the time of extracting the cataract. Some eyes are subject to spasm, which renders them much more liable to this accident. To prevent it, Mr. Ware recommends every kind and degree of pressure to be taken from the eye, before the knife has completely cut its way through the cornea. And, as soon as the knife has proceeded sufficiently low to secure the iris from being wounded, the operator should not only take heed, that his own fingers do not touch the eye, but should also direct the assistant, who supports the upper lid, to remove his fingers entirely from this part. The assistant seldom can make any pressure on the globe of the eye; however, when there is room for one of his fingers to be placed on the inner and upper part of the globe, without interfering with those of the operator, the method may be followed, in order to make the eye still more fixed. But immediately the punctuation of the cornea is completed, the assistant's finger should always be entirely removed, both from the eyelids and eye itself.

Notwithstanding the upper lid is left thus free, there will be sufficient space between it and the lower lid, to allow the progress of the knife to be seen; and, in finishing the wound, the operator should depress the lower lid with great gentleness.

With Jaeger's double knife, the risks, arising from a very early escape of the aqueous humour, are said to be avoided.

The vitreous humour may also be lost, in consequence of opening the capsule of the lens nearer the circumference than the centre of the pupil. As the crystalline is both thinner and softer at that part, the instrument will be liable to pass through both sides of the capsule, and enter the vitreous humour. This humour, having no longer any barrier to its escape, is liable to be forced out by the action of the eyelids alone; and, when pressure is afterwards made to bring the cataract through, a much greater quantity will be lost; and the cataract, instead of coming forward, will recede from the pupil. The only way to extract it now, is, by letting the upper lid be gently raised by an assistant (a rare instance, in which this is necessary after cutting the cornea), while the operator, either with the forefinger of the left hand, or with the blunt end of the curette, applied beneath the incision in the cornea, prevents the cataract from sinking further. Then, with his right hand, let him introduce a hook under the flap of the cornea, and with its point carefully entangle the cataract, and bring it away.

To prevent, however, such difficulties, Mr. Ware never attempted to puncture the capsule, until the whole pupil was in view. He was in the habit of opening the capsule with a gold-pointed needle, arched towards its extremity. Wenzel's needle, for this purpose, was flat in its extremity; Mr. Ware's, pointed; and this is their only difference. The latter introduced his instrument under the flap of the cornea, with its arched part uppermost, until its point was on a level with the

centre of the pupil. The end of the instrument was then turned inward, and gently rubbed on the capsule of the crystalline until it pierced it. In a few instances, Mr. Ware found the capsule so tough, that the point of the gold needle would not enter it, and he was obliged to use a sharp steel instrument, of the same shape as that with a gold point. As already explained, Beer was much bolder with the capsule than Ware, and there can be little doubt, that both his capsule-needle and his mode of using it are better than those of Wenzel and Ware.

The vitreous humour may also be lost, at the time of extracting the cataract, and the usual cause is an undue application of pressure. All violent pressure is quite unnecessary for forcing out the cataract, when the wound in the cornea is sufficiently large. When the wound is too small, it should be enlarged as above directed. If pressure be continued at all after the cataract has been extracted, the capsule of the vitreous humour will certainly be ruptured, and some of this part of the eye protrude. Pressure may even rupture the capsule of the vitreous humour, before the cataract has been brought through the incision in the cornea; the same consequences will ensue, and the same practice be necessary, as in the case in which the operator has unskilfully opened the capsule of the vitreous humour with the needle, in attempting to open that of the lens.

In taking away fragments of opaque matter from the pupil by means of the curette, great care is requisite to avoid wounding the posterior part of the capsule of the crystalline lens with the end of the instrument, so as to open a way for the escape of the vitreous humour.

The vitreous humour may, indeed, be forced out, after the extraction of the cataract, merely by a spasmodic action of the eyelids. On this subject, Mr. Ware, after hinting his suspicion, that, in a case of this kind, which he saw, the assistant's keeping up the lid contributed to the event, repeats his advice, "that after the cornea has been cut, the upper eyelid should be raised solely by the fingers of the left hand of the operator."

Mr. Ware seems to think, that more evil has resulted from the operator being deterred by the remedies with which the vitreous humour continues to secrete, from ascertaining that all the fragments of the cataract are removed, and that the whole of the iris has resumed its position, than from the mere loss of the vitreous humour, which is quickly regenerated.

When a portion of the vitreous humour protrudes, Beer thinks, that the safest practice is not to meddle with it, though he owns, that in this circumstance, the wound heals slowly, and is always followed by a more or less perceptible whitish scar, the pupil being generally drawn towards it, and deformed, while the iris and the partly emptied *membrana hyaloidea* become adherent to the edges of the incision in the cornea. But, says Beer, the eyesight will be but little or not at all impaired, notwithstanding one-eighth or one-fourth of the vitreous humour may be lost. However, he observes, that when one-third or half of it has escaped, a good degree of vision afterwards cannot be expected; and when more than half has been lost, the operation will have a still less successful result. He states also, that when two-thirds have been lost, though the eye may recover its natural

form, the pupillary edge of the iris will remain contracted round the empty, light-grey *membrana hyaloidea*, which projects into the anterior chamber, consequently, the pupil will be closed, and that state of the iris ensue, which is aptly termed a *sinking of the pupil*, *subsidentia pupillæ*, or *synizesis*. Some modern surgeons conceive that the mischievous effects of the loss of the vitreous humour have been overrated. Thus, one very experienced practitioner declares, that, at least two-thirds of it may escape, and yet vision not be at all injured by the accident. (See *Middlemore on Dis. of the Eye*, vol. ii. p. 137.) And another, who, pronounces the loss of the vitreous humour to be a surgical bughbear, has lately published the following statement:—"I once saw the lens violently forced out, and the vitreous humour with it, and it appeared to me, as well as to the operator, that the whole of it was discharged: nevertheless the patient recovered a faint degree of sight. This case taught me how much might be lost, without the eye being destroyed, and I soon learned, that a great part might be lost without any inconvenience." I apprehend that it is better to lose a fourth or fifth part than an eighth, although it is still better to lose none. (*Guthrie on the Certainty, &c. of Extraction*, p. 33.) In the latter observation I fully agree, but the reasoning and statements immediately before it are to me by no means convincing, unless it be proved, that "if a very small portion of the vitreous humour be lost, it is usually followed by severe inflammation: if a larger quantity is lost, there is usually less."

Mr. Ware notices the accident of extracting only a part of the cataract, and leaving the remainder behind. He is an advocate for removing all opaque substances from the pupil, except an extreme degree of irritability, to which some eyes are subject, should render the introduction of every sort of instrument, after the cataract has been extracted, difficult and dangerous. Mr. Ware usually removed opaque portions of the cataract by means of a curette, and, occasionally, when the opaque substance was large, and adherent to the capsule, he was obliged to extract it with small forceps. Before finishing the operation, he approves of always rubbing the end of the finger gently on the fore part of the eye, over the eyelids; which proceeding tends to bring into view any opaque matter, which may previously lie behind the iris. Mr. Ware relates a case, proving, that such opacities, as cannot be removed in the operation, are capable of being absorbed.

When, notwithstanding the observance of the directions laid down by Beer, as explained in the previous columns, some of the pulsatious, or scabrous surface of the cataract is detached, and continues behind in the posterior chamber, Beer says, that it ought to be immediately removed, lest the patient be left with a secondary lenticular cataract, which, he observes, is not always so certain of being dissolved and absorbed, as some imagine. The fragments may be removed in two ways; and, first, the experiment of rubbing the upper eyelid over the eye should be made; because it not unfrequently brings the remains, especially when they are gelatinous, completely through the pupil, and out of the incision in the cornea. But, if such manœuvre should not be effectual, Beer recommends cautiously introducing David's curette to the outer pupillary edge of the iris, with

its concavity towards the inner surface of the flap of the cornea, without raising this flap unnecessarily high, and then the operator is to endeavour to scoop out at once as much of the opaque matter as he can, and bring it to the inner surface of the cornea. He says, that it will rarely be necessary frequently to repeat the introduction of the curette. (B. ii. p. 387.)

According to Mr. Ware, an opacity of the capsule can be the only reason for removing it. The anterior part, he says, can alone become the object of the operator's attention: its posterior part is necessarily hidden, while the cataract remains in the eye, and afterwards, if discovered to be opaque, it is so closely connected with the capsule of the vitreous humour, that Ware believes it cannot be removed by any instrument, without hazarding a destructive effusion of this humour. When, however, the opaque lens is accompanied with an opacity in the front part of the capsule, he recommended the following plan:—After cutting the cornea, as usual, a fine-pointed instrument, somewhat smaller in size than a round couching-needle, and a little bent towards the point, should be introduced under the flap of the cornea, with its bent part upward, until its point is parallel with the aperture of the pupil. The point should then be turned toward the opaque capsule, which is to be punctured by it, in a circular direction, as near to the rim of the pupil as the instrument can be applied, without hurting the iris. Sometimes, the part included within the punctures may be extracted on the point of the instrument; and, if this cannot be done, it should be removed with a small pair of forceps. The lens, whether opaque, or transparent, should next be extracted, by making a slight pressure with the curette, either above, or below, the circumference of the cornea.

On the preceding subject, Beer remarks, that when none of the lens itself is left behind, but there is a slight degree of opacity in the anterior layer of the capsule, easily distinguishable from the cut flakes, and producing the least obstacle to vision, the opaque membrane should be taken away with the forceps, in the manner described in the preceding pages; for, otherwise, a secondary capsular cataract will follow, which will become of a snow-white colour; and if only a trivial degree of iritis take place after the operation, it will become adherent to the iris, and the pupil be contracted and disfigured. (B. ii. p. 388.)

Beer does not agree with Ware in condemning all attempts to remove the posterior layer of the capsule, when found opaque, after the extraction of the lens. The case, he says, is indicated by the light-grey speckled appearance of the whole pupil, and by the patient seeing nothing at all, or objects only indistinctly in a thick mist. Beer advises a cataract-tenaculum to be passed into the pupil, in the same way as the capsule-needle is introduced in the second stage of extraction, directing its point downwards as it enters, and upwards when it is brought out again. After it has entered the pupil, it is to be made to divide and annihilate, by repeated turns of the tenaculum, the back layer of the capsule, and also the membrana hyaloidea, directly behind it, which, in such a case, is always adherent and opaque. Of these membranes a considerable part, closely wound round the hook, may be taken out of the eye, though never without

some slight loss of the vitreous humour. In cases of this kind, the patient ought to be informed, that though his sight will be restored, a part of the cataract must be left, and will be visible behind the pupil, particularly when it is dilated; for, otherwise, suspicions may arise, that the operation has been badly done, and a relapse apprehended. (B. ii. p. 388.)

The late Mr. Ware published some remarks on the bad consequences of allowing foreign bodies of any kind, after the operation, to press unequally on the globe of the eye; comprehending, under this head, the intervention of the edge of the lower eyelid between the sides of the divided cornea; the inversion of the edge of the lower eyelid; and the lodgment of one or more loose eyelashes on the globe of the eye.

To prevent the first accident, every operator, before applying the dressings, should carefully depress the lower eyelid; and before he suffers it to rise again, should take care, that the flap of the cornea be accurately adjusted in its proper position; and, that the upper lid be dropped, so as completely to cover it. After this, the eyelid should not be opened again, for three or four days, that is, until there is a good reason to suppose the wound in the cornea closed.

The inversion of the lower eyelid is hurtful, in consequence of its making the eyelashes rub against the eye. These should be extracted the day before the operation. For the mode of effecting a permanent cure, see *Trichiasis*.

Besides the danger, to which the eye is exposed from the inversion of the edge of the lid, the eye may receive injury from the improper position of the eyelashes alone; one or more of which during the operation, may happen to bend inwards; or, becoming loose, may afterwards insinuate themselves between the inside of the lid and the eye. An eyelash bent inward should be rectified; if broken off and loose, it should be removed.

Lastly, Mr. Ware considers prematurely exposing the eye to a strong light. He censures the plan of opening the eyelids within the first two or three days after the operation; because the stimulus of the light increases the ophthalmia, and the method is apt to disturb the wound in the cornea before it is closed. Mr. Ware, however, wishes it not to be inferred, that he is an advocate for long confinement after the operation. His mode is to keep the patient wholly in bed, and to direct him to move his head as little as possible, for the first three days after the operation. During this time, a dossil of wet lint is kept on his eyes, covered with a saturnine plaster, compress, and bandage as already described. The dressing is renewed once every day, and the outsides of the eyelids washed with warm water in winter, and cold in summer. At each time of dressing, the skin of the lower lid is drawn gently down, to prevent any tendency to an inversion. Animal food is prohibited, and the patient enjoined not to talk much. On the fourth day, he is permitted to sit up for two or three hours; and if he has had no stool since the operation, a mild opening medicine is now administered. On the fifth, the time of his getting up is lengthened; and, presuming that the wound in the cornea is now closed, Mr. Ware usually examines the state of the eye. After this, no dressings need be applied in the daytime, care being taken to defend it from a strong light, by a pasteboard hood or shade, and

by darkening the room, so that no inconvenience is felt. The patient may now also look, for a short time, at large objects. The following part of the treatment need interfere very little with the wishes of the patient, unless unexpected accidents occur. (*Ware.*)

As Beer observes, if the patient be very restless, make frequent attempts to open his eyes in the least, and partly lie upon the eye, or if in changing the compresses the greatest caution be not used, the eye will perhaps be roughly pressed upon, and the iris protrude between the displaced and half-opened edges of the incision in the cornea, to which it will become adherent during a slow and seldom very violent inflammation. From the moment, when the iris thus interposes itself between the sides of the wound, the aqueous humour begins to collect, and at length pushes the iris considerably forwards. In this case, Beer recommends carefully opening the eye in a very moderate light, and adopting the expedients formerly mentioned, for the purpose of making the iris recede. The dressings should be re-applied, and the eye kept closed and very quiet for at least eight or ten days, so as to hinder a recurrence of this disagreeable accident. But, if the iris should be already adherent to the edges of the wound in the cornea, the eye incapable of bearing light, and the aqueous humour more or less accumulated in the anterior chamber, Beer says, every thing must be left to time, while the eye is kept lightly covered for about a fortnight, and the existing inflammation properly treated. Then, if the protrusion, or staphyloma of the iris should not be diminished by the means calculated for lessening the inflammation, caustic or the knife must be employed. (*Beer, b. ii. p. 391.*) The same causes, which have been above specified, as conducive to a protrusion of the iris, may also produce a discharge of the vitreous humour.

The following observations by Beer are interesting:—When the dressings have been unskilfully applied; when the incision of the cornea has been made horizontally upon a large prominent eye; when the fissure of the eyelids is exceedingly narrow, or the patient is restless a proper cicatrization of the wound in the cornea may not follow. Though the aqueous humour may collect in the anterior chamber, the partially united lamellæ of the cornea may be incapable of duly resisting the distension of that fluid, and consequently protrude in the form of a light-grey, semi-transparent, oval vesicle, extending nearly the whole length of the wound in the cornea, and being most prominent in the centre. The patient complains of an annoying sense of pressure in the eye, as in cases of protrusion of the iris; but the discharge of the aqueous humour has completely stopped, and therefore the anterior chamber presents its natural appearance, and the pupil its regular round shape, though the edges of the wound in the cornea are whitish and swollen. This case was formerly regarded as a prolapsus of the membrane of the aqueous humour; but, Beer considers it as a sort of hernia of the cornea, termed *ceratocèle*. Merely puncturing, or cutting away the cyst is of no service; for, though the aqueous humour immediately flows out, the wound soon closes again, and the tumour re-appears, attended also with some risk of the iris falling into the cyst, and becoming adherent to it. Effectual relief cannot be obtained, unless the tumour be removed with David's scissors, as close

as possible to the wound; the dressings skilfully arranged: and the eye kept closed and quiet for eight days, or a fortnight. In such a case, a whitish scar is always permanently left. (*Beer, b. ii. p. 393.*)

Beer observes, that when the pupil contracts very considerably after the incision in the cornea has been made, and the cataract at the same time remains at some distance from the uvea, too small an opening has generally been formed, and it ought to be enlarged. But if the cataract cannot be forced through the pupil, without making pressure on the lower part of the eyeball, and the closure of the pupil should still continue, the circumstance proceeds from the loss of the aqueous humour, and the second stage of extraction must be deferred a little while, until the pupil dilates again, and the operation must then be finished in a very moderate light. (*Also Guthrie's Operative Surgery of the Eye, p. 305.*)

When, in the second stage of the operation, the anterior layer of the capsule has been properly divided, and yet the cataract will not pass into the pupil, though the eye itself acts with energy. Beer says, that it is indispensably necessary to make pressure upon the lower part of the eyeball, as already advised, and to continue it, either until the cataract with its lowermost edge effectually projects through the pupil and out of the eye, or until it is moved so far directly upwards (without entering the pupil) that its lower margin is brought into view, and quite a black semilunar interspace is seen between it and the inferior pupillary edge of the iris. At this moment the operator without increasing the pressure of the finger on the eyeball, lest the vitreous humour burst and a great part of it be lost, and without lessening the pressure, lest the cataract sink back into the eye, should introduce David's curette into the above interspace, with its hollow surface applied against the back surface of the cataract, which is to be gently pushed out of the eye. In doing this, Beer owns that a small part of the vitreous humour is almost always lost; but the quantity is not at all comparable to what is lost, when the hyaloid membrane gives way before David's curette is introduced, which can then only be passed into the eye through the protruded vitreous humour for the purpose of pushing out the cataract.

Beer notices the occasional protrusion of the iris, in the third stage of the operation, more or less between the edges of the incision in the cornea, immediately after the exit of the cataract. Here, says Beer, the iris should be reduced without the least delay; and the pupil, which is completely oval, made round again; a thing, which the operator may easily perform by applying his hand flat upon the patient's forehead, letting the latter shut his eye, rubbing the upper eyelid quickly, yet gently, with the thumb, and then suddenly opening the eye, by which means a moderate light will at once strike it, and produce an expansion of the iris.

In all patients, who have been operated upon for cataracts, the edges of the eyelids become glued together with mucus on the first night after the operation: yet, according to Beer, in individuals particularly subject to copious secretions of mucus, it is not unusual for the puncta lachrymalia and lachrymal ducts to be blocked up with thickened mucus, whereby the tears are prevented from duly

passing down into the nose, so that from time to time they are discharged from the inner angle of the eye, and collect under the eyelids. In this case, the patient soon begins to complain of a violent, continual, and increasing sense of pressure on the eye, and the upper eyelid swells, unattended with any redness. Irritable persons also experience a stupefying dull headach. These inconveniences may be immediately removed by clearing away the mucus with a little lukewarm milk from the inner canthus, and letting a stream of clean water fall over the cheek. Care must also be taken to hinder a recurrence of the circumstance, and to remove it, if it should happen.

The inflammation, consequent to extraction, chiefly affects the iris and neighbouring textures. Beer refers its origin principally to the entrance of air into the interior of the eye; which, owing to the size of the wound, he says, is not entirely to be prevented. But another cause is the introduction of different instruments into the eye, and hence, the inflammation is generally severe, when it has been necessary to remove fragments of the cataract with David's curette, or to take away the capsule with forceps, or destroy it with the tenaculum-needle. However, Beer is of opinion, that a surgeon, who knows how to operate well in every mode, will not find the inflammation, under these circumstances, more violent after extraction, than other methods, and therefore he thinks, that when no considerable impediment exists, it should be preferred. Beer, who considers extraction as a radical mode of removing a cataract, thinks that when there are no great and insurmountable obstacles to its performance, and the operator can execute it as well as all other methods, and with the requisite skill, it ought to be preferred. But, when he is deficient in skill, he is himself the greatest impediment to the success of the operation. The particular cases, in which the methods of depression and reclinatio are indicated, have been already specified, and in these, of course, extraction is not advantageous. (Beer, b. ii. p. 396.)

After extraction, the loss of the lens must be supplied by proper spectacles, which should not however be fitted to the eyes for several weeks, after the cure has been accomplished, in order to let the eye recover first as much power as possible, without artificial aid. The power of adjustment will necessarily be lost, and two pairs of spectacles be required; one for near, the other, for distant objects. Young persons often recover good sight, and in one instance, Mr. Guthrie has known the lens to be reproduced. (*On the Certainty, &c. of Extraction*, p. 43.)

OF KERATONYXIS.

Gleize, having commenced an operation by extraction, was prevented from completing it by a sudden movement of the patient's head: instead of enlarging the opening in the cornea with scissors, he introduced a needle through it, and depressed the lens. This case led to the invention of the new method of operating by *keratonyxis*, as it is now termed, a description of which Gleize published in 1786. Gleize's method was simplified by Conradi, who merely opened the cornea and capsule of the lens with a lance-shaped knife, and left the removal of the cataract to be effected

by the absorbents. Several improvements were subsequently made in this method by Dr. H. Buchhorn, who first gave it the name of *Keratonyxis* (see *this word*), and adopted the practice of dividing the lens, as well as the capsule, and of bringing the fragments forward into the anterior chamber. About the same time, Mr. Saunders, in England, perfected a similar operation, and applied it particularly to congenital cataracts. (See *Guthrie's Operative Surgery of the Eye*, (pp. 331, 332.)

This operation requires the pupil to be first artificially dilated. The belladonna should be applied the day before, and on the morning of the operation, in order that the pupil may be completely dilated; and a few drops of a solution, in the proportion of five grains of the extract to a drachm of water, should be dropped into the eye, half an hour before its commencement, so as to prevent a contraction of the pupil during the operation. (*Guthrie, Op. cit.* p. 333.) The best method of keeping very young patients sufficiently steady during the performance of keratonyxis, is to bind their arms firmly to their side with a broad roller or folded sheet. They are then to be placed on a table in the recumbent position, and the head prevented from moving by an assistant pressing his hands firmly upon the temples. Keratonyxis admits of being divided into two stages: first, the introduction of the needle through the cornea and pupil as far as the cataract; and, secondly, the breaking of the lens to pieces, and the division and laceration of its capsule. For these purposes, Beer prefers a common, straight, spear-shaped, sharp-edged, couching-needle to any curved one, however fine it may be made; first, because it pierces the cornea with greater facility; secondly, because both a soft cataract and the capsule can be more effectually cut with it, a larger opening being made, through which the aqueous humour may flow over the fragments of the lens, and the dissolution of the cataract be thus rendered more certain; whereas, with a curved needle, Beer says, the lens can only be disturbed, and the capsule torn, under which circumstances, inflammation and a secondary capsular cataract are likely to be produced. He directs the instrument to be introduced either at the lower, or at the external part of the cornea, one line and a half from its margin, the point being directed obliquely towards the pupil, and the capsule is to be effectually cut by moving the extremity of the needle laterally in various ways; and, above all things, it is necessary at the time of breaking the lens piecemeal, not to let the instrument continue always within this body; but, at every stroke, to lift it completely out of the lens and capsule, and then introduce it into them again in different directions.

Dr. Jacob prefers, for the performance of this operation, a fine-sewing needle, curved at the point. He says, that it rarely or never leaves the slightest mark in the cornea. "The capsule can be opened to any extent; a soft or friable lens can be actually broken up into a pulp, by pushing the curved extremity of the needle into its centre, and revolving the handle between the fingers; large fragments can be taken up on the point of the needle from the anterior chamber, and forced back out of the way of the iris; or, if sufficiently soft, may be divided by pressing them against the back of the cornea with the convexity of the

needle," &c. (See *Dublin Hospital Reports*, vol. iv. p. 224.)

Others give the preference to an extremely fine, small, and sharp needle, slightly flattened for a short distance from its point, and with cutting edges to facilitate its passage through the cornea. It should increase in size from its point, so that its introduction may not cause the escape of the aqueous humour. (See *Middlemore on Dis. of the Eye*, vol. ii. p. 155.)

As Beer observes, keratonyxis must soon have been found as little adapted to all cataracts, as any other mode; for, otherwise, the suggestion would not have been made to practise *reclination* through the cornea. To this form of reclination, however, Beer adduces great objections; for, he says, that, in this manner, either the cataract cannot be properly turned if the iris be duly spared, but it will continue to lie obliquely, being always quite evident below the pupil, and very apt to rise again from the slightest cause; or it is indeed depressed far enough towards the bottom of the eye, but, however much the pupil may be artificially dilated, the pupillary edge of the iris is more or less injured, especially with the convexity of a curved needle. In addition to these considerations, Beer urges against this method all the objections, which apply to the practice of reclination through the sclerótica.

It may be necessary to repeat keratonyxis two, or three times, and this is more prudent, than doing too much injury on any one occasion. (*Middlemore*, vol. ii. p. 156.)

After the lens and capsule have been effectually cut in pieces, the same light mode of dressing and the same after-treatment are proper, as are adopted in cases of depression and reclination. Beer also particularly objects to any trials being immediately made of the eyesight. At the same time he assures us, that he has not met with any of the instances, so frequently mentioned in books, of persons, on whom keratonyxis has been done, seeing perfectly well, and having quite a clear pupil in a few days: under the most favourable circumstances, several weeks, and sometimes as many months, elapsed, before the pupil became quite transparent.

According to Beer, keratonyxis is not liable to many accidents. Sometimes, says he, the artificially dilated pupil contracts, as soon as the needle has pierced the cornea, and reached the cataract: in this circumstance, the operator must wait quietly, until the pupil gradually expands again, a change, which may be promoted by screening the eye with the hand. If the operation were to be continued without delay, either the pupillary edge of the iris would be seriously and dangerously hurt by the needle, or the cataract could not be effectually divided. When, contrary to expectation, the nucleus of the cataract is too hard to be broken piecemeal, reclination, and depression should be done through the cornea, as well as circumstances will allow, and these objects can be more easily effected with a part than with the whole, of the lens. When the lens is found completely fluid, but the capsule opaque only at some points, Beer, with the view of preventing a secondary capsular cataract, recommends cutting the membrane in all directions, and annihilating it as much as possible. Keratonyxis may be followed by the same evils, which occasionally take place after depression and

reclination, and which will require similar treatment. But, according to Beer's experience, one

secondary capsular cataract, which often ensues even though the pupil was quite clear at the time of the operation; and though it may not quite blind the patient, it considerably lessens his power of vision; and renders the operation incomplete.

When the sole object of keratonyxis is to break and cut the cataract and its capsule piecemeal, and the fragments are to be left to dissolve and be absorbed, the operation can be indicated only where this division, breaking, dissolution, and absorption of the cataract can be successfully wrought. Hence, Beer sets down the method as not calculated for firm, hard, lenticular cataracts; nor for those which are softish and scabrous only upon their surface; and, he says, that it is not suited for capsular-lenticular cataracts, nor for any cases, termed false cataracts, which are of a membranous nature. Keratonyxis, he observes, may be expected to answer only in fluid or gelatinous cataracts, when the capsule is either little or not at all opaque and thickened, and of course can be easily opened and cut to pieces, as in the case described under the name of encysted cataract. For the above reasons, the method is well adapted for children and young subjects, in whom the origin and general complications of a cataract involve the case in suspicious circumstances.

After keratonyxis, the dilatation of the pupil should be kept up, by means of belladonna, until all symptoms of inflammation have subsided. (See *Guthrie's Operative Surgery of the Eye*, p. 336.)

Langenbeck, who has practised keratonyxis to a considerable extent, and uses the curved, two-edged, lancet-shaped needle, thinks extraction preferable to it only when the whole cataract can be brought out at once, by means of gentle pressure on the eye, and with the aid of Daviel's curette, as in the case of a firm cataract; while he represents keratonyxis as most advantageous, where, by the manœuvre of opening the capsule, the mass of the cataract would be so divided by the instrument as not to admit of being extracted altogether; but would require the use of a scoop, forceps, or hook, for bringing out the fragments, as in examples of soft, milky, and capsular cataracts. Langenbeck also urges, as a reason against extracting soft cataracts, their greater size, whereby in their passage through the pupil in an entire state they may injure the iris. (*Neue Bibliothek für die Chir.* b. i. p. 461.)

Keratonyxis (the anterior operation of solution), and extraction, seem to Mr. Middlemore to comprise all the feasible operations, performed for the cure of lenticular cataract anterior to the iris; for he is unwilling to include reclination and depression, which he believes are more advantageously executed through the sclerótica. "If," says he, "we review the number and importance of the textures, which have been divided or injured, we find, that, with the exception of the parts actually implicated in the disease, the cornea alone is injured. At least, they are the only parts, the texture of which is necessarily penetrated." The cornea, it is well known, is not a highly sensible part; and hence the anterior keratonyxis and extraction give

less pain, than other operations for cataract. (See *Medlemore on Dis. of the Eye*, vol. ii. p. 156.)

Although keratonyxis admits of being done upon both eyes with the same hand, Dupuytren does not consider it an easier or a better operation, than that of introducing the needle, through the sclerótica. The movements of the needle seem to him to be too much confined by the pupillary margin of the iris; the subsequent inflammation and nervous symptoms as great as after the other mode; the iris more exposed to injuries; and the wound sometimes followed by an opaque cicatrix. (*Clin. Chir.* t. i. p. 54.) Yet, the record of his own success with keratonyxis, in opposition to this statement, is remarkable; for, in a list of twenty-three cases collected by Dr. Marx, eleven were followed by immediate and permanent success; six proved successful at the expiration of a month; two were followed by nervous symptoms; and six by slight opthalmia; two by iritis; one by inflammation and atrophy of the eyeball; five by the continuance of fragments of the capsule at the edge of the pupil; in five a second and third operation were requisite; one lost his sight from inflammation; two others, from an opaque cicatrix; and two from amaurosis, independently of the operation, or its consequences. At all events, however, seventeen out of twenty-one recovered their sight. (See *Dupuytren in Clin. Chir.* t. i. p. 55.) This was about equal to the success with the needle behind the sclerótica. Dupuytren did not, therefore, give up keratonyxis, but even preferred it to the foregoing method, and also to extraction, when the orbit projected a good deal; the interspace between the eyelids was narrow; the eye diminutive and sunk; the organ affected with spasmodic movements, as particularly exemplified in children, and when the centre of the capsule was the seat of cataract. (p. 57.)

Valuable information on keratonyxis has been published by Langenbeck in the 4th vol. of his first Bibliothek; in the 1st vol. of his new Bibl. p. 1, &c. 1815; and in a tract, entitled, "*Prüfung der Keratonyxis, einer Methode den grauen Star durch die Hornhaut zu recliniren, oder zuzerstücken nebst erläuternden Operationsgeschichten.*" Göttingen, 1811. See also *Conradi, in Arneemann's Magazin*, b. i. p. 95. 1791. *Gleize, Nouvelles Obs. Pratiques sur les Maladies de l'Œil*, p. 118. 1812. *G. H. Buchhorn's Diss. de Keratonyxiæ*, Halæ, 1811.

OF CONGENITAL CATARACT. *

I shall not stop here to inquire, whether the expression *congenital cataract* is used with strict propriety; but the term is reprobated by Beer as being in general incorrectly applied.

So much has been already said in a preceding section of this article, concerning the propriety and striking advantages of operating for the cataracts of children, that to expatiate further upon this point would be a mere waste of time.

We have noticed the case, which Scarpa terms the *primary membranous cataract*, and which is mentioned by that distinguished professor, as being met with in children, or young people, under the age of twenty, the substance of the crystalline itself being almost entirely absorbed, while the capsule is left in an opaque state, including, at most, only a small nucleus, not larger than a pin's

head. This disease is described by Scarpa as being exceedingly rare, and characterised by a certain transparency and similitude to a cobweb; by a whitish opaque point, either at its centre or circumference, and by a streaked and reticulated appearance. Now, this example, which is represented by Scarpa as rare, appears from the experience of Mr. Saunders, to be by no means uncommon; since at the London Infirmary for diseases of the eye, it was found, that the majority of congenital cataracts were capsular, or membranous. This last statement is also at variance with that of the late Mr. Gibson, who has asserted that, in infants, the cataract is generally fluid. (*Edin. Medical and Surgical Journal*, vol. vii. p. 397.) Ware also asserts, that, in children, born with cataracts, the crystalline humour has generally, if not always, been found either in a soft or fluid state. (*Obs. on the Cataract, and Gutta Serena*, vol. ii. p. 380.) We learn from Mr. Saunders's publication, that, in the congenital cataract, after the crystalline lens has been converted into an opaque substance, it is gradually absorbed; and, in proportion to the progress of absorption, the anterior lamella of the capsule approaches the posterior, until they form one membrane, which is white, opaque, and very elastic. This process is commonly completed long before the eighth year, and the operator will now find a substance, which he will in vain endeavour either to extract or depress. But there is one form of the congenital cataract, in which the absorption of the lens does not proceed, viz. when the centre of the lens is opaque, and its circumference is perfectly transparent. Should the capsule and lens be penetrated, however, with any instrument, the opacity soon becomes complete, and from this moment the substance of the lens begins to be absorbed.

According to the experience of Mr. Saunders in congenital cataract, the lens may be either solid, soft, or fluid, but more frequently it is partially or completely absorbed, and the cataract is capsular.

The circumstance of Mr. Gibson's never having met with a simple membranous cataract in an infant, a fact so much at variance with Mr. Saunders's account, is conceived by Mr. Guthrie to admit of satisfactory explanation by the inference, that Mr. Gibson, in Manchester, probably saw all the children there with congenital cataract soon after they were born, and before the absorption of the lens had proceeded far; while a great number of Mr. Saunders's congenital cases were brought to him in London from distant places, and not seen by him till the children were older, and the disease had made greater progress. (*Operative Surgery of the Eye*, p. 359.) Indeed, Mr. Gibson states himself, that simple membranous cataracts are by no means uncommon at the age of eight or ten, as well as in adults, who have been born blind. (See *Edin. Med. and Surg. Journ.* vol. viii. p. 399.)

The following table of forty-four cases is given in Mr. Saunders's work, for the purpose of showing in what proportion each species of cataract has been found to prevail in congenital cases:—

Solid opaque lens, with or without opacity of the capsule. Three single, two-double cataracts.	5
Solid lens, opaque in the centre, transparent in the circumference, with capsule in the same state. Five double	5

- Soft opaque lens, with or without opacity of the capsule. Two single, two double - 4
 Soft opaque lens, with solid nucleus. One single, two double - 3
 Soft opaque lens, with dotted capsule, the spots white, the spaces transparent. Two double - 2
 Fluid cataract, with opacity of the capsule. Two single - 2
 Fluid cataract, with opacity of the capsule, and closed pupil. Two double - 2
 Opaque and thickened capsule, the lens being completely absorbed, or the remains of it being thin and squamose. Six single, twelve double - 18
 Opaque and thickened capsule, with only a very small nucleus of the lens unabsorbed in the centre. Two single - 2
 Opaque and thickened capsule in the centre, remains of the lens in the circumference. One double - 1

corresponding character of congenital the eyes of each individual is exhibited
 ber of double cases, and we are inform-

the same character was preserved in the cataracts of several children of the same family. (Saunders on Diseases of the Eye, edit. by Dr. Farre, pp. 135, 136.)

Mr. Lawrence observes, that the congenital cataract "is sometimes lenticular, but more frequently capsulo-lenticular. The lens is usually opaque throughout; generally of its natural consistence, which is gelatinous, sometimes softer, or even fluid, but never hard. After losing its transparency, the crystalline lens frequently undergoes absorption: hence, we often find it lessened, reduced to a small fragment, or as thin as a wafer." (On Dis. of the Eye, p. 443.) With reference to the statement, that a congenital cataract is never hard, I may mention that Mr. Alexander, this autumn (1836), in the presence of Mr. Bainbridge of Tooting and myself, extracted from the eye of a young woman, aged eighteen, who had congenital cataracts, a lens, which was as hard as that of the eye of a boiled mackerel. Another gentleman of great experience in this subject believes, that, when lenticular cataract occurs in very early life, it is always soft, unless the lens be the seat of cretaceous, or osseous deposition. (See Middlemore on Dis. of the Eye, vol. ii. p. 94.)

Congenital cataract appears frequently to afflict several children of the same parents. In the course of the present article, I have already had occasion to advert to two striking examples of this fact. The first is related by Mr. Lucas, who attended five children of a clergyman at Leaven, near Beverley, all born with cataracts. (See Med. Obs. and Inquiries, vol. vi.) The second is mentioned by Mr. Gibson who, saw five, or six children, the families of two sisters, who were all totally blind, and in an idiotic state, having cataracts accompanied with amaurosis. (Edin. Med. and Surgical Journal, vol. viii. p. 398.) Several instances occurred to the late Mr. Saunders. In one family, two brothers were thus afflicted. In a second family, two brothers, twins, were blind with cataracts at the age of twenty. In a third family, each within a few days of the birth, it is remarkable, that the four cataracts were exactly the same character. In a third family, a brother and two sisters were born with cataracts. The eldest sister was affected with it

only in one eye, the brother and youngest sister in both eyes. In a fourth family, three brothers and a sister had all congenital cataracts. (Saunders on Diseases of the Eye, pp. 134, 135.) One very remarkable example is recorded by Dupuytren, (See Clin. Chir. t. i. p. 39.) where a lady, her daughter and three grand-children, were all afflicted with cataracts.

Children with congenital cataracts possess various degrees of vision; but, when they are totally blind, their eyes not being attracted by external objects, volition is not exercised over the muscles of these organs, which roll about with an irregular, rapid, and trembling motion.

I shall now proceed to speak of the manner of operating upon children. Until the time of Pott, the intention of surgeons, in couching, or depressing the cataract (as indeed the expression itself implies), was to push the opaque crystalline downward, away from the pupil. Pott, conscious that the cataract often existed in a fluid or soft state, was aware that it could not then be depressed; and, therefore, in such cases, he recommended using the couching-needle for the express purpose of breaking down the cataract, and of making a large aperture in the capsule, so that the aqueous humour, which he believed to be a solvent for the opaque crystalline, might come into immediate contact with this body. This operation subsequently to Pott, has been strongly and ably recommended by Hey, of Leeds, and Professor Scarpa, of Pavia. In the cases of children, it even received the approbation of Ware. (On the Operation of Puncturing the Capsule of the Crystalline Humour, p. 9.)

But, notwithstanding the utility and efficacy of lacerating the front layer of the crystalline capsule had been so much insisted upon by Scarpa and others, their observations were confined to the cataract in the adult subject, and, before the example set by Saunders, no one (excepting, perhaps, Gibson of Manchester) ventured to apply, as a regular and successful practice, such an operation to the eyes of infants and children.

The principle, on which Saunders proceeded in his operations on the congenital cataract, was founded on the opinion, that the only obstacle to the absorption of the opaque lens is the capsule; and that, as the latter also is most generally opaque, "the business of art is to effect a permanent aperture in the centre of this membrane. This applies to every case of congenital cataract which can occur." Saunders used to overcome the difficulty of operating upon children, by fixing the eyeball with Pelfer's elevator, having the patient held by four or five assistants, dilating the pupil with belladonna, and employing a very slender needle, armed with a cutting edge from its shoulders to its point, and furnished with a sharp point, calculated to penetrate with the utmost facility.

Before the operation, the extract of belladonna, diluted with water to the consistence of cream, is to be dropped into the eye, or, to avoid irritation, the extract itself may be smeared in considerable quantity, over the eyelid and brow. In less than an hour, if there be no adhesions, it produces a full dilatation of the pupil, exposing to view nearly the whole anterior surface of the cataract. The application should then be washed from the appendages of the eye.

In using the needle, Saunders most carefully abstained from doing any injury to the vitreous

humour, or its capsule, and it was an essential point with him to avoid displacing the lens. In directing the extremity of the instrument to the centre of the capsule, he passed it either through the cornea, near the edge of this membrane (the operation now called *keratonyxis*), or through the sclerótica, a little way behind the iris. By the first, which is called the *anterior* operation, Mr. Saunders conceived, that less injury would be inflicted, and less irritation excited, than by introducing the needle behind the iris, through all the tunics of the eye. In every case, the first thing aimed at was the permanent destruction of the central portion of the capsule to an extent equal to that of the natural size of the pupil. If the capsule contained an opaque lens, Saunders used next to sink the needle gently into the body of the crystalline, and moderately open its texture, cautiously observing not to move the lens at all out of its natural situation.

When the case was a fluid cataract, Saunders was content in the first operation with simply lacerating the centre of the capsule, being desirous of avoiding to increase the irritation following the diffusion of the matter of the cataract in the aqueous humour.

When the cataract was entirely capsular, Saunders acted with rather more freedom, as he entertained in this case less fear of inflammation: but, in other respects, he proceeded with the same objects in view, which have been already related, and of which the principal consisted in effecting a permanent aperture in the centre of the capsule, without detaching this membrane at its circumference; for then the pupil would have been more or less covered by it, and the operation imperfect, "because this thickened capsule is never absorbed, and the pendulous flap is incapable of presenting a sufficient resistance to the needle to admit of being removed by a second operation." (P. 145.)

Mr. Saunders found, that the greatest success attended the operation between the ages of eighteen months and four years. One operation frequently accomplished a cure; so many as five were seldom requisite.

The only particularity, in Saunders's treatment of the eye after the operation, was that of applying the belladonna externally, for the purpose of making the pupil remain dilated, till the inflammation had ceased, so as to keep the edge of the iris from contracting adhesions with the margin of the torn capsule. This last practice is found to be so important, that it is never neglected by any good operator of the present day. In leaving this part of the subject, I must advise every surgeon to read the interesting account of Saunders's practice, published by his friend and colleague, Dr. Farre.

It seems to Mr. Middlemore, that, in cases of congenital cataract, when the patient is not more than six years old, *keratonyxis* is preferable to every other operation; "because it is very easily performed, gives very little pain, and is fully adequate to the cure of the disease. The puncture of the cornea is certainly much less painful than the puncture of the sclerótica. If, however, we are disposed to operate upon an infant, a few months after birth, the thickness of the cornea, and the proximity of the iris to its neural surface, would render this operation objectionable. It would then be better to perform the posterior operation of solution; for, it would not at that age be very easy to

pass the needle through the cornea without injuring the iris." (See *Middlemore Op. cit. vol. ii. p. 106.*) Gibson appears to have been unacquainted with the usefulness of the extract of belladonna in preparing the eye for the operation. A few hours before operating, he was in the habit of ordering an opiate, sufficient to produce a considerable degree of drowsiness, so that the infant generally allowed its eyelids to be opened, and properly secured without resistance, and was little inclined to offer any impediment to the introduction of the couching-needle; but, on the contrary, presented the sclerótica to view, naturally turning up the white of its eye. If the infant was more than a year old, and whenever it was necessary, Gibson used to introduce its body and arms into a kind of sack, open at both ends, and furnished with strings to draw round the neck, and tie sufficiently tight round the legs, so that its hands were effectually secured, and the assistants had only to steady its body, and fix its head, whilst the child was laid on a table, upon a pillow. Mr. Gibson never found it necessary to use a speculum, having uniformly experienced that, after the couching-needle was introduced, he had no difficulty in commanding the eye, aided by a slight degree of pressure upon the eyeball with the index and middle fingers of his left hand, which were employed in depressing the lower eyelid. He admits, however, that the speculum can easily be applied, if an operator prefer it. He generally used Scarpa's needle; because, in infants, the free rupture of the capsule of the lens ought commonly to be aimed at, in order that the milky cataract may escape, and mix with the aqueous humour; or, if the cataract be soft, that the aqueous humour may be freely admitted to its pulpy substance which has been previously broken down with the needle. He thinks, that no peculiarity is necessary in depressing the hard cataract of infants. Before Scarpa's needle was known in this country, Mr. Gibson used Mr. Hey's, which was generally effectual, and, as he conceives, possesses the recommendation of being less liable to have its points entangled in the iris. He says, that, when a milky cataract has been thus evacuated, it renders the aqueous humour turbid; but, that, within the space of two days, the eye generally acquires its natural transparency, and vision commences. When the capsule and substance of the soft cataract have been broken down, and the aqueous humour has come into contact with the lens, the solution and disappearance of the cataract, in all the cases upon which Mr. Gibson has operated, have uniformly taken place, in a short time. (See *Edin. Med. and Surgical Journal*, vol. viii. pp. 398, 399.)

For the purpose of fixing the eye, Ware considered Pellier's elevator requisite in operating upon infants. When the patient, however, had advanced beyond the age of infancy, he sometimes fixed the eye by means of the fingers alone. For the purpose of puncturing the capsule, and breaking down the cataract, this gentleman gave the preference to an instrument, which resembles one recommended by Cheselden, for the purpose of making an artificial pupil; but it is somewhat narrower. Its blade indeed is so narrow, that it nearly resembles a needle. Its extremity is pointed, and it cuts on one side for the space of about the eighth of an inch, the other side being blunt. It is perfectly straight; is an inch long in the blade; and forms a complete wedge through its whole length. Upon

one side of the handle is a coloured spot, by attending to which, the operator may always ascertain the position of the instrument in the eye.

Ware dilated the pupil with the extractum belladonnæ, softened with a little water, and applied about half an hour before the time of operating. He believed, that, in operating upon infants, the surgeon might perform the operation with more composure, if the patient were laid upon a table, with the head properly raised on a pillow. The bent end of Pellier's elevator should be introduced under the upper eyelid, and the instrument committed to the care of an assistant. If the right eye is to undergo the operation, and the surgeon operate with his right hand, he must of course sit or stand behind the patient; and, in this case, he will himself manage the speculum with his left hand. The eye being thus fixed, Ware passed the point of the narrow-bladed knife above mentioned through the sclerótica, on the side next to the temple, about the eighth of an inch from the union of that membrane to the cornea, the blunt edge being turned downwards. The instrument was pushed forwards in the same direction, until its point had nearly reached the centre of the crystalline. The point was then brought forwards, until it had passed through the opaque crystalline and its capsule, and was plainly visible in the anterior chamber. If the cataract was fluid, and the anterior chamber became immediately filled with the opaque matter, Ware deemed it advisable to withdraw the instrument, and defer further measures until the matter had been absorbed, which absorption usually took place in the course of a few days, and sometimes of a few hours. If no visible change were produced in the pupil, the point and cutting edge of the instrument were applied in different directions, so as to divide both the opaque crystalline and its capsule into small portions, and, if

bring them forwards into the anterior chamber. This may require the instrument to be kept in the eye for a minute or two; but, if the operator preserve his steadiness, he may continue it there a much longer time without doing the least injury to the iris, or to any other part. If the cataract be found of a firm consistence (though this rarely happens in young persons), it may be advisable to depress it below the pupil; and in such a case particular care should be taken to perforate largely the posterior part of the capsule, and to withdraw the instrument immediately after the cataract has been depressed, in order to hinder it from rising again. If the opacity be in the capsule, the instrument will not act so easily upon it as it does on the opaque crystalline; but, notwithstanding this, the capsule, as well as the crystalline, may be divided by it into larger or smaller portions, which, when thus divided, will be softened by the action of the aqueous humour; and, though, in the first operation on such a case, says Mr. Ware, it may not be possible to remove the opacity, yet, on the second or third attempt, the divided portions may be brought forwards into the anterior chamber, in which place they will then be gradually absorbed, and soon disappear. After the operation, Ware seldom found it necessary to remove blood from children or persons under the age of twenty. He continued a cooling antiphlogistic treatment a few days. After this, if any opacity remained, he expected its absorption by applying a small portion of powdered sugar

into the eye once or twice a day. When, at the end of a week or ten days, the inflammation was over, and the pupil obstructed with opaque matter, Ware advised a repetition of the operation. After a similar interval, the operation, he says, may be requisite again. In most cases, Ware was obliged to operate twice; in a few instances, once proved sufficient; and only in three, out of the last twenty, did he find it necessary to operate a fourth time. (*On Puncturing the Capsule of the Crystalline Humour.*)

I think any impartial man, who considers the practice of the three preceding operators, will find great cause to admire the superior gentleness and skill which predominate in the operations of the late Mr. Saunders. For my own part, I am so fully convinced of the mischief, which has been done to the eyes, by the rash boldness, awkwardness, and unsteadiness of numerous operators, that the inculcation of gentleness and forbearance, in all operations for the cataract, seems to me the bounden duty of every man, who has occasion to write upon the subject; and I do not agree with my friend Mr. Guthrie that students ought to be taught, that "the eye is not a delicate organ; and that it will suffer more comparative violence than any other of importance in the whole body." (*On Certainty, &c. of Extraction, &c. p. 11.*)

Great manual skill, and invariable gentleness, indeed, seem to me to have had more share in rendering Mr. Saunders's operation successful, than any particularity either in his method or his instrument. I have no hesitation in declaring my own partiality to the principles, on which his practice was founded, and my belief, that they are well calculated to improve most materially this interesting branch of surgery. In conclusion, I shall mention Mr. Guthrie's general opinion, respecting the kinds of operation suited for the three classes of cataracts, into which he arranges them for the consideration of this important point: the *hard* admit only of extraction, or displacement; the *soft*, seldom of displacement, or of extraction, but usually of division; the *capsular*, neither of displacement, extraction, nor division, purely considered as such, but by laceration, and removal of the opaque body from the axis of vision by different operations, which, although they may partake of the nature of all, are yet not precisely either. All intermediate states of disease, such, for instance, as the cæcous and fluid cataracts, admit of some slight deviations from these rules, but are still regulated by the same principles. (*Operative Surgery of the Eye, p. 365.*)

With respect to extraction, also, it deserves careful recollection, that it is a method, ~~which~~, though the cataract may be of a hard consistence, is often prohibited by various unfavourable circumstances, which I have taken notice of in the foregoing pages. When cataract takes place in an extremely old, or in a very feeble individual, reclinatio, or depression is preferred by Mr. Middlemore to extraction, unless there be reason to believe, that the lens is unusually large. The ground for this preference is the tendency of the cornea to slough in such persons, and the hazard of there being an insufficient degree of reparative power to effect the union of the divided cornea. (*See Middlemore on Dis. of the Eye, vol. ii. p. 111.*) Yet, I have known incisions in the cornea heal as favourably in extremely old persons, as in young.

The case of the late Sir William Blizard, who had a cataract extracted by Mr. Lawrence at the age of ninety, was a memorable example of it.

When the crystalline lens is extracted, depressed, or destroyed, vision can never be restored to its original power. Some near-sighted persons, in whom the power of refraction is too great, regain ordinary vision; but far-sighted individuals see worse, than they did previously to the formation of the cataract. These will require convex glasses, which, however, they should not begin to employ till long after the operation, lest the intensity of the impression produced by them should bring on inflammation of the eye, and deprive the patient of the benefit already derived from the operation. (See *Dupuytren Clin. Chir. t. i. p. 77.*) Some weeks, says another experienced surgeon, should elapse, before the patient begins to use his glasses, and he will act prudently in employing spectacles at all times sparingly. (See *Lawrence on Dis. of the Eye, p. 427.*)

Consult *P. Brissau*, Nouvelles Obs. sur la Cataracte, proposées à l'Acad. des Sciences, 1705. Tournay, 1706. *Ant. Maître Jan*, Traité des Maladies de l'Œil, 4to. Paris, 1772. *Charles de St. Ives*, Nouveau Traité des Maladies des Yeux, 12mo. Paris, 1722. *J. H. Freytag*, De Cataracta, Argent. 1721. *A. Petit*, Lettre dans laquelle il démontre que le Crystallin est fort près de l'Uvée, et rapporte de nouvelles Preuves, qui concernent l'Opération de la Cataracte. (Haller, Disp. Chir. v. 570.) *L. Heister*, De Cataracta, &c. tract. Alt. 1713; Vindiciæ de Cataracta, &c. Alt. 1713; and Apologia et uberior Illustratio Systematis sui de Cataracta, Glaucomate, et Amaurosi, 12mo. Altorf. 1717. *Pott's* Remarks on the Cataract, vol. iii. of his *Chirurgical Works*. *Daviel*, Sur une Nouvelle Méthode de Guérir la Cataracte par l'Extraction du Crystallin, 1747; and in *Mém. de l'Acad. de Chirurgie*, t. v. p. 369. édit. 12mo. *A. Bischoff*, A Treatise on the Extraction of the Cataract, 8vo. Lond. 1793. *Wenzel's* Treatise on the Cataract, by *Ware*, 8vo. Lond. 1791. *W. H. J. Buchhorn*, Die Keratonyxis, Eine neue gefahrlosere Methode den grauen Staar zu operiren, &c. 8vo. Magd. 1811. *Richter's* Treatise on the Extraction of the Cataract, transl. 8vo. Lond. 1791; and *Anfangsgr. der Wundarzneikunst*, b. iii. *Jon. Waken*, A Diss. on the Theory and Cure of the Cataract, in which the Practice of Extraction is supported, &c. 8vo. 1785. *F. F. Walthers*, Abhandlungen, &c. Landshut, 1810. Also in *Quarterly Journ. of Foreign Med.* No. 6. *Kupper* Diss. de Utilitate Belladonnæ in sananda contractione nimia Iridis. Erlange, 1803. *Hilmy*, Ophthalmologische, Bibl. 1. b. ii. No. 3. the Use of Hyosciamus for dilating the Pupil proposed. *J. Wathen*, A New, &c. Method of Curing the Fistula Lachrymalis, &c., with an Appendix on the Treatment after the operation for the Cataract, 8vo. Lond. 1792. *J. A. Schmidt* in *Abhandlungen der K. K. Josephs Acad.* b. 2. pp. 209. 273; and *Ueber Nachstaar und Iritis nach Staaroperationem*, 4to. Wien, 1801; one of the most valuable Works ever published on Diseases of the eye. *Warre's* Chirurgical Observations on the Eye, 2 vols. edit. 3. *Scarpa's* Observations on the principal Diseases of the Eyes, edit. 2. *Hey's* Practical Observations in Surgery, edit. 2. *G. Ch. Conradt*, Bemerkungen über einige Gegenstände des Grauen Staars, Leipz. 1791; and in *Arnemann's* Magazin, b. 1. *Saunders* on Diseases of the Eye, by *Farre*, edit. 3. *G. J. Beer*, Practische Beobachtungen über den grauen Staar, &c. Wien, 1791. Methode den grauen Staar sammt der Kapsel auszuziehen, Wien, 8vo. 1729; *Lehré von den Augenkrr.* b. ii. Wien, 1817. *Karl. Aug. Weinhold's* Anleitung zur Reclination des Grauen Staars mit der Kapsel, 1809. *Gibson's* Practical Observations on the Formation of an Artificial Pupil, and Remarks on the Extraction of Soft Cataracts, &c. 8vo. Lond. 1811. *C. J. M. Langenbeck*, Prüfung der Keratonyxie, einer Methode den grauen Staar durch die Hornhaut zu recliniren oder zu zerstuckeln nebst erlütternden operation geschichten, 8vo. Göt. 1811; and several Papers in his *Bibliothek* of later date. *B. Travers*, in *Medico-Chir. Trans.* vols. iv. and v.; and a Synopsis of the Diseases of the Eye, 8vo. Lond. 1802, and later editions. *J. Wardrop*, Essays on the Morbid Anatomy of the Human Eye, 2 vols. 8vo. Lond. 1818. *J. Fitch*, A Practical Treatise on the Diseases of the Eye, p. 109, &c. 8vo. Lond. 1820. *Gleize*, Nouvelles Obs. Pratiques sur les Maladies de l'Œil, 1812. *Demoivre*, Traité des Maladies des Yeux, *Andrew Smith*, in *Edin. Med. and Surg. Journ.* vol. xix. p. 13. *John Sevenson*, On the Advantage of an Early Operation for the different Species of Cataract, *Edin. Med. Journ.*

vol. xix. p. 513. Also his *Treatise on the Nature, &c. of Cataract*, 8vo. ed. 2. 1836. *Wende*, Ueber den Zustand des Augenhellkünde in Frankreich, nebst Kritischen Bemerkungen, über denselben in Deutschland, Nürnberg, 1815. Also *Quarterly Journ. of Foreign Med.* No. 4. *Sir W. Adams*, on the Diseases of the Eye, 1812. Practical Inquiry into the causes of the frequent failure of Depression and Extraction; with new and improved operations; 8vo. Lond. 1817. *G. J. Guthrie*, Lectures on the Operative Surgery of the Eye, 8vo. Lond. 1822. *G. Frick*, Treatise on the Diseases of the Eye, p. 155, &c. edit. 2. with notes by *R. Welbank*, Lond. 1826. *C. Loudon*, Inquiry into the Principal Causes of the Unsuccessful Termination of Extraction by the Cornea, with the view of showing the Superiority of Dr. F. Jaeger's Double Knife, &c. Lond. 1826. *Arthur Jacob* on a Cataract-needle; *Dublin Hospital Reports*, vol. 4. p. 214. 1827. *W. Lawrence*, on Dis. of the Eye, 8vo. Lond. 1833. *Richard Middlemore*, on Dis. of the Eye, 2 vols. 8vo. Lond. 1835. *W. Mackenzie*, on Dis. of the Eye, 2d. edit. 8vo. Lond. 1835. *G. J. Guthrie*, on the Certainty of Extraction, 8vo. Lond. 1834. *Dupuytren*, Leçons Orales de Clin. Chir. t. i. art. 3. 8vo. Paris, 1832.

CATHETER, (from *καθίστημι*, to thrust into.)

A tube which is introduced through the urethra into the bladder, for the purpose of drawing off the urine when it has accumulated in this organ, and cannot be discharged in the natural way (see URINE, RETENTION OF); or sometimes for promoting its quick evacuation as soon as it has descended from the kidneys, as where the bladder, or urethra has given way, or been wounded; and it is a matter of urgent importance to prevent any further effusion of urine. Here the patient's chance of preservation will depend partly upon free incisions for the discharge of the urine already effused, and partly upon the prompt use of the catheter, to hinder fresh quantities of this fluid from getting into the cellular tissue, or even sometimes into the cavity of the peritoneum, as in a wound or rupture of the bladder. (See BLADDER, GUNSHOT WOUNDS, and WOUNDS.) Catheters are also very important means in the treatment of strictures of the urethra, and fistulæ in perinæo. (See FISTULÆ IN PERINÆO; URETHRA, STRICTURES OF; and URINARY ABSCESSSES.) Occasionally, they are employed for the injection of fluid into the bladder, as where coagula, are lodged in this vicius, or where it is advantageous to have it in a distended state during the performance of an operation, as that of *Lithotritry*. (See this word.) Of course, there are two kinds of catheters; one intended for the male; the other, for the female urethra. With respect to catheters, three things are to be considered:—1st, the instrument itself; 2d, the manner of introducing it; and 3d, the conduct to be pursued after its introduction.

Catheters were anciently composed of copper; Celsus' knew of no other kind. As these, however, had the inconvenience of becoming incrustated with verdigrise, they at length fell into disuse, and others, made of silver, were substituted for them. This change, which was made as early as the time of the Arabian practitioners, still receives the approbation of the best modern surgeons. A common silver catheter is a tube, of such a diameter as will allow it to be introduced with ease into the urethra, and of various figures and lengths, according as it is intended for the young or adult, the male or female, subject. For an adult female it should be about six inches long; and, for young girls, four or five. For men, the length ought to be from ten inches and a half to eleven inches. But, as the instrument need not enter far into the bladder, Mr. John Bell's advice to avoid too great a length merits observance. (*Principles of Surgery*, vol. ii. p. 193.) 1h

edges of diseased prostate gland, the catheter should be much longer, than in others. (See PROSTATE GLAND.) As the urethra in some instances is narrow, and in others, wide, surgeons should be furnished with catheters of different diameters. The choice of the instrument, with respect to its width, is likewise determined very much by the nature of the disease of the urethra. (Langenbeck, *Bibl. b. i.* p. 1177.) For a woman, the diameter ought to be at least two lines; and for girls, a line and a half. For male adult subjects, Desault recommends the thickness of two lines and one-third; and, for boys, that of a line and a half. In general, whenever the urethra is pervious, it is better to follow the advice of Desault, and employ a largish catheter, which will enter the passage more easily, and not be entangled in the folds of the membranous lining of the canal, while it will afford a more ready outlet for the urine. On the other hand, a small catheter should be preferred, when there are obstructions in the passage. Catheters also differ in shape: those which Desault used for male subjects had only a slight curvature of one-third of their length; a curvature, which began insensibly from their straight part, and was continued to the very end of their beaks. The curvature was also regular, so as to form the segment of a circle of six French inches in diameter. Amussat recommends the use of straight catheters, which are passed as far as the pubes, while the penis is drawn upwards, which is then brought down between the thighs so as to lessen the bend of the urethra. One advantage imputed to a straight catheter is, that it may be rotated between the surgeon's fingers, whereby the chance of its surmounting every obstacle will be increased. (*Archives Gén. de Méd.* t. iv. Also *P. Ecot, Dis. du Catharisme exercée avec la Sonde droite*, Strasb., 1825, 4to.) As the course of the healthy urethra in the male subject is regular, the caprice evinced by surgeons in the different curvatures of their catheters, cannot be founded on any correct anatomical principles, and the bend of the instrument (at least for subjects of the same age and stature) should generally not vary at all, but be strictly adapted, as Langenbeck remarks, to the natural track of the urethra. (*Bibl. i.* p. 1177.) The female catheter, however, has only a slight curvature towards its beak; a shape adapted to the direction of the meatus urinarius. Desault also improved silver catheters, by causing them to be made with elliptical openings, or eyes, at the sides of the beak, with rounded edges, instead of the longitudinal slits previously in use, in which the lining of the urethra was frequently entangled, and lacerated, so that acute pain and profuse hemorrhage were the consequences. With the view of preventing these evils, he also filled up the openings with lard. (See *Œuvres Chir. de Desault*, t. iii. p. 118.) On each side of the external end of the catheter is a small ring, by means of which, and some tape, it can be fixed.

Besides silver catheters, surgeons now frequently employ flexible ones made of elastic gum. These last, indeed, are of so much importance, that they may be said to constitute one of the greatest improvements in modern surgery. I shall not here inquire, whether they were first invented by Wreden, Fickel of Wurzburg, or Bernard of Paris; this is a point which the German and French must settle themselves. Imperfect

attempts had been made by others at earlier periods to invent catheters possessing the property of flexibility. Van Helmont proposed the use of catheters made of horn; but this substance was found to be too stiff, and to be very quickly coated with depositions from the urine. Fabricius ab Aquapendente employed leather catheters, which were objectionable, inasmuch as they were soon softened by the urine and mucus of the urethra, when they shrivelled and became impervious. Other flexible catheters were also formerly tried, composed of spiral springs of silver wire, covered with the skins of particular animals. These last, however, were quickly spoiled by putrefaction; and when left in the urethra any considerable time, the beak sometimes entirely separated from the rest of the instrument and was left behind in the bladder.

The gum catheters, now in use, are liable to none of the preceding inconveniences; they are formed of silk tubes, woven for the purpose, and covered with a coat of elastic gum; they are sufficiently flexible to accommodate themselves to the different curvatures of the urethra; they are not softened by the urine; and they constantly remain with their cavity unobliterated. Their smooth and polished surface makes them continue a long while free from incrustations, deposited from the urine. Sometimes they are introduced with a stilet, or wire, which is passed into their canal, in order to give them a certain curvature, and a greater degree of firmness; but, in general, it is withdrawn as soon as the tube is in the bladder.

Elastic catheters are less irritating to the urethra, and less apt to become covered with calcareous incrustations, than silver tubes; they can also be frequently introduced, when a metallic one will not pass.

The selection of good bougies and catheters, especially for the male subject, is a business of the first-rate importance; for, by employing such as are disposed to break, "many a practitioner has doomed his patient to years of dreadful, and, perhaps hopeless suffering, and brought down irreparable disgrace upon his own head." (*Med. Chir. Journ.* vol. v. p. 75.) M. Nicod, in performing the operation of lithotomy upon a male, found the stone, which was very brittle, one inch and a half long, and eight or nine lines thick, traversed, in the direction of its greater diameter, by a piece of elastic gum catheter, which had acted as a nucleus for the deposition of calcareous matter. (See *Olc. sur le Danger d'employer des mauvaises Sondes de Gomme élastique*; *Journ. de Médecine*, par *Jeroux*, Oct. 1816.) A short time ago, M. Roux was obliged to cut into the bladder to extract an elastic gum catheter, which, in consequence of not having been properly secured, had slipped into that viscus. (See *Velpeau, Nouv. Elém. de Méd. Opér.* t. iii. p. 921.)

Formerly, the best elastic catheters used to be fabricated at Paris; but such as are now made in London are in some respects better than French, being generally more regular. Gum catheters are of twelve different sizes, which correspond to twelve holes in a plate of brass. "Each catheter, therefore (says Mr. Crosse) has its size designated by its number, which greatly facilitates the ascertaining of the progress of the case towards a cure. Numbers 1 and 2 are smaller than can be procured in England, and are so slender that I thought there

might be danger of their breaking, until I was convinced, by seeing the method of making them, that there is no reason for fearing any such thing. A firm tissue of silk is woven upon a brass stilet, of the size of the cavity of the instrument to be made. In weaving this tissue, the orifice or eye is left, and the whole therefore consists of one entire thread. The successive layers of varnish are deposited on the outer surface of the silken tissue, their number depending on the size of the instrument; and each coating of varnish undergoes a long process of scouring before the next is put on, for which purpose women are employed by Feburier." (See *Sketches of the Medical Schools of Paris*, by J. G. Crosse, 1815, pp. 122, 123.)

According to this gentleman, however, English gum catheters possess advantages:—"They retain their curve better without the stilet, are less liable to crack, and have eyes more smooth and better formed." (P. 124.) In London, elastic catheters as small as the French, are now also brought to perfection.

When the object of passing a catheter is merely to empty the bladder, without any design of leaving the instrument afterwards in the urethra, Langenbeck prefers one made of silver. (*Bibl. für die Chir.* b. i. p. 1176. Also *Velpeau, Méd. Opér.* t. iii. p. 912.)

In retention of urine from stricture, a surgeon will often succeed in introducing into the bladder a silver catheter, or an elastic gum catheter, mounted on a firm iron stilet. The catheter, recommended on such an occasion by Sir Benjamin Brodie, if the stricture be of recent formation, is nearly of the full size of the urethra; but, if the stricture has been of long duration, the instrument should be considerably smaller. He also prefers one, which is shorter, and less curved, than an ordinary silver catheter; and which is fixed in a wooden handle, whereby it is rendered more manageable. (*On Dis. of Urinary Organs*, p. 34. ed. 2.) If an elastic gum catheter is used, he says, that the iron stilet should have a flat handle, like that of a common sound. (See URINE, RETENTION OF.) In retention of urine from chronic enlargement of the prostate gland, Sir B. Brodie rarely uses any thing but a gum catheter, which has one advantage, viz. that it may be retained in the urethra and bladder, with very little inconvenience to the patient, which is not the case with a silver catheter. (*Brodie Op.* cit. p. 143.)

Sometimes spasm about the perineum renders the introduction of a catheter difficult. In this case, a dose of opium should be administered before a second attempt is made. When inflammation prevails in the passage, the introduction may often be facilitated by a previous bleeding.

The operation of introducing the catheter may be performed, either when the patient is standing up, sitting, or lying down, which last posture is the most favourable. In order to pass a catheter with ease and dexterity, the following circumstances must be observed:—The instrument must be of suitable shape and size; a just idea of the perineum and curvature of the urethra must be entertained; the catheter must be introduced with the greatest care and delicacy; and the relaxation of the abdominal muscles has been insisted upon. (*Langenbeck, Bibl.* i. p. 1177.), though I confess, that it does not appear to me how this circumstance is of importance.

A catheter should always be used with a light hand, and held, as it were, loosely in the fingers. "It will then in great measure find its own way in that direction, in which there is the least resistance. If you grasp it firmly, it can only go where you direct it, and it is likely to puncture and lacerate the membrane of the urethra, and the substance of the prostate, and to make a false passage." (See *Brodie on Dis. of the Urin. Organs*, p. 145. ed. 2.) Force, says another distinguished surgeon, is never necessary. The instrument should be allowed to find its way, as much by the influence of its own weight, as by that of any extraneous power. If it meets with resistance, it is to be withdrawn a little way, and then tried in another direction. (See *Velpeau, Nouv. Elem. &c.* t. iii. p. 915.)

One of the most important maxims is, never to force forward the instrument when it is stopped by any obstacle. If there are no strictures, the stoppage of the catheter is always owing to one of the following circumstances:—Its beak may be pushed against the os pubis. This chiefly occurs when the handle of the instrument is prematurely depressed. Here the employment of force can obviously do no good, and may be productive of serious mischief. The beak of the catheter may take a wrong direction, and push against the side of the urethra, especially at its membranous part, which it may dilate into a kind of pouch. In this circumstance, if force were exerted it would certainly lacerate the urethra, and occasion a false passage. The end of the catheter may be entangled in a fold of the lining of the urethra, and here force would be equally wrong. Lastly, the point of the instrument may be stopped by the prostate gland, in which case force can be of no service, and may do great harm. Hence, it is always proper to withdraw the instrument a little, and then push it on gently in a different position.

There are three methods of introducing a male catheter, viz. with the concavity, in the first stage of the operation, directed either towards the abdomen, towards the left groin, or towards the surgeon himself. Of course, the latter plan requires the instrument to be turned so as to place its concavity upwards, as soon as the beak has arrived in the perineum; and hence the French surgeons call this method the "tour de maître."

The operation may be divided into three stages. In the first, the catheter passes, in the male subject, that portion of the urethra which is surrounded by the corpus spongiosum; in the second, it passes the membranous part of the canal, situated between the bulb and the prostate gland; and in the third, it enters the gland, and the neck of the bladder.

In the first stage, little trouble is usually experienced; for the canal is here so supported by the surrounding corpus spongiosum, that it cannot easily be pushed into the form of a pouch, in which the end of the instrument can be entangled.

When the catheter is to be introduced with its concavity towards the abdomen, and the patient is in the recumbent posture, the thighs are to be separated, and the legs moderately bent. The surgeon is to draw back the prepuce, and to hold the penis between the thumb and forefinger of his left hand, which are to be applied on each side of the corona glandis, and not at all to the under surface of the penis, so as to avoid pressing upon the com-

movement of the urethra. After the catheter has been well oiled, its handle is to be held between the thumb and forefinger of the right hand, and to rest with the back of the little finger upon the patient's abdomen, in the vicinity of the navel. Now, while the handle is parallel to the axis of the body, the beak is to be introduced into the urethra; the penis being extended, and drawn forwards, as it were, over the instrument, while the latter is gently pushed on, until its beak has reached the arch of the pubes. When the penis cannot be drawn further over the catheter, the beak has arrived in this situation, where it stops in front of the arch, and is pressing against the posterior side of the urethra. At this particular moment, the handle is to be depressed towards the patient's thighs, and the manœuvre well managed generally directs the end of the catheter at once through the prostatic portion of the urethra into the cavity of the bladder. In short, as soon as the beak of the instrument has passed under the arch of the pubes, and the surgeon very slowly brings the handle forwards, or downwards, the beak is elevated, and glides into the bladder. In this stage of the operation, the penis must be allowed to sink down, and not be kept tense, as this would only render the passage of the instrument more difficult.

The operation, however, is not always successfully accomplished. The beak of the catheter may be stopped by the margin of the urethral opening in the deep perineal fascia; or it may take a wrong direction, so as to push the membranous part of the urethra to one side or the other.

The first kind of impediment is best avoided by not depressing the handle of the catheter too soon; that is, before the point has passed beyond the arch of the pubes. When the membranous part of the urethra is pushed to one side or the other, the instrument ought to be withdrawn a little, and then pushed gently on in a different direction; but, if this expedient is unavailing, the index finger of the left hand may be introduced into the rectum, for the purpose of raising up the membranous part of the urethra, and guiding the extremity of the catheter. The passage of the catheter through the opening in the deep perineal fascia, and especially the attempt to hit the entrance of the prostate gland are the most difficult things in the operation. It is by using too much force, and directing the end of the catheter in a wrong manner, that unskilful surgeons sometimes rupture the membranous portion of the urethra.

When the prostate gland is enlarged, the urethra becomes lengthened; and, as it approaches the bladder, it makes a more sudden turn upwards than is natural. The catheter, therefore, should be longer, and more bent in that direction, than in other cases.

In the third stage of the operation, the beak of the instrument has to pass the prostate gland and neck of the bladder. The principal obstacles to its passage, in this situation, arise from spasm of the neck of the bladder, and muscles in the perineum, and from the instrument being pushed against the prostate gland, instead of into the continuation of the aperture through it. The first impediment may generally be avoided by waiting a few moments, and gently rubbing the perineum, before attempting to push the catheter further into the passage. The hindrance caused by the prostate is best cleared by using an instrument,

the end of which is more curved than its other part.

When the catheter has turned round the pubes, and is just about to enter the neck of the bladder, is the critical moment, at which may be seen whether a surgeon can or cannot manage the operation with skill; for if he knows how to pass the instrument, he suddenly, but not violently, changes its direction. He depresses the handle with a particular kind of address, and raises the point, which, as if it had suddenly surmounted some obstacle, slips into the neck of the bladder, and the urine bursts out in a jet from the mouth of the catheter.

They who are unskilful press the tube forward, and persist, as they first began, in drawing up the penis, on the supposition that, by stretching this part, they lengthen the urethra, and make it straight, whereas they elongate only that part of the canal into which the catheter has already passed. (*John Bell's Principles of Surgery*, vol. ii. p. 213.)

Dr. Quain's view of some of the foregoing points, as deduced from anatomical facts, I consider interesting:—"If (says he) the integument, superficial fascia, and muscles, be removed from the penis and perineum, we can observe what takes place on the introduction of a catheter. No impediment occurs, during its passage through that part of the tube which corresponds with the corpus spongiosum; for, there it is supported by the body of the penis, and it is also quite straight. But, where it corresponds with the bulb, it is comparatively unsupported, and also slightly dilated at its lower surface. On arriving close to the perineal fascia, should the point of the catheter deviate to either side, or be elevated, or depressed too much, it will miss the foramen, carrying the urethra with it, and so the latter will be pinched between the margin of the foramen and the instrument. If, in such a position of the parts, force be used, or, if the catheter be depressed, with a view to make it correspond with the curves of the urethra, the latter must be torn through, or considerably injured. A catheter, in its construction, resembles an angular lever, though not intended to act as such; but, it virtually becomes such, if, after its process is impeded, and it is thereby rendered fixed, an effort be made to depress the handle; for, then the beak is made to move in the opposite direction, and will readily tear through the urethra. The effect of drawing the penis upwards may be exemplified in this way: when the catheter has reached the bulb (the urethra and perineal fascia being fully exposed), if it deviates to either side, the point will be observed to catch on the margin of the foramen; but, if the urethra is drawn upwards, the impediment will be removed by the widening of the aperture." (*See Quain's Anatomy*, p. 454. ed. 3.) With respect to the opinion, that the direction of the urethra becomes horizontal and its canal straight, when the penis is drawn directly forwards, Dr. Quain states, that, when the penis is so placed, the urethra has to descend nearly an inch, to reach the urethral aperture in the deep perineal fascia, after which it turns somewhat upwards. "Moreover, the part of the urethra, between the root of the penis and the neck of the bladder, will be found loose and relaxed, no matter with what degree of force the penis be drawn forwards; for that will affect only the part of the urethra

which corresponds with the body of the organ, as must be evident, when the attachments of the latter to the bones by its suspensory ligament and crura are considered." (*Quain, Op. cit. p. 455.*)

Whether the urethra can be made to accommodate itself to a straight instrument, is another question. The urethra is naturally not straight, nor nearly so. If it had been straight, it would have extended in the direction of the bulb in a line, that would pass above the anus to the point of the os coccygis. "Instead of this (asks M. Velpeau) what happens? The urethra gradually disengages itself from the corpus spongiosum and the whole of the bulb, to pass through the deep perineal fascia, enter the pelvis, and terminate at least two inches above the level of the anus, and consequently higher up than the line above specified." (*See Nouv. Elém. de Méd. Opér. t. iii. p. 911.*) When, however, the symphysis is short, the prostate not much thickened, the urethra passing through it nearer to its lower than its upper surface, and the pelvis is wide, M. Velpeau alleges, that, extending the penis will efface a good deal of this curve, and allow straight instruments (which on their part also press downwards with more or less force, the bottom of the prostatic portion of the urethra, and the neck of the bladder) to be conveyed without much difficulty into the latter organ. The latter fact we see exemplified every day: the question, whether the curve can be effaced by drawing the penis forwards, is easily settled by an examination instituted in the way proposed by Dr. Quain. For additional observations on the surgical anatomy of the urethra. See URETHRA.

When the catheter is to be introduced with its concavity downwards, or by the "tour de maître," the beak is to be passed into the urethra, and the penis drawn over it, as it were, as in the foregoing method. In other words, the instrument, well oiled, is to be introduced, with its convexity uppermost, as far as it can be, without using force. As soon, however, as the end of the catheter has reached the point at which the canal begins to form a curve under the pubes, the surgeon is to make the penis and the instrument perform a semi-circular movement, by inclining them towards the right groin, and then towards the abdomen. In the execution of this manœuvre, care is to be taken to keep the beak of the catheter stationary, so that it may be the centre of the movement, and simply revolve upon itself. This part of the operation, the object of which is to turn the concavity of the catheter upwards, ought to be done very slowly, a large sweep being made with the handle, while particular care is taken not to retract, nor move the beak from its position. The handle is then to be depressed, and the operation finished exactly in the same manner as when the first plan is pursued. As Desault properly observes, the only circumstance, in which the two first methods differ, from the third, is, that in this the same thing is performed by two movements, which is done in the others by one; so that the operation is rendered more complex. No doubt there is great difficulty in keeping the point of the catheter entirely stationary during the semi-circular movement of the handle. Indeed, it is alleged, that, if after laying bare the urethra and the deep perineal fascia in the dead subject, "a catheter be passed down with its concavity turned towards the perineum, we

shall find, that, as the turn is being made, the point of the instrument will describe the arch of a circle, carrying the urethra with it round the margin of the urethral foramen," and an impediment will occur, unless the urethra is kept perfectly tense. (*See Quain's Anatomy, p. 455. ed. 3.*) Hence, many judicious surgeons never practise the "tour de maître," except when their patients are corpulent; and, indeed, many of them not then, as they prefer the third method, which is begun with the handle of the catheter, inclined towards the patient's left groin. In treating retention of urine from diseased prostate gland, "I generally find," says an able surgeon, "that I introduce the catheter best by keeping the handle of it at first close to the left groin of the patient. I pass it, as far as possible, in this position; then I bring the handle forwards, nearly at a right angle to the pubes, and not elevating it towards the patient's navel. The next thing is to depress the handle, which is to be done gently and slowly, by placing a single finger on it, and pressing it downwards towards the space between the thighs. In depressing the handle, you generally find the point of the catheter slide into the bladder. Sometimes, however, this does not happen, until you withdraw the stylet; and, in the act of doing this, the introduction of the catheter is completed." In many instances, the operation will be best accomplished by taking care, at the moment when the handle is depressed, to keep the concave surface closely pressed against the arch of the pubes, so that it may turn round it as a centre. (*Brodie on Dis. of Urin. Organs, p. 145., ed. 2.*)

The depth to which the catheter has entered, the cessation of any feeling of resistance to the motions of the beak when revolved upon its axis, and the issue of the urine, are the circumstances by which the surgeon knows, that the instrument has passed into the bladder. In most persons, the signs denoting the entrance of the instrument into the bladder, are sufficiently clear. But, in certain examples, several of them may be absent, and the diagnosis be so obscure as to embarrass the surgeon. Then, if thick mucus, or clots of blood, fill the eyes of the catheter, the urine will not flow. When the bladder is empty, or contracted, the catheter may enter to so inconsiderable a depth, the elevation and depression, and the rotation of it to the right, or left, may be so limited, that doubts may exist about the situation of its beak. A large collection of blood in the anterior half of the bladder may cause deception, as no urine will escape till the catheter has passed completely through it. A catheter has been known to penetrate deeply between the bladder and rectum, and admit of almost as extensive movements, as if it had entered the bladder. A mistake is still more likely to happen, when, in consequence of ulceration of the lower side of the urethra, an accidental pouch has been formed, in front of the rectum, and in the substance of the perineum, as M. Velpeau once noticed in a man who died in the hospital in 1825, and as M. Roux observed in several instances. In fact, such a pouch may be supposed to be a diseased bladder, and this the more readily, as the catheter, directly it passes into it, gives issue to a small quantity of urine. (*See Velpeau, Nouv. Elém. de Méd. Opér. t. iii. p. 917.*)

According to the experience of Desault, the practice of gradually letting out a part of the

urine, after the catheter has been introduced, is by no means advantageous. He also disapproves of running into the opposite extreme, that is to say, of letting the urine flow out of the catheter, as fast as it is secreted; for, then, the bladder is kept constantly relaxed, and the detrusor muscle will not be likely to recover its tone. When the bladder is continually empty, it is liable to come into contact with the end of the catheter; a circumstance which has sometimes caused considerable irritation, pain, and even ulceration of that viscus. Besides these inconveniences, there are some others; the catheter is sooner obstructed with mucus, and covered with incrustations, than when it is closed with the stilet. The patients are likewise obliged to remain in bed, where they are either wet with their urine, or compelled to have incessantly a pot for it reception. The best practice, therefore, seems to be that of letting out all the urine, as soon as the catheter is introduced, and then closing the instrument, until the bladder has become moderately distended again; for experience proves, that such moderate distention and relaxation of the muscular fibres of the bladder, alternately kept up, have the same good effects upon that organ, as moderate exercise has upon other parts of the body.

When a catheter is to be left in the urethra, it should always be properly fixed, or else it is apt to slip out, or even pass too far into the passage. For this purpose, some surgeons use cotton thread, which they fasten to the rings, or round the external end of the catheter. The two extremities of the thread are then carried some way along the dorsum of the penis, when they are tied together, and afterwards conveyed in opposite directions round the part, till they meet underneath it, where they are tied in a bow. When a silver catheter is employed, a tape, or narrow riband, is passed through each of the rings, and conveyed to each side of the pelvis, where it is fastened to a circular bandage. Mr. Hunter remarks, that the common bag-truss for the scrotum answers extremely well, when two or three rings are fixed on each side of it along the side of the scrotum, and the ring of the cannula is fastened to any of them with a piece of tape. (*On the Venereal Disease*, ed. 2. p. 159.) He also notices another method: "When the catheter (says he) is fairly in the bladder, the outer end is rather inclined downwards, nearly in a line with the body. To keep it in this position we may take the common strap, or belt part, of a bag-truss, with two thigh straps, either fixed to it, or hooked to it, and coming round each thigh forwards by the side of the scrotum, to be fastened to the belt, where the ends of the bag are usually fixed. A small ring or two may be fixed to each strap just where it passes the scrotum, or root of the penis; and with a piece of small tape, the ends of the catheter may be fixed to those rings, which will keep it in the bladder. It seems Mr. Hunter did not, like Deauville, disapprove of leaving the catheter unchained, and he adds, therefore, a bit of rag, about four or five inches long, with a hole at the end of it, passed over the exterior end of the catheter, and the loose end allowed to hang in a basin, placed between the thighs, will catch the water, which cannot discharge itself from the catheter, and keep the patient dry; or, if another pipe is introduced into the catheter, it will answer the same purpose." (*Op. cit.* p. 191.) The following, which is the

French method of retaining the catheter in the bladder, is the most convenient with which I am acquainted:—"A metallic ring, the circumference of which should be more than sufficient to encircle the penis, is to be covered with cloth, and four long pieces of tape, with the same number of short ones, attached to it. This ring, enclosing the penis, is fixed against the pubes by the long pieces of tape, which, surrounding the pelvis in different directions, meet and are tied posteriorly. One of the short pieces is carried through the ring, or round the groove of the catheter, on each side; and being tied to its fellow, fixes the instrument securely in the bladder." (*See Averill's Operative Surgery*, p. 105.) But there are numerous modes of fixing a catheter, which need not be specified; for although they are of importance, the principles which should be observed in adopting them are the main things to be understood. These are, first, never to fix a catheter in such a way, that too much of the instrument projects into the cavity of the bladder; (*J.allemand, Perforation de la Vessie par les Sondes fixés; Revue Méd.* Nov. 1822. p. 299.) and, secondly, to be careful, that the thread, or tape, which is applied, will not irritate or make too much pressure upon the parts.

Mr. Hey has offered some good practical remarks on the introduction of the catheter. If, says he, the point of the catheter be less turned up than the urethra, the point will be pushed against the posterior part of the passage, instead of following the course of the canal. The posterior part of the urethra has nothing contiguous to it which can support it; and no considerable degree of force will push the point of the catheter through that part between the bladder and the rectum. If this accident is avoided, still the point will be pushed against the prostate, and cannot enter the bladder. Mr. Hey tells us, that the truth of this is illustrated, by the assistance which is derived, whenever the catheter stops at the prostate, from elevating the point of the instrument with a finger introduced in the rectum. He notices the impropriety of pushing forwards the point of the catheter, before its handle is sufficiently depressed, as the point would move in a horizontal direction, and be likely to rupture the posterior side of the urethra.

Throughout the writings of Sir Benjamin Brodie on this subject, I find the same caution repeatedly given, not to let the catheter press too much upon the inferior and posterior side of the urethra; and the same thing is insisted upon by the best practical surgeons in France:—"If the end of the catheter were directed too much against the lower side of the urethra," says M. Velpeau, "it would pass with difficulty, and be likely to hitch first in the fossa navicularis, then in the excavation at the bulb, and next in the prostatic depression, and make in one of these situations a false passage. By making the beak keep regularly along the upper side, such accidents will be avoided, unless it be raised too much," &c. He adds, that even this erroneous direction, if not excessive, will be attended with no real inconvenience, except between the crura penis, and the part of the urethra just in front of the symphysis of the pubes. (*See Velpeau, Nouv. Élem. de Méd. Opér.* t. iii. p. 915.) The skill appears to this surgeon, as it did long ago to Hey and Brodie, to consist in guiding the catheter, in the axis of the urethra, from the glans to the

CATHETER.

bladder, keeping it lightly resting against the dorsal side of the passage. (See also *Malgaigne Man. de Méd. Opér.* p. 650.)

In order to pass the catheter, Mr. Hey places his patient on a bed, in a recumbent posture, his breech advancing to, or projecting a little beyond, the edge of the bed. If the patient's feet cannot rest upon the floor, he supports the right leg by a stool, or by the hand of an assistant. The patient's head and shoulders are elevated by pillows; but the lower part of the abdomen is left in a horizontal position. Mr. Hey commonly introduces the catheter with its convexity towards the abdomen; and having gently pushed down the point of the instrument, till it becomes stopped by the curvature of the urethra, under the symphysis pubis, he turns the handle towards the navel, pressing at the same time its point. In making the turn, he sometimes keeps the handle at the same distance from the patient's abdomen, and sometimes makes it gradually recede; but, in either method, he avoids pushing forwards the point of the catheter any farther, than is necessary to carry it just beyond the angle of the symphysis pubis. When he feels that the point is beyond that part, he pulls the catheter gently towards him, hooking, as it were, the point of the instrument upon the pubes. He then depresses the handle, making it describe a portion of a circle, the centre of which is the angle of the pubis. When the handle of the catheter is brought into a horizontal position, with the concave side of the instrument upwards, he pushes forwards the point, keeping it close to the interior surface of the symphysis pubis; for, when passing in this direction, it will not hitch upon the prostate gland, nor injure the membranous part of the urethra.

If the surgeon uses a flexible gum catheter, it is of great consequence to have the stilet made of some firm metallic substance, and of a proper thickness. Mr. Hey always made use of brass wire for the purpose. If the stilet is too slender, the catheter will not preserve the same curvature during the operation; and it will be difficult to make the point pass upwards behind the symphysis pubis in a proper direction. If the stilet is too thick, it is withdrawn with difficulty.

When the stilet is of a proper thickness, this instrument has one advantage over the silver catheter, which is, that its curvature may be increased while it is in the urethra, which is often of great use, when the point approaches the prostate gland. In all cases where an elastic gum catheter is preferred, care must be taken that it does not pass unnecessarily far into the bladder; and, if it be too long, a part of it ought to be cut off, or a shorter one employed.

When the proper manœuvres with a silver catheter do not succeed, the surgeon must change it, taking a larger or a more slender one, with a greater or less curve, according to such observations as he may have made in his first attempt. But, if the catheter has been of a good form or commodious size, yet has not passed easily, he should, instead of choosing a rigid catheter of another size or form, take a flexible one for his second attempt. The flexible catheter is generally slender, and of sufficient length, and its shape may be accommodated to all occasions, and to all forms of the urethra; for, having a stiff wire, we can give that wire, either before or after it has been passed into the catheter, whatever shape we please; and

what is of still greater importance, we can introduce the instrument without or with the wire, as circumstances may require; or what is more advantageous, we can introduce the wire particularly so as not quite to reach the point of the catheter, but only to within two inches or a little more of this part, by which contrivance the point, if previously warmed, and wrought in the hand, has so much elasticity, that it follows the precise curve of the urethra, and yet has sufficient rigidity to surmount any slight resistance. If this too fail, and especially if there be the slightest reason to suspect, that the resistance is not merely spasmodic, but arises from stricture near the neck of the bladder, in a young man, or swelling of the prostate in an old one, we may take a small bougie, turn up the extremity of it with the finger and thumb, so as to make it incline towards the pubes, and, allowing no time for the wax to be softened, pass it quickly down to the obstruction, turn it with a vertical or twisting motion, and make it enter the constricted part. On withdrawing it in about ten minutes or a quarter of an hour, the urine generally escapes, or the catheter may now be introduced. (*John Bell's Principles of Surgery*, vol. ii. p. 215.)

Mr. Hey found, that, in withdrawing the stilet of an elastic gum catheter, the instrument becomes more curved; and he availed himself of this information, by withdrawing the stilet, as he introduced the catheter beyond the arch of the pubes, by which artifice the point was raised in the due direction. He says, you may sometimes, though not always, succeed in introducing an elastic gum catheter, by using one which has acquired a considerable degree of curvature and firmness, by having had a curved stilet kept in it a long while. Introduce this without the stilet, with its concavity towards the abdomen, taking care not to push on the point of the instrument, after it has reached the symphysis pubis, until its handle is depressed into a horizontal position.

Sir Benjamin Brodie, in speaking of retention of urine from diseased prostate gland, advises surgeons to provide themselves with a sufficient number of gum catheters, "mounted not on small flexible straight wires, but on strong iron stilets, having the curve of a silver catheter. The stilets, which belong to the larger gum catheters, should have flattened iron handles, resembling that of a common sound. Like Mr. Hey, he approves of keeping catheters, thus prepared, for a considerable time before they are wanted for use; they will then become fixed in the proper curvature. With the stilet, such a catheter is as inflexible as if it were made of silver; without it, it is capable of retaining its shape to a certain extent, yet it is flexible. Sir B. Brodie always first tries to pass such an instrument. In difficult cases, he admits, that the gum catheter without the stilet will not succeed. He concurs with all experienced surgeons, that, in chronic enlargement of the prostate gland, a catheter, large enough to fill the urethra, without stretching it, is more easy of introduction than a small one; and that the stilet ought to be considerably curved. (*On Dis. of the Urinary Organs*, p. 144. ed. 2.) Speaking of catheters, another excellent modern practitioner remarks, "Elles pénètrent d'autant mieux, toute proportion gardée, que leur volume est plus considérable." (*Vespaie, Nouv. Élém. de Méd. Opér.* t. iii. p. 912.)

When it is necessary to draw off the urine

frequently, and the surgeon cannot attend often enough for this purpose, a catheter must be left in the urethra, till an attendant, or the patient himself, has learnt the mode of introducing the instrument.

Mr. Hey imputes the formation of a false passage, or the rupture of the membranous part of the urethra, generally to the method of pushing forwards the catheter, before its handle has been depressed. In this manner, the course of the instrument crosses that of the urethra, and the point of the catheter, pressing against the posterior side of the membranous part of the urethra, is easily forced through the coats of that canal. The want of due curvature in the catheter, and of sufficient bluntness in its point, greatly contributes to facilitate the injury. When it has once happened, the point of the instrument passes more readily into the wound, than along the urethra against the symphysis pubis; and a great deal of skill is requisite to prevent this disadvantageous occurrence from repeatedly taking place, and rendering the case more and more serious.

Mr. Hey surmounted a difficulty of this kind, by bending upwards the point of a silver catheter, so as to keep it more closely in contact with the anterior part of the urethra, and thereby pass over the wound made in the posterior side of the canal. In the instance alluded to, as it was necessary to leave an elastic gum catheter in the urethra, Mr. Hey procured some brass wire of a proper thickness, with which he made a stilet; and, having given it the same curvature as that of the silver catheter, he introduced it about four hours after the preceding operation, and fixed it by tying it to a bag-truss. Mr. Hey sometimes succeeded by partly withdrawing the stilet, at the moment when he wished to increase the curvature of the catheter.

In an instance in which the urethra had suffered a violent contusion, Mr. Hey drew off the urine with a silver catheter of unusual thickness, after he had failed with instruments of a smaller bore. He suspected that the urethra was ruptured, and was obliged to raise the point of the catheter by a finger introduced into the rectum, and to use bleeding, purgatives, the warm bath, and opium, before it could be made to pass. The gum catheter was afterwards employed. It is an unsettled point, whether it is best to leave the catheter in the urethra, until the power of expelling the urine has been regained, or to draw off the urine twice a day, and withdraw the catheter after each operation. Mr. Hey thinks, that no general rule can be laid down; some patients cannot bear the catheter to remain introduced; others seem to suffer no inconvenience from it. On the whole, however, he commonly prefers removing the catheter. In this manner, he is of opinion, that the power of expelling the urine again is soonest acquired.

The preceding question is often determined by the nature of the disease; and, as Mr. Hunter observes, in cases of debility of the bladder, and where a catheter passes with difficulty, or with great uncertainty, as well as in other instances, in which it must be used frequently, and for a length of time, it will be necessary to keep it introduced, so as to allow the water to pass freely through it. (*On the Ven. Dis. edit. 2. p. 191.*)

In the majority of retentions of urine from diseased prostate gland, Sir Benjamin Brodie deems it prudent to allow the catheter to remain. "If you

remove it, so abundant is the flow of urine, which immediately takes place from the kidneys, that you will find the bladder loaded, and requiring the reintroduction of the catheter, within five or six, perhaps even within three or four hours. It will be necessary to use the catheter again, after another short interval; and it will often happen, when there has been no difficulty in the first introduction of it, that there is considerable difficulty afterwards." (*Brodie, on Dis. of the Urin. Organs, p. 148. ed. 2.*)

In France, a conical silver catheter (*sonde conique*) has sometimes been employed in difficult cases by Boyer, Roux, &c. This instrument has a very slight curvature, and an extremity almost pointed. By force, regularly applied, it is introduced into the bladder in spite of all opposition. Care is taken to keep it in the centre of the passage, and the direction of its point is judged of by the position of the lateral rings. The rule mentioned by Roux, for commencing the great depression of the outer extremity of the instrument, is when, by the finger in the rectum, the point can be felt to have reached the apex of the prostate. (*See Sketches of the Medical Schools of Paris, by J. G. Crosse, p. 112.*) In bad cases, the conical catheter is usually allowed to remain introduced three or four days; and on being withdrawn, a small gum catheter generally admits of being used.

The forcible manner in which the conical silver catheter has been employed, must often do great and dangerous mischief. Thus, in two examples, which were witnessed and examined by M. Roux himself after the decease of the patients, a false passage had been made, no gum catheter could be passed, the urine was effused in the cellular membrane, and the parts were gangrenous. (*See p. 116 of the above work.*) According to Mr. Crosse, the French surgeons employ the conical silver catheter with too little discrimination, and "in their practice they seem to make no nice distinctions between impediments to the flow of urine from spasm, irritable and inflamed state of the canal, disease of the prostate gland, and cartilaginous stricture of long duration. If the conical catheter be admissible at all, it is in the last of these cases, particularly when combined with fistula in perinæo; and here all surgeons, who are familiar with the treatment of diseases of the urethra, occasionally use means, which approach very closely to the forcing method of the French. I have heard of instances, in which John Hunter employed great force with the silver catheter, and overcame the obstruction. I have seen Mr. Pearson (who generally treats strictures as mildly, and, I need hardly say, as successfully, as any man) take a steel sound, and pass it gradually and forcibly on into the bladder, at the same time feeling his way, as it were, by keeping one finger in the rectum: the relief of the patient, and the ultimate cure of the disease, were the results of this practice." (*P. 118.*) The conical silver catheter has been used by Sir A. Cooper. Without altogether condemning the occasional employment of this instrument, I perfectly coincide with Mr. Crosse, that it is one, with which young men, of little caution and no experience, may do more harm in the first few cases they meet with, than the rest of their life will afford them opportunities of doing good.

Mr. Hunter refers to instances, in which the common catheter had been pushed through the projecting part of the prostate gland into the bladder, and the water then drawn off; but, "in one patient, the blood from the wound passed into the bladder, and increased the quantity of matter in it. The use of the catheter was attempted a second time; but, not succeeding, I was sent for. I passed the catheter till it came to the stop, and then, suspecting that this part of the prostate projected forwards, I introduced my finger into the anus, and found that gland very much enlarged. By depressing the handle of the catheter, which of course raised the point, it passed over the projection; but unfortunately the blood had coagulated in the bladder, which filled up the holes in the catheter, so that I was obliged to withdraw it, and clear it repeatedly. This I practised several days; but, suspecting that the coagulum must in the end kill, I proposed cutting him (the patient) for the stone; but he died before it could be conveniently done, and the dissection, after death, explained the case," &c. (*On the Ven. Dis.* ed. 2. p. 172.)

To a surgeon duly acquainted with anatomy, the introduction of the female catheter is exceedingly simple. From motives of delicacy, the instrument should be passed without any exposure. The surgeon should hold the catheter in his right hand, while he introduces the forefinger of his left hand between the nymphæ, so as to feel upon the upper surface of the passage the little papilla, which surrounds, and denotes to the touch, the precise situation of the orifice of the meatus urinaris. Holding the concavity of the catheter forward, the surgeon, guided by the forefinger of his left hand, is then to introduce the instrument upward into the bladder. A female catheter should always be furnished with some contrivance to prevent its slipping completely into the bladder: the following case, mentioned in a respectable periodical work, fully proves the truth of this remark:—

Some years ago, a surgeon, practising in the country, was required to introduce the catheter for a lady labouring under retention of urine. During the operation he was observed to exhibit signs of confusion, and to quit his patient in considerable embarrassment. The same day he abruptly left his home, and was never seen afterwards. The lady passed several years of dreadful suffering, attributed, by herself and the professional gentleman on whom the treatment of the case devolved, to aggravation of the original complaint. At length an abscess presented itself in the sacral region, and the surgeon punctured it, when his instrument came in contact with some unusually hard substance imbedded in the centre of the abscess. With a pair of forceps, he now extracted, to his utter astonishment, a blackened female catheter. From this period, the lady's sufferings all terminated. A similar accident nearly happened in the practice of another gentleman. (See PROSTATE GLAND; URETHRA; AND URINE, RETENTION OF.)

Medico-Chir. Journ. vol. v. p. 75. Lond. 1818. *J. Hunter*, on the Venereal Disease, ed. 2. in various places. *Key's Practical Obs.* in Surgery, ed. 3. *John Bell's Principles*, vol. II. Sketches of the Medical Schools of Paris, by *J. G. Crosse*, p. 111. &c. *Jos. M. Sweeney*, Obs. on the Catheter, *Edin. Med. and Surg. Journ.* No. 88. p. 92. *Richter's Anfangsgr. der Wundarzneikunst. Leimwand, Perforation de la Vessie par les Sondes fixes, Revue Méd.* Nov. 1822. *Langenbeck, Bibl. für die Chir.* b. 1. p. 175. 12mo. Götting. 1836. *Desault*,

Œuvres Chir. t. III. *Amussat*, *Archives, Gén. de Méd.* t. IV. *Berton*, *Op. cit.* Mal. 1826. *Alf. A. L. M. F. Jean*, *Nouv. Elém. de Méd. Opér.* t. III. p. 306. 8vo. Paris, 1832. *Quain's Elém. of Anatomy*, p. 464. 8vo. Lond. 1834. *Sir Benjamin Brodie*, on Dis. of the Urinary Organs, ed. 2. 8vo. Lond. 1835. *J. F. Malgaigne*, *Manuel de Méd. Opér.* p. 654. 12mo. Paris. 1834.

CATLING, often spelt, in surgical books, *catlin*, is a long, narrow, double-edged, sharp-pointed, straight knife, which is chiefly used in amputations of the leg and forearm, for dividing the interosseous ligaments and the muscles, &c. situated between the two bones.

CAUSTICS. (from *caus*, to burn.) Medicines, which destroy parts by burning, or chemically decomposing them. The potassa fusa, the potassa cum calce, the antimonium muriatum, the argenti nitras, the hydrargyri nitrico-oxydum, the acidum sulphuricum, and the cupri sulphas, are caustics in frequent use.

CAUTERY. (from *caus*, to burn.) *Canteries* are of two kinds, viz. *actual* and *potential*. By the first term is implied a heated iron; by the second, any caustic application. The high opinion, which the ancients entertained of the efficacy of the actual cautery may be well conceived from the following passage:—"Quoscumque morbos medicamenta non sanant, ferrum sanat; quos ferrum non sanat, ignis sanat; quos vero ignis non sanat, insanabiles existimare oportet." (*Hipp.* sect. 8. aph. 6.) The actual cautery has been employed for the stoppage of bleeding, where the vessels could neither be tied, nor compressed. It has been also employed for the destruction of carcinomatous tumours and ulcers, fistulæ, polypi, and a variety of fungous diseases. Whoever looks over the writings of Hippocrates, will discover, that the actual cautery was a principal means of relief in several chronic affections, as dropsies, diseased joints, &c.

In modern times, the actual cautery has been more and more relinquished, in proportion as surgery has attained a higher state of improvement. On the Continent, however, it still retains advocates. In France, most of the professors recommend and employ it in particular cases. Hospital gangrene, a peculiar disorder, much more frequently seen in foreign and in military hospitals, than in the charitable institutions for the reception of the sick poor in England, is little affected by any internal remedies. "Vegetable and diluted mineral acids are the local means employed with effect in mild cases. I have (says Mr. Crosse) already alluded to a case of Pelletan's, where carbon was applied, and the progress of the disease impeded. But, the actual cautery is the only means, that has been found effectual, in stopping the fatal progress of bad cases of hospital ulcer, and the iron is applied red hot, so as to produce an eschar on every point of the surface of the sore." (See *Sketches of the Medical Schools of Paris*, p. 84. and the article HOSPITAL GANGRENE.)

Desault often employed the actual cautery to destroy fungous tumours of the antrum. (See ANTRUM.) The same practice was followed by Pelletan and other surgeons in France. Mr. Crosse saw it adopted in one such case with good effect. (P. 86.) Part of the fungous was cut away, and the deeper portion, out of the reach of the knife, cauterised. This practice is now generally renounced, and the removal of the whole of the bone, or bones, from which the tumour arises,

completed in the manner elsewhere described. (See BONES, EXCISION OF; also ANTRUM.)

CERPHALOMA. See CANCER and FUNGUS HEMATOIDES.

CERATOTOME. (from *κίρα*, a horn, and *τομή*, to cut.) The name given by Wenzel to the knife, with which he divided the cornea.

CERATUM CALAMINÆ. (L.) A good simple dressing.

CERATUM CANTHARIDIS. (L.) formerly used as a dressing for blisters, when it was wished to keep up a discharge from them. On account of the tendency of cantharides to bring on stranguery by being absorbed, the ceratum sabinae is now generally preferred to the cerate of cantharides.

CERATUM CETACEI. (L.) The spermaceti cerate. A mild, unirritating salve, for common purposes.

CERATUM CONIL. R. *Unguenti Conii* lbj. (See UNGUENTUM.) *Cetacei* ʒij. *Cera Albe*, ʒij. M. One of the formulæ at St. Bartholomew's Hospital, occasionally applied to cancerous, scrofulous, and phagedenic sores.

CERATUM HYDRARGYRI SUBMURIATIS. R. *Hydrarg. Submuriatis*, ʒi. *Cerati Lapid. Calamin.* ʒss. M. Some practitioners are partial to this as a dressing for chancres.

CERATUM PLUMBI ACETATIS. (L.) A mild, astringent, unirritating salve.

CERATUM PLUMBI COMPOSITUM. (L.) An excellent, gently astringent salve, for common purposes.

CERATUM SABINÆ. R. *Sabinæ foliorum recentium contusorum*, lbj. *Cerae flavae*, lbss. *Adipis preparatæ*, lbj. Mix the savin with the melted wax and hog's lard, and strain the composition.

The common application for keeping open blisters, on the plan recommended by Mr. Crowther. (See BLISTERS.)

CERATUM SAPONIS. R. *Plumbi oxydi semivitrei*, lib. j. *Aceti cong.* j. *Saponis unc.* viij. *Olei olivæ*, *Cera flavae*, sing. lib. j.

The soap cerate of St. Bartholomew's Hospital. The three first ingredients are to be mixed together and boiled gently till all the moisture is evaporated; after which, the wax and oil, previously melted together, must be added. The whole composition, from first to last, must be incessantly stirred, without which the whole will be spoiled. This formula was introduced by Pott, as a convenient application to simple fractures.

In applying this cerate, spread on linen, to fractures of the leg or arm, one caution is necessary, namely, that it be in two distinct pieces; for if, in one piece, the limb be encircled by it, and the ends overlap each other, it will form a partial constriction of the fractured part, in consequence of the subsequent tumefaction. (*Pharm. Chirurg.*)

In the North London Hospital, this plaster is not employed, nor indeed is it truly of any essential use.

CERUMEN AURIS. A degree of deafness is frequently produced by the lodgment of hard dry matter in the substance of the meatus auditorius. The best plan, in such cases, is to syringe the ear with warm water, which should be injected with moderate force.

In some instances, deafness depends on a dis-

festive secretion of the cerumen, and a consequent dryness of the meatus. Here, a drop or two of sweet oil may now and then be introduced into the ear, and fomentations applied.

CHALAZIUM. (from *χάλαζα*, a hailstone.) When the hordeolum or styne does not suppurate, but changes into a hard little tumour, it receives this appellation. (See HORDEOLUM.)

CHAMOMILE. The flowers are used, in surgery, for making a fomenting decoction.

CHANCRE. (from *κακίς*, cancer venereus.) A sore, arising from the direct application of the venereal poison to any part of the body. Of course it almost always occurs on the genitals. Such venereal sores, as break out from a general contamination of the system, in consequence of absorption, never have the term *chancre* applied to them. (See VENEREAL DISEASE.)

CHARPIE is a name, given by the French to a collection of filaments, separated from pieces of old linen rag, four or five inches square, and of loose texture. It is preferred to lint, as absorbing much better. It is of two kinds, the *charpie brute*, and the *charpie rapée*. The *brute* is either fine or coarse; the first being placed in immediate contact with the wound, or ulcer, on account of its softness, and absorbent qualities; the second is employed, as an upper stratum, for purposes of economy. The *rapée*, which is made by scraping fine linen rag, or long charpie with the back of a knife, is more irritating than *charpie brute*, and imbibes the discharge, with greater promptitude. (See *Cutler's Guide in Dressing*, and the *Methodic Application of Bandages*. 12mo. Lond. 1834.)

CHEMOSIS. (from *χαίω*, to gape.) When inflammation of the eye is violent, it frequently happens, that lymph, or blood, is effused in the tissue membrane, which connects the conjunctiva with the anterior hemisphere of the eye. Hence, the latter membrane is gradually elevated upon the eyeball, and projects towards the eyelids, so as to conceal within it the cornea, which appears as if it were depressed.

Acute ophthalmia, with chemosis, demands rigorous antiphlogistic treatment. Both general and topical bleeding should be speedily and copiously put in practice, with due regard, however, to the age and strength of the patient. When chemosis is considerable, Scarpa approves of making an incision in the conjunctiva, near its junction with the cornea, for the discharge of the lymph or blood lodged under the distended membrane. In adults, the free exhibition of calomel is also mostly proper. (See OPHTHALMY.)

CHEVASTER, or CHEVA'STRE. A double-headed roller, the middle of which was applied to the chin; the bandage then crossed at the top of the head, and passed on each side to the nape of the neck, where it crossed again. It was next carried up to the top of the head, and so on, till all the roller was exhausted.

CHIA'STRE. A bandage for stopping hemorrhage from the temporal artery. It is double-headed, about an inch and a half wide, and four ells long. Its middle is applied to the opposite side of the head: the bandage is carried round to the bleeding temple, and there made to cross over a compress on the wound. The roller is then continued over the coronal suture, and under the chin, care being taken to make the bandage cross

upon the compress. In this way, the rest of it is applied round the head.

CHILBLAINS are the effect of inflammation, arising from cold. A chilblain, in its mildest form, is attended with a moderate redness of the skin, a sensation of heat and itching, and more or less swelling, which symptoms, after a time, spontaneously disappear. The intolerable itching and sense of tingling, accompanying the inflammation of the milder description of chilblains, are observed to be seriously aggravated by exposure to heat. In a more violent degree, the swelling is larger, redder, and sometimes of a dark blue colour; and the heat, itching, and pain, are so excessive, that the patient cannot use the part. In the third degree, small vesicles arise upon the tumour, which burst and leave excoriations. These often change into ill-conditioned sores, which sometimes penetrate even as deeply as the bone, discharge a thin ichorous matter, and generally prove very obstinate. As Dr. John Thomson has remarked, "when the serum contained in the vesications is let out by a small opening, a portion of new cuticle is usually formed to supply the place of that which has been separated; but, when the inflammation is severe, and the affection neglected, or improperly treated, the parts, which are the seat of vesication, are liable to pass into the state of vitiated ulcers. In this state, they yield a thin, ichorous, or sanious discharge, and are in general brought, only after a long time, and with much difficulty, to a healthy suppuration. In neglected cases, these ulcers not unfrequently become covered with foul sloughs. Ulceration often supervenes, and the soft parts, covering the bones, are destroyed." (*On Inflammation*, p. 638.) The worst stage of chilblains is attended with sloughing.

Chilblains are particularly apt to occur in persons, who are in the habit of going immediately to the fire, when they come home in winter with their fingers and toes very cold; they are also frequent in persons, who often go suddenly into the cold, while very warm. Hence, the disease most commonly affects parts of the body, which are peculiarly exposed to these sudden transitions; for instance, the nose, ears, lips, toes, heels, and fingers. Richter remarks, that they are still more frequently occasioned, when the part suddenly exposed to cold, is in a moist perspiring state, as well as warm. Young subjects are much more liable to this troublesome complaint than adults; and females, brought up in a delicate manner, are generally more afflicted than the other sex.

The most likely plan of preventing chilblains is to accustom the skin to moderate friction; to avoid hot rooms and making the parts too warm; to adapt the quantity and kind of clothing to the state of the constitution, so as to avoid extremes, both in summer and winter; to wash the parts frequently with cold water; to take regular exercise in the open air in all kinds of weather; and to take particular care not to go suddenly into a warm room, or very near the fire, out of the cold air.

Although chilblains of the milder kinds are only local inflammations, yet they have some peculiarity in them; for they are not most benefited by the same antiphlogistic applications, which are most effectual in the relief of inflammation in general.

One of the best modes of curing chilblains of the milder kind is to rub them with snow, or ice-

cold water, or to bathe them in the latter, several times a day, keeping them immersed each time, till the pain and itching abate. After the parts have been rubbed or bathed in this way, they should be well dried with a towel, and covered with flannel or leather socks.

This plan is perhaps as good a one as any; but it is not that which is always congenial to the feelings and caprice of patients; and with the constitutions of some it may even disagree. In such cases, the parts affected may be rubbed with spirit of wine, linimentum saponis, a mixture of tincture of opium and hartshorn, tinctura myrrhæ, or a strong solution of alum, or vinegar. A mixture of oleum terebinthinæ and balsamum copaivæ, in equal parts, is a celebrated application. A mixture of two parts of camphorated spirit of wine, and one of the liquor plumbi subacetatis has also been praised. Mr. Wardrop speaks highly of one part of the tincture of cantharides, with six of the soap liniment. (*Medico-Chir. Trans.* vol. v. p. 142.)

With respect to vesications, "their occurrence is always hastened, and the inflammation, upon which they depend, greatly aggravated by the action of external heat; and, hence, the propriety of continuing cold applications to frost-bitten parts, so long as their temperature continues above the natural standard, or the inflammation excited seems to retain an acute character. From the tendency, which the inflammation excited, has to pass into gangrene, the more stimulating applications, such as spirit of wine, diluted ammonia, or oil of turpentine may be required; but should these applications prove too stimulating, their strength may be lessened by additions of greater or less portions of the linimentum ex aqua calcis." (*Thomson on Inflammation*, p. 648.)

When chilblains suppurate and ulcerate, they require stimulating dressings, such as lint dipped in a mixture of the liquor plumbi subacetatis dilutus, and liquor calcis; tinctura myrrhæ, or warm vinegar. If a salve be employed, one which contains the hydrargyri, nitrico-oxylum, or the unguentum zinci with myrrh, camphor, opium, or the Peruvian balsam, will be found most beneficial. The muriate, or hydrochlorate of lime, in the form of an ointment, has been found by Lisfranc, to be an excellent application to ulcerated chilblains. (*Revue Méd.* Feb. 1826.) Ulcers of this kind frequently require to be touched with the nitrate of silver, or dressed with a solution of it.

Chilblains, attended with sloughing, should be poulticed, till the dead parts are detached. The sores should then be first dressed with some mildly stimulating ointment, such as the unguentum resinæ flavæ, or unguentum zinci. With the first of these, in a day or two, a little of the hydrargyri nitrico-oxylum may be mixed; but the surgeon should not venture on the employment of very irritating applications, till he sees what the parts will bear, and whether such will be requisite at all; for, were he too bold, immediately he leaves off the poultices, he might bring on sloughing again.

Rees's Cyclopædia, art. Chilblains. *Richter's Anfangsgr. der Wundarzn.* b. 1. *Thomson's Lectures on Inflammation*, p. 637. &c. *Lasus, Pathologie Chirurg.* t. II. p. 388, &c. *Calislem, Systema Chirurgiæ Modernæ*, vol. I. p. 304, &c. ed. 1798. *Pearson's Principles of Surgery*, p. 158, &c. ed. 1808. *Mc J. Cheyne, Handb. der Chir.* b. I. p. 73. Heidelberg. 1826.

CHIMNEY-SWEEPERS' CANCER. See **SCORRUM.** (See p. 357.)

CHORDEE. (French, from *chorde*, a chord.) When inflammation is not confined merely to the surface of the urethra, but affects the corpus spongiosum, it produces in it an extravasation of coagulable lymph, as in the adhesive inflammation, which, uniting the cells together, destroys the power of distention of the corpus spongiosum urethrae, and makes it unequal in this respect to the corpora cavernosa penis, and therefore a curvature takes place at the time of an erection, which is called a *chordee*. The curvature is generally in the lower part of the penis. When the chordee is violent, the inner membrane of the urethra is so much upon the stretch, that it may be torn, and a profuse bleeding from the urethra excited, that often relieves the patient, and even sometimes proves a cure. This is the *inflammatory chordee*; another kind has been named *spasmodic*.

In the beginning of the inflammatory chordee, bleeding from the arm is often of service; but it is more immediately useful to take blood from the part itself by leeches; for, we often find, that when a vessel gives way, and bleeds a good deal, the patient is greatly relieved. Exposing the penis to the steam of hot water, frequently affords great relief. Poultices have also beneficial effects; and both fomentations and poultices will often do most good when they contain camphor. Opium, given internally, is of singular service; and if it be joined with camphor, the effect will be still greater. Hyocissamus will sometimes agree with the patient better than opium, or even than the acetate, or muriate of morphia; and frequently opium has the best effect, when administered in the form of an enema.

When the chordee continues after all inflammation has terminated, no evacuations are required; for the consequences of the inflammation will gradually cease on the absorption of the extravasated coagulable lymph. Mercurial ointment, rubbed on the part, will promote this event. When the common methods of cure are unavailing, hemlock is sometimes useful. Electricity is said to have been of service. A chordee is often longer in going off than any other consequence of a gonorrhoea, but, in the end, it disappears.

For bringing about the removal of the extravasated lymph, camphorated mercurial ointment is better than the simple unguentum hydrargyri. According to Mr. Hunter, *spasmodic chordee* is benefited by bark. (*On the Venereal Disease*, ed. 2.) The recent leaves of belladonna powdered, and made into an ointment with an equal weight of lard, and rubbed over the penis, are stated to hinder, pumpkin, and relieve chordee more effectually, than any other application hitherto proposed. (*J. A. Paris, in Pharmacologia*, vol. ii. p. 110, ed. 5.)

In the summer of 1828, I attended with Dr. Langens, of King Street, Finsbury, and Mr. Holt, of Compton Street, Brunswick Square, a gentleman attacked with gonorrhoea, whose case was remarkable on account of the situation and quantity of the effused lymph; for, it occupied the portion of the corpus spongiosum towards the glans, and produced an considerable swelling; and such pressure on the corresponding portion of the urethra, that the patient required the use of a catheter for nearly a month, as well as the most active antiphlogistic treatment. The mobility of the bladder

without the power of emptying it; the suffering from tenesmus; and the high degree of fever; made this a most severe case.

CICATRIX. A scar: the mark left after the healing of a wound, or ulcer. Also, the new-formed production, or the substance of the cicatrix, which is covered with a very delicate adherent and smooth, shining cuticle, the existence of which is easily demonstrated by means of a blister, or maceration. Under this inorganic stratum is a dense tissue, composed, according to Dupuytren, of fibrous layers, more or less dense, and crossing one another in all directions. Between the *tissue of the cicatrix*, as Dupuytren calls it, and the cuticle, there is no trace of rete mucosum, which circumstance seems to him to explain, why a cicatrix, presents the same colour in the negro and the European, the exceptions being accounted for on principles noticed in the article **BURNS** and **CICATRISATION**. The tissue of a cicatrix contains neither subaceous follicles, nor hair-bulbs: at all events, this is the case, when the whole thickness of the skin has been destroyed. The same tissue is pierced by a small number of exhalant, or absorbent pores; and, instead of being connected to the subjacent parts by fibro-cellular septa, is bound down to them by a dense laminated substance, so that a depression or hollow is frequently the result.

The appearance, and likewise in some measure the texture of a cicatrix, were observed by Dupuytren, to differ according to the causes, which produced the solution of continuity. The lapse of many years will not prevent a man of experience from distinguishing the cicatrices of burns from those which have been caused by sharp instruments; and both these kinds from others resulting from ulcerated cancer, herpetic diseases, syphilitic sores, or scrofulous abscesses. The importance of this kind of knowledge in medical jurisprudence, is very properly insisted upon by Dupuytren, sometimes to establish the identity of individuals, and sometimes to define the nature of the cause by which the solution of continuity has been produced.

The vascularity of cicatrices is various. In general, they are only furnished with a few very minute capillary ramifications, scarcely capable of being injected. In the face, they are sometimes seen retaining all their whiteness in the midst of the general redness of the countenance occasioned by heat, blushing, &c.; yet they are not insensible to external impressions, and as they are acutely painful, when inflamed, they must receive nerves, though in small number. How sensitive they are with respect to different states of the atmosphere, and how faithfully the painful shootings in them, announce to many individuals, the temperature and moisture of the air, is another point adverted to by Dupuytren, in proof of their having nerves. (*See Clinique Chir. t. ii. p. 42.*)

CICATRISATION. The process by which wounds and sores heal. Granulations having been formed, the next object of nature is to cover them with skin. The parts which had receded by their natural elasticity, in consequence of the breach made in them, now begin to be brought together by the contraction of the granulations. The contraction takes place at every point, but principally from edge to edge, bringing the circumference towards the centre of the sore, which thus becomes

smaller and smaller, even although little or no new skin may be formed.

The contracting tendency is in some degree proportioned to the general healing disposition of the sore, and looseness of the parts. When granulations are formed upon a fixed surface, their contraction is mechanically impeded; as, for instance, on the skull, the shin, &c. Hence in all operations on such parts, as much skin as possible should be saved.

For weeks, and, sometimes for months, after the first formation of a cicatrix, its organisation sometimes becomes more and more perfect. Its thickness and strength gradually augment, and its diameter lessens by a consecutive contraction, which only ceases when the cicatrix has become pale and firm, such as it is to remain during the rest of life. This contraction of a cicatrix, exemplified after all suppurating wounds and ulcers, is strongly manifested after burns, and has been taken advantage of to remedy the looseness and redundant length of the skin of certain organs, as of the eyelids, so as to turn the inverted eyelashes from the eyeball. (See *Dupuytren, Clin. Chir. t. ii. p. 41.*)

The shape of a sore, as well as its situation, makes also a considerable difference in its readiness to heal: thus, as Sir Astley Cooper has remarked, a sore of a circular form *cæteris paribus*, will be longer in cicatrising, than another of much greater length, but less diameter.

When there has been a loss of substance, making a hollow sore, and the contraction of the granulations has begun, and made a good deal of progress, before they have had time to rise as high as the skin, then the edges of the skin are generally drawn down, and tucked in by it.

The contraction of the granulations continues, till the healing is complete: but it is greatest at first. That there is a mechanical resistance to such contraction, is proved by the assistance, which may be given to the process by the application of a bandage.

Besides the contractile power of the granulations, there is a similar power in the surrounding edge of the cicatrising skin, which assists the contraction of the granulations, and is generally more considerable than that of the granulations themselves, drawing the mouth of the wound together like a purse. The contractile power of the skin is confined principally to the very edge, where it is cicatrising, and, as Hunter believed, to those granulations, which have already cicatrised; for, the natural or original skin, surrounding this edge, does not contract, or at least not nearly so much, as appears by its having been thrown into folds and plaits, while the new skin is smooth and shining.

The uses of the contraction of granulations are various. It facilitates the healing of a sore, as there are two operations going on at the same time, viz. contraction and skinning.

It avoids the formation of much new skin, the advantage of which is evident; for it is with the skin as with all other parts of the body, viz. that such as are originally formed are much fitter for the purposes of life, and less liable to ulceration, than those which are newly formed.

Like all abnormal organic substances (says Dupuytren) cicatrices are readily irritated, and they are destroyed by inflammation with prodigious rapidity. In most cases, a few days, or even a few hours will annihilate the reparative work of several

months, and make the solution of continuity as extensive as at first. Frequently however, such destruction does not extend through the whole thickness of the cicatrix. It also merits attention, that a cicatrix is not invaded by exanthematous diseases, such as small-pox, measles, and scarlatina, but continues pale in the middle of the phlogosis of the surrounding parts. (See *Dupuytren, Clin. Chir. t. ii. p. 47.*) On the other hand, we know from the details of Lord Anson's voyage, the propensity of scurvy to attack and re-open them.

When the whole surface of a sore has skinned over, the substance, the remains of the granulations on which the new skin is formed, still continues to contract, till hardly any thing more is left than what the new skin stands upon. This is a very small part, in comparison with the first-formed granulations, and it in time loses most of its apparent vessels, becoming white and ligamentous. All newly healed sores are at first redder than the common skin, but in time they become much whiter.

As the granulations contract, the surrounding old skin is stretched to cover the part, which is deprived of skin.

When a sore begins to heal, the surrounding old skin, close to the granulations, becomes smooth, and rounded with a whitish cast, as if covered with something white. This, Mr. Hunter supposed to be a beginning cuticle, and it is as early and sure a symptom of healing as any. While the sore retains its red edge all round, for perhaps a quarter, or half an inch in breadth, we may be certain, that it is not in a healing state.

Skin is a very different substance, with respect to texture, from the granulations upon which it is formed; but it is not known, whether it is a new substance formed by the granulations, or a change in the surface of the granulations themselves.

The new skin most commonly takes its rise from the surrounding old skin, as if elongated from it; but, according to Mr. Hunter, not always. In very large sores, but principally old ulcers, in which the edges of the surrounding skin have but little tendency to contract, and the cellular tissue underneath to yield, or the old skin to become drawn over the ulcerated surface, the nearest granulations do not acquire a cicatrising disposition. In such cases, new skin forms in different parts of the ulcer, standing on the surface of the granulations, like little islands.

This power of the centre of a sore to form new skin, however, is not universally admitted; and, while Sir Astley Cooper acknowledges the fact of insulated portions of skin being sometimes seen in the middle of sores, he maintains, that such appearance is produced in consequence of the whole of the skin not having been destroyed by ulceration, and granulations having arisen from the part of the skin, which was left. This, he says, only happens in irregularly formed sores, where, after the healing process has gone on to the centre, the sore breaks out again at the circumference.

Whatever change the granulations undergo to form new skin, they are generally guided to it by the surrounding skin, which gives this disposition to the surface of the adjoining granulations.

The new-formed skin is never so large as the sore was, on which it is formed, owing to the contraction of the granulations, and the yielding

of the surrounding old skin. If the sore is situated where the adjoining skin is loose, as in the scrotum, then the contractile power of the granulations being quite free from obstruction, a very little new skin is formed; but if the sore is situated where the skin is fixed or tense, the new skin is nearly as large as the sore.

The new skin is at first commonly on the same level with the old. This however is not the case with scalds and burns, which frequently heal with a cicatrix higher than the skin, although the granulations may have been kept from rising higher than this part.

The new-formed cutis is neither so yielding, nor so elastic, as the original was; it is also less moveable. It gradually becomes, however, more flexible and loose. At first it is very thin and tender, but it afterwards becomes firmer and thicker. It is a smooth continued skin, not formed with those insensible indentations, which are observed in the natural or original skin, and by which the latter admits of any distention, which the cellular tissue itself will allow of.

This new cutis, and indeed all the substance which had formerly been granulations, is not nearly so strong, nor endowed with such lasting and proper actions, as the originally formed parts. The living principle itself is less active; for when an old sore breaks out, it continues to yield, till almost the whole of the new-formed matter has been absorbed, or has mortified.

The young cutis is sometimes full of vessels; but they afterwards disappear, and the part becomes white. Hence, the white appearance of the cicatrices or marks of small-pox.

The surrounding old skin, being drawn toward the centre by the contraction of the granulations, is thrown into loose folds, while the new skin itself seems to be upon the stretch, having a smooth shining appearance.

The new cuticle is more easily formed from the cutis, than the cutis itself from granulations. Every point of the surface of the cutis is concerned in forming cuticle, so that this is forming equally every where at once; but the formation of the cutis is principally, if not entirely, progressive from the adjoining skin.

The new cuticle is at first very thin, and rather pulpy than horny. As it becomes stronger, it looks smooth and shining, and is more transparent than the old cuticle.

The rete mucosum is later in forming than the cuticle, and, in some cases, never forms at all. In blacks who have been wounded, or blistered, the cicatrix is a considerable time before it becomes black; and in one black, whom Mr. Hunter saw, the centre of a sore, which had been upon his leg when young, remained white when he was old. It is ascertained, however, that the new skin does not always become white; but may become red, and, after a little time, turn blacker than the original skin. On this point, many interesting observations were made by Dupuytren, and are adverted to in the article Burns.

It is also observed, it appears, that whether the cicatrix be white or dark coloured, depends upon the rete mucosum. The new skin will be white; but it may become variously coloured, as the rete mucosum is. (See *Andral, Précis Anat. Pathol.* t. i. p. 266. and *ii.* art. *Brûlures.*)

As the rete mucosum is itself, only an inorganic secretion, produced, according to Breschet, by certain minute glands of the cutis, the differences ascribed by Dupuytren to the various degrees of injury sustained by the rete mucosum itself, will be more correctly referred to the mischief done to those glands, or organs, by which the rete mucosum is formed, or rather to the degree of injury done to the colouring apparatus of the derma, composed of a secreting parenchyma and excretory ducts. (See *M. G. Breschet et M. Rouzel de Vauseme Sur la Structure de la Peau*; Paris, 1835.) Andral notices, that some cicatrices after having long continued paler than the rest of the skin, have gradually assumed colour, and even become darker than it. In this case (says he) an augmented secretion of colouring matter has followed an unusual activity communicated to the nutritive movement. But, he adds, this darker colour may depend on the capillary circulation being slower. (See *Andral, Précis Anat. Pathol.* t. i. p. 266.) This distinguished pathologist seems then not to have made up his mind upon the point.

Muscle and cartilage are the only two parts of the body incapable of being reproduced in the processes of cicatrization: when a muscle is divided, it unites by means of a tegidinous substance; and, except in very young subjects, the cartilages of the ribs invariably unite with the intervention of bone. Cruveilhier believes, that the reparation of solutions of continuity is not truly the work of the proper texture of the divided organ, but that of the surrounding cellular tissue. Whatever may be the texture injured, whether muscle, nerve, brain, lung, or liver, he observes, that the cicatrix is always fibrous, and the proper texture of the organ never extends into it. Hence he dissents from those physiologists, who think, that the nervous influence can be transmitted through the cicatrices of nerves. He notices the osseous character of the cicatrix in fractures of bones and cartilages; and the disposition of a cicatrix, which is to form part of a cutaneous, or mucous surface, to approach in its character to that of the texture, for which it is to be a substitute. (See *Cruveilhier Anat. Pathol.* t. i. livr. 6. *Maladies des Extrémités.*) The 5th pl. of this livraison gives an interesting view of the state of the muscles, blood-vessels, nerves, &c. in a shoulder stump, a long while after an amputation by Larrey.

Hunter, on the Blood, Inflammation, &c. Thompson's Lectures on Inflammation, p. 399 &c. Sir Astley Cooper's Lectures on Surgery. M. G. Breschet, Nouvelles Recherches sur la Structure de la Peau. Paris, 1835. Dupuytren, Clin. Chir. t. i. and ii. art. Brûlures. Svo. Paris, 1832. G. Andral, Précis d'Anat. Pathol. t. i. p. 265. Svo. Paris, 1829. J. Cruveilhier, Anat. Pathol. logique, t. i. fol. Paris, 1829—1835. livr. vi. pl. b. An interesting paper on Warty Tumours in Cicatrices, by Mr. Cesar Hawkins, is contained in Lond. Med. Chir. Trans. vol. xix. Svo. Lond. 1835.

CICUTA. See CONIUM.

CINCHONA. As one of the designs of this dictionary is to embrace the subjects of a surgical pharmacopœia, Peruvian bark, which is administered in a great number of surgical cases, cannot be passed over in silence.

Its great repute for stopping mortifications, and accelerating the separation of sloughs, every person, whether of the medical profession or not, has frequently heard of. Indeed, so high is the character of the medicine, that many practitioners

under it in some stage, or another, of almost every distemper, often prescribe it when it is totally useless, give it when it actually does harm, and make their patients swallow such quantities as operate perniciously, when smaller doses would effect striking benefit. Some men are credulous enough to think, that from the Peruvian bark vigour and strength are directly extricated, and infused into the constitution, in exact proportion to the quantity of the medicine, which the stomach will keep down and digest.

While a doctrine of this sort prevails, we must expect to see indiscriminate and erroneous practice. The generality of diseases will always be attended with an appearance of languor and weakness, and, certainly, while there exists a supposition that a drug is at hand, possessing the quality of evolving and communicating strength, it would be absurd to fancy, that so important an article will not be largely exhibited in a multiplicity of surgical cases. I shall not presume to hazard an idea of the powers of the Peruvian bark in the practice of physic; but, I have not the least doubt, that they have been unwarrantably exaggerated in surgery, so as to blind and prejudice many a practitioner of good abilities, and lead him to adopt injudicious and hurtful methods of treatment.

Under particular circumstances, bark has undoubtedly the quality of increasing the tone of the digestive organs; and, of course, whenever the indication is to strengthen the system by nourishing food, and the appetite fails, this medicine may prove of the highest utility, provided it be given in moderate doses, and it be found to agree with the stomach and bowels. But, the plan of making the patient swallow as much of it as can be got into his stomach, must, in my opinion, be invariably followed by bad, instead of good, effects. How can it be reasonably expected, that the stomach, which is already out of order, can be set right by having an immoderate quantity of any drug whatever forced into it? In fact, if the alimentary canal were in a healthy state, must not such practice be likely to throw it into a disordered condition?

Bark is an excellent medicine, when judiciously administered; but, like every other good medicine, in bad hands, it may be the means of producing the worst consequences. How much good does mercury effect in an infinite number of surgical diseases, when prescribed by a surgeon of understanding; what a poison it becomes under the direction of an ignorant practitioner! With respect to cases of mortification, bark is often most strongly indicated, when the sloughing is not surrounded with active inflammation, when the patient is debilitated, and his stomach cannot take nutritious food. I have always regarded the notion of giving bark, as a specific for gangrene, as totally unfounded and absurd. I have watched its effects in these cases, and could never discern, that it had any peculiar power of operating directly upon the parts, which are distempered. Whatever good it does, is by its improving the tone of the digestive organs, and making them more capable of conveying nourishment, and, of course, strength into the constitution.

I should feel guilty of a degree of presumption in speaking thus freely upon this subject, were not my sentiments in some measure supported by those

of certain surgical writers; the remembrance of whom will always be hailed with assigned veneration and esteem. Mr. Samuel Sharp was not bigoted to bark; and, while he allowed it to possess a share of efficacy, he would not admit, that it was capable of miraculously accomplishing every thing, which the ignorant or prejudiced alleged. "I know," says he, "it will be looked upon by many as a kind of scepticism, to doubt the efficacy of a remedy, so well attested by such an infinity of cases; and, yet, I shall frankly own, I have never clearly to my satisfaction, met with any evident proofs of its preference to the cordial medicines usually prescribed; though I have a long time made experiment of it with a view to search into the truth.

"Perhaps, it may seem strange, thus to dispute a doctrine established on what is called matter of fact; but, I shall here observe, that in the practice of physic and surgery, it is often exceedingly difficult to ascertain a fact. Prejudice, or want of abilities, sometimes misleads us in our judgment, where there is evidently a right and a wrong; but, in certain cases, to distinguish how far the remedy, and how far nature operates, is probably above our discernment. In gangrenes, particularly, there is frequently such a complication of unknown circumstances, as cannot but tend to deceive an unwary observer. Mortifications arising from mere cold, compression, or stricture, generally cease upon removing the cause, and are, therefore, seldom proper cases for proving the power of the bark. However, there are two kinds of gangrene, where internals have a fairer trial; those are a spreading gangrene from an internal cause, and a spreading gangrene from violent external accidents, such as gunshot wounds, compound fractures, &c. Yet, even here we cannot judge of their effect with absolute certainty; for, sometimes, a mortification from internal causes is a kind of critical disorder. There seems to be a certain portion of the body destined to perish, and no more; of this we have an infinity of examples brought into our hospitals, where the gangrene stops at a particular point, without the least assistance from art. The same thing happens in the other species of gangrene from violent accidents, where the injury appears to be communicated to a certain distance, and no farther; though, by the way, I shall remark in this place, contrary to the received opinion, that gangrenes from these accidents (where there has been no previous straitness of bandage) are as often fatal, as those from internal causes.

"As I have here stated the fact, we see how difficult it is to ascertain the real efficacy of this medicine; but, had bark in any degree those wonderful effects in gangrenes, which it has in periodical complaints, its pre-eminence would no more be doubted in the one case, than in the other. What, in my judgment, seems to have raised its character so high, are the great numbers of single observations published on this subject, the authors of which, not having frequent opportunities of seeing the issue of this disorder, under the use of cordials, &c. and some of them, perhaps, prejudiced with the common supposition, that every gangrene is of itself fatal, have therefore ascribed a marvellous influence to the bark, when the same has proved successful." (*Sharp's Crit.* viii, on Amputation.)

Some further remarks on this subject will be reserved for the article MORTIFICATION.

Bark is given so extensively in the practice of surgery, that there are few important cases, in which, in certain circumstances, and at some period or another, it is not indicated. When persons have been weakened by a course of mercury, or by the effects of any disease whatsoever; moderate doses of bark will frequently be found of great service. But, it only becomes so on the principles above suggested, and, so far as my judgment extends, this medicine should never be prescribed in any surgical cases in excessive and unreasonable quantities.

One desirable result of the complete establishment of the modern doctrine, that the virtues of the various kinds of cinchona reside in two salifiable bases, or alkaline elements, termed *cinchonina*, and *quina*, is that of being able to prescribe preparations, which will concentrate all the efficacy of the medicine in formulæ of moderate bulk, not likely at least to disorder the alimentary canal by the mechanical effects of quantity.

The sulphate of quinine or quinia, "appears to be the most efficient of all the salts of bark. We must be careful not to combine it with substances that form insoluble compounds with it. The infusion of roses comp. is objectionable as a vehicle, on account of the astringent matter which it contains, and which therefore precipitates the quinia from its solution." The form, in which Dr. Paris prefers to prescribe it, is that of solution, with a minim of sulphuric acid to every grain of the salt. (*Pharmacologia*, vol. ii. p. 163.) It is frequently made into pills, with the conserve of roses, or joined with hyoscinum, squills, opium, and other medicines. Professor Brande does not agree with Dr. Paris, respecting the compound infusion of roses being an unfit vehicle for sulphate of quinine, and recommends the subjoined formula. R. Quinæ sulphatis gr. ij. Infus. rosæ comp. 5 xi. Tinct. cort. aurant. syrapi ejusdem āā 3 ss. M. ft. haustus bis in die sumendus.

"Although the pale bark yields chiefly *cinchonina*, with a small quantity of quinia, and the yellow quinia, with a small proportion of cinchonina, yet the quantities of the opposite principles are too small to give a character to the medical properties, or the chemical nature of the barks. In the red bark of the pharmacopœias, these salts exist together in nearly equal proportions." (See *Thomson's Elements of Materia Med.* p. 489. ed. 2.)

CINNABAR ARTIFICIAL (*Hydrargyri sulphuretum rubrum*), is chiefly employed by surgeons for fumigating venereal ulcers. An apparatus is sold in the shops for this purpose. The powder is thrown upon a heated iron, and the smoke is conducted by means of a tube to the part affected. For this it is an inferior preparation to the grey oxide.

CIRCUMCISION, (from *circumcido*, to cut round.) The operation of cutting off a circular piece of the prepuce. (See *PHIMOSIS*.)

CIRSOCELE, (from *κίρως*, a varix, and *κύημα*, a tumour.) Cirsocele a varicose enlargement of the spermatic vein. See *Varicocele*.

CIRSOPHTHALMIA, (from *κίρως*, a varix, and *ὀφθαλμία*, the eye.) A general varicose affection of the eye.

CHAB. (See *GONORRHOEA*.)

CLOACA. The openings leading through the new bony shell, in cases of necrosis, down to the enclosed dead bone are termed *cloacæ*.

COLLYRIUM ALUMINIS. R. Aluminis purif. gr. xii. ʒj. Aq. rosæ, ʒvj. Misce.

COLLYRIUM CUPRI SULPHATIS CAMPHORATUM. R. Aq. cupri sulphatis camphoratæ, ʒij. Aq. distillatæ, ʒiv. M. Recommended by the late Mr. Ware, for the purulent ophthalmia of children.

COLLYRIUM HYDRARGYRI OXYMURIATIS. R. Hydrarg. oxymuriatis, gr. ss. Aq. distillat. ʒiv. M. This collyrium is sometimes employed, after the acute stage of ophthalmia has subsided, and it will disperse many superficial opacities of the cornea.

COLLYRIUM OPIATUM. R. Opii Extracti gr. x. Camphoræ gr. vj. Aquæ distillatæ ferventis, ʒxii. Beat the two first ingredients together in a mortar, and mix the hot water gradually, and strain the fluid. (See *Wilson's Pharm. Chir.* p. 70.)

COLLYRIUM PLUMBI ACETATIS. — R. Aquæ rosæ, ʒvj. Plumbi acetatis, ʒj. Misce: or, R. Aq. distillatæ, ʒiv. Liq. plumbi acetatis gutt. x. M.

COLLYRIUM ZINCI SULPHATIS. — Zinci sulphatis, gr. v. Aq. distillatæ, ʒiv. M. It may be made gradually stronger.

COLLYRIUM ZINCI SULPHATIS CUM MUCIAGINE SEMINIS CYDONII MALI. R. Aq. plantaginis, ʒiv. zinci sulphatis, gr. v. et mucil. sem. cydon. mal. ʒss. M. In order to check the morbid secretion from the eyelids, in cases of fistula lachrymalis, or what Scarpa calls *il fusso palpebrale puriforme*, this celebrated Professor recommends a few drops of the above collyrium to be insinuated between the eyelids and the eye.

COLPOCELE. (from *κόλπος* the vagina, and *κύημα*, a tumour.) A tumour or hernia, situated in the vagina.

COLPOPTOSIS. (from *κόλπος*, the vagina, and *πίπτω*, to fall down.) A bearing or falling down of the vagina. (See *VAGINA*, *PROLAPSUS* OF.)

COMPRESS. (from *comprimo*, to press upon.) Folded linen, lint, or other materials, making a sort of pad, which surgeons place over those parts of the body on which they wish to make particular pressure; and for this purpose a bandage is usually applied over the compress. Compresses are termed *graduated*, when of a conical form, and the apex is so applied, as to make the pressure act very particularly on a certain point.

COMPRESSION OF THE BRAIN. (See *HEAD*, *INJURIES* OF.)

CONCUSSION OF THE BRAIN. (See *HEAD*, *INJURIES* OF.)

CONDYLOMA, (from *κόνδυλος*, a tubercle, or knot.) The term is generally applied to an excrescence of a hard warty description about the anus. The practitioner may either destroy it with caustic, tie its base with a ligature, or remove it at once with a knife: the first is generally the worst; the last the best and most speedy method.

CONIUM MACULATUM. Hemlock. — *Cicuta*. This is a medicine to which my observations in practice incline me to impute considerable efficacy. However, there is no doubt

that, when it is represented as a certain cure for cancer and scrofula, exaggeration is employed. It is an excellent remedy for irritable painful sores of the scrofulous kind, and it will complete the cure of many ulcers in which the venereal action has been destroyed by mercury, though the healing does not proceed in a favourable way. Hemlock is likewise beneficial to several inveterate malignant sores, particularly, some which are every now and then met with upon the tongue. It is an eligible alternative in cases of *noli me tangere*, porrigo, and various herpetic affections. I have seen several enlargements of the female breast give way to hemlock conjoined with calomel. Some swellings of the testes also yield to the same medicines. Hemlock certainly has not the power of curing cancer; but its narcotic anodyne qualities tend to lessen the pain of that distemper, so as to render it by no means a contemptible remedy in that intractable kind of case.

Respecting hemlock, Mr. Pearson observes, that the extract and powder may be sometimes given with evidently good effect in spreading irritable sores; whether they are connected with the active state of the venereal virus, or whether they remain after the completion of the mercurial course; and it would seem, that the benefit, conferred by this drug, ought not to be ascribed solely to its anodyne qualities, since the same advantages cannot always be obtained by the liberal exhibition of opium, even where it does not disagree with the stomach. He states, that cicuta is almost a specific for the venereal ulcers, which attack the toes at their line of junction with the foot, and which frequently become gangrenous. Also in spreading sores, which are accompanied with great pain, and no appearance of remarkable debility, hemlock will often do more than bark, diluted sulphuric acid, or cordials. The common mode of exhibiting hemlock is in the form of pills, made of the extractum conii, five grains to each. However, I have always thought three grains sufficient to begin with, the dose being afterwards gradually augmented. It is curious how large a quantity may at last be taken in this manner. Mr. J. Wilson, in his *Pharmacopœia Chirurgica*, informs us of a remarkable case of cancerous ulcer, for which the patient took a hundred and twenty pills, each consisting of five grains of the extractum conii, in twenty-four hours, and this without any benefit being produced, or any inconvenience to the patient.

The stomach being a little disordered, and the head somewhat giddy, is a sign of the dose being sufficiently strong.

"According to some writers, but more particularly Dr. Withering, there are several ways, in which the views of a medical practitioner, in prescribing this remedy, may be frustrated. The plant chosen for preparing the extract may not be the true *conium maculatum*, which is distinguished by red spots along the stalk. It may not be gathered when in perfection, namely, when beginning to flower. The inspissation of the juice may not have been performed in a water-bath, but, for the sake of despatch, over a common fire. The leaves, of which the powder is made, may not have been cautiously dried and preserved in a well-stopped bottle; or if so, may still not have been guarded from the ill effects of exposure to light. Or, lastly, the whole medicine may have suffered from the mere effects of long keeping. From any of these

causes, it is evident, the powers of cicuta may have suffered; and it happens, no doubt, very frequently, that the failure of it ought, in fact, to be attributed to one or other of them." (*Pharmacopœia Chirurgica*, published in 1802. p. 174.)

The activity of hemlock is now found to reside in a resinous element, termed conia, obtained separately, by evaporating an ethereal tincture of the leaves on the surface of water. A dose of half a grain will produce vertigo and headach. The watery extract of this plant has been proved by Orfila to have but little power. (*J. A. Paris, in Pharmacologia*, vol. ii. p. 180. ed. 6.) According to Professor A. T. Thomson, the extract is an objectionable preparation owing to the difficulty of preserving it. The best, he says, is the tincture of the Edinburgh and Dublin Colleges. (See *Thomson's Elements of Materia Medica*, p. 429. ed. 2.)

I have sometimes prescribed as an alternative, with manifest benefit in several surgical diseases, a pill containing three grains of extractum conii, or, what is preferable, the dried leaves, one of hydragryi submurias (calomel), and one of antimoni sulphuretum præcipitatum. In various cases of scrofulous diseases, and also in several very painful irritable ulcers and swellings, it is occasionally applied in the form of fomentations, lotions, and poultices. The latter are generally made by mixing the powder with the common bread and water cataplasm: the lotions, by dissolving ʒij. or ʒiv. of the extract in ʒviij. of water.

F. Hoffman, of Hemlock, 8vo. Lond. 1763. *A. Storck*, Libellus, quo demonstratur cicutam non solum usu interno tutissime exhiberi, sed et esse simul remedium valde utile, &c.: editio altera, 8vo. Vindob. 1761. Also *Supplementum Necessarium de Cicuta*, 8vo. Vindob. 1761. *J. Pearson*, On various Articles of the Materia Medica, &c. 2d ed. 8vo. London, 1807. *J. A. Paris*, *Pharmacologia*, ed. 6. *A. T. Thomson*, *Elem of Mat. Med.* p. 425. &c. ed. 2. 8vo. Lond. 1835.

CONJUNCTIVA, GRANULAR. The following account of this subject is given by Dr. Frick: This disease is mostly the sequel of purulent ophthalmia. It is characterised by a rough, scabrous, or granulated state of the palpebral conjunctiva, with a gleet or puriform discharge from its surface. The constant friction of the eyelids upon the globe brings on a varicose state of the sclerotic conjunctiva, and a dusky appearance of the cornea. The patient complains of a sensation similar to that produced by sand or other extraneous matter, under the eyelids; the eye cannot endure the light; and there is a troublesome epiphora. In the recent stage, a cure is easily accomplished by the application of a few leeches to the eyebrows, and pencilling the part once or twice a day with the vinous tincture of opium, or the ung. hydrarg. nitrat. When these means fail, the sulphate of copper, or nitrate of silver, may be used; though not so freely as to produce a slough, but only to change the diseased condition of the part. (See *Frick on Dis. of the Eye*, p. 240. ed. 2.) Mr. R. Welbank recommends the use of these means to be followed by ablution with tepid water, and the application of a few leeches. He also recommends counter-irritation and active aperients. The upper eyelid, he says, should be completely everted and examined, as there is sometimes at the angle, where the conjunctiva passes from the globe to

the lid, a crescentic fringed fold, not unlike a cock's comb, apt to keep up a tedious inflammation of the cornea. Dr. Frick considers excision of the granular surface proper only when it is hard, insensible, and prominent, or the excrescences hang like peduncles from the surface of the eyelids. In this state, Dr. Vetch recommends the application of a little burnt alum, or verdigris, and then washing it off with a syringe. (See the article CORNEA.)

CONTUSED WOUNDS. (See WOUNDS.)

CONTUSION. (from *contundo*, to bruise.) A bruise. Slight bruises seldom meet with much attention; but when they are severe, very bad consequences may ensue, and these are the more likely to occur when the accidents are not taken proper care of.

In all severe bruises, besides the inflammation which the violence necessarily occasions, there is an instantaneous extravasation of blood in the cellular tissue, in consequence of the rupture of many of the small vessels of the part. In no other way, can we account for those very considerable tumours, which often rise immediately after injuries of this nature. The black and blue appearance, instantly following many bruises, can only be explained by there being an actual effusion of blood from the small arteries and veins, which have been ruptured. Even largish vessels are frequently burst in this manner, and considerable collections of blood are the consequence. Blows on the head often cause a large effusion of blood under the scalp, and sometimes a smaller extravasation under the aponeurosis of the occipitofrontalis muscle. I have attended cases, in which more than a pint of blood was effused in the former of these places. The most copious extravasations on the head, indeed, are generally directly under the scalp, where the larger branches of the temporal, occipital, and frontal arteries are situated. I attended a man in the King's Bench, over whose sacrum an extravasation of three quarts of blood took place from a severe contusion, and, in the North London Hospital there is now (January 1837) a man, who, in consequence of being jammed between the side of the Regent's Canal and a barge, sustained a fracture of the right thigh, a laceration of the scrotum with protrusion of the testes and an extravasation of several pints of blood under the left gluteal region.

Besides the rupture of an infinite number of small vessels, and an extravasation of blood, which attend all bruises in a greater or less degree, the tone of the fibres and vessels, which have suffered contusion, is considerably disordered. Nay, the violence may have been so great, that the parts are from the first deprived of vitality, and must slough.

Parts at some distance from such as are actually struck, may suffer greatly from the violence of the contusion. This effect is what the French have named *contrecoup*.

The bad consequences of bruises are not invariably proportioned to the force which has operated; much depends on the nature and situation of the part. When a contusion takes place on a bone, which is thinly covered with soft parts, the parts always suffer very severely, in consequence of being pressed, at the time of the accident, between two hard bodies. Hence, bruises of the shin so frequently cause sloughing and troublesome

sores. Contusions affecting the large joints are always serious cases; the inflammation occasioned is generally obstinate, and abscesses and other diseases, which may follow, are proper grounds for serious alarm.

The species of mischief, resulting from what are termed wind contusions, is noticed in the article GUNSHOT WOUNDS.

In the treatment of bruises, three indications present themselves. The first is to prevent and diminish the inflammation, which from the violence done, must be expected to arise. The bruised parts should be kept perfectly at rest; and either be fomented, or covered with linen constantly wet, with the liquor plumbi acetatis dilutus, or the lotio ammon. acetatis. When muscles are bruised, they are to be kept in a relaxed position, and as quiet as possible.

If the bruise be violent, it will be proper to apply leeches, and this repeatedly; and even in some cases, particularly when joints are contused, to take blood from the arm. In every instance, the bowels should be kept well open with calomel and saline purgatives.

A second indication is to promote the absorption of the extravasated fluid by discutient applications. These may at once be employed in all ordinary contusions, not attended with too much violence; for then nothing is so beneficial as maintaining a continual evaporation from the bruised part, by means of the cold saturnine lotion, and, at the same time, repeatedly applying leeches. In common bruises, however, the *lotio ammoniac murata* (see this article) is an excellent discutient application; but most surgeons are in the habit of ordering liniments for all ordinary contusions, and as these applications prove serviceable in accelerating the absorption of the extravasated blood, the practice is highly praiseworthy. The linimentum saponis, or the linimentum camphora, is as good as any that can be employed. (See LINIMENTUM.)

In many cases, unattended with any threatening appearances of inflammation, but in which there is a good deal of blood and fluid extravasated, bandages act very beneficially, by the remarkable power which they have of exciting the action of the lymphatics, by means of the pressure which they produce.

A third indication is to restore the tone of the parts. Rubbing the parts with liniments has a good deal of effect in this way. But, notwithstanding such applications, it is often observed, that bruised parts continue for a long while weak, and even swell, and become oedematous, when the patient takes exercise, or allows them to hang down, as their functions in life may require. Pumping cold water, two or three times a day, on a part thus circumstanced, is the very best measure which can be adopted. A bandage should also be worn, if the situation of the part will permit. These steps, together with perseverance in the use of liniments, and in exercise gradually increased, will soon bring every thing into its natural state again.

When blood is extravasated under the skin in large quantity, so as to form a considerable tumour, the best practice is generally to avoid making any opening for its discharge. The opening would not procure the evacuation of a great part of it; if internal bleeding were going on, it would encourage it; and the air having access to the blood remain-

ing behind, would certainly be followed by its putrefaction. Hence, irritation, suppuration, and sloughing. In the greater number of instances, collections of blood under the skin, from contusions, are quietly, though sometimes slowly, absorbed; and the kinds of mischief, here specified, are thus avoided. In the two remarkable cases, which I have adverted to in the North London Hospital and King's Bench Infirmary, this observation was well illustrated.

COPPER. The subacetate and sulphate are used in surgery. The first, often called *ærgo*, or prepared verdigris, is employed as an escharotic. Mixed with an equal quantity of powdered cantharides, it is sometimes applied for the removal of warts and other excrescences. At present, the old practice of destroying the surface of chancre with the view of hindering the absorption of venereal matter, and rendering the exhibition of mercury needless, is not attempted with sulphate of copper, but occasionally with nitrate of silver.

CORNEA. (from *cornu*, a horn.) The anterior transparent convex part of the eye, which in texture is tough like horn. It has a structure peculiar to itself, being composed of a number of concentric cellular lamellæ, in the cells of which is deposited a particular sort of fluid. It is covered externally by a continuation of the conjunctiva, which belongs to the class of mucous membranes; and it is lined by a membrane, the tunica humoris aquei, which belongs to the serous class.

FLESHY EXCRESCENCES OF THE CORNEA.

Mr. Wardrop, in his *Essays on the Morbid Anatomy of the Human Eye*, has published an excellent chapter on this subject. Besides pterygia, which are treated of in another part of this dictionary, Mr. Wardrop states, that the cornea is subject to two kinds of caruncles, or fleshy excrescences. One appears at birth, or soon after it, and resembles the *nævi materni* so frequent on the skin of various parts of the body. The second is described, as having a greater analogy to the fungi which grow from mucous surfaces, and being in general preceded by ulceration.

Of the congenital excrescence of the cornea, Mr. Wardrop has seen two remarkable instances. The first was in a girl, eight or ten years of age, on whose left eye there was a conical mass, the base of which grew from about two-thirds of the cornea, and a small portion of the adjoining sclerotic coat.

The second example occurred in a patient upwards of fifty years old. The tumour had been observed from birth, was about as large as a horse-bean, and only a small portion of it seemed to grow from the cornea. The other part was situated on the white of the eye, next the temporal angle of the orbit. From the middle of the excrescence, upwards of twelve long firm hairs grew, and hung over the cheek.

Mr. Wardrop acquaints us, that a similar tumour, with two hairs growing out of it, was seen at Lisbon by Dr. Barron, of St. Andrew's. Mr. Crampton also mentions, that he once saw a "tuft of very strong hairs proceeding from the sclerotic." (*Essay on the Entropion*, p. 7.) And De Gazelles met with an instance, in which a single hair grew from the cornea. (*Journ. de Médecine*, t. xxiv.) According to Mr. Wardrop, this species

of excrescence of the cornea greatly resembles the spots, covered with hair, which are frequent on various parts of the surface of the body.

With regard to the second kind of tumour growing from the cornea, a fungus, proceeding from an ulcer of this part of the eye, is stated to be very uncommon. However, it is said, that when a portion of the iris protrudes through an ulcer of the cornea, the growth of a large excrescence from the projecting part is not so unusual. Of such a disease, Mr. Wardrop has cited examples from *Maitre Jean's Traité des Maladies des Yeux*. Excrescences, growing from the cornea, are also quoted from the following works:—*Handbuch der Pathologischen Anatomie*, von F. G. Voigtel, Halle, 1804. *Praktische Beobachtungen über den grauen Star und die Krankheiten der Hornhaut*, von Joseph Beer, Wien, 1791. *Plaichner's Dissertation de Fungo Oculi*. (See Wardrop's *Essays on the Morbid Anatomy of the Human Eye*, vol. i. chap. 4.) Others are likewise described by Mery, in *Mém. de l'Acad. des Sciences*, 1703; by Dupré, in *Phil. Trans.* vol. xix.; and Home, in the same work, vol. lxxxi.

The only treatment which excrescences of the cornea admit of, is that of removing them with a scalpel and a pair of forceps, or destroying them with caustic.

ABSCESSSES OF THE CORNEA.

When the matter is collected between the lamellæ of the cornea, it first appears like a small spot; and, instead of resembling a speck in colour, it is of the yellow hue of common pus. As the quantity of the matter increases, this spot becomes broader, and it does not alter its situation from the position of the head. If it be situated among the external layers of the cornea, or immediately below the corneal conjunctiva, a tumour is formed anteriorly, and, if touched with the point of a probe, the contained fluid can be felt fluctuating within, or if the eye be looked at sideways, an alteration in the form of the cornea may be readily perceived.

When the matter collects between the interior lamellæ, it does not produce any evident alteration in the external form of the cornea; but, if it be touched with the point of a probe, a fluctuation can be more or less distinctly perceived, and the spot alters its form, and becomes somewhat broader.

Such collections of matter appear on every part of the cornea. Sometimes they alter their situation by degrees, and sink downwards; and sometimes they change both their situation and form. They seldom cover more than one-fourth, or one-third of the cornea.

When the quantity of matter is small, it is often completely absorbed during the abatement of the inflammatory symptoms, and it generally leaves no vestige behind it. In other cases, the cornea is eroded externally, producing an ulcer, and subsequent opacity. In some few instances, the internal lamellæ of the cornea give way, and the matter escapes into the anterior chamber. When an artificial opening is made, the matter often does not readily flow out; and it is sometimes so tenacious, and contained in a cavity so irregular, that it neither escapes spontaneously, nor can it be evacuated by art.

It is particularly to the cases, in which the matter collects between the layers of the cornea, that

the terms *unguis*, and *onyx*, are applied. (See *Wardrop's Essays on the Morbid Anatomy of the Human Eye*, vol. i. chap. 6.) According to a late writer, these words should be restricted to what he names "crescentic interlamellar depositions." (*Travers's Synopsis of the Diseases of the Eye*, p. 115.) Where the cornea is affected with *onyx*, this gentleman commends antiphlogistic treatment. (P. 278.) And with respect to a large collection of matter in the cornea, whether the puriform *onyx*, or central abscess, he observes, that it requires "a supporting constitutional treatment, mild cathartics, and the application of blisters: calomel should be avoided, and the cornea can seldom be punctured with advantage." (P. 280.)

OPACITIES OF THE CORNEA.

Opacity of the cornea is one of the worst consequences of obstinate chronic ophthalmia. The term *opacity* is used, when the loss of transparency extends over the whole, or the greater part of the cornea: while other cases of a more limited kind are named *specks*. The distinction, as Beer observes, is chiefly important in respect to the prognosis. (*Lehre von den Augenkr.* b. ii. p. 77. *Ryall in Dubl. Trans.* vol. v. p. 9.)

Scarpa distinguishes the superficial and recent species of opacity from the *albugo* and *leucoma* (see these words), which are not in general attended with inflammation, assume a clear pearl colour, affect the very substance of the cornea, and form dense specks. The *nebula*, or slight opacity, allows the iris and pupil to be discerned through a kind of cloudiness, and consequently does not entirely bereave the patient of vision. The *nebula* (he says) is an effect of protracted or ill-treated chronic ophthalmia. The veins of the conjunctiva, much relaxed by the long continuance of the inflammation, become preternaturally turgid and prominent; afterwards they begin to appear irregular and knotty, first in their trunks, then in their ramifications, near the union of the cornea with the sclerotica, and lastly, in their most minute ramifications, returning from the delicate layer of the conjunctiva, spread over the cornea.

When this happens, some reddish streaks begin to be perceptible, in the interspaces of which, very soon afterwards, a thin milky albuminous fluid is effused, which dims the diaphanous state of the cornea. The whitish, delicate, superficial speck, thence resulting, forms precisely what is termed *nebula*, or the kind of opacity here to be considered. And since this extravasation may happen only at one point of the cornea, or in more places, the opacity may be in one speck, or in several distinct ones, but which altogether diminish, more or less, the transparency of this membrane.

The opacity of the cornea, which sometimes takes place in violent acute ophthalmia, seems to Scarpa to be quite different from *nebula*. The first is a deep extravasation of coagulable lymph in the internal cellular texture of the cornea, or else the opacity proceeds from an abscess between the layers of this membrane about to end in ulceration. On the other hand, the *nebula* forms slowly upon the superficies of the cornea, in long-protracted chronic ophthalmia; is preceded first by a varicose enlargement of the veins in the conjunctiva, next of those in the delicate lamina of this tunic, continued over the front of the cornea; and finally it is followed

by an effusion of albuminous lymph in the texture of this thin layer, expanded over the transparent part of the eye. This effusion never elevates itself in the shape of a pustule. Wherever the cornea is affected with *nebula*, the part of the conjunctiva, corresponding to it, is constantly occupied by a network of varicose veins, more knotty and prominent than other vessels of the same description; and though the cornea be clouded at more points than one, there are distinct corresponding fasciculi of varicose veins in the white of the eye. Scarpa injected an eye affected with chronic ophthalmia, and *nebula*, and he found that the wax easily passed, both into the enlarged veins of the conjunctiva, and those of that part of the surface of the cornea where the opacity existed; the inosculation all round the margin of the cornea were beautifully variegated, without trespassing that line which bounds the sclerotica, except on that side, where the cornea was affected with this species of opacity.

Mr. Travers does not adopt precisely the same definition of a *nebula* as Scarpa; for he describes it as a thickening of the conjunctiva, and an effusion of adhesive matter between it and the cornea, or between the *lamella* of the latter, commonly the product of acute strumous ophthalmia. (*Synopsis*, &c. p. 118.) Nebulous opacities are indeed universally admitted to be more numerous than what Scarpa represents.

According to Scarpa, the superficial opacity, which alone he calls *nebula*, demands, from its very origin, active treatment; for, though at first it may only occupy a small portion of the cornea, when left to itself it advances towards the centre of this membrane, and the ramifications of the dilated veins upon this coat, growing still larger, at length convert the delicate continuation of the conjunctiva upon the surface of the cornea, into a dense opaque membrane, obstructing vision.

The curative indication in this disease, as insisted upon by Scarpa, is to make the varicose vessels resume their natural diameters, or, if that be impracticable, to cut off all communication between the trunk of the most prominent varicose veins of the conjunctiva, and the ramifications coming from the surface of the cornea, the seat of the opacity. The first mode of treatment is executed by means of topical astringents, especially Janin's ointment, and success attends it, when the opacity is in an early state, and not extensive. But when advanced to the centre of the cornea, the surest treatment appears to Scarpa to be the excision of the fasciculus of varicose veins near their ramifications, that is, near the seat of the opacity, with a pair of small forceps and curved scissors. (Scarpa sulle *Melutrie degli Occhi*, c. 8.)

According to the experience of Dr. Vetch, Scarpa's plan of removing the plexus of varicose vessels, together with a portion of the conjunctiva, produces no good effect, "except in cases of great relaxation of the membrane covering the eye." He asserts, that new vessels immediately appear in the room of those removed, and the good derived from the bleeding does not compensate for the irritation produced by the operation. (*A Practical Treatise on the Diseases of the Eye*, p. 86.) Another experienced writer also declares, that the plan of dividing the red vessels proceeding to the opaque part cannot be of any service. (See *Larocque on Dis. of the Eye*, p. 372.) However, when it is reflected, that Scarpa advises this prac-

tice only for advanced cases, and particularly recommends topical astringents for the more recent stages of the disease, he nearly agrees with Dr. Vetch, as far as this point is concerned. But, Scarpa's account of the disease and its treatment is left imperfect by the omission of any notice of the connection, frequently existing, between opacity of the cornea, and a rough, scabrous, granulated state of the lining of the eyelids. Yet, perhaps, Scarpa was not to be expected to treat of this combination, in his chapter on nebula; because his definition of the superficial opacity will not altogether suit the affection of the same membrane, referred to in the following observations:—It is remarked by Dr. Vetch, that, after the complete cessation of conjunctival ophthalmia, as far as regards that portion of the membrane which covers the eye, the villous elongation of the vessels of the lining of the eyelids, instead of recovering their natural state, acquire a further increase of size, so as to produce a rough, scabrous, or granulated surface, with a secretion of puriform matter. The irritation of this unequal surface gradually induces an inflammatory state of the sclerotic vessels, and, consequently, a greater flow of blood towards the cornea: the superficial vessels become varicose; the conjunctiva assumes a dusky and loaded appearance; and the cornea becomes opaque, not partially, but throughout the whole extent of its structure. This affection, says Dr. Vetch, is essentially different from those nebulous, or partial opacities, which take place in primary sclerotic inflammation, and which consist in slight extravasations, accompanied by intolerance of light, and in which any affection of the palpebral linings is a secondary, instead of a primary circumstance. The cornea is of the green colour presented by a broken gun-flint; and while it is sufficiently diaphanous to permit the perception of light, it is yet too opaque to allow the patient to discern external objects, except by their shades. Nor can the colour of the iris, and limits of the pupil be seen. Dr. Vetch also describes the conjunctiva as being sometimes so much relaxed, and its vessels so generally loaded, as to give it a dusky appearance similar to that of the cornea; and, in other instances, without much alteration of its thickness, or transparency, it is said to lose for a considerable extent its close attachment to the subjacent lamina of the cornea. Along with the opaque state of the cornea, there is more generally an enlargement of individual vessels, which penetrate almost to its centre, increase as they come outwards, and terminate in trunks, which run to the duplicature of the conjunctiva. Dr. Vetch represents this disease of the palpebræ as consisting at first in a highly villous state of their membranous lining. This state, if not rectified by proper treatment, gives birth to granulations, which, in time, become more deeply sulcated, hard, or warty, accompanied by an oozing of purulent matter. Dr. Vetch has explained, that the use of the actual cautery, excision, and friction, for the purpose of curing the diseased state of the eyelids, may be traced back to Hippocrates who prefers escharotics. Dr. Vetch ascribes their first employment in these cases to St. Ives. Mr. Saunders, he observes, took an early and just view of the relations, existing between the diseased conditions of the palpebral linings, and the opaque state of the cornea; and he succeeded in establishing the cure of the latter

by the removal of the former. In short, Dr. Vetch admits, that, in the case, which more especially formed the claim of Mr. Saunders to the discovery of the nature of the disease, the practice of excision was attended with complete success. Dr. Vetch contends, however, that this method is, for the most part, inadequate to the cure of the disease; and that there are very few cases, in which the more certain and consistent process of gradually repressing the diseased surface by escharotic substances will not produce a more complete and permanent cure. After giving a fair trial to a great variety of escharotics, made into ointments, and applied to the inside of the upper eyelid, Dr. Vetch found the direct application of the escharotic substances themselves was preferable. When there is too much increased action in the vessels of the sclerotic coat, Dr. Vetch recommends the use of escharotics to be preceded by cupping on the temples; or, when there is any risk of a slough, the application of a leech to the inside of the lower eyelid. Whatever will bring on a determination of blood to the head is to be avoided, and a low regimen observed.

The escharotics, preferred by Dr. Vetch, are the sulphate of copper and nitrate of silver, scraped in the form of a pencil, and fixed in a portcrayon. In this way, he says, they should be applied, not, as some have conceived, with the view of producing a slough over the whole surface; but, with great delicacy, and in so many points only, as will produce a gradual change in the condition and disposition of the part. As long as there is any secretion of pus, the above application may be materially assisted by the daily use of the undiluted liquor plumbi acetatis. When the disease resists these remedies, and its surface is hard and warty, Dr. Vetch, applies to the everted surface, powder of verdigris, or burnt alum, finely levigated; or even lightly touches the diseased surface with caustic potash. In employing these remedies, he enjoins confining their operation to the point of contact, so as to prevent them from hurting the eye. Hence they are to be applied in very minute quantities with a fine camel's hair pencil, and to be washed off with an elastic gum syringe, before the eyelid is returned. Of the employment of astringent collyria, in conjunction with escharotics, Dr. Vetch disapproves. (See *Practical Treatise on the Dis. of the Eye*, p. 67, &c.) With respect to the treatment by excision, as first practised by Mr. Saunders with scissors, and afterwards by Sir W. Adams with a knife, the principle of cure does not appear to me different from that aimed at with escharotics, unless these latter be supposed not always to destroy, but sometimes to cause, an absorption of the fungous granulations. At present, the last method is considered most effectual; and, during the operation the eyelids should be everted over a probe.

For the form of disease, termed by Mr. Travers "strumous nebula, with vessels overshooting the cornea," this gentleman recommends pyalism. He says, that, "the hydargyrum cum creta, or oxy-muriate, in small, but frequent doses, will sometimes succeed better in this case, than the other forms of mercury, and the combination of calomel with antimony, better than that with opium." When the internal exhibition of mercury either disorders the bowels, or has no effect on the constitution, frictions are to be preferred. (*Synopsis*

of the *Diseases of the Eye*, p. 232.) In the particular form of opacity, to which he alludes, he disapproves of dividing the vessels of the conjunctiva, before the inflammation has declined. (P. 285.)

The following varieties of corneal opacity are enumerated by Mr. Lawrence, as admitting of removal:—"A general dulness, or haziness, and sometimes a thin nebula of the cornea, occur in iritis, and other internal inflammations of the eye; the change appears diffused through its whole texture. Often a more or less thick film covers the cornea in the purulent ophthalmia of infants, the conjunctival layer being thickened and loosened by the inflammation; the cornea assumes a pale greyish colour, and this appearance sometimes extends over the whole surface. A general nebulous, or more opaque state of the cornea, is produced in corneitis. There is also nebulous opacity, often accompanied with some redness in strumous ophthalmia. These four cases present examples of impaired transparency, which admit of complete relief. Indeed, it is sufficient in these cases to arrest the inflammation, which has caused the opaque change, and the latter will disappear of itself. In the first, and the two last instances, there is general disturbance of the corneal circulation, and interstitial deposition; in the second, the mucous layer alone is the seat of change. The dotted opacity, caused by inflammation of the membrane of the aqueous humour also disappears, when the inflammation has been arrested.

"Another, and a denser kind of opacity arises from inflammation of a more serious character. The change affects the surface, and the corneal laminae more or less deeply: it is interstitial deposition under considerable inflammation of the corneal texture." White and dense opacities of this kind may be lessened, but cannot be entirely removed. They may be occasioned by lime, or by effusion of matter when suppuration has taken place. In the latter case, the opacity has at first a yellowish, and subsequently a light brownish tint. When the corneal laminae are affected throughout, it seems to Mr. Lawrence, that we cannot do much good. Our first object, where inflammation is present, is to stop it, and then the newly deposited matter will often be absorbed. In children this is exemplified with remarkable frequency. After having waited a little to see what the removal of inflammation will accomplish, Mr. Lawrence would try an issue, or seton in the temple, with regulation of diet and the stomach and bowels; and finally stimulants, and astringents, particularly a solution of the nitrate of silver, gr. ij. to each oz. of water, but gradually increased. This may either be dropped into the eye or applied to the opaque part by means of a camel-hair brush. (See *Lawrence on Dis. of the Eye*, p. 371.)

From some observations, published by Mr. Wardrop, it would appear, that certain opacities of the cornea are produced by an increase in the quantity of the contents of the eyeball, and not by the deposition of an albuminous fluid in the texture of the cornea, as often takes place in the common speck. He considers it proved by cases, in which the cornea remains perfectly transparent the instant the aqueous humour is evacuated. Some cases are decided by taking away the view of recommending the puncturing of the cornea, and discharging the aqueous humour, for the relief of

the kind of opacity to which I have here alluded. (See *Med. Chir. Trans.* vol. iv. p. 180, &c.)

For other opacities, refer to ALBUGO, LEUCOMA, and STAPHYLOMA.

ULCERS OF THE CORNEA.

An ulcer is a common consequence of the bursting of a small abscess, which not unfrequently forms beneath the delicate layer of the conjunctiva continued over the cornea, or in the very substance of the cornea itself, after violent ophthalmia. At other times, the ulcer is produced by the contact of corroding matter, or sharp-pointed bodies insinuated into the eyes, such as quick-lime, pieces of glass, or iron, thorns, &c. As Dr. Vetch has observed, ulceration of the cornea is a very frequent consequence of purulent ophthalmia. The little abscess of the cornea is attended with the same symptoms, as severe acute ophthalmia; especially with a troublesome sensation of tension in the eye, cyclophoria, and nape of the neck, with ardent heat, copious secretion of tears, aversion to light, and intense redness of the conjunctiva, particularly near the point of suppuration. The inflammatory pustule, compared with similar ones in any other part of the body, is slow in bursting after matter is formed. Scarpa deems it improper, however, to puncture the small abscess; for, though it assumes the appearance of being perfectly matured, the matter contained in it is so tenacious, and adherent to the substance of the cornea, that not a particle issues out of the artificial aperture, and the wound exasperates the disease, increases the opacity of the cornea, and often occasions another small abscess to form in the vicinity of the first. Indeed, if the observations of Mr. Travers be correct, "The ulcer of the cornea begins, not in abscess, but in a circumscribed deposit of lymph, or in purer ulcerative absorption without pus." (*Synopsis of the Dis. of the Eye*, p. 106.) And, Dr. Vetch takes notice, that the observation, with respect to fluid matter never forming in the cornea, he invariably found true in several cases, where the whole of the eyeball had been destroyed by inflammation. (*On the Dis. of the Eye*, p. 52.) This author differs from Scarpa, however, respecting the question of opening pustules or abscesses of the cornea; for, he remarks, that, whenever the matter or slough is removed, the ulcer, however deep and extensive, will fill up without leucoma being the consequence. By a little address, he says, it may, in most instances, be removed in a mass upon the point of a lancet, or couching-needle. (*Op. cit.* p. 50.) This remark applies both to cases, where lymph or tenacious matter more or less protrudes, and to instances, in which it is quite confined between the lamellae of the cornea. Scarpa thinks that the safest plan is to temporize until the pustule spontaneously bursts, promoting it by means of frequent fomentations, bathing the eye with warm milk and water, and applying emollient poultices. The spontaneous bursting of the little abscess is usually denoted by a sudden increase of all the symptoms of ophthalmia; particularly by an intolerable burning pain at the point of the cornea, where the abscess first began, greatly increased by motion of the eye or eyelid. The event is confirmed by ocular inspection, and at the spot where the white pustule existed, a cavity appears, as may best be seen when the eye is viewed in the profile. Extraneous bodies in the eye, which have simply

divided a part of the cornea, or lodged in it, when soon extracted, do not in general cause ulceration, as the injured part heals by the first intention. Those which destroy, or burn the surface of this membrane, or which, when lodged, are not soon extracted, excite acute ophthalmia, suppuration at the injured part, and at length ulceration.

As Dr. Vetch has observed, the appearance of ulceration varies according to the degree of apostematation, or tendency towards it, in the surrounding cornea: when this part is clear, the case is doing well; but when opacity comes on, the ulcer is increasing. The soft middle lamina, he says, is destroyed with great rapidity when the inflammation is violent; but as soon as the ulcer reaches the internal coat, it often proceeds no further. (*On Dis. of the Eye*, p. 52.)

The ulcer of the cornea, as Scarpa remarks, has this, in common with all solutions of continuity in the skin where this is delicate, tense, and endowed with exquisite sensibility, that, at its first appearance, it is of a pale ash-colour; has its edges high, and irregular; creates sharp pain; discharges, instead of pus, an acrid serum, and tends to spread widely and deeply. Such is the precise character of ulcers upon the cornea; and such is the nature of those upon the nipples of the mammae, the glans penis, lips, apex of the tongue, the tarsi, the entrance of the meatus auditorius externus, nostrils, &c. Ulcers of this description, neglected or ill-treated, speedily enlarge, make their way deeply, and destroy the parts in which they are situated. If they spread superficially upon the cornea, the transparency of this membrane is destroyed; if they proceed deeply, and penetrate the anterior chamber of the aqueous humour, this fluid escapes, and a fistula of the cornea may ensue; and if they form a larger opening in it, besides the exit of the aqueous humour, they occasion another more grievous malady than the ulcer itself, namely, a prolapsus of a portion of the iris, an escape of the crystalline lens and vitreous humour, in short, a total destruction of the whole organ of sight. It is therefore of the highest importance, as soon as an ulcer appears upon the cornea, to impede its growing larger, as much as the nature of it will permit; the morbid process should be converted into a healing one, and the surgeon must exert his skill with more attention, the more extensively and deeply the ulceration has proceeded. According to Scarpa, the cicatrix of a larger ulcer impairs the texture of the cornea so much, that the injury is irreparable. Yet Dr. Vetch assures us, that when a slough covers an ulcer of considerable extent, and is taken off with great caution so as not to wound the inner tunic of the cornea, or, when it cannot be removed, if it be slightly scarified and divided, the cornea may recover its transparency after two-thirds of it have been in this state. (*On the Dis. of the Eye*, p. 51.)

They who inculcate that no external application can be adopted with benefit, for the cure of this disease, before the acute ophthalmia has been subdued, or at least diminished, are, in Scarpa's opinion, deceived. He argues that local remedies ought, in the very first instance, to be applied to the ulcer, such as are appropriate to lessen the irritability and stop the destructive process going on; and that afterwards means should be taken to cure the ophthalmia, if it does not subside gradually, as the ulcer heals. According to Scarpa's doctrine,

it is the ulcer which keeps up the ophthalmia, not the ophthalmia the ulcer. The case, however, is excepted, in which the ulcer makes its appearance during severe ophthalmia. Here the first indication is to abate inflammation.

The view entertained by Mr. Lawrence, is precisely the opposite of that taken by Scarpa. Ulcers of the cornea, he observes, frequently occur in inflammation of the external tunics, in the purulent, and strumous ophthalmia. "Here, as in other instances, the ulcer is the consequence of inflammation; we should invert the order of occurrences, if we represented the latter, as produced by the irritation of the former. It is not necessary to adopt any local treatment merely in reference to the ulcer. The ordinary treatment must be employed for the inflammation. When that is removed, the ulcers will heal." (*Lawrence on Dis. of the Eye*, p. 368.)

Scarpa observes, that as soon as the sensibility in the ulcer abates, the ophthalmia retreats with equal speed; and when the ulcer heals, the inflammation disappears gradually, or, at most, requires only the use of an astringent and corroborant collyrium for a few days. He finds analogous examples of this in ulcers of other parts, particularly in the little foul ulcers on the inside of the lips, the apex of the tongue, the nipples, glans, penis, all which at their first appearance, assume an ash-coloured surface, and excite inflammation of the part in which they are seated. To subdue this inflammation, we do nothing more than cure the excessive irritability in these ulcers, and convert the ulcerative process into cicatrization: this done, the surrounding inflammation immediately disappears of itself.

These good effects, Scarpa says, may be obtained by caustic, which will remove the irritability in the part affected; and convert the ash-coloured surface of the ulcer into an eschar, which, as a kind of epidermis will moderate the pressure of the neighbouring parts upon the ulcer, and at length convert the process of ulceration into that of granulation and cicatrization.

The caustic to which Scarpa gives the preference, is the nitrate of silver scraped to a point like a pencil. The eyelids being opened, and the upper one raised by means of Pellier's elevator, the ulcer of the cornea is to be touched with the apex sufficiently to form an eschar. Should any of the caustic dissolve in the tears, the eye must be copiously bathed with warm milk, or a little oil of almonds be dropped into it. (*Ryall in Dubl. Trans.* vol. v.) At the instant the caustic is applied, the patient complains of a most acute pain; but this aggravation is amply compensated by the ease experienced a few minutes after the operation: the burning heat in the eye ceases; the eye and eyelids become capable of motion without pain; the flux of tears and the turgidity of the vessels of the conjunctiva decrease; the patient can bear a moderate light, and enjoys repose. These advantages last while the eschar adheres to the cornea.

On the separation of the eschar, sometimes at the end of two, three, or four days after the application of the caustic, the primary symptoms of the disease recur, especially the smarting and burning pain at the ulcerated part of the cornea; the effusion of tears; the restraint in moving the eye and eyelids; and the aversion to light; but all these inconveniences are less in degree than before. At their recurrence, the surgeon is to renew the application of the nitrate of silver, making a good

eschar upon the whole surface of the ulcer, which will, as before, be followed by perfect ease in the eye. The application of the caustic is, if required to be repeated a third time; that is, if upon the separation of the eschar, the extreme irritability in the ulcer is not exhausted, and its progressive mischief checked. When the case goes on favourably, the sensibility of the eye is found lessened after each separation of the eschar; the ulcer also abandoning its pale ash-colour, assumes a delicate, fleshy tint; a certain sign that the destructive process, which prevailed, is turned into a healing one. The turgid state of the vessels of the conjunctiva, and the degree of ophthalmia, disappear in proportion as the ulcer draws near to a cure. As soon as ease is felt in the eye, and granulations begin to rise, whether after the first, second, or third application of the caustic, the surgeon must refrain from its further employment, and use only the following collyrium: *R. Zinci Sulphatis gr. iv. Aq. Rosæ, ʒ iv. Mucil. sem. Cydon. mali ʒss M.* This is to be used every two hours, the eye, in the intervals, being defended from the air and light, by means of a gentle compress, and retentive bandage. When, besides the ulcer of the cornea, a slight relaxation of the conjunctiva remains, Janin's ointment, towards the end of the treatment, introduced between the eye and eyelids, morning and evening, proves serviceable.

To cure those superficial excoriations of the cornea, which make no excavation in the substance of this membrane, and which, in reality, are only a detachment of the cuticle, covering the layer of the conjunctiva continued over the cornea, the use of caustic is not requisite. The above collyrium and the avoidance of too much light, and of exposure to the air will be sufficient.

According to Dr. Vetch, when the ulcerative process is likely to destroy the membrane, which lines the cornea, it can only be checked by measures calculated to subdue the inflammation, upon which it depends. "As long, therefore, as there is an appearance of activity in the disease, or recurrence of pain, local blood-letting, by cupping or leeches, must be steadily adhered to. The indication of the ulcer healing is easily seen in the diminished activity of the inflammation, relief from pain, and the clean aspect of the ulcerated part. The injection of vegetable, tepid, astringent infusions may be used, or milk and water only. When called upon in extreme cases, where the immediate perforation of the inner membrane is threatened, we may, with great propriety, resort to the operation of puncturing the cornea at a place as remote as possible from the ulcer. Next in importance to a diminution of the action, on which the ulcer depends, is the removal by scarification of any slough thrown out from its surface or imbedded in the adjoining part of the cornea. Sometimes, but always subordinate to these indications, we may add some topical applications to the ulcer; a solution of nitrate of silver, the infusion of tobacco, or calomel in powder, applied with a camel's hair pencil." (*On Diseases of the Eye*, p. 57.) In indignant protrusions of the inner membrane of the cornea, this author decidedly condemns the use of the argentic nitrate in the free manner proposed by Scarpa, observing, that, "if the caustic touches by accident the edge of the ulcer, or any part but the apex of the projecting vesicle, it will often produce much mischief."

Sometimes the ulcer assumes the form of a fungous excrescence upon the cornea, appearing to derive its nourishment from a band of blood-vessels of the conjunctiva; and, on this account, it occasions, not unfrequently, a serious mistake in being taken for a real pterygium. Left to itself, or treated with slight astringents, it produces, in general, a loss of the whole eye. It requires the speedy adoption of some active and efficacious plan, to destroy all the fungus upon the cornea, to annihilate the vessels of the conjunctiva tending to it, and to impede the progress of ulceration. This consists first in cutting away the fungus, with a pair of small scissors, to a level with the cornea, continuing the incision far enough upon the conjunctiva, to remove, with the excrescence, that string of blood-vessels from which it seems to derive its supply. Having effected this, and allowed the blood to flow freely, Scarpa applies the nitrate of silver to all the cornea, which appears to have been the seat of the fungus, so as to make a complete eschar; and if, upon its separation, the whole morbid surface should not be destroyed, he repeats the caustic until the ulcerative process changes into a healing one.

The action of the caustic cannot always be calculated with precision, and therefore a portion of the whole thickness of the cornea may be destroyed with the fungus, which never fails to be followed by a prolapsus of part of the iris, through the aperture made in the cornea. This accident may seem grievous, yet it is not irreparable. (See Iris, Prolapsus or.)

Mr. Lawrence is not such an advocate as Scarpa for the employment of caustic, believing, that the notion of ulcers of the cornea commonly requiring its application has led to injurious practice. "Generally speaking (says he) I have found corneal ulcers to heal most rapidly under antiphlogistic treatment, and without the use of local stimuli, or astringents." And, "in obstinate cases of chronic ulceration, which, with little inflammation will sometimes creep slowly over the cornea, healing on one side, while it advances on the other (he adds) I have found great benefit from an issue in the temple." (*Lawrence, ibid.* p. 368.)

Dr. Mackenzie, in his practice, seems to take a middle course between that of Scarpa and that of Lawrence. "In all cases (says he) we endeavour of course, to check the ulcerative process by those measures, which are fitted for subduing the particular ophthalmia, in which the ulcer has taken its origin. The girl, whose case I have related, was in a state of great debility in consequence of over depletion. Within 24 hours, the tonic plan of treatment arrested the progress of a deep ulcer of one of her cornea. In chronic superficial ulcer, which often proves very tedious, calomel, given so as to affect the mouth, is sometimes necessary. In almost all cases of ulcerated cornea, counter irritation will be found useful. As the inflamed state of the eye abates, the patient finds the pain greatly relieved. It frequently happens, however, that the ulcer itself proves a principal cause of prolonging the inflammation." In such a case, Dr. Mackenzie recommends coating the ulcer with nitrate of silver in solution, or in substance, as an anodyne, superior to any sedative lotion, or internal narcotic. In cases of superficial ulcer, he considers it best to touch its surface with a hair pencil, dipped in a solution of from 4 to 10 grains

of the nitrate of silver in an ounce of distilled water. Some prefer a solution of one grain of muriate of mercury in half an ounce of water, to which is added an equal quantity of vinum opii. Dr. Mackenzie, however, only sanctions the employment of nitrate of silver, when the ulcer betrays no disposition to heal of itself. (See *Mackenzie on Diseases of the Eye*, p. 577. ed. 2.) Every experienced surgeon will coincide with this gentleman, that, in all cases of deep and even in severe cases of superficial ulcers of the cornea near the centre of the pupil, the pupil should be kept dilated with belladonna. (*Ibid.* p. 580.) This is done to prevent the iris from getting-in contact with the cornea, and becoming adherent to it. He recommends the belladonna, however, not to be dropped into the eye, but applied to the eyebrow and eyelids. In penetrating ulcer of the cornea, Mr. Middlemore is also in favour of belladonna. (*On Dis. of the Eye*, vol. i. p. 486.) Where the ulcer depends on severe inflammation, this gentleman aims at subduing the latter by means of bleeding and mercury. He admits, however, that mercury is hurtful in the deep crescentic ulcer of old feeble subjects, and in certain forms of sloughing and scrofulous ulceration of the cornea. In all cases of deep circumscribed ulcer, unattended by severe inflammation, he approves of touching the sore with the solid nitrate of silver. In slighter instances, and particularly in the extensive superficial ulcer, the lotion of zinc, or of the nitrate of silver, in the proportion of two or more grains to the ounce of water, seem to him preferable. (See *Middlemore on Dis. of the Eye*, vol. i. p. 483.)

Two cases of ulcer of the cornea are recorded, which were benefited by Mr. Wardrop's operation of puncturing the cornea and discharging the aqueous humour. In the first example, there was an ulcer on the central part of the cornea, and a cluster of blood-vessels passing towards it. The whole eyeball was also much inflamed. The puncture was made at the place where the vessels passed. The patient's severe headach was relieved, and under the use of fomentations, and the vinous tincture of opium, all the other symptoms rapidly subsided. In the second case, there were two or three erosions, with a good deal of mudiness of the cornea, headach, &c. The obscurity of this membrane instantly disappeared, and the headach subsided upon the aqueous humour being discharged. With the help of bleeding and fomentations, the symptoms abated, the ulcer healed in a few days, and the eye recovered. (See *Med. Chir. Trans.* vol. iv. pp. 186, 187.)

In superficial ulcers of the cornea, attended with much inflammation of the conjunctiva, Mr. Travers recommends opium, combined so as to operate upon the skin, and keeping the bowels well open. Here he differs from Scarpa, in specifying the use of the nitrate of silver, as the best local treatment. Warm fomentations, he says, afford temporary relief, and when the inflammation of the sclerotic is intense, he advises the exhibition of mercury. (*Synopsis of the Diseases of the Eye*, p. 278.)

With regard to the treatment of indolent, and deep-sloughing ulcers of the cornea, Mr. Travers praises, in addition to the employment of the nitrate of silver, the occasional use of leeches, and the administration of tonics and sedatives.

The same author has also noticed chronic interstitial ulcers, where the cornea is transparent, "but indented, like a bounce, when struck upon a marble hearth, or pitted, according as the ulcers are diffused, or circumscribed." These are said to succeed acute inflammation, when large quantities of blood have been lost, and to occur frequently in children imperfectly nourished, or in adults, who are very debilitated. With the aid of good diet, tonics, and moderate topical stimulants, like the vinum opii, or the zinc collyrium, they become hazy, which denotes the commencement of the adhesive inflammation. (*Op. cit.* p. 117.)

Saturnine lotions and ointments, applied to ulcers of the cornea, either superficial, or deep, produce an opaque cicatrix. Hence, they are totally inadmissible. (See *Jacob, in Dublin Hospital Reports*, vol. v. p. 369. *Mackenzie on Dis. of the Eye*, p. 576. ed. 2.)

OSSIFICATION OF THE CORNEA.

Mr. Wardrop has seen only one instance of ossification of the cornea; and, in that case, the whole eye was changed in its form, and the cornea had become opaque. On macerating the latter part, a piece of bone, weighing two grains, oval-shaped, hard, and with a smooth surface, was found between its lamellæ. A piece of bone was also found between the choroid coat and retina.

The same gentleman informs us, that Walter had, in his museum, a piece of cornea, taken from a man sixty years of age, containing a bony mass, which was three lines long, two broad, and weighed two grains.

In Mr. Wardrop's publication, there is also recorded a curious case, in which a portion of bone was formed, either in the substance of the cornea, or immediately behind it, and which was extracted from the eye by Mr. Anderson, surgeon at Inverary. The patient was a woman thirty-one years of age, and the formation of the bony substance, which was about half as large as a sixpence, is said to have been occasioned by a fall against the root of a tree, fifteen years before the operation, by which accident the eye was struck, though not cut. (See *Wardrop's Essays on the Morbid Anatomy of the Human Eye*, vol. i. chap. 10.)

ALTERATION IN THE FORM OF THE CORNEA.

This is the last subject which I shall take notice of in the present article. It is well known, that the convexity of the cornea varies in different persons, and in the same individual at different periods of life, this part of the eye being naturally most convex in young subjects. It appears also from the experiments of the late Mr. Ramsden, and those of Sir E. Home, that the sphericity of the cornea is altered according to the distance at which objects are viewed.

Sometimes the cornea projects, or collapses, so considerably, without its transparency being affected, that sight is much impaired, or quite destroyed. The first case has been called, by some authors, the *Staphyloma pellucidum*; the second, *Rhytidosis*.

Levillé, the French translator of Scarpa's book on the diseases of the eye, has described a case, in which the cornea of both eyes became of a conical form. Mr. Wardrop met with two examples of a similar disease; but only one eye

was affected in each of them. In both cases, the conical figure of the cornea was very remarkable, and the apex in the cone was in the centre of the cornea. When the eye was viewed laterally, the apex resembled a piece of solid crystal; and when looked at directly opposite, it had a transparent sparkling appearance, which prevented the pupil and iris from being distinctly seen.

One of these cases occurred in a lady upwards of thirty years of age, and the changes produced in her vision were very remarkable. At the distance of an inch, or an inch and a half, she could plainly distinguish small objects, when held towards the temporal angle of the eye, although it required considerable exertion; but the sphere of vision was very limited.

On looking through a small hole in a card, she could distinguish objects held very near the eye, and could even read a book.

At any distance greater than two inches, vision was very indistinct; and at a few feet, she could neither judge of the distance, nor the form of the object.

When she looked at a distant luminous body, such as a candle, it was multiplied five or six times, and all the images were more or less indistinct. She could never find any glass sufficiently concave to assist her vision. She did not remark this complaint in her eye until she was about sixteen years of age, and it had undergone no change since that time.

In Mr. Wardrop's publication may be read a letter from Dr. Brewster, giving an explanation of the phenomena of the foregoing case.

It appears, that Mr Phipps had opportunities of watching the progress of several cases, in which the cornea had become conical, and that he never saw the disease in persons under the age of fourteen or sixteen. The same gentleman also observed, that when the cone is once complete, the disease seldom makes any further progress, except that the apex sometimes becomes opaque.

Burgman saw a remarkable case, where the cornea of both the eyes of a person, who had been hanged, were so prodigiously extended, that they reached down to the mouth, like two horns. (Haller, *Disputationes Chirurg.* tom. ii.) The chapter of Mr. Wardrop on the preceding subject will be found highly interesting to such as are desirous of further information concerning this curious disease of the eye.

See Wardrop's *Essays on the Morbid Anatomy of the Eye*, vol. i. chap. 13. For information relative to diseases of the cornea, see M. Geiger, *De Fistula Corneae*, Tub. 1742. C. F. Giffith, *De Ulcibus Corneae*, Tub. 1744. J. W. Baum, *De Maculis Corneae*, &c. Tub. 1743. A. G. H. Folger, *De Maculis Corneae*, 4to. Göt. 1778. A. G. Richter, *Anfangsgr. der Wundarz.* b. iii. Kap. 4. 8vo. Göt. 1795. Ant. Scarpa, *Trattato delle Malattie degli Occhi*, ed. 2. 8vo. Pavia, 1816, chap. 8. 10. J. Beer, *Praktische Beobacht. über den grauen Star, und die Krankheiten der Hornhaut*, Wein. 1799, und *Lehre von den Augenkr.* b. 2. Wein, 1817. M. J. Chelius, *Ueber die durchsichtige Hornhaut des Auges, ihre Function, und ihre Krankhaften Veränderungen*, 8vo. Karlsruhe, 1818. A. Clemens, *Diss. sistens Tunicæ Corneæ et Humoris Aquei Monographiam Physiologico-pathologicam*, 4to. Göt. 1814. J. Wardrop, on the Morbid Anatomy of the Human Eye, vol. i. 8vo. edit. 1808. B. Travers, *Synopsis of the Mts. of the Eye*, 8vo. Lond. 1820. J. Veith, on Diseases of the Eye, 8vo. Lond. 1820. Isaac Ryall, on the Use of nitrate of silver in certain affections of the Eye; *Trans. of King's and Queen's Coll. of Physicians in Ireland*, vol. v. art. 1. Dubl. 1828. Dr. Jacob, in *Dubl. Hospital Reports*; vol. 5. H. Lawrence, on Dis. of the Eye, 8vo. Lond. 1832. William Mackenzie, on Dis. of the Eye, ed. 2. 8vo. 1835. Richard Middlemore, on Dis. of the Eye, vol. i. 8vo. Lond. 1835.

CORNS. *Clavi. Spina pedum. Calli. Condylomata, &c.* A corn, technically called *clavus*, from its fancied resemblance to the head of a nail, is a brawn-like hardness of the skin, with a kind of root sometimes extending deeply into the subjacent cellular tissue. When this is the case, the indurated part is fixed; but while the hardness is more superficial, it is moveable. Some corns rise above the level of the skin, in the manner of a flat wart. They are hard, dry, and insensible, just like the thickened cuticle which is formed on the soles of the feet, or on the hands of labouring people.

In the first instance, a corn is a thickening of the cuticle, which is secreted by the cutis in a redundant horny form, from the influence of pressure. But, every thickening of the cuticle is not a corn, which term seems to Sir Benjamin Brodie, only applicable where the cuticle is thickened over a projecting portion of bone, on which the pressure is concentrated. A complete corn, he observes, is combined with the formation of a small bursa between the cuticle and the cutis. The thickened cuticle of corns, situated externally, becomes dry, hard, and horny; while that of corns, placed between the toes, remains soft, and in some degree moist: and hence the distinction into *hard* and *soft* corns. (See Brodie in *Lond. Med. Gaz.* for 1835, 1836. p. 776.)

Corns are entirely owing to repeated and long-continued pressure. Hence, they are most frequent in situations exposed to pressure, and where the skin is near bones, as on the toes, soles of the feet, &c. However, corns have occasionally been seen over the crista of the ilium, from the pressure of stays, and even on the ears, from the pressure of heavy ear-rings.

Corns of the feet are usually owing to tight shoes, and, consequently, are more common in the higher classes, and in women than other subjects. In females, indeed, the old ridiculous fashion of wearing high-heeled shoes was very conducive to corns. In shoes thus made, the whole weight of the body falls principally on the toes, which become wedged and compressed.

Though some persons who have corns suffer little, others occasionally endure such torture from them, that they are quite incapable of standing or walking. Doubtless the great pain proceeds from the irritation of the hard corn on the tender cutis beneath, which is frequently very much inflamed, in consequence of the pressure. Every thing which accelerates the motion of the blood, which heats the feet, which increases the pressure of the corn on the subjacent parts, or the determination of blood to the feet, or which promotes its accumulation in them, exasperates the pain. Hence, the bad effects of warm stockings, tight shoes, exercise, long standing, drinking, &c. The pain in warm weather is always more annoying than in winter.

If a person merely seeks temporary relief, it may be obtained by pulling off his tight shoes, sitting down, placing his feet in a horizontal posture, and becoming a little cool; the prominent portion of the corn should be cut off, as far as it can be done, without exciting pain, or bleeding, and the feet should be bathed in warm water.

When the bursa, under the horny cuticle, in consequence of inflammation, becomes distended with fluid, or suppurates, the pain and soreness are excessive, and the slightest pressure cannot be endured. Here the removal of the hard cuticle

and letting out the confined fluid, small as it may be in quantity, give prompt relief. (See *Brodie*, in *Lond. Med. Gaz.* for 1835, 1836. p. 999.)

The radical cure essentially requires the avoidance of all the above causes, and, particularly, of much walking, or standing. Wide, soft shoes, should be worn. Such means are not only requisite for a radical cure, but they alone very often effect it. How many women become spontaneously free from corns in childbed, and other confinements! Though the radical cure is so easy, few obtain it, because their perseverance ceases as soon as they experience the wished-for relief.

When business, or other circumstances, prevent the patient from adopting this plan, and oblige him to walk or stand a good deal, still it is possible to remove all pressure from the corn. For this purpose, from eight to twelve pieces of linen, smeared with an emollient ointment, and having an aperture cut in the middle, exactly adapted to the size of the corn, are to be laid over each other, and so applied to the foot, that the corn is to lie in the opening, in such a manner that it cannot be touched by the shoe, or stocking. When the plaster has been applied some weeks, the corn commonly disappears, without any other means. Should the corn be in the sole of the foot, it is only necessary to put in the shoe a felt-sole, wherein a hole has been cut, corresponding to the situation, size, and figure of the induration.

A corn may also be permanently eradicated, by the following method, especially when the plaster, and felt-sole with a hole in it, are employed at the same time:—The corn is to be rubbed twice a day with an emollient ointment, such as that of marshmallows, or with the lument of ammonia, which is still better; and in the interim, is to be covered with a softening plaster. Every morning and evening, the foot is to be put for half an hour in warm water; and whilst there, the corn is to be well rubbed with soap. Afterwards, all the soft, white, pulpy outside of the corn, is to be scraped off with a blunt knife; but, the scraping is to be left off, the moment the patient begins to complain of pain from it. The same treatment is to be persisted in, without interruption, until the corn is totally extirpated, which is generally effected in eight or twelve days. If left off sooner, the corn grows again.

A multitude of other remedies for curing corns are recommended. They all possess, more or less, an emollient and discutient property. The principal are green-wax, soap, mercurial and hemlock plasters, a piece of green oil-skin, &c. They are to be applied to the corn, and renewed as often as necessary. A successful composition consists of two ounces of gum ammoniacum, the same quantity of yellow wax, and six drachms of superacetate of copper. In a fortnight, if the corn yet remain, a fresh plaster is to be applied.

It is frequently difficult and hazardous to cut out a corn. The whole must be completely taken away, or else it grows again; and the more frequently it is partially cut away, the quicker is its growth rendered. When the skin is moveable, and, consequently, the corn not adherent to the subjacent parts, its excision may be performed with facility and safety, but not without pain. But, in the opposite case, either leaving a piece of the corn behind, or wounding the parts beneath, can seldom be avoided.

Mr. Wardrop recommends cutting, or tearing away, as much of the corn as can be done with safety; then keeping the toe for some time in warm water; and after the adjacent skin has been well dried, rubbing the exposed surface of the corn with the argentum nitratum, or wetting it, by the means of a camel's-hair-pencil, with a solution of the oxy muriate of mercury in spirit of wine. Either of these applications, two or three times repeated, he says, will mostly effect a cure. (See *Med. Chir. Trans.* vol. v. p. 140.)

Mr. Higginbottom recommends the employment of nitrate of silver nearly in the same manner as Mr. Wardrop. The corn is to be softened by keeping the foot in warm water for half an hour. As much of the corn is then to be removed, with a sharp knife, as can be done without making a wound. The corn and surrounding skin are then to be moistened with warm water, and the nitrate of silver rubbed on the corn very freely and lightly on the skin, so as not to occasion vesication. The part is then to be exposed in order that it may become dry. About the fourteenth day, when the cuticle around the corn is peeling off, the foot is to be put in warm water again, and the silver, and as much of the subjacent corn as possible removed with a knife. Then the nitrate of silver is to be reapplied, and the plan repeated, till the corn is perfectly destroyed. (See *Higginbottom on the use of Nitrate of Silver*, p. 177, ed. 2. Also *Cuttsen's Syst. Chir. Hodierna*, part. ii. p. 200.)

COUCHING. The depression of a cataract out of the axis of sight, or the displacement, breaking, and disturbance of the opaque lens in various ways with a kind of needle for these purposes, so as to bring about the dispersion and absorption of it. (See CATARACT.)

COUVRE CHEF. The name of a bandage. (See BANDAGE.)

CRANIUM, FRACTURES OF. See HEAD, INJURIES OF.)

CONALGIA. See JOINTS, DISEASES OF.

CREOSOTE. (See ΚΡΕΟΣΟΤΕ.)

CREPITUS. The grating sensation, or noise, occasioned by the ends of a fracture, when they are moved, and rubbed against each other; one of the most positive symptoms of the existence of such an accident.

CUPRI SULPHAS (*Sulphate of Copper*) is an escharotic, and an ingredient in several lotions for ulcers, collyria for the eyes, and injections for the urethra.

CURVATURE OF THE SPINE. (See VERTEBRÆ, DISEASES OF.)

CYSTITOME. (from κύστις, and τέμνω, to cut.) An instrument, invented by M. de la Faye, for opening the capsule of the crystalline lens.

CYSTOCELE. (from κύστις, the bladder, and κύλη, a tumor.) A hernia, formed by a protrusion of the bladder. (See HERNIA.)

CYSTOTOMIA. (from κύστις, the bladder, and τέμνω to cut.) The operation of opening the bladder, for the extraction of a stone or calculus. (See LITHOTOMY.)

CUPPING is performed by means of a scarificator, and a glass, shaped somewhat like a bell. The scarificator is an instrument containing a number of lancets, sometimes many as twenty, which are so contrived, that when the instrument is applied to any part of the surface of the body, and a spring is pressed, they suddenly start out,

and make the necessary punctures. The depth to which the lancets penetrate, may be made greater or less, at the option of the practitioner. As only small vessels can be thus opened, a very inconsiderable quantity of blood would be discharged, were not some method taken to promote the evacuation. This is commonly done with a cupping-glass, the air within the cavity of which is rarified by the flame of a small lamp, containing spirit of wine, and furnished with a thick wick. This plan is preferable to that of setting on fire a piece of tow, dipped in this fluid, and put in the cavity of the glass: "a clumsy expedient, adding unnecessarily to the sufferings of the patient, by cauterizing the skin; doing harm also by rarifying the air more than necessary within the glass, in consequence of which the edges of the cup compress the cutaneous vessels so much as to obstruct the influx of blood. The larger the glass, if properly exhausted, the less pain does the patient suffer, and the more freely does the blood flow." (See *Mapleson on the Art of Cupping*, p. 63—65. 12mo. Lond. 1813.) According to Dr. Osborne, those cupping-glasses, which have broad spreading edges are far inferior, both in convenience of application, and in power of preserving a vacuum to those with perpendicular edges. He also recommends an assortment of cupping-glasses with oval and other shaped mouths. (See *Dublin Journ. of Med. Science*, vol. iii. p. 341.) When the mouth of the glass is placed over the scarifications, and the rarified air in it becomes condensed as it cools, the glass is forced down on the skin, and a considerable suction takes place.

When the operation is about to be done, a basin of warm water, a piece of fine sponge, and a lighted candle, should be provided. As many of the cupping-glasses as may be judged necessary are to be put in the basin. If sixteen or twenty ounces of blood are to be taken away, four glasses of a size adapted to the surface to which they are to be applied, will generally be required. Each glass is then to be held for an instant over the flame of the spirit-lamp, and immediately placed upon the skin. Upon the quickness with which this is done, the neatness and efficacy of the operation will depend. If dry cupping be only intended, the glasses may be allowed to remain on the skin for a few moments, and be replaced five or six times, with a little variation of their position, in order to prevent the skin from being hurt by their pressure. If the intention be to scarify and take away blood, the glass ought not to remain more than a minute, when the scarificator is to be instantly applied; for by the quickness with which the application of the scarificator succeeds the removal of the glass, the patient is saved a degree of pain, which he would otherwise suffer from the making of the punctures. When the glasses are so full as to be in danger of falling off, or the blood is coagulated in them, they should be removed, emptied, and applied again. For the sake of neatness, care should be taken to insert the nail under the upper part of the glass, and remove it so as to keep its bottom downwards, the scarifications being at the same time wiped with a sponge, wet in warm water. The glasses also, previously to each application, should be rinsed in warm water, but not dried. For other useful directions, see *Mapleson's Treatise*, p. 64, &c.

Trials have been made of syringes, calculated to

exhaust the air from cupping-glasses; but the plan is not found so convenient as that above described.

A common pledget, or bit of rag, is usually applied as a dressing for the punctures made with a scarificator.

If a little smarting be not minded, Mr. Mapleson prefers the application of arquebuse water, or spirits of wine, as it immediately stops the oozing of blood, and prevents subsequent itching. (P. 69.)

Instead of a scarificator, Dr. Osborne recommends an instrument, which he proposes to name *polytome*, which consists of several lancets with circular edges, fixed parallel in a frame, to which a convenient handle is attached. The instrument is drawn rapidly along the skin, so as to make a row of continuous incisions of about one-sixteenth or one-eighth of an inch in depth and an inch in length. This instrument has been suggested as better calculated, than a scarificator, to insure an adequate discharge of blood. (See *Osborne in Dublin Journ. of Med. Science*, vol. iii. p. 340.) Such an instrument might perhaps be added to the case of cupping instruments with advantage, if it were only to be employed where the short deep punctures of common scarificators failed to procure a sufficient degree of bleeding.

CURETTE. (French.) An instrument, shaped like a minute spoon, or scoop, invented by David, and used for taking away any opaque matter, which may remain behind the pupil after a cataract has been extracted.

DACRYOMA. (from *δακρῦμα*, to weep.) An impervious state of one or both the puncta lachrymalia, preventing the tears from passing into the lachrymal sac.

DAUCUS. See CATAPLASMA DAUCI.

DECOCTUM CHAMOMELI. R. *Florum chamomeli*, $\frac{3}{4}$ ss. *Aquæ distillatæ*, lbj. Boil ten minutes, and strain the liquor. A common decoction for fermentations. (See FOMENTUM.)

DECOCTUM DULCAMARÆ. R. *Dulcamaræ caulis concisæ unciam*, *Aquæ octarium cum semisse*. Decoque ad octarium, et cola.

The decoction of bittersweet, or woody nightshade, is occasionally given in the treatment of various cutaneous diseases. The dose is one or two table spoonfuls, three times a day. An aromatic tincture should be added.

DECOCTUM HELLEBORI ALBI.—(*Decoctum Veratri*.) R. *Pulveris radicis hellebori albi*, $\frac{3}{4}$ j. *Aquæ distillatæ*, lbj. *Spiritus vinosi rectificati*, $\frac{3}{4}$ ij. Boil the water and powder, till only one-half the fluid remains, and when cold, add the spirit.

This is used as a lotion for psora, porrigo, and some other cutaneous affections.

DECOCTUM LOBELIÆ. (*Blue Cardinal Flower of Virginia*.) R. *Radicis lobeliæ syphiliticæ siccæ manip. j.* *Aquæ distillatæ*, lb. xij. Boil till only four quarts remain. The lobelia, once praised for its virtues in syphilis, is now scarcely ever thought of in the treatment of that disorder. The patient is at first to take half a pint twice, and afterwards four times a day. It operates, however, as a purgative, and the doses must be regulated according as the bowels bear them.

DECOCTUM MEZEREI. R. *Corticis radidis mezerei recentis*, $\frac{3}{4}$ j. *Radicis glycyrrhizæ contusæ*, $\frac{3}{4}$ j. *Aquæ distillatæ*, lbj. Boil the mezecon in the water, till only two pints re-

main; and, when the boiling is nearly finished add the liquorice root. Formerly more prescribed than at present for venereal nodes and nocturnal pains in the bones, in doses of from four to eight ounces, three times a day.

DECOCTUM PAPAVERIS. R. Papaveris somniferi capsularum concisarum, ʒ iv. Aquæ, lbiv. Boil for a quarter of an hour, and strain. A common fomenting fluid.

DECOCTUM SARSÆ. R. Sarsæ radici concisæ, ʒ iv. Aquæ ferventis, lbiv. The sarsaparilla is to be macerated for four hours, near the fire, in a vessel lightly closed. The root is then to be taken out, bruised and put into the fluid again. The maceration is to be continued two hours longer, after which the liquor is to be boiled till only two pints remain. Lastly, it is to be strained.

DECOCTUM SARSÆ COMPOSITUM. R. Decocti sarsæ ferventis, lbiv. Sassafras radici concisæ, guaiaci ligni rasi glycyrrhizæ radici contusæ, singulorum, ʒj. Mezeri radici corticis, ʒij. To be boiled together for a quarter of an hour, and then strained. This, and the preceding decoction of sarsaparilla, are much prescribed in venereal cases, and, at the present time, are often prescribed in combination with hydriodate of potash, in doses of from three to five grains of the latter, three times a day. Sarsaparilla is also given for the cure of a variety of cutaneous diseases, and in scrofula.

The simple decoction is frequently directed for the restoration of the constitution after a course of mercury, sometimes mixed with an equal quantity of milk. The common dose of both the decoctions is from four to eight ounces, three times a day.

The compound one possesses similar qualities to those of the famous Lisbon diet drink, for which it is now a common substitute.

DECOCTUM ULMI. R. Ulmi corticis recentis contus. ʒiv. Aquæ, lbiv. Boil to two pints, and then strain the liquor. Frequently prescribed in cutaneous diseases.

DECOCTUM VERATRI. See **DECOCTUM HELLEBORI ALBI.**

DELTESCENCE. When an external inflammation, with its usual effects, swelling, redness, &c. subside with extraordinary rapidity, the case is said to terminate in *delitescence*.

DEPRESSION OF THE SKULL. See **HEAD, INJURIES OF.**

DEPRESSION OF THE CATARACT. (See **CATARACT.**)

DETERMINATION. When the blood flows into a part more rapidly and copiously than is natural, it is said, in the language of surgery, that there is a *determination* of blood to it.

DIÆRESIS. (from διαίρεσις, to divide.) A division of substance; a solution of continuity. This was formerly a sort of generic term applied to every part of surgery, by which the continuity of parts was divided.

DIGESTION. (from digère, to dissolve.) By the *digestion* of a wound, or ulcer, the old surgeons meant bringing it into a state, in which it formed healthy pus.

DIGESTIVES. Applications which promote this object.

DIORTHOSIS. (from διορθώω, to direct.) One of the ancient divisions of surgery: it sig-

nifies the restoration of parts to their proper situations.

DIPLOPIA. (from διπλῶς, double, and ὄψ, the eye, or ὁρτομαι, to see.) *Visus duplicatus.* Even when the eyes are perfectly healthy, an object, under certain circumstances, appears double when viewed with both of them. "Thus, (as Dr. Arnott has observed) if a person hold the two forefingers in a line from his eyes, so that one may be more distant than the other, by then looking at the nearest, the more distant will appear double, and by looking at the more distant, the nearer will appear double." (*Elem. of Physics*, vol. ii. p. 217.) It is not, however, double vision of this kind, which I mean here to consider; but only those forms of the disorder, which depend upon, or are connected with morbid or abnormal states either of the eye itself, or other parts, which directly or indirectly exercise an influence over it. Double vision is of two kinds. For instance, the patient either sees an object double, treble, &c. only when he is looking at it with both his eyes, and, no sooner is one eye shut, than the object is seen single and right; or else he sees every object double, whether he surveys it with one or both his eyes. The disorder is observed to affect persons in different degrees. Patients seldom see the two appearances which objects present, with equal distinctness; but generally discern one much more plainly and perfectly than the other. The first distinct shape, which strikes the eye, is commonly that of the real object, while the second is indistinct, false, and visionary. Therefore, patients labouring under this affection, seldom make a mistake, but almost always know which is the true and real object. However, there are cases in which the patient sees with equal clearness the two appearances which things assume, so that he is incapable of distinguishing the real object from what is false and only imaginary.

The disorder is sometimes transitory and of short duration, and may be brought on in a healthy eye by some accidental cause, generally an irritation affecting the organ. Sometimes, the complaint is continual; sometimes, periodical. In particular instances, the patient only sees objects double, when he has been straining his sight for a considerable time, as, for example, when he has been reading a small print for a long while by candlelight. In this case, the disorder becomes lessened by shutting the eyes for a few moments. There are also instances, in which the objects have a double appearance only at a particular distance, and not either when they are nearer or further off. Sometimes the patient sees objects double only upon one side; as, for example, when he turns his eyes to the right hand, while nothing of this sort is experienced in looking in any other direction. In certain cases, objects appear double, in whatever way the eyes are turned and directed.

The causes of double vision may be divided into four classes. Namely, the object which the patient looks at, may be represented double upon the retina; which is the effect of the first class of causes. Or, the object may be depicted in one eye differently from what it is in the other, in regard to size, position, distance, clearness, &c.: this is the effect of the second class of causes. Or, the object may appear to one eye to be in a different place from that which it seems to the other to

occupy; the effect of the third class of causes. Or, lastly, the sensibility of the optic nerves is defective, so that the image of an object, though it may appear single to one eye as well as the other, yet, in one identical situation will seem double to both of them. When the complaint originates from causes of the first and fourth class, the patient sees things double, whether he is using only one, or both eyes; but, when it proceeds from the second and third classes of causes, the patient sees objects double only when he is looking at them with both eyes, and no sooner does he shut one, than objects put on their natural, single appear-

The following are the chief causes of the first class of a single object being depicted upon the retina as if double:—1. An unevenness of the cornea, which is divided into two or more convex surfaces. (*Haller, Element. Physiol. t. v. p. 85.*) According to Beer, this conformation of the cornea is mostly a result of several preceding ulcers of that membrane, in which circumstance the patient sees with the affected eye not merely double, but treble, and quadruple, of which facts Beer has met with some examples. (*Lehre von den Augenkr. b. ii. p. 31.*) However, in a far greater number of instances, such unevenness of the cornea, though equally considerable, does not occasion this defect of sight.

We have principally an opportunity of observing cases of this sort after the operation of extracting the cataract. Hence it would seem, that the inequalities must be of very particular shape to produce double vision. The diagnosis of this cause is easy enough; but, the removal of it is impracticable; for, how is it possible to restore the original shape of the cornea? On this case, however, Beer delivers a more favourable prognosis than Richter; for he states, that, when the patient is not decrepit, the double vision, from altered shape of the cornea, will gradually disappear of itself, when proper care is taken of the constitution, and in particular of the eye. (*B. ii. p. 32.*)

2. An inequality of the anterior surface of the crystalline lens, whereby the same is divided into several distinct surfaces, it is suspected may be one cause of diplopia. M. Prévost has given the history of his own case of double vision with a single eye, which he conceives may arise from such a cause. (*See Annales de Chimie, &c. t. 51. p. 210. Paris. 1832.*) An instructive case of irregular refraction from some defect in the lens, is that of Professor Airy, who derived vast assistance from a lens, the spherical surface of which was $3\frac{1}{2}$ inches, and the cylindrical $4\frac{1}{2}$ inches. Vision was most distinct when the cylindrical surface was turned from the eye, and the glass close to the organ. (*See Trans. of Cambridge Phil. Soc.*) A double aperture in the iris, or, as the case is termed, a double pupil, and a deviation of the pupil from its natural position, have been enumerated as causes of diplopia. (*Beumer, in Act. Soc. Hassiac, t. i. No. 27.*) However, Richter deems the reality of the first of these causes doubtful; for cases have been noticed where double vision was not the effect of there being two openings in the iris. (*Janin, Mém. sur l'Œil.*) But, were the disorder actually to originate in this way, the experiment might be made of converting the two apertures into one.

The causes of the second class, by the effect of which the object is represented, in regard to its size, position, distance, &c. differently in one eye

from what it is in the other, are for the most part rather possible, than such as have been actually observed. The causes which make objects assume an appearance contrary to the real one, may sometimes be confined to one eye, to which things are depicted diversely from what they are to the other healthy eye, so that the patient sees, as it were, double. Thus, for example, there may be a stronger refraction of the rays of light in one eye, than the other; the patient may be a *myops* with one eye, and a *presbyops* with the other; and then the object will seem to one eye large, to the other small; to one eye distant, to the other plainly near. This state of the sight, indeed, is said to have occurred after operating upon a cataract in one eye. (*Heuermann.*) However, that this is not always the consequence of operating upon a cataract in one eye, while the other is perfect, is sufficiently clear. (*See CATARACT.*) In particular examples, perpendicular objects seem to have a sloping posture. When it is considered, that only one eye is thus affected, and that to it things will appear sloping, and to the other straight, double vision must be the effect. (*See SIGHT, DEFECTS OF.*)

When both eyes are so directed to an object, that it becomes situated in the axis of vision of each of these organs, such object is represented in both at the same place, that is, it is depicted upon that part of the retina, on which the axis of sight falls. Thus, the object seems to both eyes to be in the same place, and though the two organs discern the thing, it only communicates a single appearance. But, when one eye is turned to any object in a different direction from that of the other; that is to say, when one eye is turned to an object in such a way, that the object is situated in the axis of vision of this eye, while the opposite eye is so turned, that the same object is placed on one side of its axis of vision; in other words, when a person squints; the object is depicted in one eye upon a different part of the retina from what it is in the other; consequently, the object appears to the two respective organs to be differently situated, and the patient is affected with diplopia. This is the third species of this disorder, which arises from strabismus as a third kind of occasional cause. Such patients naturally see objects double only when they behold them with both eyes. A lady, whom I know, is much annoyed with diplopia, the effect of deep-seated disease in the orbit, whereby the eye is forced out of its natural position.

A person who squints, usually has one eye stronger than the other, and the weakness of one of those organs is the common cause of the strabismus. Such a person does not see objects double, because he only sees with one eye well, and with the other so faintly and imperfectly, that scarcely any impression is made. Hence, every case of strabismus is not necessarily combined with diplopia; indeed, the common kind of squinting is not joined with it. A person affected with strabismus, only sees double when the sight of each eye is equally strong, and when the squinting does not depend upon any weakness of one of the eyes, but, upon some other occasional causes. The principal causes of the latter sort are of a spasmodic nature, viz.: an irritation affects some muscle of the eye in such a manner, that the patient is incapacitated from moving both his eyes according to his will, and from directing them to any object, so that such object may be at once in the axis of vision of both.

On this base, the observations of Sir E. Home are interesting, who has made various reflections on the effect of an irregular action of the straight muscles of the eye in producing double vision. (*Phil. Trans.* 1797.) Perhaps, however, the cases adduced furnish no very conclusive evidence that the diplopia depended merely on the state of the muscles, independent of that of the brain. (See *Machensie on Dis. of the Eye*, p. 30. ed. 2.)

Richter states, that, in the majority of cases, the irritation is seated in the gastric organs, though any other species of irritation may operate upon the eyes in a similar manner. This kind of diplopia is frequently attendant on other spasmodic diseases — symptom. It often accompanies hypochondriasis. Sometimes, it is the consequence of violent pain. Richter informs us of a man who saw double, and squinted, during a severe headache. He states, that another was affected in the same way during a toothach. Sometimes diplopia is owing to a paralysis of one of the muscles of the eye (*Morgagni de Sedibus et Causis Morborum*, epist. xiii. art. 20. a paralysis of the abductor muscle); sometimes to a tumour in the orbit. The diagnosis of this kind of diplopia is free from difficulty; the patient having been affected with squinting, ever since things appeared double to him.

The views which Sir E. Home took of diplopia from irregular action, spasm, or weakness of any particular muscle of the eye, led him to propose a plan of treatment, the principle of which is to keep the muscle affected for a time perfectly at rest, which is easily done by covering the eye with a bandage, and not allowing the organ to be at all employed.

The fourth class of causes are such irritations as act upon the optic nerves, changing their sensibility in such a way, that objects do not make that sort of impression upon them which they ought to do. Thus, things sometimes have the appearance of being coloured, when they are really not so; immoveable objects seem in motion, straight objects appear oblique, and in the cases which we are now treating of, single things seem to the eye double, treble, &c. This faulty kind of sensibility may also be produced by irritation in eyes which are perfectly sound; but, it is most readily occasioned in eyes which are preternaturally weak and irritable. In these, very trivial irritations will often excite it. In the treatment, the common indication is to discover and remove whatever irritation conduces to this effect; but the attempt frequently fails. In irritable eyes, the disorder is often brought on by very slight irritations, which cannot always be diminished, or removed. Here, the grand indication is to cure the weakness and irritability of the organs.

According to Richter, the fourth class of causes of diplopia is the most frequent. The irritations are of various kinds, and generally seated in the abdominal viscera. Diplopia is sometimes the consequence of inebriety, foulness of the stomach, intermitting fevers, hypochondriasis, worms, &c. However, the complaint is occasionally excited by other sorts of irritation. It has frequently followed a violent fright. It may be connected with spasmodic and painful diseases of several kinds. Severe headaches and toothachs are sometimes joined with this affection of the sight. Richter mentions a boy, who, being in the woods, was struck by the bough of a tree over the eye; and, in consequence of the

accident, became affected with diplopia. He informs us of a man who rode a journey on horseback along a snowy road on a very sunshiny day, and was affected in the same manner. This affection of the eyes is sometimes the effect of injuries of the head. (See *Hill's Cases in Surgery*, p. 108. *Schmucker, Med. Chir. Remerk.* b. i. No. 26. *Hennen's Military Surgery*, p. 345. ed. 2.) In the North London Hospital there is at the present time (January, 1837), a woman, under my care, who was admitted on account of a blow on her head, whereby she was stunned. On recovering from this, she became affected with diplopia. At first, all objects appeared double, unless one eye were shut: afterwards, they were seen correctly with both eyes open, if within six or eight inches of these organs. In a still later stage, objects above the horizontal line were seen single; below it, double, except when one eye was shut.

Persons who have weak eyes are apt to become double-sighted, whenever they look attentively for a long while at any light shining objects. Patients in fevers are also sometimes double-sighted. (*Goose's Cases*, &c. vol. ii.)

Diplopia frequently terminates in some other disorder of the eyes, and is often the forerunner of amaurosis.

The cure partly depends upon the nature of the remote cause, and partly upon the condition of the eye. Some causes are easy; others difficult, of removal.

The treatment consists in endeavouring to find out and remove the irritation occasioning the disorder. The majority of such irritations are of the same nature as those which give rise to gutta serena. (See AMAUROSI.) Indeed, both the complaints are often only different effects of the same cause, and of course require a similar mode of treatment. The boy, whom Richter mentions as having become double-sighted, in consequence of being struck over the eye with the bough of a tree, was cured by the external use of the infusum radicis valerianæ and spiritus vini crocatus, with which the eyelids and adjacent parts were rubbed several times a day. A diplopia, which followed a violent fright, was cured by valerian, preceded a few doses of bitartrate of potash. The case recorded by Dr. Hennen, as proceeding from a gunshot wound of the soft parts, covering the root of the nose and right eyebrow, yielded to abstinence, occasional emetics, and cold collyria. (*Principles of Mil. Surgery*, ed. 2. p. 345.) The woman in the North London Hospital, who had diplopia as a consequence of concussion of the brain, was materially benefited by cupping, and purgative medicines, followed up by mercury, and blistering the nape of the neck; and latterly, by the exhibition of the carbonate of iron. A hypochondriacal patient got rid of the disorder by means of the warm bath. A diplopia, supposed to arise from disorder of the biliary secretion, was cured by means of pills made of gum galbanum, guaiacum, rhubarb, and Venice soap, assisted with emetics and purgatives.

When the irritation is only of temporary duration, as, for instance, that of looking at shining objects; when the disorder continues after the removal of the irritation; or, lastly, when the irritation cannot be well detected; the surgeon is to endeavour, by means of nervous and soothing medicines, either to remove the impression, which

the irritation has left upon the nerves, or to render the nerves insensible to the continuing irritation. The following remedies have proved useful in cases of diplopia:—Hartshorn, dropped into the hand, and held before the eyes; the external use of the spiritus vini cretaceus; warm bathing of the eye, particularly, in a decoction of white poppy heads; bathing the eye in cold collyria; the internal administration of bark, valerian, small doses of ipecacuanha, oxide of zinc, and oleum cajuput. (See *Richter's Anfangsgr. der Wundarzn.* b. iii. kap. 15.)

According to Beer, the diplopia, which is not an effect of the continuance of another disease after inflammation of the eye; but probably depends upon injury of the retina, caused by such inflammation, usually diminishes, without the assistance of art, if the eye be not abused. (*Lehre von den Augenkr.* b. ii. p. 32.)

See A. Vater et J. C. H. Incker, *Visus Vitia duo rarissima; alterum duplicati, alterum dimidiati*, &c. Wittenb. 1723. (*Haller Diss. ad Morb.* t. i. p. 305.) J. J. Klauhold, *De Visu duplicato*, 4to. Argent. 1736. *Bruchner*, *De Visione simplici et duplici*, 4to. Argent. 1751. Euler, *Récherches Physiques sur la diverse Réfrangibilité des rayons de lumière*; *Mém. de l'Acad. des Sciences*, &c. Berlin, p. 300. 1751. *Kluge* *De Diplopia*, 4to. Gott. 1771. B. *Gauch*, *Chir. Cases*, &c. vol. ii. p. 12. &c. 8vo. Lond. 1792. Sir E. Home's Obs. on the Straight Muscles of the Eye, and the Structure of the Cornea, in *Phil. Trans.* for 1797. *Keghellini*, *Lettera sopra l'offesa delli cristallo in una Donna*, &c. 8vo. Venet. 1749; An instance of Diplopia from double pupil. *Dict. des Sciences Méd.* t. ix. p. 497. J. Haydon, *Essays on the Morbid Anatomy of the Human Eye* vol. ii. p. 216. &c. 8vo. Lond. 1818. Robert G. Graves, M.D., on Double and Single Vision, in *Dubl. Jour. of Med. Sciences* vol. i. p. 275. 8vo. 1832. Mucklenzie, on Dis. of the Eye, ed. 2. Ayr. in *Trans. of Cambridge Phil. Society*

DIRECTOR, an instrument, in such common requisition, that it is always contained in every pocket case. It ought to be made of silver, which qualifies it to be bent into any convenient shape. Its ordinary use is to direct the knife, and protect the parts underneath from its edge or point. The surgeon introduces the director under the parts which he means to divide, and then either cuts down, along the groove, with a common bistoury, or cuts upward with a narrow, curved-pointed bistoury, the point of which is turned upwards, and which he carefully introduces along the groove. This instrument and the probe-pointed bistoury are commonly employed for opening sinuses, for cutting fistula in ano, and fistulae in other situations, and for dilating the stricture in hernia. The French employ the director very commonly in that stage of operations for aneurism, in which the artery is to be separated from the adjacent vein, or nerve. the director is put under the artery, which the surgeon then examines carefully, and even presses upon, to ascertain what effect is produced on the pulsations of the aneurism, and whether any of the consequences of pressing on a nerve are excited. If the experiment be satisfactory, the ligature is then introduced with an eye probe, which is passed along the groove of the director. This plan was pursued by Dupuytren. (See *Clin. de Chir.* t. i. p. 277.)

DISLOCATION. (*From discolo*, to put out of place.) A Luxation. When the articular surfaces of the bones are forced out of their proper situation, the accident is termed a dislocation or luxation.

Sir Astley Cooper has justly remarked, that, of

the various accidents, which happen to the body, there are few, which require more prompt assistance, or in which the reputation of the surgeon is more at stake, than cases of luxation; for, if much time be lost prior to the attempt at reduction, there is great additional difficulty in accomplishing it, and it is often entirely incapable of being effected. If it remains unknown, and consequently unreduced, the patient becomes a living memorial of the surgeon's ignorance, or inattention. Hence, this experienced surgeon forcibly inculcates the careful study of anatomy; the want of an accurate knowledge of the structure of the joints being the chief cause of the many errors, which happen in the diagnosis and treatment of dislocated bones. The following passage cannot be too deeply impressed upon the surgeon's mind:—“A considerable share of anatomical knowledge is required to detect the nature of these accidents, as well as to suggest the best means of reduction; and, it is much to be lamented, that students neglect to inform themselves sufficiently of the structure of the joints. They often dissect the muscles of a limb with great neatness and minuteness, and then throw it away, without any examination of the ligaments, the knowledge of which, in a surgical point of view, is of infinitely greater importance; and from hence arise the numerous errors of which they are guilty, when they embark in the practice of their profession; for, the injuries of the hip, elbow, and shoulder, are scarcely to be detected, but by those who possess accurate anatomical information. Even our hospital surgeons, who have neglected anatomy, mistake these accidents; for I have known the pulleys applied to an hospital patient, in a case of a fracture of the neck of the thigh-bone, which had been mistaken for a dislocation, and the patient cruelly exposed, through the surgeon's ignorance, to a violent and protracted extension. It is therefore proper, that the form of the ends of the bones, their mode of articulation, the ligaments by which they are connected, and the direction in which the larger muscles act, should be well understood.” (*Surgical Essays*, part i. p. 2.)

The most important differences of luxations are:—1. With respect to the articulation, in which these accidents take place; 2. The extent of the dislocation; 3. The direction in which the bone is displaced; 4. The length of time the displacement has continued; 5. The circumstances, which accompany it, and which make it simple or compound; and lastly, 6. With respect to the causes of the accident.

1. Every kind of joint is not equally liable to dislocations. Experience proves, indeed, that in the greater part of the vertebral column, luxations are absolutely impossible, unless there be also a fracture, the pieces of bone being articulated by extensive, numerous surfaces, varying in their form and direction, and so tied together by many powerful elastic means, that very little motion is allowed. Experience proves, also, that the strength of the articulations of the pelvic bones can scarcely be affected by enormous efforts, unless these bones be simultaneously fractured. Boyer has therefore set down luxations of joints with continuous surfaces as impossible. (*Traité des Mal. Chir.* t. iv. p. 17.) And, Sir A. Cooper observes, that, in the spine, the motion between any two bones is so small, that dislocations hardly ever occur, except between

the first and second vertebræ, although the bones are often displaced by fracture (*Surgical Essays*, p. 14.); and sometimes the articulating processes may be luxated after one of the bodies has given way.

In articulations with contiguous surfaces, the facility with which dislocations happen, depends upon the extent and variety of motion in such joints. Thus, in the short bones of the carpus, and particularly of the tarsus, and at the carpal and tarsal extremities of the metacarpal and metatarsal bones, where flat broad surfaces are held together by ligaments, strong, numerous, and partly interarticular, and where only an obscure degree of motion can take place; dislocations are unfrequent, and can only be produced by uncommon violence. It is in the loose joints, which admit of motion in every direction, that dislocations most frequently occur; as is exemplified in the joint of the humerus with the scapula. On the contrary, the ginglymoid joints, which allow motion only in two directions, are not so often dislocated. The articular surfaces of the latter are of great extent; and, consequently, the heads of the bones must be pushed a great way in order to be completely dislocated; and the ligaments are numerous and strong.

2. With respect to the extent of dislocation, luxations are either *complete* or *incomplete*. The latter term is applied, when the articular surfaces still remain partially in contact. Incomplete dislocations can scarcely happen except in ginglymoid articulations, as those of the foot, knee, and elbow. In these, the luxation is generally incomplete; and very great violence must have operated, when the bones are completely dislocated. In the elbow, the dislocation is sometimes partial, with respect to the ulna and radius. In the orbicular articulations, luxations are usually complete. However, "the os humeri sometimes rests upon the edge of the glenoid cavity, and readily returns into its socket." (*A. Cooper, Essays*, part i. p. 14.) The lower jaw is sometimes partially dislocated in a manner different from what is commonly meant by this expression, viz. one of its condyles is luxated, while the other remains in its natural situation.

A partial dislocation sometimes occurs at the ankle-joint. "An ankle was dissected at Guy's, and given to the collection of St. Thomas's, which was partially dislocated: the end of the tibia rested still in part upon the astragalus; but a large portion of its surface was seated on the os naviculare, and the tibia, altered by this change of place, had formed two new articular surfaces, with their faces turned in opposite directions towards the two bones. The dislocation had not been reduced." (*Sir A. Cooper.*)

3. In the orbicular joints, the head of the bone may be dislocated at any point of their circumference; and the luxations are named accordingly *upward*, *downward*, *forward*, and *backward*. In the ginglymoid articulations, the bones may be dislocated either laterally, or forward, or backward.

4. The length of time a dislocation has existed makes a material difference. In general, recent dislocations may be easily reduced; but when the head of a bone has been out of its place several days, the reduction becomes exceedingly difficult; and, in older cases, often impossible. The soft

parts, and the bone itself, have acquired a certain position; the muscles have adapted themselves in length to the altered situation of the bone, to which they are attached, and, sometimes, cannot be lengthened sufficiently for it to be reduced. Indeed, I believe, that Sir Astley Cooper's statement is quite correct, that the difficulty in the reduction, arising from the muscles, is proportioned to the length of time that has elapsed from the period of the accident. (*On Dislocations*, p. 26.)

Desault and Boyer suspected, that frequently the opening in the capsular ligament soon becomes closed, and resists the return of the head of the bone into its original situation. However, with regard to the doctrine of the reduction being at first ever prevented by this cause, I believe with Sir Astley Cooper, that it is destitute of foundation. (*Surgical Essays*, part i. p. 18.; and *Treatise*, &c p. 25.) Thus, in Mr. Thompson's dissection of a dislocated humerus, the capsular ligament was completely torn from the whole circumference of the humerus. In one of Mr. Crampton's cases, it was detached to the extent of more than half the circumference; and, in an instance of direct dislocation forwards, the rent was of sufficient extent, "but no more, to permit the head of the bone to pass easily through it." (*See Thompson, in Med. Obs. and Inq.* vol. ii. p. 349. *Ph. Crampton, in Dublin Journ. of Med. Science*, vol. iii. p. 47—49.)

5. The difference is immense, in regard to the danger of the case, arising from the circumstance of a dislocation being attended, or unattended, with a wound, communicating internally with the joint, and externally with the air. When there is no wound of this kind, the danger is generally trivial, and the dislocation is termed *simple*: but should there be such a wound, together with the dislocation, the case is denominated *compound*, and is frequently accompanied with peril. Indeed, the latter kind of accident sometimes renders amputation necessary, and, in too many instances, has a fatal termination.

6. The causes of dislocations are external or internal. A predisposition to such accidents may depend on circumstances natural, or accidental. The great latitude of motion, which the joint admits of; the little extent of the articular surfaces; the looseness and tenuity of the ligaments; the lowness of one side of the articular cavity, as the anterior and inferior part of the acetabulum; and the shallowness of the cavity, as of that of the scapula; are natural predisposing causes of luxations.

A paralytic affection of the muscles of a joint, and a looseness of its ligaments, are also predisposing causes. When the deltoid muscle has been paralytic, the mere weight of the arm has been known to cause such a lengthening of the capsular ligament of the shoulder-joint, that the head of the os brachii descended two or three inches from the glenoid cavity.

Two cases, illustrative of the tendency to dislocation from a weakened, or paralytic state of the muscles, are recorded by Sir A. Cooper. The first is that of a junior officer of an India ship, who, for some trifling offence, had been placed with his foot upon a small projection on the deck, while his arm was kept forcibly drawn up to the yardarm for an hour. "When he returned to England, he had the power of readily throwing that arm from its socket, merely by raising it to-

wards his head; but a very slight extension reduced it. The muscles were wasted, also, as in the case of paralysis." The other example happened to a young gentleman, troubled with a paralytic affection of his right side from dentition. "The muscles of the shoulder were wasted, and he had the power of throwing his os humeri over the posterior edge of the glenoid cavity of the scapula, from whence it became easily reduced." In these cases, no laceration of the ligaments could have occurred, and the influence of the muscles in preventing dislocation, and in impeding reduction, is exemplified. (*Surgical Essays*, part i. p. 10.) Mr. Brindley, of Wink Hill, communicated to Sir A. Cooper an account of a dislocation of the os femoris, which the patient, a man of 50, is able to produce and reduce whenever he chooses. One of my pupils gave me an account of a similar case in another part of the country.

The looseness of the ligaments sometimes makes the occurrence of dislocations so easy, that the slightest causes produce them. Some persons cannot yawn, or laugh, without running the risk of their lower jaw being luxated. Collections of fluid within the knee, causing a relaxation of the ligament of the patella, are often followed by a dislocation of that bone. And, whenever a bone has been once dislocated, it ever afterwards has a tendency to be displaced again by a slighter cause, than what was first necessary to produce the accident. This tendency likewise increases with every new displacement.

Diseases, which destroy the cartilages, ligaments, and articular cavities of the bones, may give rise to a dislocation. The knee is sometimes, but not frequently, partially luxated in consequence of disease; and the thigh is now and then dislocated in consequence of the acetabulum and ligaments being more or less destroyed. Such dislocations are termed *spontaneous*.

At St. Thomas's Hospital, there is a preparation of a knee, dislocated in consequence of ulceration, and in the state of ankylosis, the leg forming a right angle with the femur directly forwards. (See *Sir A. Cooper's Surg. Essays*, part i. p. 11.)

An enarthrosis joint can only be dislocated by external violence; a blow, a fall, or the action of the muscles, when the axis of the bone is in a direction more or less oblique with respect to the surface with which it is articulated.

Any external force may occasion a dislocation of ginglymoid joints, which case is generally incomplete; but in the ball and socket articulations, the action of the muscles sometimes has a share in producing the accident. So, when a person falls on his elbow, while his arm is raised outwards from his side, the force, thus applied, will undoubtedly contribute to push the head of the os brachii out of the glenoid cavity, at the lower and internal part. Still, the sudden action of the pectoralis major, latissimus dorsi, and teres major, which always takes place from the alarm, will also aid in pulling the head of the bone downwards. Under certain circumstances, the action of the muscles alone may produce a dislocation, without the conjoint operation of any outward force, as is commonly exemplified in the lower jaw, and in some dislocations of the patella. But, in other cases, when the patient is aware in time of the violence which is about to operate, and his muscles are prepared for resistance, a dislocation cannot be

produced without the greatest difficulty, (*Sir A. Cooper*, *Op. cit.* p. 15.) unless the posture of the member at the moment be such as to render the action of the strongest muscles conducive to the displacement, instead of preventive of it, as is frequently the case in luxations of the shoulder.

Dislocations are constantly attended with more or less laceration or elongation of the ligaments; and in the shoulder and hip, the capsules are always torn, when the accident is produced by violence. Some instances, in which the ligaments are only lengthened and relaxed, I have already quoted. Sometimes a dislocation is attended with a fracture: mostly when the ankle is luxated, the fibula is broken; and in dislocation at the hip, the acetabulum may be fractured. (*Sir A. Cooper*, *Op. cit.* p. 15. *Wallace*, in *Dubl. Trans. of King's and Queen's College*, vol. v.)

SYMPTOMS OF DISLOCATIONS.

Every dislocation produces pain and incapacity in the limb or part; but, these are only equivocal symptoms, and cannot distinguish the case from a fracture, nor even from a simple contusion. A severe, but obtuse, pain arises from the pressure of the head of the bone upon the muscles; sometimes the pain is rendered more acute by the pressure being made upon a large nerve. (*Sir A. Cooper's Treatise*, p. 5.)

In order that a dislocation of the hip or shoulder may happen, there must be a particular attitude of the limb during the action of the external violence. Indeed the displacement can hardly occur from the direct action of the cause on the articulation itself. The force always acts with greater effect; the further it is from the joint, and the longer the lever is, which it affects. Thus, in a fall on the side, when the arm, raised considerably from the trunk, has to sustain all the weight of the body on a point at its inner side, the probability of a dislocation is evident, and even that the head of the bone has been forced through the lower portion of the capsular ligament.

The symptoms, which Boyer terms positive, deserve to be well remembered.

1. In dislocations of orbicular joints, and complete luxations of ginglymoid joints, the articular surfaces are not at all in contact, and the point, where the dislocated bone is lodged, cannot be upon the same level with the centre of the cavity, from which it has been forced. Hence a change in the length of the limb. In the ginglymoid joints, such alteration can only be a shortening proportioned to the extent of the displacement. But, in the orbicular joints, the bone may be displaced and carried above, or below, the articular cavity, so that, in the first event, a shortening, in the second, an elongation of the limb, will be produced. But as the direction of the member is at the same time altered, it is not always practicable to place the limbs parallel together, nor to bring them near the trunk, for the purpose of judging whether they are lengthened or shortened. A comparison, however, made without this advantage, will generally enable the surgeon to form a correct opinion. The proper length of a dislocated limb cannot be restored, except by putting the bone back into the cavity, from which it has slipped. In general, this cannot be accomplished without considerable efforts, while a slight exertion is usually sufficient to restore the proper length of the

limb in cases where the shortening depends upon a fracture. Also when once the natural length of the limb has been restored in dislocations, it remains; while, in fractures, the shortening recurs as soon as the extension is discontinued. As for elongation of the limb, it can never happen in cases of fracture, as it does in certain dislocations.

2. In many cases, the direction of the axis of the limb is unavoidably altered. This circumstance arises from the resistance of that portion of the articular ligaments, which has not been ruptured, as well as from the action of the muscles. In dislocation of orbicular joints, the tension of certain muscles, is a cause of a rotatory movement of the dislocated limb at the moment of the displacement, and which it afterwards retains. Thus in dislocations of the thigh bone at the hip, the toes, and knee are turned outward or inward, according as the head of the bone happens to be situated at the inside, or outside of the joint. The alteration in the length of the part, and in its position generally, is permanent when it depends upon a dislocation; whereas in fractures the same changes occur, but can be made to cease at once, without any particular effort.

3. The absolute immobility of a limb, or, at least, the inability of performing certain motions, is amongst the most characteristic symptoms of a dislocation. In complete luxations of some ginglymoid joints, the dislocated limb is absolutely, or very nearly, incapable of any motion. Thus, in the dislocation of the forearm backwards, the particular disposition of the bones, and the extreme tension of the extensor and flexor muscles, confine the limb in the half-bent state, and at the same time resist every spontaneous motion, and likewise almost every motion which is communicated. In the orbicular joints, the painful tension of the muscles, which surround the luxated bone, nearly impedes all spontaneous movements; but, in general, analogous motions to that, by which the displacement was produced, can be communicated to the limb, though not without exciting pain. Thus, in the dislocation of the humerus downward, the elbow hardly admits of being put near the side, nor of being carried forward, and backward; but it can easily be raised up. In the dislocation of the acromial end of the clavicle, the patient can bring the arm towards the trunk, separate it a little from the side, or carry it forward or backward; but he cannot raise it in a direct way. Lastly, in complete lateral dislocations of such joints as have alternate motions, the patient has the power of performing no motion of the part; but, the complete destruction of all the means of union allows the limb to obey every species of extraneous impulse.

Sometimes, as Sir A. Cooper has remarked, a considerable degree of motion continues for a short time; thus, in a man, brought into Guy's Hospital, whose thigh-bone had just been dislocated into the foramen ovale, a great mobility of the femur still remained; but, "in less than three hours, it became firmly fixed in its new situation by the contraction of the muscles." (*Surgical Essays*, part i. p. 3.)

4. In dislocations attended with elongation of the limb, the general and uniform tension of all the muscles arranged along it, gives to these organs an appearance as if they lay nearer the circumference of the bone, and the limb were smaller

than its fellow. The muscles, however, which belong to the side, from which the dislocated bone has become more distant, appear tenser and harder. On the contrary, in dislocations, where the limb is shortened, the muscles are relaxed; but being irritated, they contract and accommodate themselves to the shortened state of the limb. Hence, the extraordinary swelling of their fleshy part, and the manifestly increased diameter of the portion of the member to which they belong. We have a striking example of this in the dislocation of the thigh upward and outward, where the muscles at the inner side of the limb form a distinct oblong tumour. In dislocations of the thigh, the glutæus maximus on the same side is flattened, if the bone is carried inward; but it is more prominent, when the thigh-bone is carried outward; and its lower edge is situated higher, or lower, than in the natural state, according as the luxation may have taken place upward or downward. In the complete luxation of the forearm backward, the triceps is tense, and forms a cylindrical prominence, owing to the displacement of the olecranon backward.

The form of the joints principally depends upon the shape of the heads of the bones. Hence, the natural relation of the bones to each other cannot be altered, without a change being immediately produced in the external form of the joint. The changes, which the muscles, passing over the luxated joint, at the same time undergo in their situation and direction, contribute likewise to destroy the harmony of the outlines of the limb.

When the head of a bone has slipped out of the articular cavity, it may often be felt in its new situation, while at the articulation itself may be remarked a flatness caused by one of the neighbouring muscles stretched over the articular cavity, and more deeply the outline and depression of this cavity itself can be perceived. The bony eminences, situated near the joint, and whose outlines were gradually effaced in the general form of the member, are sometimes rendered more apparent by the displacement, and project, in a stronger degree, than in the natural state, while, in other instances, they project less, and become more concealed. On this part of the subject, Sir A. Cooper is particularly correct, when he observes, that the head of the bone can generally be felt in its new situation, excepting in some of the dislocations of the hip, and its rotation is often the best criterion of the accident. *The natural prominences of bone, near the joint, either disappear, or become less conspicuous, as the trochanter at the hip-joint. So times the reverse occurs; for in dislocations of the shoulder, the acromion projects more than usual.* (*Surg. Essays*, part i. p. 4.)

The lines, made by the contour of the limb, and the natural relation of the bones, are so manifestly broken in dislocations of ginglymoid joints, that, when there is no inflammatory swelling, the case is at once manifest. More certain knowledge, however, and more correct information, respecting the kind of displacement, are to be obtained, by attentively examining the changes of position, which certain processes, or prominent points of the dislocated bone, or bones, have undergone, and which are the more obvious in these joints, inasmuch as they give attachment to the principal muscles. The natural relations of these pro-

cesses being known, the least error of situation ought to strike the well-informed practitioner. Thus, in the elbow-joint, a considerable difference in the respective height, and in the distances between the olecranon and internal and external condyles, can be easily distinguished. But, the thing is less easy, when the surrounding parts are so swelled and tense, as to make the bony projections deeper from the surface, and less obvious to examination. Even then, however, a good surgeon will at least find something to make him suspect the dislocation, and the suspicion will be confirmed, when he again examines the part after the swelling has begun to subside. It is of the utmost consequence to make out, what the case is as early as possible; for the unnatural state, in which the soft parts are placed, keeps up the swelling a long while; and if the surgeon wait till this has entirely subsided, before he ascertains that the bones are luxated, he may have waited till it is too late to succeed in reducing them, and the patient may remain for ever afterwards deprived of the free use of his limb. (*Boyer, Traité des Maladies Chir. t. v. p. 45, &c.*) It is not only the inflammatory swelling, which may tend to conceal the ends of the bone; sometimes a quicker tumour arises from the effusion of blood in the cellular tissue, and causes an equal difficulty of feeling the exact position of the heads of the bones. (See Sir A. Cooper on Dislocation, p. 5.)

Dislocations are sometimes attended with particular symptoms, arising altogether from the pressure caused by the head of the luxated bone on certain important organs. Thus, the sternal end of the clavicle may compress the trachea, and impede respiration; the head of the humerus may press upon the axillary plexus of nerves, and produce a paralytic affection of the whole arm. In one instance, cited by Sir A. Cooper, a dislocated clavicle pressed upon the œsophagus, and endangered life. (*Surg. Essays, part i. p. 4.*)

As Kirkland has observed, some luxations are worse injuries than fractures: of this description, are dislocations of the vertebrae, cases which seldom happen without fracture, and are mostly fatal; dislocations of the long bones, attended with protrusion of their ends through the skin, and even a comminution of them; and followed by severe inflammation, extensive abscesses, necrosis, and not unfrequently gangrene.

According to Sir A. Cooper, young persons are rarely the subjects of dislocations from violence; but, he admits, that they do sometimes experience them, and relates an instance, which happened in a child seven years of age. In general, in them the bones break, or the epiphyses give way, much more frequently than the articular surfaces are displaced. (*Surg. Essays, part i. p. 16.; and Treatise, &c. p. 23.*) Suspected luxations of the hip in children commonly turn out to be disease of the joint, one instance of which is given by the preceding author. For such examples I have also been sometimes consulted. Also, when a dislocation of the elbow is suspected in a child, because the bone appears readily to return into its place, but directly to slip out of it again, the case is always found to be an oblique fracture of the condyles of the humerus. Old persons are less liable to dislocation, than individuals of middle age; a fact, which is accounted for by the extremities of bones in old subjects being so softened,

that the violence sooner breaks than luxates them. (*Sir Astley Cooper, on Disloc., &c. p. 23.*)

PROGNOSIS.

In general, every unreduced dislocation must deprive the patient more or less of the use of the limb or part; for nature cannot re-establish the natural relations which are lost. There is indeed an effort made to restore some of the motions, and the use of the limb in a certain degree; but it is always imperfectly accomplished, and, in the best cases, only a confined degree of motion is recovered. Nature cannot in any way alter the lengthened or shortened state of the limb; and she can only correct, in a very imperfect manner, its faulty direction. There are even some cases which little or no amendment can be effected.

If there are any exceptions to these observations, they are in young subjects, or in arthrodia joints, which are seldom extensively displaced; and as, in the natural state, their motions are but limited, the loss of these motions, in consequence of the natural relations not having been restored, is of less importance. Thus, the bones of the carpus, those of the tarsus, and the acromial end of the clavicle, may be dislocated, and be reduced either imperfectly, or not at all, without the functions of the limb being materially impaired. (*Boyer, Maladies Chir. t. iv. p. 54.*) Generally, however, after a time, some degree of motion is regained, and the limb, or part, becomes to a certain extent more useful, than at first. This statement applies even to dislocations of the hip, shoulder, lower jaw, elbow, thumb, &c.

Dislocations of enarthrosis joints are generally much less dangerous, than those of ginglymoid ones; for the action of the muscles has some share in producing them; the violence done to the external parts is less; and the injury of the soft parts is not so considerable. Even, in the same kind of joints, the seriousness of the case materially depends on the extent of the articular surfaces, and the number and strength of the muscles and ligaments.

Dislocations of ginglymoid joints, however, are more easily reduced, than those of enarthrosis ones, the muscles of which are powerful, and capable of making great resistance to the efforts of the surgeon. This is frequently the case in luxations of the shoulder and thigh.

It may be said, however, of the luxations of enarthrosis joints, that, although their reduction may require considerable efforts, yet it can be accomplished, and that the accident leaves no ill effects. On the contrary, in dislocations of ginglymoid joints, the same reason, which renders them more frequent, makes them also more serious. The solidity of these joints prevents the uniting means from being destroyed, except by great violence; and the extent of the articular surfaces does not permit a considerable displacement, especially a complete one, without extensive injury of the ligaments, and surrounding soft parts. It is for these reasons, no doubt, that compound luxations and protrusion of the heads of the bones are most commonly seen in ginglymoid articulations.

The more recent a luxation is, the more easy it is to reduce, and therefore, *ceteris paribus*, the less grave is the injury. In this point of view, dislocations of ginglymoid joints are the most

serious, because they sooner become irreducible than those of enarthrosis articulations.

Simple dislocations are much less dangerous, than those, which are complicated with contusion, the injury of a large nerve or blood-vessel, inflammatory swelling, fracture, wound, and, especially, a protrusion of the end of the bone. (*Boyer, Maladies Chir. t. iv. pp. 55, 56.*)

Dislocations from disease of the parts of bones, entering into the formation of the joints, termed *spontaneous luxations*, cannot admit of reduction: when they arise from the hip-disease, it is not merely in consequence of the ligaments being destroyed, parts of the acetabulum itself are more or less absorbed. However, there are other *spontaneous* dislocations from preternatural looseness of the ligaments, where reduction may be accomplished with the greatest facility; though the displacement generally recurs from slight causes.

Mr. Wallace has made some interesting pathological remarks on dislocations, deduced from the dissection of an unreduced dislocation of the head of the femur on the dorsum ilii, accompanied by a fracture of the superior edge of the acetabulum, which formed part of the new articular surface. The case confirmed one point, which indeed was previously well known; namely, that when a bone is allowed to remain unreduced, and in such a situation, that the natural movements of the limb are prevented or restricted, its muscles become diminished in size, or wasted. Mr. Wallace's case demonstrated further, however, that such atrophy affects the external rotator muscles in a greater degree than others, in consequence of their action having been rendered almost impossible by the existence of check ligaments extended from the ilio-pubic symphysis to the lesser trochanter.

Mr. Wallace likewise notices the fact, that if, at the time of dislocation, a tendon be torn across at its junction with the muscle, the detached ends of the muscular fibres become connected with those parts, with which they may be brought in contact. In the case adverted to, this had happened to the pyramiform.

Mr. Wallace next explains, that, if, the fleshy fibres of a muscle be torn through, they reunite by a tendinous tissue. This fact was exemplified in the gemini and quadratus. If a muscle be so torn, or injured, as to render its reunion by tendon impracticable, its entire texture becomes changed, or rather the muscle is absorbed, and "there is deposited in its place a substance of a peculiar texture, resembling a mixture of adeps and fibro-cartilage." In the case referred to, this had happened to the obturator internus.

Another circumstance, exemplified in this instance, was, that, when the distance between the points of attachment of a muscle, is either increased, or diminished, the muscular fibre has the power of undergoing such changes of shortening, or elongation, as may be necessary to adapt itself to its new state. "The triceps femoris, and some others, were in this case, shortened; and the quadratus and gemini were elongated."

"When any of the ligaments of a joint have been torn during the act of dislocation, if the bone be allowed to remain in such a situation, that the torn ligaments can no longer serve any useful purpose, they are completely absorbed, and disappear, or they are converted into cellular tissue, and become confounded with the surrounding parts.

Thus, in the present case, there were not the slightest remains of the round ligament.

"In all complete dislocations of the enarthrodial joint, the capsular ligament must necessarily be ruptured. If the bone be returned into its natural situation, the laceration is quickly repaired; but, if the displacement be allowed to continue, a perfect capsule will be formed round the new joint, and the original lacerated capsule will contribute to form a greater or a smaller portion of this new capsule, according to the situation of the parts." Mr. Wallace deems it probable, that, in his case, the capsule was lacerated, although the dislocation was only partial in consequence of a part of the acetabulum having been broken off. "Yet (says he) of this laceration, there was not any appearance. The new capsule was remarkable for its great thickness; but it was not formed of those regular fibres, which enter into the formation of the original capsule;" and "although its inner surface had the power of secreting synovia, it did not exhibit the smooth, shining aspect of synovial membrane."

According to Mr. Wallace's investigations, nature does not possess the power of forming articular cartilage in those accidental joints, which result from unreduced dislocations. "The new articular surfaces are always covered by a lamina of bone, which resembles in appearance that ivory-like substance, sometimes found on natural articulating surfaces. As a cartilaginous surface cannot play easily on a bony surface, the original cartilage, which may have covered the head of the dislocated bone, becomes absorbed, and its situation occupied by the same kind of tissue, as that which forms the new surface, upon which the head of the bone may be applied." Another thing, noticed by Mr. Wallace, is the alteration of the articular cavity, in consequence of the removal of the head of the bone. It becomes contracted in size and altered in form; and "the cartilage, which formerly covered its surface, disappears, being replaced by ligamentous fibres, which grow at right angles from the surface of the bone, and these extending outwards, become confounded with the surrounding parts."

Mr. Wallace finally adverts to the wonderful facility, with which the osseous tissue, apparently unyielding as it is, adapts itself to varied states. "At one time, we find it so completely removed, that not a vestige of large masses of it remains; and, on other occasions, great additions are made to the original bone to serve useful purposes. Again, without either increase, or diminution of the quantity of osseous matter, we find the bone to be, as it were, so completely new modelled, that its acquired shape has scarcely any resemblance to its former figure. In the present dissection, the acetabulum was nearly removed; a new plate of bone for the formation of an articulating surface was deposited on the ilium, and the head of the femur was completely remodelled." (*See Wallace in Trans. of King's and Queen's College, Dublin, vol. v. p. 250, &c.*)

When the head of a bone is thrown and left for a certain time upon a thick stratum of muscular fibres, a new capsular ligament may form for its enclosure; but, when it is thrown upon a thin layer of muscle, or upon the surface of a bone the muscle may be absorbed, and a new bony socket, or cavity, be produced, as explained

by Sir Astley Cooper. Even when the humerus has been thrown forwards on the ulna, new osseous deposits are sometimes arranged in such a manner on the latter as to constitute an articular cavity for the reception and support of the lower end of the humerus. Of this, there is an interesting representation* given by Cruveilhier. (See *Anat. Pathologique*.) Sometimes, when the upper head of the humerus remains dislocated in the axilla, a new articular cavity is formed for it below the neck of the scapula.

TREATMENT OF DISLOCATIONS IN GENERAL.

It was correctly explained by Pott, that the difficulty, which attends the reduction of luxated joints, principally arises from the resistance of the muscles. "The mere bones composing the articulations, or the mere connecting ligaments, would in general afford very little opposition; and the replacing the dislocation would require very little trouble or force, was it not for the resistance of the muscles and tendons attached to and connected with them: for, by examining the fresh joints of the human body, we shall find, that they not only are all moved by muscles and tendons, but also, that although what are called the ligaments of the joints do really connect and hold them together, in such manner as could not well be executed without them; yet in many instances, they are, when stript of all connection, so weak and lax, and so dilatable, that they do little more than connect the bones and retain the synovia, and that the strength, as well as the motion, of the joints depends, in great measure, on the muscles and tendons connected with and passing over them; and this in those articulations which are designed for the greatest quantity, as well as for celerity, of motion. Hence, muscles require our first and greatest regard, these being the parts, whose resistance must be either eluded or overcome. (See *Pott's Chir. Works*, vol. i.)

That the muscles are the chief cause of resistance is proved by cases, in which the dislocation is accompanied with injury of a vital organ; for, then the bone may be reduced by a very slight force. Thus, in a man, who had an injury of his jejunum, and a dislocation of his hip, the bone was most easily replaced. (Sir A. Cooper, *Surgical Essays*, part i. p. 20.) In short, any thing, which produces faintness or weakness, facilitates the reduction, as intoxication, nausea and sickness, paralysis, &c.

The following are some of the principles laid down by Pott:—

1. Although a joint may have been luxated by means of considerable violence, it does by no means follow, that the same degree of violence is necessary for its reduction.

2. When a joint has been luxated, at least one of the bones, of which it is composed, is detained in that unnatural situation by the action of some of the muscular parts in connection with it; which action is not under the direction of the will of the patient.

3. That all the force used in reducing a luxated bone, ought always to be applied to the other extremity of the said bone, and as much as possible to that only. Mr. Pott argues, that if the extending force were applied to a distant part of the limb, or to the bone below or adjoining, it would necessarily be lost in the articulation which is not luxated, owing to the yielding nature of the ligaments,

and be of little or no service, in that which is dislocated. This remark, though made by Pott, and generally received as true, is incorrect; for it tends to state, that if extension be made at the ankle or wrist, the force does not operate on the hip or shoulder.

4. That in order to make use of an extending force with all possible advantage, and to excite thereby the least pain, and inconvenience, it is necessary that all parts serving to the motion of the dislocated joint, or in any degree connected with it, be put into such a state as to give the smallest possible degree of resistance.

5. That in the reduction of such joints as consist of a round head, moving in an acetabulum or socket, no attempt ought to be made for replacing the said head, until it has by extension been brought forth from the place where it is, and nearly to a level with the said socket. This will show us, says Mr. Pott, a fault in the common ambi, and why that kind of ambi, which Mr. Freke called his commander, is a much better instrument than any of them, or indeed than all; because it is a lever joined to an extensor, and that capable of being used with the arm, in such a position as to require the least extension, and to admit the most; besides which it is graduated, and therefore perfectly under the dominion of the operator; it will show us, why the old method by the door or ladder sometimes produced a fracture of the neck of the scapula; as Mr. Pott saw it do himself. Why, if a sufficient degree of extension be not made, the towel over the surgeon's shoulder, and under the patient's axilla, must prove an impediment rather than an assistance, by thrusting the head of the humerus under the neck of the scapula, instead of directing it into its socket. Why the bar, or rolling-pin, under the axilla produces the same effect. Why the common method of bending the os humeri downward, before sufficient extension has been made, prevents the very thing aimed at, by pushing the head of the bone under the scapula.

6. That whatever kind or degree of force may be found necessary for the reduction of a luxated joint, that such force be employed gradually; that the lesser degree be always first tried, and that it be increased gradually. (See *Pott's Chir. Works*, vol. i.)

The supposition of the reduction being sometimes prevented by the capsular ligaments, Sir A. Cooper considers erroneous; in dislocations from violence, those ligaments are always extensively lacerated; and the idea of the neck of the bone being girt, or confined by them, is altogether untrue. (See *Ag. Essays*, part i. p. 18.) But, in addition to the resistance of the muscles, there are, in old dislocations, three circumstances pointed out by Sir A. Cooper as causes of the difficulty of reduction:—1. The extremity of the bone contracts adhesion to the surrounding parts, so that in dissection, even when the muscles are removed, the bone cannot be reduced. In this state, he found the head of a radius, which had been long dislocated upon the external condyle, and which is preserved in the collection of St. Thomas's Hospital. In a similar state, he has also seen the dislocated head of the humerus. (On *Dislocations*, p. 28.) 2. The socket is sometimes filled up with adhesive matter. 3. A new bony socket is sometimes formed, in which the head of the bone is so completely confined, that it could not be extricated without breaking its new lodgment. (*Surgical Essays*, part i. p. 21.; and *Treatise*, &c. p. 10.)

Dislocations in general cannot be reduced without trouble; but, after the reduction is accomplished, it is easily maintained. On the contrary, fractures are for the most part easy of reduction; but cannot be kept in this desirable state without difficulty. The moment extension is remitted, the muscles act, the ends of the broken bone slip out of their proper situation with respect to each other, and the distortion of the limb recurs. As a modern writer has observed, the reduction is only a small part of the treatment of fractures: the most essential point of it, is the almost daily care which a fracture demands, during the whole time requisite for its consolidation. The contrary is the case in luxations. Here, in fact, the reduction is every thing, if we put out of consideration the less frequent cases, in which the dislocation is complicated, and attended with such grave circumstances, as render it indispensably necessary to continue for a length of time the utmost surgical care. But, even then, the protracted treatment is less for the dislocation itself, than for the extraordinary circumstances, with which it is accompanied. (See Roux, *Parallele de la Chirurgie Anglaise avec la Chirurgie Française*, p. 207.)

All the ancient writers recommend the extending force to be applied to the luxated bone; for instance, above the knee in dislocations of the thigh-bone, and above the elbow in those of the humerus. We have stated, that Pott advised this plan, and the same practice, which is approved by J. L. Petit, Duverney, and Callisen, is generally adopted in this country.

However, many of the best modern surgeons in France, for instance, Fabre, D'Apouy, Desault, Boyer, Richerand, Leveillé, and Dupuytren, advise the extending force not to be applied on the luxated bone, but, on that with which it is articulated, and as far as possible from it. It is said, that this plan has two most important advantages:—first, The muscles, which surround the dislocated bone, are not compressed, nor stimulated to spasmodic contractions, which would resist the reduction; secondly, The extending force is much more considerable, than in the other mode; for, by using a long lever we obtain a greater degree of power.

In Pott's remarks, we find even him influenced against the latter practice, by the supposition, that part of the extending force is lost on the joint, intervening between the dislocation, and the point at which the extension is made; a notion quite unfounded, as every man who reflects for one moment, must soon perceive. When extension is made at the wrist, the ligaments, muscles, &c. which connect the bones of the forearm with the os brachii, have the whole of the extending force operating on them, and they must obviously transmit the same degree of extension, which they receive, to the bone above, to which they are attached. Indeed, this matter seems so plain, that I think it would be an insult to the reader's understanding to say any more about it, than that such eminent surgeons, as have contrary sentiments, can never have taken the trouble to reflect for themselves on this particular subject. Whether the force, necessary to be exerted in some instances, would have a bad effect on the intervening joint, may yet be a question; but, as Desault's and Dupuytren's practice was extensive, and they did not find any objection of this kind, we have no right to conclude that such would exist.

It, however, the common objection to Desault's plan of applying the extending force be unfounded, the question still remains to be settled, whether this practice is most advantageous on the grounds above specified. This is a point, which, perhaps, cannot be at once peremptorily decided altogether in the negative, or the affirmative, since what may be best in one kind of dislocation, may not be so in another. Thus, Sir A. Cooper states, that, so far as he has had an opportunity of observing, it is generally best to apply the extension to the bone, which is dislocated: but, that dislocations of the shoulder are exceptions, in which he mostly prefers to reduce the head of the bone by placing his heel in the axilla, and drawing the arm at the wrist, in a line with the side of the body, whereby the pectoralis major and latissimus dorsi are kept in a relaxed state. (*Surgical Essays*, part i. p. 25.)

Extension may either be made by means of assistants, who are to take hold of a napkin, table-cloth, or sheet, folded longitudinally, and put round the part, at which it is judged proper to make the extension; or else a multiplied pulley may be used. In cases of difficulty, Sir A. Cooper deems the pulley preferable. "When assistants are employed, their exertions are sudden, violent, and often ill-directed, and the force is more likely to produce laceration of parts, than to restore the bone to its situation. Their efforts are also often uncombined, and their muscles are necessarily as fatigued, as those of the patient, whose resistance they are employed to overcome." In dislocations of the hip-joint, and in those of the shoulder which have been long unreduced, pulleys should always be employed. (*Surgical Essays*, part i. p. 24.) But, whether pulleys be used or not, nothing more need be added to what Mr. Pott has stated, concerning the propriety of using moderate force in the first instance, and increasing the extending power very gradually.

In order to measure the force used in the extension with pulleys, M. Malgaigne has invented and repeatedly used an instrument, termed a *dynamometer*. Mr. Weiss was kind enough to shew me, some time ago, one which he has constructed; and Mr. Crose informs us, that he has procured one, which seems to answer every purpose.

The extension should always be first made in the same direction, in which the dislocated bone is thrown; but, in proportion as the muscles yield, the bone is to be gradually brought back into its natural position. Thus the head of the bone becomes disengaged from the parts, among which it has been placed, and is brought back to the articular cavity again by being made to follow the same course, which it took in escaping from it.

Extension will prove quite unavailing, unless the bone, with which the dislocated head is naturally articulated, be kept motionless by *counter-extension*, or a force at least equal to the other, but made in a contrary direction.

The mode of fixing the scapula and pelvis, in luxations of the shoulder and thigh, will be hereafter described.

In dislocations of ginglymoid joints, extension and counter-extension are only made for the purpose of diminishing the friction of the surfaces of the joints, so that the reduction may be rendered more easy.

When the attempts at reduction fail, the want of

success may be owing to the extension not being powerful enough, and the great muscular strength of the patient, which counteracts all efforts to replace the bone.

In the latter case, the patient may be freely bled, and put into a warm bath, so as to make him faint. The opening in the vein should be made large, because a sudden evacuation of blood is more likely to produce weakness and swooning, than a gradual discharge of it; and the patient, for the same reason, may be bled as he stands up. In difficult cases, the expedient of intoxication has been recommended, as, when the patient is in this state, his muscles are incapable of making great resistance to reduction. Under these circumstances, opium is sometimes administered with advantage.

The means to be employed for the reduction of dislocations (says Sir Astley Cooper) are both constitutional and mechanical. It is generally wrong to employ force only, as it becomes necessary to use it in such a degree as to occasion violence and injury; and it will be shown in the sequel, that the most powerful mechanical means fail, when unaided by constitutional remedies. The power of the muscles, in the first instance, is to be duly appreciated, as this forms the principal cause of resistance. The constitutional means to be employed for the purpose of reduction are those, which produce a tendency to syncope, and this necessary state may be best induced by one or other of the following means, viz., by bleeding, warm bath, and nausea. Of these remedies, I consider bleeding the most powerful: and that the effect may be produced as quickly as possible, the blood should be drawn from a large orifice, and the patient kept in the erect position: for, by this mode of depletion, syncope is produced, before so large a quantity of blood as might injure the patient is lost. However, the activity of this practice must be regulated by the constitution of the person; for as the accident happens to all the varieties of constitution, it must not be laid down as a general rule; but when the patient is young, athletic, and muscular, the quantity removed should be considerable, and the method of taking it away that which I have described.

coldly, in those cases where the warm bath may be thought preferable, or where it may be considered improper to carry bleeding any farther, the bath should be employed at the temperature of 100° or 110°; and as the object is the same as in the application of the last remedy, the person should be kept in the bath at the same heat till the fainting effect is produced, when he should be immediately placed in a chair, wrapped in a blanket, and the mechanical means employed.

"Of late years, I have practised a third mode of lowering the action of the muscles, by exhibiting nauseating doses of tartarised antimony; but as its action is uncertain, frequently producing vomiting, which is unnecessary, I rather recommend its application, merely to keep up the state of syncope, already produced by the two preceding means, which its nauseating effects will most readily do, and so powerfully overcome the tone of the muscles, that dislocations may be reduced with much less effort, and at a much more distant period from the accident than can be effected in any other way." (Sir A. Cooper on Dislocations, &c. pp. 29, 30. Also *Surgical Essays*, part i. p. 22.) In cases

of unusual difficulty, the use of antimonium tartariz. together with the warm bath and bleeding, seems rational and judicious: but, except in cases of that description, I should prefer long-continued, unremitting, not too violent, extension, which will at last overcome the muscles of the most athletic man. Sometimes the resistance made to reduction by muscles acting in obedience to the will, may be eluded by the patient's attention being suddenly taken from the injured part, at which moment the action of those muscles is suspended, and a very little effort on the part of the surgeon will reduce the bone. A case, illustrating this circumstance, is recorded by Sir A. Cooper. (*Surgical Essays*, part i. p. 25; and *Treatise*, &c. p. 34.) This principle was never neglected by Dupuytren, and it was partly by availing himself of it, that he succeeded even without the pulley in reducing not less than thirty-three dislocations of the shoulder and hip, which had continued for periods varying from a fortnight to more than three months. (See Dupuytren, *Chir. Clin.* t. i. p. 126. Also, M. Marx, in *Répertoire Général d'Anat. et de Physiologie Pathol.* 1re. Trimestre, 1829.)

Sir Astley Cooper believes, that much mischief is produced by attempts to reduce dislocations of long standing in very muscular persons. He has seen great contusion of the integuments, laceration, and bruises of the muscles, and stretching of the nerves, leading to an insensibility and paralysis of the hand follow an abortive attempt to reduce a dislocation of the shoulder. He is of opinion, that three months for the shoulder, and eight weeks for the hip, may be set down as the period from the accident, when it would be imprudent to make it attempt, except in persons of very relaxed fibre, or advanced age. (*On Dislocations*, &c. p. 35.)

Mr. Twining succeeded, however, in reducing a dislocation of the humerus in a robust healthy sailor, which had continued fifteen weeks. Gradually increased extension with the pulleys was maintained for fifty minutes, and, during that time nausea and faintness were induced by a large dose of tartar emetic, and the abstraction of blood of blood. (*Sec Trans. of Med. and Phys. Soc. of Calcutta*, vol. iv. art. 8. 1829.)

A case is mentioned by Mr. Lawrence, in which he succeeded in reducing the upper heads of the radius and ulna, when they had been displaced twenty-six days; one to the outside of the external condyle of the humerus, the other directly backward, with fracture of the coronoid process. (See *Lancet* for 1830, 31, p. 445.) Mr. Crose refers to some dislocations of the radius and ulna backwards, which had been reduced at sixty-three and even seventy days; but, in one of these cases, the olecranon was fractured in the attempt, owing to the resistance of the triceps. In five weeks, however, the patient regained the use of the limb. (See *Prov. Med. and Surg. Trans.* vol. v.) In several instances, Desault succeeded in reducing dislocations of thirty, or thirty-five days' standing, and even occasionally after an interval of two months and a half, or three months. (*Œuvr. Chir. de Desault*, par Richat, t. i.)

The practice of Desault then was encouraging, in relation to the reduction of old dislocations. But M. Flaubert, surgeon to the Hôtel Dieu at Rouen, published five cases of an opposite tendency; for his attempts at reduction of the shoulder after eleven and fifteen days, five weeks, and seven

weeks, and at reduction of the elbow joint after twenty-seven days, were ineffectual. The first patient died of rupture of the axillary artery. The second and third were seized immediately after the operation with palsy of the arm, from which the former scarcely recovered at all, and the latter but very imperfectly; consequently, the brachial nerves must have been injured. The fourth was attacked with palsy of the entire side, and died of inflammation and softening of the spinal chord in the neck produced by the four lowest branches of nerves, which form the brachial plexus, being torn out of the spinal chord by the roots. And the fifth suffered laceration of all the soft parts around the elbow joint, and probably of the arteries also, and lost entirely the use of the forearm. (See *Flaubert*, in *Répertoire Général*, &c. t. iii.) One instance, in which a woman died from the violence used in attempting to reduce a dislocated shoulder, is recorded by Sir A. Cooper. (*On Dislocations*, p. 422.)

Professor Gibson has met with two instances, in which the axillary artery, which had become firmly adherent to the head of the bone, was torn across, and the patients lost their lives. One of the dislocations had existed nine weeks; the reduction took up an hour and three quarters; and, on the following day, a swelling of an aneurismal character was noticed. The subclavian artery was taken up; but, the patient died. (See *Amer. Journ. of Med. Sciences*, No. 3. and *Amer. Ed. of this Dict. by Dr. Reese*.)

The experience of Dupuytren proves, after all, however, that old dislocations may frequently be reduced at so late a period as eighty-two days, and even more; that this may generally be accomplished without much torture to the patient; and that, with proper precautionary measures, none of the serious accidents occur which M. Flaubert met with. In every instance, the warm bath is used immediately before the attempt at reduction is made. The joint is also covered for some time previously with poultices containing laudanum, or extract of monkshood, henbane, or nightshade. If the patient is young and vigorous, bloodletting is practised once, or oftener, according to circumstances. During the operation, the surgeon takes care to distract the patient's attention by some powerful means, from the suffering which he endures, or rather dreads. The mere idea of pain, or fear, says M. Marx, causes the muscles to contract, so as to make a material impediment to the reduction. But, if care be taken, during the process of extension, and the other necessary manœuvres, to divert the patient's attention from the accident to other subjects, the muscles cease to make resistance, and the bone returns into its place. In this way they may sometimes be taken, as it were, by surprise. A material point gained by making the patient talk, is specified by a critical writer as overlooked by M. Marx: namely, besides distracting the attention, it hinders the chest from retaining that fixed state, which is necessary for every violent exertion. (See *Edinb. Med. and Surg. Journ.* No. 102. p. 185.)

In seven of Dupuytren's cases, the dislocation had existed only for a week or less. In five, it had continued fifteen or eighteen days. In three, between twenty-one and twenty-six days. In three, between thirty-one and thirty-seven days. In five, between forty-one and fifty-two days. In four,

between sixty and eighty-two days. In two, for three months; and in two, for two years. In one of the last, reduction was not attempted; and, in another of seventy-six days' standing, three attempts were unsuccessfully made to reduce a dislocation of the elbow; but, in all the rest, the operation was completely successful. (See M. Marx, in *Répertoire Gén. d'Anat. &c.* 1829; also, Dupuytren, *Chn. Chir.* t. i. p. 121, &c.)

It deserves notice, that Dupuytren's own successful cases were twenty-three; that he never employed pulleys; and that, in attempting to reduce old dislocations of the shoulder, he made the extension considerably upwards, as first recommended by Charles White, of Manchester, afterwards by M. Motte, and of late years by M. Malgaigne. He always availed himself of as long a lever as he could obtain, by applying the extending means as far from the dislocated joint as was practicable. Thus, in dislocations of the shoulder, the extension was made at the wrist; in those of the hip, it was made just above the ankle.

The reduction of a dislocation is known by the limb recovering its natural length, shape, and direction, and being able to perform certain motions, not possible while the bone was out of its place. The patient experiences a great and sudden diminution of pain; and, very often, the head of the bone makes a noise at the moment when it returns into the cavity of the joint.

In order to keep the bone from slipping out of its place again, we have only to hinder the limb from moving. When splints will act powerfully in supporting the joint, they are often used, as in dislocations of the ankle, wrist, &c. As the humerus cannot be luxated, except when at some distance from the body, a return of its dislocation will be prevented by confining the arm close to the side in a sling. The spica bandage, applied after such an accident, is more satisfactory to the patient, than really efficacious. Whatever bandage is used to keep the arm from moving, should be put on the lower end of the bone, as far as possible from the centre of motion. According to Sir Astley Cooper, the hip is rarely dislocated a second time; but the humerus, and the lower jaw very frequently slip again from their sockets, which are shallow. Bandages for the prevention of this return of displacement are, therefore, in such cases, particularly necessary. Rest is required for some time after the reduction, in order that the ruptured ligaments may unite. The strength of the muscles, &c. will also be greatly promoted by friction, and pouring cold water over the limb. (*On Dislocations*, p. 35.)

When a bone is broken and dislocated, an endeavour should be made to reduce the dislocation without loss of time, and then pay attention to the fracture. Also if there be a compound fracture of the leg, and a dislocation of the shoulder, the fracture is to be secured in splints, and the dislocation then reduced. (Sir A. Cooper on *Dislocations*, p. 16.) The case of a bone, dislocated and fractured at the same time, might be attended with considerable difficulty of reduction: fortunately it is an uncommon accident.

COMPOUND DISLOCATIONS

Mean such as are attended with a wound communicating with the cavity of the injured joint. Some joints are more disposed than others to compound dislocations. The accident scarcely ever takes

place at the hip. Sir Astley Cooper has known, one instance of it at the shoulder, and he has seen one of the knee; but the case is very frequent at the ankle. (*On Dislocations*, p. 19.) In most instances, the opening in the skin is caused by the protrusion of the bone, but sometimes by the part having struck against a hard or an irregular body. Cases of this description are frequently attended with great danger; and the same nicety of judgment is requisite in determining, whether amputation ought to be immediately performed, or an effort made to preserve the limb as in compound fractures, and bad gunshot injuries; and many of the observations which I shall have to offer upon the latter subjects, will be applicable to the present.

When the dislocation of a large joint is conjoined with an external wound, leading into the capsular ligament, the latter circumstance has a particular tendency to increase the danger. In many cases, injuries of this description are followed by violent and extensive inflammation, abscesses, mortification, fever, delirium, and death. When the patient is advanced in years, much debilitated, or of an unhealthily irritable constitution, a compound luxation, especially if attended with severe contusion and other injury of the soft parts, often has a fatal termination. A man, above the age of seventy, and much addicted to drinking, was brought into the North London Hospital with a compound dislocation of the first phalanx of his right thumb. The case was reduced; but considerable swelling and a livid redness of the hand ensued, with a small irregular pulse; and death occurred in about a week from the time of the accident. This, however, is not the general event of compound dislocations; and whatever may have happened in former times, we now know, that, in the present improved state of surgery, and in moderately good constitutions, these accidents mostly admit of cure. This statement may be made, without any censure being cast upon every instance of amputation performed in such cases. I know, that this operation is sometimes indispensable directly after the accident, and I am equally aware, that it may become necessary in a future stage, when extensive abscesses, or sloughing, joined with threatening constitutional symptoms, have taken place. My only design is to recommend the endeavour to cure the generality of compound luxations. But, if a case were to present itself, attended with serious contusion and laceration of the soft parts, I should be as earnest an advocate for amputation as any surgeon.

Sir Stephen Love Hammick, in speaking of compound dislocations of the ankle, advises amputation, "where the lower heads of the tibia and fibula are very much shattered; where, together with the compound dislocations of these bones, some of the tarsal bones are displaced and injured; where any large vessels are divided, and cannot be secured without extensive enlargement of the wound, and disturbance of the soft parts; where the common integuments, with the neighbouring tendons and muscles, are considerably torn; where the protruded tibia cannot by any means be reduced; and where the constitution is enfeebled at the time of the accident, and not likely to endure pain, discharge, and length of confinement." (*A. Cooper's Surgical Essays*, part ii, p. 146.) Perhaps, as general remarks, these may not be in-

accurate; but there are exceptions to them. Thus we find in Sir A. Cooper's publication, several cases, in which compound dislocations of the ankle terminated well, notwithstanding the displacement and removal of the astragalus, other instances of which kind of success are to be found in the records of surgery. (See *Laumonier*, in *Fourey*, *Méd. éclairée*; *Percy*, in *Journ. de Méd. continué* Nov. 1811, p. 348.; *Professor Stevens of New York*, see *Reese's American ed. of this Dict.*) However, if the ends of the tibia and tarsal bones, especially the astragalus and os calcis are broken, the operation of amputation is recommended on high authority. (*Sir A. Cooper's Surg. Essays*, part ii, p. 181.) But, with regard to the division of large blood-vessels, Sir A. Cooper states, that he would not at once proceed to amputation on that account. "The case from Mr. Sandford of Worcester, sent me by Mr. Carden, clearly shows, that the division of the anterior tibial artery does not, if it be well secured, prevent the patient's recovery. I also once saw a compound fracture, close to the ankle joint, accompanied by a division of that artery; and, although the patient was in the hospital, and a brewer's servant, who possessed the worst constitution to struggle against severe injuries, yet this man recovered without amputation." Nor, in Sir A. Cooper's opinion, would all hope be precluded, even if the posterior tibial artery were injured (*Vol. cit.* p. 186.) For the method of securing these vessels, see *ARTHRITIS*.

The following are the circumstances, which Sir A. Cooper has known give rise to the necessity for amputation in compound dislocations of the ankle.

1. The advanced age of the patient.
2. A very extensive lacerated wound.
3. Difficulty of reducing the ends of the bones he considers rather as a reason for sawing them off, than for amputation.
4. The extremely shattered state of the bones.
5. Dislocations of the tibia outwards cause greater injury of the bones and soft parts, than those inwards, and more frequently require amputation.
6. Sometimes the bone cannot be kept reduced, owing to the tibia in the dislocation outwards, being obliquely fractured.
7. Division of a large blood-vessel, attended with extensive wound of the soft parts.
8. Mortification.
9. Excessive contusion.
10. Extensive suppuration.
11. Necrosis, where the sequestra do not admit of removal.
12. Very great and permanent deformity of the foot.
13. When tetanus comes on, Sir A. Cooper does not approve of the operation.
14. A very irritable state of constitution, such as is often met with in very fat subjects, who take no exercise. (*On Dislocations*, &c. p. 332., &c.)

The treatment of a compound dislocation requires the reduction to be effected without delay, and with as little violence and disturbance as possible. When the extremity of the bone protrudes, and is smeared with sand or dirt, as frequently happens from its having touched the ground, "it should be washed with warm water, as the least extraneous matter admitted into the joint will produce and support a suppurative process, and the utmost care should be taken to remove every portion of it adhering to the end of the bone. If the bone be shattered, the finger is to be passed into the joint, and the detached pieces are to be removed, but this is to be done in the most gentle manner possible, so as not to occasion unnecessary irritation; and if the wound be so small as to admit

the finger with difficulty, and small loose pieces of bone even be felt, the integuments should be divided with a scalpel, to allow of such portions being removed without violence." (*Sir A. Cooper on Dislocations*, p. 254.) If any difficulty of reduction should arise from the bone being girt by the integuments, the opening in them should be dilated with a scalpel. The limb is then to be placed in splints, with the necessary pads, eighteen-tailed bandage, &c. Sir A. Cooper judiciously recommends the portions of this bandage not to be sewed together, "but passed under the leg, so that piece may be removed when it becomes stiff;" and by fixing another to its end, before it is withdrawn, the fresh piece may be applied, without any disturbance of the limb. (*Surg. Essays*, part ii. p. 120.) Or the limb may be laid on M'Intyre's apparatus, with which a common roller will answer even better than the eighteen-tailed bandage. The wound is to be freed from any dirt, clots of blood, or other extraneous matter, and its lips are to be accurately brought together with strips of adhesive plaster. Sir A. Cooper considers lint dipped in the blood, which oozes out, the best kind of first dressing. The joint is to be covered with linen, kept constantly wet with the liquor plumbi acetatus dilutus, or, with what is better, spirit of wine and water; the bandage is to be loosely laid down, and the splints fastened on the limb with their proper straps, or pieces of tape, and the limb is to be kept perfectly at rest in an eligible posture. The patient, if strong and young, is to be bled. An anodyne, the first night or two, will be highly proper. Saline draughts, antimonials, and a low regimen, are also indicated during the first few days of the symptomatic fever, which commonly follows.

According to Sir A. Cooper, purgatives should be used with the utmost caution; "for (says he) there cannot be a worse practice, when a limb has been placed in a good position, and adhesion is proceeding, than to disturb the processes of nature by the frequent changes of position which purges produce; and I am quite sure, that, in cases of compound fracture, I have seen patients destroyed by their frequent administration. That which is to be done by bleeding and emptying the bowels, should be effected within an hour or two after the accident, before the adhesive inflammation arises." (*Surgical Essays*, part i. p. 121.) Here the fracture bed, invented by Mr. Earle, would allow purgatives to be used, without any disturbance of the limb.

If the case take a favourable course, the constitutional fever will not be excessive, nor will the pain and inflammation of the limb be immoderate. Sometimes, the wound will unite more or less, without suppuration; a circumstance particularly desirable, as tending more than any thing else to lessen the danger, by changing the case, as it were, from a compound into a simple one. In other cases, the wound is not united; but the inflammation and suppuration are not violent, nor extensive; the constitution is not dangerously disturbed; and hopes of ultimate success may be reasonably entertained. When the wound is disposed to heal favourably, adhesive plaster, with or without lint, or a pledget of soft soap cerate, is the best dressing. In other instances, while the suppuration is copious, and the parts are tense and painful, emollient poultices are the most eligible.

When the symptomatic fever and first inflammatory symptoms are over, and much discharge prevails, attended with marks of approaching weakness, the patient is to be allowed more food, and directed to take bark, cordials, porter, wine, &c. If his nights are restless, he must have opiates; if he sweats profusely, sulphuric acid; and, in short, all such medicines, as his particular complaints may require, are to be prescribed.

When the inflammation of a compound dislocation is violent or extensive, general bleeding, the application of leeches, and the use of fomentations, and poultices, are the most likely means of lessening the mischief. Yet, it is only in strong habits, that venesection to any extent can be prudently practised in large cities, or crowded hospitals.

The following are the instructions delivered by Sir A. Cooper, on the subject of dressings:—"If the patient complain of considerable pain in the part, in four or five days, the bandage may be raised, to examine the wound; and, if there be much inflammation, a corner of the lint (or other dressing) should be lifted from the wound, to give vent to any matter which may have formed; but this ought to be done with great circumspection, as there is danger of disturbing the adhesive process, if that be proceeding without suppuration. By this local treatment, it will every now and then happen, that the wound will be closed by adhesion; but, if in a few days it be not, and suppuration take place, the matter should have an opportunity of escaping; and the lint being removed, simple dressings should be applied. After a week or ten days, if there be suppuration with much surrounding inflammation, poultices should be applied upon the wound, leeches in its neighbourhood, and upon the limb at a distance, the evaporating lotion should still be employed; but, as soon as the inflammation is lessened, the poultices should be discontinued." (*Surgical Essays*, part ii. p. 121.)

In certain examples, the most skilful treatment is unavailing. The joint and limb become affected with considerable pain and swelling; the fever runs high; delirium comes on, and the patient may even perish from the violence of the first symptoms, the limb being generally at the same time attacked by gangrene. If these first dangers are avoided, the wound may yet not heal favourably; the inflammation may be considerable, or of an erysipelatous nature; large abscesses under the fascia may be formed; the bones may be affected with necrosis; and the hectic symptoms and sinking state of the patient, may make the only chance of recovery depend upon amputation. But, even this operation is sometimes deferred till too late, and the patient must be left to his fate.

Whoever gives the smallest reflection to the nature of compound luxations, will perceive, that it is often a matter of the highest importance to make a right decision at the very beginning, whether amputation should be immediately done, or an attempt made to save the limb. In some instances, the patient's sole chance depends upon the operation being performed at once, without the least delay, and the opportunity of doing it never returns. The surgeon should take off the limb as soon as he has seen the nature of the injury, and not wait till a general tendency to swelling and gangrene has spread through the

member, and every action in the system is disturbed. Amputation, under these circumstances, is sometimes unavoidable, the system not being in a condition to bear it, and the patient likely to die on the operating table; and every surgeon knows, that when the operation is performed for a spreading gangrene, it is always performed with a very diminished chance of success. Indeed, until certain facts were adduced by Baron Larrey, Mr. Lawrence, Mr. A. C. Hutchison, and others, it was not long ago, altogether prohibited. (Sec AMPUTATION and MORTIFICATION.)

But, besides this first critical period, the surgeon often has to exercise a nice degree of judgment in a future stage of the case; I mean when the suppuration is copious, the wound open, the bones affected with necrosis, and the health impaired. Here the practitioner may sometimes err, in taking off a limb that might be saved; or, he may commit a worse fault, and make the patient lose his life in a fruitless attempt to save the member. No precepts can form the right practitioner in this delicate part of surgery; genius alone cannot do it; the opportunity of making observations, and the talent of profiting by them, are here the things which make the consummate surgeon.

It should ever be recollected, in regard to bad compound dislocations, that in young subjects, and in a salubrious air, many cases will do well, which, in old persons, and in the polluted atmosphere of London, and crowded hospitals, would be fatal without amputation.

The constitutions of some individuals are so irritable, that whether an attempt be made to save the limb, or amputation be at once performed, the case has a rapid and fatal termination. According to Sir A. Cooper, persons who are much loaded with fat "are generally irritable, and bear important accidents very ill: indeed," says he, "they generally die, whichever plan of treatment be pursued." However, he adds, that such corpulent people as take a great deal of exercise, form exceptions to the foregoing remark. (*Surgical Essays*, part ii. p. 195.)

There is a practice in regard to compound dislocations, which I think ought at all events to be adopted only in a few cases: I mean the plan of sawing off the head of the luxated bone. According to Leveillé, this method is recommended by Hippocrates, as a means of accelerating and perfecting the cure. (*Nouvelle Doctrine Chirurgicale*, t. ii. p. 44.) However, it seems not to have done sufficient good in ancient times, to have obtained a lasting reputation. In fact, when it was mentioned by the late Mr. Gooch, it had sunk into such oblivion, that it was received as an entirely new proposal. "Compound luxations (says this author,) are of a more dangerous nature than compound fractures, for very plain reasons; but, if a surgeon should judge it advisable to attempt saving a limb under such threatening circumstances, I am inclined to think, from what I have observed, he will be more likely to succeed by sawing off the head of the bone, especially if it has long been quite out, and exposed to the air."

Mr. Gooch afterwards takes notice of a case in which Mr. Cooper, of Bungay, sawed off the heads of the tibia and fibula, and preserved the limb, the patient being able to walk and work for his bread for many years afterwards. Other examples are also briefly mentioned, in which the lower

head of the radius was sawn off, and the head of the second bone of the thumb.

The late Mr. Hey, of Leeds, was induced, to make trial of this plan in a compound luxation of the ankle. The example, however, which he published, is decidedly unfavourable to the practice, as the following passage will show:—"I was in hopes that this patient would have been able to walk stoutly, but, in this I was disappointed. He walked indeed without a crutch; but his gait was slow, his leg remaining weak, and his toes turning outwards, which rather surprised me, as his leg was very straight, when I ceased attending him."

Mr. Hey did not recite this case with the view of recommending a similar practice in all cases of this accident; for he had not always adopted it, nor was he of opinion, that the same mode of treatment, whether by replacing the bones, sawing off their extremities, or amputating the limb, ought to be universally practised. When the laceration of the capsular ligament and integuments is not greater than is sufficient to permit the head of the tibia to pass through them; and, when, at the same time, the joint, or contiguous parts have suffered no other injury: Mr. Hey recommends, the replacing of the bone, and a union of the integuments by suture, with the treatment adapted to wounds of the joints. (*Practical Obs. in Surgery*, chap. xi. ed. 2.)

That in a few cases recorded by Gooch, and Hey, the patients recovered with a new sort of joint, only proves to my mind the great resources and activity of nature, and her occasional triumph over the opposition she meets with from injudicious surgery. A limb so treated must ever afterwards be shorter than its fellow, and consequently the patient be more or less a cripple. We have seen that, in the only instance published by Mr. Hey, considerable deformity was the consequence of the practice. I cannot help adding my belief, that this gentleman would have experienced more success in the treatment of compound dislocations, had he relinquished the objectionable method of sewing up the wound. In such accidents, every kind of irritation should be avoided as much as possible, and that the wound may be conveniently closed with sticking plaster, the observation of numerous cases has perfectly convinced me.

The most ingenious arguments, which have yet been urged in behalf of the practice of sawing off the ends of the bones, in compound dislocations of the ankle, are those recently published by Sir A. Cooper. However, he does not advise the plan without restrictions. If the dislocation (says he) can be easily reduced, without sawing off the end of the bone; if it be not too obliquely broken to remain firmly upon the astragalus after being reduced; if the end of the bone be not shattered, for then the small loose pieces of bone should be removed, and the surface of the bone be smoothed by the saw; if the patient be not excessively irritable, and the muscles affected with violent spasms, impeding reduction, and causing a displacement of the bones after they have been reduced; Sir Astley Cooper advises the immediate reduction of the parts, and uniting the wound by adhesion. In the opposite circumstances, rather than amputate the limb, he would saw off the ends of the bones. (*Surgical Essays*, part i. p. 154; and *Treatise*, p. 302.)

M. Roux gives much praise to the English surgeons for the judicious boldness which they have evinced in cases of this description. Although Fabricius Hildanus, Ferrand, Desault, Laumonier, and several other French surgeons, have, like many British practitioners, ventured to remove the whole of the astragalus, when this bone was totally separated from the scaphoides, and protruded in compound luxations; yet M. Roux acknowledges, that the bold practice of sawing off the lower end of the humerus, the lower end of the radius, the lower end of the tibia, and also of the fibula at the same time, originated with, and was first executed by, English surgeons. (*Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise*, pp. 208, 209.)

DISLOCATIONS OF THE LOWER JAW.

The lower jaw can only be luxated forward, and either one or both of its condyles may become displaced in this direction. Every dislocation, except that forward, is rendered impossible by the formation of the parts. The lower jaw cannot even be dislocated forward, unless the mouth, just before the occurrence of the accident, be very much open. Whenever the chin is considerably depressed, the condyles slide from behind forward, under the transverse root of the zygomatic processes. The cartilaginous cap which envelopes the condyles, and follows them in all their motions, still affords them an articular cavity; but, the depression of the bone continuing, the ligaments give way, the condyles glide before the *eminencia articularis*, and slip under the zygomatic arches. Hence a dislocation mostly happens, while the patient is laughing, gaping, &c. A blow on the jaw, a spasm, or any irregular action of the muscles, when the mouth is wide open, may easily cause the accident. The case has occasionally arisen from the exercise of great force in drawing out the teeth. Sir Astley Cooper has known a complete luxation, that is to say, of both condyles, produced by a boy suddenly putting an apple into his mouth, to keep it from the reach of a play-fellow. (*On Dislocations*, p. 389.) Whenever the jaw has once been dislocated, the same causes more easily reproduce the occurrence. In certain individuals, the ligaments are so loose, that a dislocation is produced by any slight attempt to yawn, laugh, or (as Lamotte has observed) to bite any substance which is rather large. (*Leveillé, Nouvelle Doctrine Chir.* t. ii. p. 54.) There have been persons, who could scarcely ever laugh heartily, without their lower jaws being luxated. But, of all the causes of this occurrence, yawning alone, even without the combination of any external force, is by far the most common.

When the jaw is depressed, if the muscles contract, the anterior fibres of the masseter tend to bring the condyles under the zygoma. The external pterygoid muscle will also contribute to produce the same effect.

Dislocations of the lower jaw are attended with a great deal of pain, which Boyer imputes to the pressure produced by the condyles on the deep-seated temporal nerves, and those going to the masseters, which nerves pass before the roots of the zygomatic process. The mouth is wide open, and cannot be shut. It is more open in recent dislocations, than in those which have continued for some time. An empty space is felt before the

ear, in the natural situation of the condyles. The coronoid process forms under the cheek-bone a prominence, which may be felt through the cheek or from within the mouth. The cheeks and temples are flattened by the lengthening of the temporal, masseter, and puccinator muscles. The saliva flows in large quantities from the mouth, the secretion of which fluid is greatly increased by the irritation of the parotid gland. The arch, formed by the teeth of the lower jaw, is situated more forward than that formed by the teeth of the upper jaw. During the first five days after the accident, the patient cannot speak, and, according to Boyer, he cannot swallow. When only one condyle is dislocated, the mouth is distorted, and turned towards the opposite side, while the fellow-teeth of the jaws do not correspond. However, Mr. Hey asserts, that frequently the position of the chin is not perceptibly altered. (*Practical Obs.* p. 322.) The mouth cannot be shut; but, it is not so widely open as in the complete luxation. (*Sir A. Cooper on Dislocations*, p. 392.)

When a dislocated jaw has remained unreduced for several days or weeks, the symptoms are not so well marked. In such instances, the chin becomes gradually approximated to the upper jaw; the patient recovers by degrees the faculty of speaking and swallowing; but he stammers, and the saliva dribbles from his mouth. The sufferings induced by a dislocated jaw, it is said, may even prove fatal, if the case continue unrelieved, but, we are not to believe Hippocrates when he positively declares the accident mortal, if not reduced before the tenth day. Indeed, Sir Astley Cooper, in noticing the severity of the pain, assures us that he has never seen any dangerous effect produced; on the contrary, that in time, the jaw becomes more closed, and a considerable degree of its motion is restored. (*On Dislocations*, p. 389.)

Monteggia attended a man two months after such a luxation, which had not been understood; and Fabricius ab Aquapendente assures us, that he had never seen the prognostic of Hippocrates verified, though he had had many patients of this sort under his care. (*Leveillé, Nouvelle Doctrine Chir.* t. ii. p. 58.)

Dislocations of the lower jaw may be reduced in the following manner:—The surgeon is first to wrap some linen round his thumbs, to keep them from being hurt by the patient's teeth, and then introduce them into the mouth, as far as possible along the grinding teeth. At the same time, he is to place his fingers under the chin and base of the jaw; and while he depresses the molars with his thumbs, he raises the chin with his fingers, by which means the condyles become disengaged from their situation under the zygomas; at which instant the muscles draw the condyles so rapidly back into the articular cavities again, that the surgeon's thumbs might sometimes be hurt, did he not immediately move them outward between the cheek and the jaw.

The reduction having been accomplished, a fresh displacement is to be prevented by applying a four-tailed bandage, as recommended for the fractured jaw. For a few days, the patient should avoid all food requiring much mastication.

The ancients used to place between the grinding teeth two pieces of stick; and while they used them as levers to depress the back part of the bone, they raised the chin by means of a bandage. The

late Mr. Fox, the dentist, had a patient, whose jaw had been dislocated on both sides, in the extraction of a tooth: the reduction was first effected on one side, by placing a piece of wood, a foot long, upon the grinders, and then raising the part of it that was held in the hand. Mr. Fox next reduced the other condyle in the same manner. Sir Astley Cooper, in reducing a complete luxation of the lower jaw, prefers putting the patient in the recumbent posture, introducing two corks behind the molar teeth, and then elevating the chin. (*On Dislocations*, p. 391.) When only one condyle is dislocated, whatever method of reduction be followed, it need only be applied to the side affected.

DISLOCATIONS OF THE VERTEBRÆ.

What have been called dislocations of the spine, are considered by Sir Astley Cooper as really fractures of the vertebræ, with displacement of the bones, but not of the intervertebral substance. The only true dislocations of the spine admitted by him, are those of the first and second cervical vertebræ. (*On Dislocations*, &c. p. 17.)

The large surfaces with which the vertebræ support each other; the number and thickness of their ligaments; the strength of their muscles; the little degree of motion which each vertebra naturally has; and the vertical or slightly oblique direction of the articular processes, are generally supposed to make dislocations of the dorsal and lumbar vertebræ impossible, unless there be also a fracture of the above-mentioned processes. Thus, Sir Astley Cooper, in his very extensive experience, has never witnessed a separation of one vertebra from another through the intervertebral substance, without fracture of the articular processes; or, if those processes remained unbroken, without a fracture through the bodies of the vertebræ. In three cases, recorded by Dupuytren, the intervertebral substance was lacerated, and the bodies of the vertebræ were uninjured; but, in two of them, the spinous, transverse, and articular processes were broken off; while, in the third, all these parts were not hurt. (*Clin. Chir.* t. i. p. 395.) These cases can only result from immense violence. The symptoms would be an irregularity in the disposition of the spinous processes, retention or incontinence of the urine and feces, paralysis and a motionless state of the lower extremities, and other circumstances which will be presently enumerated, noticed by Dupuytren in one remarkable case, the effects of the pressure or other injury to which the spinal marrow would be subjected. Similar symptoms may also arise when the spinal marrow has merely undergone a violent concussion, without any fracture or dislocation whatever; and it is certain, that most of the cases, mentioned by authors as dislocations of the lumbar and dorsal vertebræ, have only been concussions of the spinal marrow, or displacement with fracture.

The cervical vertebræ, however, having less extensive articular surfaces and a greater degree of motion, are occasionally luxated. The dislocation of the first vertebra from the second, is the most common; but luxations of the cervical vertebræ lower down, though rare, are possible. Indeed, according to Boyer, many examples have happened, in which one of the inferior oblique or articular processes of a cervical vertebra, as been

dislocated, so as to cause a permanent inclination of the neck towards the side opposite to that of the displacement. (*Mal. Chir.* t. iv. p. 114.)

Whether the case published by Sir C. Bell, under the name of a subluxation of the spine, ought to be received as an unequivocal specimen of a displacement of the last cervical from the first dorsal vertebra, I cannot presume to determine. This author speaks of an evident loosening between these two bones; of a considerable space between them; of the destruction of the intervertebral substance; and of an immense quantity of pus around the injured part of the spine; as circumstances seen in the dissection. "On the back part, the pus had extended under the scapulae, and on the fore part was bounded by the oesophagus," and, in the spinal canal, it had descended through the whole length of the sheath to the cauda equina. (*Sir C. Bell, Surg. Obs.* vol. i. p. 148.)

Rust declares, however, that even the lumbar and dorsal vertebræ may be dislocated. (*Arthrokakotomie*, p. 71.) Sir C. Bell also describes a case of complete dislocation of the last dorsal from the first lumbar vertebra, with entire division of the spinal chord. A small portion of bone was broken off. (*On Injuries of the Spine and Thigh-bone*, p. 25. pl. 2. fig. 2 and 3.) We learn from Mr. Lawrence, that the museum of St. Bartholomew's Hospital contains specimens of luxated cervical vertebræ. In one of these, the right inferior articular process of the fifth vertebra is dislocated forwards. The portion of the vertebral column, above the seat of the injury, is twisted to the left, and the body of the fifth having been partially displaced, projects beyond that of the sixth vertebra. This displacement could not have been effected without considerable injury of the fibro-cartilage. The upper and anterior part of the body of the sixth and seventh vertebræ has been slightly fractured on the left side. In another case, the inferior articular processes of the fifth cervical vertebra are partially separated from those of the sixth. The bodies of the same bones are partially separated behind. A third specimen exhibits a dislocation of the sixth from the seventh cervical vertebra. The inferior articular processes of the sixth are completely dislocated forwards, and its body projects over that of the seventh. Mr. Lawrence has recorded one case, proving that complete dislocation both of the articular processes and body, without fracture, may occur in the cervical region of the spine. (See *Med. Chir. Trans.* vol. xiii. p. 391—394.) A gentleman, attending my lectures, three or four years ago, lent me a specimen of a complete dislocation of the middle cervical vertebræ without fracture. The preparation was shown by me to the surgical students at University College. The accident befel a person, who was sitting upon an omnibus as it passed rapidly under a gateway, the upper part of which struck against him with immense violence. Baron Dupuytren has also recorded an instance of a dislocation of the sixth from the seventh cervical vertebræ, without any previous fracture. The patient, a woman fifty-six years old, lived thirty-four hours after the accident. There was total loss of sensibility in the lower extremities, and the rectum, bladder, parietes of the abdomen, and all parts below the diaphragm, seemed, as it were, dead. Above this point, the upper ex-

tremities were also in a state of incomplete paralysis, with respect both to motion and feeling. Respiration was frequent and laborious; but the speech, senses, motions of the countenance, and intellectual faculties, were not affected, and seemed to belong to another individual. The pulse was full and soft; the tongue dry and brownish; and the skin natural in point of temperature and exhalation. (See *Dupuytren, Clin. Chir.* t. i. p. 390.) *

DISLOCATION OF THE HEAD FROM THE FIRST VERTEBRA, OR ATLAS.

The os occipitis and first cervical vertebra are so firmly connected by ligaments, that there is no instance of their being immediately luxated from an external cause; and, were the accident to happen, it would prove fatal, by the unavoidable compression and injury of the spinal chord.

Five examples of displacement of the atlas by disease are in the museum at Leyden, and are described by Sandifort. Boyer has seen one at La Charité; and an interesting description of a similar case, illustrated by engravings, has been recently published by Schupke. (*De Luxatione Spontanea Atlantis et Epistrophei*, 4to. Berol. 1816.) In this tract is collected, from the writings of J. P. Frank (*Delect. Opusc.* vol. v.), from those of Reil (*Fieberlehre*, b. ii. § 102.), and of Rust, &c. an exact detail of the symptoms of the disease; an important topic, on which Boyer confesses his inability to give any information. The symptoms have been described by Mr. Lawrence as follows:—"Pain in the neck, becoming more severe at night, or in swallowing a large mouthful, or drawing in deep breath, is the first symptom. This pain affects one side of the neck, especially when the head is moved towards the shoulder; it extends from the larynx towards the nape, and often to the scapula of the pained side. No external alteration is perceptible; but firm pressure on the region of the first and second vertebra produces considerable pain, and thus points out the seat of disease. The difficulty of swallowing and breathing, and hoarseness, increase, alternating with pain in the neck, which seems to fix about the back of the head, and becomes intolerable on moving that part. The head sinks towards one shoulder, the face being turned a little down; for, in general, the articulations are affected on one side only, and that was the left in seven out of nine examinations after death. If both sides are affected, the head will incline directly forwards. In this state things continue for several weeks or months; and before worse symptoms come on, there is often apparent improvement, freer motion, and more natural situation of the head. But, the uneasiness in speaking and swallowing returns; the pain becomes more severe and extensive; the head falls a little backwards, and shrinks towards the opposite side. The patient feels as if the head were too heavy, and he carefully supports it with his hands, when he moves from the sitting to the lying position, or *vice versa*. This may be considered a pathognomonic symptom of the affection. Another symptom, which, at this period, shows the true nature of the disease, is a peculiar expression of pain in the countenance, which, combined with the position and stiffness of the head, constitutes so characteristic an assemblage of appearances, that it is enough to have seen it once, in order to

recognise it again immediately. In the further progress of the case, noise in the head, deafness, giddiness, cramps, and convulsions, partial paralysis, particularly of the upper limbs, loss of voice, purulent expectorations, and hectic symptoms supervene. Generally no external change is observable, either in the neck, or in the nape; and Rust observed, in one case only, swelling of the affected side, which broke and left fistulous ulcers. But, the slightest pressure in the region of the three upper vertebrae is acutely painful, and sometimes, in the advanced period of the disease, a grating of rough surfaces is distinctly perceptible when the head is turned. The patient may continue for months in this helpless and painful state, and then dies, either from exhaustion and debility, or, which is more frequent, suddenly and unexpectedly." (*Lawrence, in Med. Chir. Trans.* vol. xiii. p. 406.) These spontaneous displacements of the atlas may depend upon caries and scrofulous disease of its articular surfaces, or upon an exostosis of its transverse process, or a similar tumour growing from the neighbouring portion of the os occipitis, or petrous portion of the temporal bone. By these causes, the anterior, or posterior arch, or one of the sides of the atlas, has been made to intercept a third, the half, and even two-thirds, of the diameter of the foramen magnum. Notwithstanding these changes, life may be carried on, and the nutritive functions performed sufficiently well to afford time enough either for the exostoses to attain a large size, or for the ankylosis, binding together the head and most of the cervical vertebrae, to acquire great solidity. The size of the foramen magnum, and the dimensions of the vertebral canal in the neck, are considerably beyond what would be necessary for simply continuing the spinal marrow, so that the free lateral movements of the head and atlas can be executed without any risk of pressure on that important part. Hence spontaneous displacement can occur in these cases to a considerable degree, without impairing the functions of the spinal chord. (*Lawrence, in Med. Chir. Trans.* vol. xiii. p. 411.) According to Boyer, the atlas is never found free and distinct, when thus displaced; but is confounded at least with the os occipitis, and mostly with five or six of the subjacent vertebrae. And, another interesting fact is, that, in cases of this description, the joint between the atlas and occiput is never the only one, which is displaced and deformed, unless the disease be very slightly advanced; for, the articulation of the processus dentatus with the atlas, and sometimes that of the point of the same process with the occiput, are considerably affected. Sometimes the processus dentatus and the occiput retain their natural position with respect to each other, and the atlas alone seems to be displaced between them. Sometimes the second vertebra is out of its place with respect to the os occipitis, in the same direction as the atlas, but not in quite so great a degree. Lastly, in some other instances, the two vertebrae are twisted in opposite directions; as, for instance, one to the left, the other to the right; or *vice versa*. In one of the cases, recorded by Sandifort, this kind of lateral displacement in opposite directions was so extensive, that an interspace, only six lines in breadth, was left between their approximated annular margins. An instance was seen by Duverney, where the displacement of the

two vertebrae was from before backward, and where the processus dentatus was approximated to the posterior arch of the atlas to the extent of two-thirds of the annular opening in this vertebra. In these cases, nothing can be more obvious, than that there must be a destruction, or, at all events, a thoroughly diseased state of the ligaments between the atlas and dentatus, and of those connecting the dental process to the occiput. (Boyer, vol. cit. p. 105.)

As for the treatment of the preceding forms of disease, experience has hitherto furnished little satisfactory knowledge. But, as an analogy is seen between these cases and the scrofulous and carious affections of other joints, blisters, setons, and issues, have been proposed and tried. Rust found these remedies only capable of retarding the progress of the disease, and of producing an abatement of the symptoms. The pain often reaching from the back of the head to the forehead, was rendered less severe; and the difficulty of swallowing was considerably lessened. But the means here specified were not found adequate to arrest the morbid change in the bones. However, Rust thinks that greater benefit might be expected, if a case were to present itself arising altogether from a local cause, without its origin being connected with constitutional disease.—(Salzburger Med. Chir. Zeitung, jahrgang. 1813. b. iii. p. 108.) In a later work, he adverts to some examples, in which a cure was effected by nature. Indeed, the occasional termination of the disease by ankylosis is a full proof of this fact. (Arthrokakologie, §118.)

DISLOCATIONS OF THE FIRST CERVICAL VERTEBRA FROM THE SECOND.

The rotatory motion of the head is chiefly performed by the first vertebra moving on the second. When this motion is forced beyond its proper limits, the ligaments which tie the processus dentatus to the edge of the foramen magnum are torn; and, supposing the head to be forced from the left to the right, the left side of the body of the vertebra is carried before its corresponding articulating surface, while the right side falls behind its corresponding surface. Sometimes the processus dentatus, whose ligaments are ruptured, quits the foramen formed for it by the transverse ligament and the anterior arch of the first vertebra, and presses on the medulla oblongata. But, according to Boyer, the processus dentatus may be displaced in two ways: 1st. It may be carried directly backwards, the transverse and other ligaments being broken. This mode of displacement Boyer considers as the most difficult and uncommon, as it can hardly take place, except from a fall from a great height upon the back of the head, while the spine is bent forwards. (Traité des Mal. Chir. t. iv. p. 109.) However, the accident may happen in another manner, as in Sir C. Bell's instance, where it occurred from the chin striking against a curb-stone. (Surg. Obs. vol. i. p. 150.) 2dly, In a violent rotation, in which the face is carried sideways beyond the proper limits, the lateral and accessory ligaments of the processus dentatus may be stretched and twisted spirally round this process. The force operates entirely upon them, and not at all upon the transverse ligament. Now when the lateral and accessory ligaments of the processus dentatus have given way, and an effort

to incline the head to one side is kept up, one of the sides of the space, bounded by the transverse ligament, may present itself near the point of the processus dentatus, which may then pass below the transverse ligament without rupturing it.

In children, where the processus dentatus is not fully developed, and the ligaments are weaker than in the adult, a perpendicular impulse may break the lateral and accessory ligaments, and then force the processus dentatus under the transverse ligament, without rupturing this latter part; as Boyer conceives must have been the case in the child, which J. L. Petit mentions as having been instantaneously killed by being lifted up by the head.

Lastly, when the transverse, lateral, and other ligaments are capable of making very great resistance to a force, tending to rupture them all, and to throw the processus dentatus directly backwards, this process, if more slender than common, may be broken near its base, and this portion of it forced back upon the spinal marrow. A case, exemplifying the occurrence, used to be related by Mr. Else in his lectures, and is recorded by Sir Astley Cooper. (On Dislocations, p. 348.; Boyer, vol. cit. p. 110.)

Patients can hardly be expected to survive mischief of this kind in so high a situation: when the transverse ligament is broken, and the processus dentatus is thrown directly backward against the medulla oblongata, the effect must be instant death, as happened in the case recorded by Sir C. Bell (Surg. Obs. vol. i. p. 150.), and in that mentioned by Mr. Else.

The causes of this formidable accident are various: a fall on the head from a high place; the fall of a heavy body against the back of the neck; a violent blow; a forcible twist of the neck; tumbling; standing upon the head; the rash custom of lifting children up by the head, &c. Louis believed, that the first vertebra was dislocated from the second in the malefactors hanged at Lyons, at which place the executioner used to give a sudden twist to the body at the moment of its suspension, and then bear with all his weight upon it. Under such circumstances, Boyer conceives, that the processus dentatus might pass under the transverse ligament, without any rupture of the latter.

Perhaps, the only recorded instances of luxation of the processus dentatus, independently of external violence, or previous disease, are two; one noticed by Mr. Cruikshank (See Lond. Med. Gaz. vol. iii.); the other by Dr. Wm. Thompson (Edin. Med. and Surgical Journ. vol. xlii. p. 279.).

When dislocations of the cervical vertebrae occur at the third, fourth, fifth, or sixth of these bones, and only one articular process is luxated, the accident is not always fatal. In these instances, the vertebral canal is not so much lessened as to compress the spinal marrow, and occasion immediate death.

With regard to the prognosis of all luxations in which the processus dentatus is displaced suddenly and not gradually by disease, I may observe, that such cases are mostly fatal. Mistaken notions have been entertained upon this point, in consequence of particular dislocations of the neck having been successfully treated.

A child was brought to Desault, with its neck bent, and its chin turned towards the right shoulder. The accident had been a consequence of the head having being fixed on the ground, while the feet were up in the air. A surgeon hap-

pened to be with Desault at the time, and they agreed to make an attempt to reduce the luxation, and to apprise the mother, that though the child might be cured, there was a possibility of its perishing under their hands. Being permitted to do what they judged proper, they fixed the shoulders, and the head was gently raised, and gradually turned into its natural position. The child could now move freely; the pain ceased; and a considerable swelling in the situation of the luxation, yet left, was dispersed by the application of emollient poultices. (*Leveillé Nouvelle Doctrine Chir. t. ii. p. 62.*)

Another alleged instance of the reduction of a dislocation of the neck is recorded. (*Schmucker's Vermischte Chir. Schriften, b. i.*) However, both in this case, and that related by Desault, there can be no doubt, that the accident was not a dislocation of the dentata from the atlas, but a luxation of one of the oblique processes of a cervical vertebra lower down. Whenever the processus dentatus is suddenly displaced or fractured, the effects on the medulla spinalis, one would expect, must be inevitably fatal. A case, indeed, was attended by Mr. Cline, in which the processus dentatus had lost a part of its natural support, in consequence of a transverse fracture of the first vertebra, and in which the child survived the accident a year. (See Sir A. Cooper on Dislocations, p. 549.)

My friend, Mr. Benjamin Phillips, has favoured me with the following very remarkable case, a more particular account of which has been inserted in the Transactions of the Royal Med. Chir. Society of London, vol. xx. :—

"Wm. Cross fell from a hayrick to the ground, the occiput first coming in contact with the soil; he was stunned by the accident; but, in a few minutes, was able to walk to the residence of the parish surgeon, by whom he was bled and purged. In two or three days he was enabled to resume his usual avocations.

"The only inconvenience which succeeded to the accident, was inability to rotate the head; and for this symptom, three weeks after the accident, I saw him.

"He complained of a slight tenderness over the superior cervical region, which was a little painful upon pressure, and presented a very inconsiderable tumefaction.

"The conclusion come to was, that either chronic inflammation or caries affected the atlanto-axial articulation. Under this impression, leeches were applied every two days for three weeks, without any other benefit than a lessening of the tenderness. By means of caustic potash, an issue was maintained over the point for nearly four months; but rotation of the head was still impracticable.

"After the drying up of the issues, or in about six months from the receipt of the injury, he had an attack of pleurisy, for which it was necessary to resort to very active depletion.

"When he had become convalescent from the pleurisy, symptoms of anasarca were manifested, under which he ultimately sunk, eleven months after the receipt of the injury.

"Sensation and motion, with the exception I have named, were in no degree impaired, and about this there could be no fallacy; for, he was accustomed to feed himself while lying on his back, and to walk to the water-closet daily. During the last

three months of his life, he had complained of some difficulty in swallowing, and his voice was observed to be rather thick; but, upon looking into the throat, there was no obvious cause for these symptoms.

"After death the cervical region was examined and, at first sight, no very particular lesion was evident; but, upon more careful examination, it was found that a complete transverse fracture of the atlas had occurred. The anterior moiety of the ring, including the joints of articulation with the occiput, had been carried downwards and forwards in front of the axis, had arrived on the same plane with it, and had become connected to it by perfect bony union. The strength of the transverse ligament, which embraces the neck of the processus dentatus, had been sufficient to retain that organ in its grasp, and, consequently, the latter had been fractured and carried down with it; and to this circumstance the patient, no doubt, owed his life; for had the ligament given way, the process would inevitably have lacerated the spinal cord.

"The morbid specimen is in the possession of Sir C. Bell. The importance of this unique case arises from its invalidating the principle, so confidently laid down, that such an injury in this region must necessarily be fatal."

T. E. Schmidt, De Luxatione Nuchæ. *Haller, Disp. Chir. t. ii. p. 351. Tub. 1747. S. T. Soemmering, Bemerkungen über Verrenkung und Bruch des Rückgrats, 8vo. Berlin, 1793. Boyer, Traité des Mal. Chir. t. iv. p. 100. &c. 8vo. Paris, 1814. A. E. Schupke, De Luxatione Spontanea Atlantæ et Epistrophei, 4to. Berol. 1816. Sir C. Bell, Surgical Obs. vol. i. p. 145, 149, &c. 8vo. Lond. 1816. Obs. on Injuries of the Spine, &c. 4to. 8vo. Lond. 1824. Sir A. Cooper, on Dislocations, &c. p. 548—551, &c. 4to. Lond. 1822. Lawrence, in Med. Chir. Trans. vol. 13. Dupuytren, in Clin. Chir. t. i. art. 15. Wm. Thomson, M.D. in Ed. Med. Surg. Journ. vol. xiii. Benjamin Phillips, in Med. Chir. Trans. vol. xx. p. 78.*

DISLOCATIONS OF THE CLAVICLE.

Are much less common than fractures, which are said to occur six times more frequently. In fact, the clavicle is so strongly articulated both with the sternum and scapula, that its dislocations are rare in comparison with those of many other joints.

The clavicle may be luxated at its sternal extremity, forwards, backwards, and upwards; but never downwards, on account of the situation of the cartilage of the first rib. The luxation forwards is the most frequent; dislocations backwards and upwards are unusual; and one directly backwards is still more rare. This last case Sir Astley Cooper has never known arise from violence; but, he conceives, that it might happen from a blow on the fore part of the bone, rupturing the capsular ligament and that between the clavicle and rib. The only instance of the dislocation backwards, with which this experienced surgeon is acquainted, proceeded from great deformity of the spine. In this extraordinary case, the bone gradually slipped behind the sternum, and produced so much inconvenience, by its pressure on the œsophagus, that the late Mr. Davie, of Bungay, in Suffolk, was obliged to remove its sternal extremity. (Sir A. Cooper on Dislocations, p. 395, 401.)

If the dislocation be forwards, a hard circumscribed tumour is felt, or even seen, on the front and upper part of the sternum. According to Boyer, when the shoulder is carried forward and outward, the tumour disappears; but, in Sir Astley Cooper's account, it is said, that the projection on

DISLOCATION.

the sternum will subside, if the shoulder be drawn backward. The shoulder, being elevated, the projection descends; if it be drawn downwards, the dislocated extremity of the bone becomes elevated to the neck. The motions of the clavicle are painful, and the patient moves the shoulder with difficulty. The point of the acromion is less distant from the central line of the sternum than usual. The dislocation forwards is sometimes incomplete, only the front of the capsular ligament being torn. The dislocation forwards is generally produced by a fall upon the point of the shoulder, when the force pushes the clavicle inwards and forwards; but, it also frequently happens, from falls upon the elbow, when this is separated from the side, and thus the clavicle is propelled violently inwards and forwards against the anterior portion of the capsular ligament. (*Sir A. Cooper on Dislocations*, p. 399.)

When the luxation is upwards, the distance between the sternal ends of the clavicles is diminished.

When the dislocation is backwards, there is a depression where the end of the clavicle ought to be, and the head of the bone forms a projection at the front and lower part of the neck, which, as J. L. Petit remarks, may compress the trachea, œsophagus, jugular vein, carotid artery and nerves. The head is inclined towards the side, on which the accident itself is situated.

In reducing dislocations of the sternal end of the clavicle, we are to make a lever of the arm, by means of which the shoulder is brought outwards; and when thus brought outwards, it is to be pushed forwards, if the dislocation be in that direction; backwards, if the dislocation be behind; and upwards, if the dislocation be above.

The same position of the arm, and the same apparatus, as in fractures of the clavicle, are to be employed. The wedge-like pad, with its thick part towards the axilla, for the purpose of inclining the shoulder outward, a sling for the support of the weight of the arm, and a bandage judiciously applied, are especially necessary. In consequence of the obliquity and smoothness of the articular surfaces, the reduction is easy, but great attention is requisite to prevent a return of the displacement.

Dislocation of the scapular end of the clavicle from the acromion upwards is the only case. The rarity of a dislocation of the scapular end is owing to the strength of the ligaments tying the clavicle and acromion together. However, while Desault and Boyer represent the case as much less common than displacements of the sternal end of the bone, Sir Astley Cooper's experience pronounces them to be more frequent. (*On Dislocations*, p. 405.) I have seen not less than four or five dislocations of this kind. The last was in a man under Mr. Keenridge, of Staines.

A fall on the top of the shoulder may cause the dislocation upwards. The scapular end of the clavicle then slides upwards on the acromion, and the shoulder is drawn inwards by the muscles which approximate the arm to the body. It has been asserted, that the violent action of the trapezius muscle, in pulling the clavicle upwards, may tend to produce the accident; but, as Sir Astley Cooper has remarked, the mere action of this muscle, without the simultaneous operation of the pectorals, could never tear both the ligaments of the acromion process, which must be broken ere

this dislocation can happen. When the projection is but slight, as Sir A. Cooper has sometimes noticed, the circumstance indicates that the internal ligament is not ruptured. (*On Dislocations*, p. 406.) Pain at the top of the shoulder, a projection of the end of the clavicle under the skin covering the acromion, and a depression of the shoulder, are symptoms indicating what has happened. The patient also inclines his head to the affected side, and avoids moving his arm or shoulder.

This dislocation is reduced by carrying the shoulder outwards, putting a thick cushion in the axilla, and applying Desault's bandage for fractures of the clavicle (see *Fractures*), making the turns ascend from the elbow to the shoulder, so as to press the luxated end of the bone downward, and keep it in its due situation, at the same time that the elbow is confined close to the side, and supported in a sling, by which means the shoulder will be kept raised and inclined outwards. This plan, which is advised by Boyer, is more efficient than the common practice, which consists in applying a compress, the figure of 8, bandage, and supporting the arm in a sling. However, the exact maintenance of the reduction, by any apparatus whatever, is found to be a matter of the greatest difficulty, and some slight deformity will remain, though it is agreeable to know that, notwithstanding this disadvantage, the use of the limb returns very well. I have seen cases in proof of the truth of this statement, and one example was shown me by my friend Mr. Vincent, in St. Bartholomew's Hospital. The same observations are applicable to luxations of the sternal end of the bone. Dr. James Cocke, of Baltimore, has reported, in vol. i. of *New York Med. and Phil. Journ.*, the successful reduction of a dislocation of the scapular end. (*Reese's Amer. ed. of this Dictionary*.)

DISLOCATIONS OF THE OS BRACHII.

Nature, which varies according to the necessities of different animals, the number of their joints, has also been provident enough to vary the structure of these parts, according to the use of the different portions of their economy. To great moveableness some unite considerable solidity; for instance, the vertebral column. Others are very strong, but only admit of a slight yielding motion, as we observe in the carpus, tarsus, &c. Lastly, other joints admit of a great latitude of motion; but their strength is easily overpowered by the action of external bodies. In man, such is the shoulder-joint.

Of all the very moveable articulations, not one is so often luxated as the shoulder-joint. Bichat mentions, that it appears, from a comparative table, that, in some years, this accident, at the Hôtel-Dieu, has been as frequent, and even more so, than dislocations of all the other bones taken collectively.

Here every thing seems to facilitate the escape of the bone from its natural cavity. An oval shallow cavity, surrounded by a margin of little thickness, receives a semi-spherical head, which is twice as broad as the cavity in the perpendicular direction, and three times as extensive from before backward. With respect to the ligaments, the joint is only strengthened by a mere capsule, which is thin below, where nothing opposes a dis-

location; but thicker above, where the acromion, coracoid process, and triangular ligament, form an almost insurmountable obstacle to such an accident. With regard to the muscles and motions of this joint, strong and numerous fasciculi surround the articular surfaces; make them easily move in all directions; and, pushing the head of the os brachii against the different points of the capsule, distend this fibrous sac; and, when their power exceeds the resistance, actually lacerate it. As for external bodies, what bone is more exposed than the os brachii to the effect of their force?

Thus subjected to the influence of these predisposing causes, the os brachii would be in continual danger of being dislocated, if the scapula, which is as moveable as itself, did not furnish a point of support for it, by accompanying it in all its motions. This point of support accommodates itself to the variations in the position of the head of the os brachii, so that to the moveableness of the articular surfaces, their strength is in a great measure owing.

The shoulder-joint, which is very liable to luxations in a general sense, is not equally so at all points. The head of the humerus cannot be displaced upwards. Here are situated the acromion and coricoid process, the triangular ligament stretched between them, the tendons of the biceps, supraspinatus, and the fleshy portion of the deltoid; insurmountable obstacles to the luxation of the head of the bone upwards. Supposing there were a force calculated to produce such an effect, the head of the bone must necessarily be driven outward as well as upward, ere its head could be displaced. This seemed to Desault impossible, because the trunk prevents the lower part of the arm from being directed sufficiently inward to produce this effect. However, many cases of this dislocation are now upon record; and one, to which I shall presently advert, was caused by a direct blow on the forepart of the shoulder; a cause, which seems not to have been contemplated.

On the contrary, at the other margins of the glenoid cavity, there is little resistance. At the inferior one, the long portion of the triceps; at the internal one, the tendon of the subscapularis; and at the external edge, those of the infraspinatus, and teres minor, will allow primitive luxations to take place, downward, inward, or outward. Downward, between the tendon of the long portion of the triceps, and the tendon of the subscapularis, which last, in a case dissected by Sir A. Cooper, was ruptured (*Surg. Essays*, part i. p. 7.; and *On Dislocations*, p. 421, 422.); inward, between the fossa subscapularis, and muscle of this name; outward, between the fossa infraspinata, and infraspinatus muscle.

According to Sir Astley Cooper, the os humeri is liable to be thrown from the glenoid cavity of the scapula in four directions: three of these luxations are complete; the other is only partial. The first is *downwards and inwards*, the dislocation into the axilla, as it is usually called, in which case, the head of the bone rests upon the inner side of the inferior costa of the scapula. The second is *forwards*, under the pectoral muscle, the head of the bone being placed below the middle of the clavicle, and on the sternal side of the coracoid process. The third is the dislocation *backwards*, in which the head of the bone can be plainly felt and seen, as a protuberance at the back and outer part of the inferior costa of the scapula, upon the

dorsum of this bone. The fourth, which is only partial, is when the front of the capsular ligament is torn, and the head of the bone rests against the outer side of the coracoid process. "Of the dislocation in the axilla (says Sir Astley Cooper) I have seen a multitude of instances; of that forwards, on the inner side of the coracoid process, several; although it is much less frequent than that in the axilla: of the dislocation backwards, I have seen only two instances during the practice of my profession for 38 years." (*On Dislocations*, &c. p. 416.)

Sometimes, after the head of the bone has escaped from the internal or inferior part of the capsule, it is carried behind the clavicle, forming a case of consecutive dislocation upward; a specimen of which was preserved in Desault's museum. But here the secondary displacement only takes place slowly; and when it occurs, its reduction can rarely be effected, on account of the strong adhesions, contracted by the surfaces of the bone. Thus, in the specimen referred to, a new cavity was formed behind the clavicle, and the humerus adhered by new ligaments to the surrounding parts.

The action of external bodies, directed against the arm, but particularly falls, in which this part is forced against a resisting body, gives rise to primitive dislocations; and then the different species of the accident are determined, by the particular position of the humerus at the instant when the injury takes place.

Should this bone be raised from the side without being carried either forward or backward; should the elbow be elevated, and the fall take place on the side, then the weight of the trunk, almost entirely supported by this bone, forces downward, its upper part, which stretches and lacerates the lower part of the capsular ligament. Thus a luxation downward is produced, and its occurrence may also be facilitated by the combined action of the latissimus dorsi, pectoralis major, and teres major, muscles, as Fabre has judiciously remarked; for being at this period involuntarily contracted to support the trunk, they act with the power of a considerable lever; the resistance being the head of the bone, which they draw downward, while the fixed point is the lower end of the bone, resting against the ground. Some authors also consider, as the immediate cause of a dislocation downward, the strong action of the deltoid, which is supposed to depress the head of the bone, and push it downward through the capsular ligament. In support of this opinion, Bichat mentions the well-known case of a notary, who luxated his arm downward in lifting up a register.

The rationale of the primitive luxation inward differs very little from that of the preceding case. The elbow is both separated from the side, and carried backward: in falling, the weight of the body acts on the humerus, the front part of the capsule is lacerated, and a luxation takes place in this direction.

The dislocation outward (or, as Sir Astley Cooper calls it, backward) is produced in the same sort of way. The elbow is carried forward, towards the opposite shoulder; the capsule is stretched outward; and if a sufficient force act on the limb, it is lacerated. But, how could such a force arise? In a fall, the arm being pushed

against the trunk, and kept there, cannot move extensively enough to cause such a laceration. Hence, a luxation outward, or rather backward, under the spine of the scapula, must necessarily be rare; and Desault, in all his experience, never saw such an accident. Besides, when, in a fall, the arm is raised from the side, and inclined forward or backward, the weight of the body only operates upon it obliquely, and the limb is very little exposed to the action of the *latissimus dorsi*, *pectoralis major*, and *teres major* muscles. However, a few instances of dislocation of the head of the humerus in this direction have been recorded. Kirkland met with two cases, and reduced them. Sir Astley Cooper, in the course of 38 years, has met with two examples. In a dead subject, Boyer remarked a singular inclination of the glenoid cavity backwards, its articular surface, also, presenting on this side an extraordinary elongation, and the humerus readily slipping under the spine of the scapula. (*Mal. Chir.* t. iv. p. 176.)

A dislocation of the head of the humerus on the dorsum of the humerus was brought into the North London Hospital in 1835, and reduced by Mr. Morton, then one of the house surgeons. Two similar cases have also been reported from the Middlesex Hospital. (See *Lond. Med. Gaz.* for 1832, 1833, p. 478., and for 1833, 1834, p. 142.) In one of these examples, the accident occurred as follows:—The patient was reaching down a box from the top of another, which was on a bedstead. In doing this, her arm was extended upwards and forwards, the hand being placed so as to receive the box, when this suddenly slipped off the other, and she felt her right arm give way, and fall powerless by her side. The symptoms and mode of reduction will be presently noticed. In the other example, the patient, a woman, aged 94, trod upon some orange-peel, slipped, and fell on the forepart of the shoulder.

In the patient, whose history was published by M. Fizeau, and in whom a dislocation of the humerus outwards and backwards was seen both by that gentleman and Boyer, there was also the particularity, that the luxation was readily reproduced. (*Journ. de Méd. par Corvisart*, &c. t. x. p. 386.) Hence, Boyer suspects that this rare kind of displacement must have been facilitated by some preternatural disposition of the articular surfaces. Experience proves, however, that this is not an essential, or even a common circumstance. No dislocation occurs more frequently, than that downward, in which the influence of the weight of the body, and of the action of the muscles, is direct. However, the luxation inward, or, as Sir Astley Cooper and others call it, forwards, is common.

In all primitive dislocations from violence, and not from paralysis of the deltoid, and a gradual yielding of the capsule, I believe the latter part is always extensively lacerated. In general, authors have paid too little attention to this circumstance, which dissections have repeatedly demonstrated. Desault had two specimens of it imitated in wax; one was in a dislocation inward; the other in a dislocation downward, both of which were met with in subjects who died at the Hôtel-Dieu.

Desault has observed the same occurrence. M. Dupuytren has alluded to it. Thompson, who long ago noticed the laceration of the capsule, (*See Med. Ob. and Inq.*)

The case which he dissected, is perhaps the earliest post mortem examination of a dislocated shoulder; and the identical preparation is now in the museum of University College, London.

Desault conceives, that the capsule may be sufficiently torn to let the head of the bone escape; but that the opening may afterwards form a kind of constriction round the neck of the humerus; so as to prevent the return of the head of the bone into the place which it originally occupied. The correctness of this statement, however, is positively denied by Sir A. Cooper, who remarks that they who entertain this belief, must forget the inelastic structure of the capsular ligament, and never have witnessed by dissection the extensive laceration which it suffers in dislocations from violence. (*Surgical Essays*, part i. p. 18.)

Some further pathological observations on dislocations of the shoulder, will be hereafter laid before the reader.

Several causes may lead to a consecutive luxation. If a fresh fall happen, while the arm is separated from the trunk, the head of the humerus, which nothing confines, obeys, with the utmost facility, the power of displacing it in this manner, and is again pushed out of the situation which it accidentally occupies.

A man, in going down stairs, meets with a fall, and dislocates the humerus downwards: he immediately sends for Desault, who defers the reduction till the evening. In the mean time, the patient, in getting upon a chair, slips and falls again. The pain was more acute, than when the first accident occurred; and Desault, on his return, instead of finding the head of the humerus as it was in the morning, in the hollow of the axilla, finds it behind the *pectoralis major* muscle.

The action of muscles is a permanent cause of a new dislocation. When the humerus is luxated downward, the *pectoralis major*, and the deltoid, draw the upper part of this bone upward and inward, which, only making a weak resistance to their action, changes its position, and takes one in the above double direction.

The various motions imparted to the arm may also produce the same effect, according to their direction. Thus, in consequence of unskilful efforts to reduce the bone, a luxation inward frequently follows one downward. By the French surgeons, a great deal of importance has been attached to the division of dislocations of the humerus into primary and consecutive; and perhaps some of their statements, on the secondary change in the position of the head of the bone, may be exaggerated. That a subsequent alteration in the situation of the bone may happen, from the causes specified by Desault, can hardly be questioned. The observations of Petit, Hey, and others, confirm the fact; and I have myself seen a dislocation in the axilla change into one forward, under the pectoral muscle. However, Sir Astley Cooper believes that, excepting from violence, and the effect of absorption, the nature and direction of a dislocation are never changed, after the muscles have once contracted. (*On Dislocations*, p. 416.) Perhaps, with the latter qualification, no great difference prevails between him and other writers.

SYMPTOMS.

Whatever may be the kind of dislocation; a depression is always manifest under the acromion.

which forms a more evident projection, than in the natural state. Almost all the motions of the arm are painful; some cannot be performed in any degree; and they are all very limited. The arm cannot move without the shoulder moving also; because, the articulation being no longer able to execute its functions, both it and the shoulder form, as it were, one body. When the limb is moved, a slight crepitus may sometimes be felt, probably in consequence of the synovia having escaped through the laceration of the capsule. (*Sir A. Cooper on Dislocations*, p. 418.)

To these symptoms, generally characteristic of every sort of dislocation of the humerus, are to be added such as are peculiar to each particular case. When the luxation is downward, the arm is a little longer than in the natural state; the natural roundness of the shoulder is lost, in consequence of the deltoid muscle being drawn down with the head of the bone; and the patient cannot use the arm. The elbow is more or less removed from the axis of the body by the action of the deltoid, the long head of the biceps and supraspinatus muscle being also stretched, and tending to draw the bone outward. The pain, which arises from this position, compels the patient to lean towards the dislocated limb, to keep the forearm half bent, and the elbow supported on his hip, in such a way that the arm, having a resting place, may be sheltered from all painful motion, especially that of the elbow inwards. By this posture alone, Desault often recognised the accident. The head of the humerus may be felt in the axilla; but "only when the elbow is considerably removed from the side." (*Sir A. Cooper on Dislocations*, p. 417.) This last circumstance is worthy of notice, as the inability to feel the head of the bone has led to mistakes.

With the general symptoms of dislocations of the humerus, a luxation inward has the following:—The elbow is separated from the axis of the body, and inclined a little backward; the humerus seems to be directed towards the middle of the clavicle; motion backward is not very painful, but that forward is infinitely so; there is a manifest prominence below the clavicle under the great pectoral muscle; and the arm is said by Desault to be a very little longer than natural, but by Sir Astley Cooper to be somewhat shortened. (*On Dislocations*, p. 435.) The coracoid process is on the outer side of the head of the bone; which latter part, being lodged between the clavicle, second rib, and the coracoid process, the limb is even less moveable than in the dislocation into the axilla.

With regard to the foregoing disagreement, between the statements of Desault and our distinguished countryman, I find that Baron Dupuytren used to believe, that the elongation of the limb only occurred in the dislocation downwards below the glenoid cavity; but, in consequence of the researches of M. Malgaigne, and experiments made by himself, he was induced to alter his opinion on this point. M. Malgaigne observed, that, when the head of the humerus occupies the concavity of an arch, formed by the acromion, the coracoid process, and the coraco-acromial ligament, it must evidently be upon a lower level, whether under one or the other pillar of this arch. In a shoulder joint, the ligaments of which had been recently dissected, Dupuytren dislocated the head

of the humerus under the coracoid process, and ascertained by a careful measurement, that the arm was lengthened about half an inch. (*Dupuytren, Clin. Chir.* t. iii. p. 93.)

In the dislocation inwards, or under the pectoral muscle, the cushion of the shoulder is less flattened, than in the dislocation downwards; and the elbow cannot be brought forwards without acute pain being produced. This case is much less common, than the dislocation downwards, and Dupuytren believed it to be seldom primitive, but almost always consecutive to the dislocation downward. (*Clin. Chir.* t. iii. p. 102.) A dissection by Mr. Crampton, however, leaves no doubt about the possibility of a dislocation inwards being sometimes primitive. (See *Dubl. Journ. of Med. Science*, vol. iii. p. 47.); a fact, which even Dupuytren's own description of the manner in which the accident is usually caused, would render sufficiently certain. If this dislocation commonly occur from a fall on the elbow, while separated from the side and inclined backwards (*Dupuytren*, t. iii. p. 101.), does not this imply that, under these circumstances, the head of the bone is propelled inwards, or forwards, so as to lacerate the capsule in that direction?

Were a dislocation outward to present itself, it would be particularly characterised by a hard tumour under the spine of the scapula; and by the somewhat increased length of the arm. The motions of the arm would be impaired, but not in so great a degree as in the foregoing cases. In one example, related by Mr. Toulmin, of Hackney, the arm could be moved considerably either upwards, or downwards; but, motion forwards, or backwards, was very limited. And from the observations of Mr. Coley, of Bridgenorth, it would seem, that this dislocation may be attended with the peculiarity of the arm lying close to the side. (*Sir A. Cooper on Dislocations*, p. 441—443.)

In the cases, brought to the Middlesex Hospital, the arm hung by the side, without being directed forwards or outwards. (See *Land. Med. Gaz.* 1832, 1833, p. 478. and 1833, 1834, p. 142.) The same fact was noticed in the case reduced by Mr. Morton in the North London Hospital. The shoulder is merely flattened in front. (*Dupuytren, Clin. Chir.* t. iii. p. 102.)

The principle was formerly inculcated, that all dislocations of orbicular joints, were complete; but, Sir Astley Cooper and Baron Dupuytren have proved, that dislocations of the shoulder may be incomplete; and the latter makes a similar statement also with regard to dislocation of the hip. (*Clin. Chir.* t. iii. p. 104.) The case, adduced in proof of this last observation, seems to have been the effect of disease. But, without disease the head of the humerus may burst through the anterior part of the capsule, and without entirely quitting the articular cavity, lie upon the outer side of the coracoid process. A vacancy is chiefly perceived at the posterior part of the glenoid cavity.

The distinguishing circumstances, between a dislocation and a fracture of the upper part of the humerus, should be well understood; for, were the surgeon to mistake a dislocation for a fracture, and neglect to reduce the bone, he would render himself liable to very heavy damages, and the loss of his professional prospects. Let it be re-

membered, therefore, that, in the dislocation downwards, 1. The arm is considerably lengthened; whereas, in a fracture of a living bone, if there is no displacement, the limb is of its natural length; but, when there is displacement, as one end of the fracture rides over the other, the limb must be shortened. Thus, in one instance of such dislocation under Dupuytren, a measurement of the distance between the point of the acromion and the olecranon, and one of the condyles of the humerus, showed that it was one French half inch greater in the injured limb than in the other. In an experiment upon a recently dissected shoulder-joint, the elongation was found to exceed an inch and a half. (*Clin. Chir.* t. iii. p. 94.) The reason of this difference seems to me to have depended upon the first measurement being made in a case which had existed some time; and, I believe, that in a recent dislocation downwards, the elongation must be greater than the half inch noticed by Dupuytren in the particular instance referred to. This point alone, being ascertained, may satisfy every practitioner, as it always did Dupuytren, that the case is certainly not a fracture. 2. Another distinction, necessarily resulting from the foregoing, and pointed out by M. Malgaigne, consists in the increased breadth or depth of the portion of the great pectoral muscle, constituting the front boundary of the armpit. Thus, if the distance between the lower edge of the clavicle and lower and front margin of the armpit be measured, it will be found to be at least half an inch greater, than on the opposite side of the body. 3. The head of the humerus must necessarily form a prominence below the clavicle, or, as Sir A. Cooper has stated, in the axilla, if the arm be raised. 4. The deltoid readily yields, and is pressed inwards, when the fingers are applied to it under the acromion. These four symptoms, which never attend a fracture, were demonstrated in one patient under Dupuytren, in a theatre crowded with students. (See *Dupuytren, Clin. Chir.* t. iii. p. 84.)

Many authors speak of an cedematous swelling of the upper extremity, as a frequent consequence of a dislocation inward. In the time of Desault and Bichat, this occurrence was not often noticed at the Hôtel-Dieu, except in very old luxations; and when it was, beneficial effects were obtained, in certain instances, by applying, for a few days, a moderately tight bandage from the fingers up to the axilla.

One consequence, mentioned by Avicenna, is a palsy of the upper extremity, arising from the pressure, made by the head of the bone, when dislocated inward, upon the axillary plexus of nerves. Indeed, when the nerves have been long compressed, this affection is very difficult of cure. In this case, Desault used to apply the moxa above the clavicle. The success, which was experienced by some patients, did not invariably follow in others. But, when the head of the humerus has only made a momentary pressure on the nerves, the paralysis often goes off of itself, and its dispersion may always be powerfully promoted by the use of liniments containing ammonia.

ON THE REDUCTION.

We may refer to two general classes, the infinitesimal means for the reduction of a dislocated humerus. The first are designed to push back, by some kind of mechanical force, the head

of the bone, into the cavity from which it is displaced, either with or without making previous extension. The others are merely intended to disengage the head of the bone from the place which it accidentally occupies, leaving it to be put into its natural situation by the action of the muscles. The first all act nearly in the following manner:—Something, placed under the axilla, serves as a fulcrum, on which the arm is moved as a lever, the resistance being produced by the dislocated head of the humerus, while the power is applied either to the lower part of this bone, or the wrist. The condyles of the humerus being pushed downward and inward, the head of the bone is necessarily moved in the opposite direction, towards the glenoid cavity, into which it slips with more or less facility. Thus operated the machine, so celebrated, among the ancients and moderns, under the name of the *ambi* of Hippocrates; whether used exactly in the form described by him, or with the modifications devised by Paul of Ægina, Ambrose Paré, Duverney, Freke, &c.

Extension removes the bone from its unnatural situation, and has been executed in different ways. Sometimes, the weight of the body on one side, and the dragging of the end of the dislocated bone on the other, tend to produce this effect. Such was the action of the ladder, door, &c. described in Hippocrates's *Treatise on Fractures*, and repeated in modern works. Sometimes, the trunk is fixed in an unchangeable manner, while the arm is extended, as is practised in employing the machine of Oriliusius, one of the methods formerly adopted in public places, where wrestlers combated. Sometimes, no extension is sensibly executed; and while the end of the humerus is pushed outward by a body placed under the axilla, the surgeon pushes it upward into the glenoid cavity.

The following are the objections common to all these contrivances:—However well covered the body placed under the axilla may be, to serve as a fulcrum, there is always a more or less inconvenient chafing, frequently dreadful stretching and laceration of parts, in consequence of its application, when the trunk is suspended upon it, as in the instance of the door, &c. In this way, Petit saw a fracture of the neck of the humerus produced, and even a laceration and aneurism of the axillary artery.

When the luxation is consecutive, how can mechanical means bring back the head of the bone, through the track it has taken? For instance, if a dislocation inward has succeeded one downward, the head of the bone must be brought down, before it can be replaced.

If these means were ever safely employed, it was when a primitive luxation downward was quite recent, and the head of the bone very near the glenoid cavity.

Desault often employed the following method:—While the patient was seated upon a chair of moderate height, he took hold of the hand on the affected side, placed it between his knees, which he moved downward and backward, in order to make the extension and disengage the head of the bone, while an assistant held back the trunk to effect the counter-extension. This was sometimes executed by the weight of the body, and effort of the patient. At the same time, the surgeon's hands were applied to the arm, in such a way, that the four fingers of each were put in the hollow

of the axilla, and the thumb on the outer part of the arm, which being pushed upward, and a little outward, the head of the humerus usually returned with ease into its natural cavity.

Petit describes this plan, but combined with the use of a napkin, passed under the patient's axilla, and over the surgeon's neck, who raises the dislocated end of the bone, by extending his head.

When the luxation downward was very recent, Desault occasionally reduced it, by a still more simple process; namely, by placing his left hand under the axilla, to serve as a fulcrum, while with the right, applied to the lower and outer part of the arm, he depressed the humerus towards the trunk, and at the same time raised the upper part of the bone. The head of the humerus, directed upward and outward by this double motion, returned into the glenoid cavity without the least resistance.

The facility, with which the humerus may often be reduced, when the patient is faint, or intoxicated, or taken by surprise, is well known to every surgeon of experience. In one case, Mr. Hey desired the assistants to keep the arm elevated at a right angle with the body, preparatory to the commencement of the extension. In doing this, they kept the arm a little upon the stretch, and, while the arm was in this state, he placed his fingers below the head of the bone, that he might be ready to co-operate with them; and pressing his fingers upwards into the axilla, that he might feel the head of the bone distinctly, the reduction was unexpectedly accomplished by this gentle effort. (See *Hey's Surgery*, p. 295. ed. 2.) A similar case follows at p. 296. He once saw a luxated shoulder reduced by the mere efforts of the patient, an elderly man, who, after placing his hand upon the back of a low chair, and moving his body in different directions, suddenly cried out as if hurt more than usual. He then sat down, and said that he was easy, and could move his arm better: in fact, the os humeri had returned into the glenoid cavity.

Reduction, by means of the surgeon's heel in the patient's axilla, is commended by Sir Astley Cooper as the best in three-fourths of recent dislocations. The patient (he observes) should be placed in the recumbent posture, upon a table, or a sofa, and near its edge. "The surgeon then binds a wetted roller round the arm, immediately above the elbow, upon which he ties a handkerchief. Then, with one foot resting on the floor, he separates the patient's elbow from his side, and places the heel of his other foot in the axilla." The arm is then steadily drawn with the handkerchief for three or four minutes, at the end of which, the bone in common cases is easily replaced. If more force be required, a long towel can be used, with which several persons may pull. Sir Astley Cooper generally bends the fore-arm nearly to a right angle with the os humeri, because this position relaxes the biceps, and lessens its resistance: in many cases, however, he makes the extension at the wrist; a plan, in which he finds more force requisite, but the bandage is less apt to slip.

Another simple mode of reduction, which Sir Astley Cooper considers proper for recent dislocations, delicate females, and very old, relaxed, emaciated persons, is that by means of the surgeon's knee, as a fulcrum, in the patient's axilla.

The patient is placed on a low chair, on the side of which the surgeon rests his foot, while he takes hold of the os humeri just above the condyles, and applies his other hand to the acromion. The arm is then drawn down over the knee, and the head of the bone returns into its place. (*On Dislocations*, p. 432.)

In some cases, the preceding methods are inadequate, and greater extension must be made. The following was the practice of Desault:—

The patient is laid upon a table covered with a mattress; a thick linen compress is applied to the axilla, on the side affected, and upon this compress the middle of the first extending bandage is placed, the two heads of which ascend obliquely before and behind the chest, meet each other at the top of the sound shoulder, and are held there by an assistant, so as to fix the trunk, and make the counter-extension. The action of this bandage does not affect the margin of the pectoralis major and latissimus dorsi, in consequence of the pad projecting over them. If this were not attended to, these muscles being drawn upward, would pull the humerus in this direction, and thus destroy the effect of the extension, which is to be made in the following manner:—

Two assistants take hold of the forearm, above the wrist; or else the towel, doubled several times, is to be applied to this part. The two ends are to be twisted together, and held by one or two assistants, who are to begin pulling in the same direction in which the humerus is thrown. After this first proceeding, which is designed to disengage the head of the bone from its accidental situation, another motion is to be employed which differs according to the kind of luxation. If this should be downward, the arm is to be gradually brought near the trunk, at the same time that it is gently pushed upward. Thus, the head of the bone being separated from the trunk, and brought near the glenoid cavity, usually glides into this situation with very little resistance.

When the luxation is inward, after the extension has been made in the direction of the humerus, the end of this bone should be inclined upward and forward, in order that its head may be guided backward; and *vice versa*, when the luxation is outward.

When the head of the bone has been disengaged by the first extension, the motion, imparted to it by the rest of the extension, should in general be exactly contrary to the course which the head of the bone has taken, after quitting the glenoid cavity. When there is difficulty experienced in replacing the head of the bone, we should, after making the extension, move the bone about in various manners, according to the different direction of the dislocation, and the principle just noticed. This plan often accomplishes what extension alone cannot; and the head of the bone, brought by such movements towards its cavity, returns into it, during their execution.

When the dislocation is consecutive, the first extension, made in the direction of the displaced bone, brings back its head to the situation where it was primitively lodged, and the case is then managed just as if it were a primitive dislocation. (*Desault*.)

When the muscles are very powerful, or the displacement has continued several days, Sir Astley Cooper, instead of the treatment by the heel in

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the axilla, recommends the patient to be put upon a chair, and the scapula to be fixed by means of a bandage, which allows the arm to pass through it, and is buckled on the top of the acromion so that it cannot slip downward. A wetted roller is next applied round the arm, just above the elbow, and over the roller a strong worsted tape, fixed with what the sailors term the *close-hitch* knot. The arm should now be raised to a right angle with the body; and, if much difficulty be experienced, even above the horizontal line, in order to relax more completely the deltoid and supraspinatus muscles. Two persons are then to pull the worsted tape, and two the scapula bandage, in opposite directions, with a steady, equal, and combined force. After the extension has been kept up a few minutes, the surgeon is to place the knee in the axilla, with his foot resting upon the patient's chair; he now raises his knee, while he pushes the acromion downwards and inwards, and the head of the bone usually slips into the glenoid cavity. Sometimes, Sir Astley Cooper has seen a gentle rotatory motion of the limb, made during the extension, bring about the reduction.

In old cases, and others attended with great difficulty from the powerful contraction of the muscles, Sir Astley prefers making the extension with pulleys, because with them, when the resistance is likely to be long, jerks and unequal force are more likely to be avoided than in the preceding method of reduction; and the assistants less apt to be fatigued. The patient sits between two staples, which are screwed into the sides of the room; the bandages are then applied precisely in the same way as when the extension is made without pulleys; and the force is applied in the same direction. The surgeon is to pull the cord of the pulley gently and steadily until pain is complained of, when he is to maintain the extension already made, but not increase it. During this stop, he should converse with the patient, and direct his mind to other subjects. In two or three minutes, more force should be applied and very gently increased, until pain be again complained of, when another stop should be made. The surgeon should proceed in this way for a quarter of an hour, at intervals slightly rotating the limb. When the extension seems great enough, an assistant should hold the cord of the pulley, and keep up the degree of extension, while the surgeon puts his knee into the axilla, and resting his foot upon the chair, gently raises and pushes back the head of the bone towards the glenoid cavity, into which it generally returns without the snap usually heard when the reduction is effected by other means. Sir Astley Cooper precedes the use of the pulleys with venesection, the warm bath, and a grain of tartarised antimony every ten minutes, until faintness is produced, as already noticed in our general remarks. (*On Dislocations*, p. 942.)

When considerable extension is required, Mr. Crampton prefers the power of a lever to that of a pulley. The lever, he observes, is always at hand, as there are few places, in which a pole, or a ladder, cannot be readily procured; but, its superiority over the pulley consists in the facility with which the direction of the extending force can be varied, while the force is still maintained, and the adjustment with which the force can be withdrawn as soon as it has produced its effect." (*See Dubl. Journal of Med. Science*, vol. iii. p. 183.) Mr.

Crampton's mode of employing the ladder is entirely different from that of the ancients. It is employed merely as a lever; with one end, fixed on the ground by a person's foot; while the surgeon takes hold of the other end, its direction is obliquely upwards from the ground; the patient stands with his legs introduced between the transverse pieces of it; a bandage connects the wrist to the point of the ladder, in the proper direction of the extension; and counter-extension is made with a folded sheet, or table-cloth.

When the head of the humerus is dislocated forwards, or under the middle of the clavicle, Sir Astley Cooper recommends the biceps to be relaxed, and the extension to be made obliquely downwards and a little backwards. In most instances of this kind, he says, the plan of reduction, by means of the heel in the axilla, will also succeed, care being taken to apply the foot rather more forward than in a dislocation into the axilla, so that it may press on the head of the bone. However, when the dislocation has continued several days, he considers gradual extension with pulleys necessary. As soon as the head of the bone has been drawn below the level of the coracoid process, it is to be pressed backwards with the surgeon's heel or knee, and the elbow at the same moment pulled forwards. (*Op. cit.* p. 439.)

When the head of the bone had deserted the axilla, and slipped under the pectoral muscle, Mr. Hey found, that it could be more readily brought back into the axilla by making the extension in the direction opposite to that in which it has passed from the axilla: "This effect is often greatly promoted by making the extension with the arm elevated, as Mr. White has advised." (*See Hey's Surgery*, p. 298. ed. 2.)

The dislocation on the dorsum of the scapula appears, from some cases in Sir Astley Cooper's work, to be reducible by nearly the same mode of extension as that employed for the reduction of the dislocation in the axilla. Mr. Coley, of Bridgenorth, who met with two cases of luxation backwards, advises the reduction to be effected by elevating the arm, and rotating it outwards, so as to roll the head of the humerus towards the axilla, when it is to be kept in this position while the arm is brought down into a horizontal direction: on the extending force being now applied, the bone is easily reduced. (*Op. cit.* p. 444.) In one case in the Middlesex Hospital, "The patient was seated on the ground, with the sound side close to a wall, in which was a staple on a level with the shoulder, to which the apparatus for fixing the trunk and scapula was attached. Extension was made by two men by means of a cloth attached to the humerus, the direction of which was forwards, outwards, and a little upwards, the surgeon standing behind the patient, and retaining the scapula from yielding forwards. After hanging on for some time, and then by a more forcible extension, the head of the bone slipped into its socket with a snap. An effort at the reduction by one man on the towel had previously failed." (*See Lond. Med. Gaz.* 1832, 1833. p. 479.) The case in the North London Hospital was reduced by Mr. Morton with the utmost facility.

In the partial dislocation forwards, or that where the head of the bone lies at the scapular side of the coracoid process, the mode of reduction is the same as that employed in the complete dislocation

forwards; but it is necessary to draw the shoulders backwards; and as soon as the reduction is accomplished, the bone is to be kept from slipping forwards again by maintaining the shoulders in that position with a bandage. (*Sir Astley Cooper, Op. cit.* p. 449.) The elbow and fore-arm should also be supported, as much forward as possible, in a sling.

In Dublin, the extending power is applied to the wrist, as in France and Germany. (*Ph. Crampton, Dubl. Journ.* vol. iii. p. 182.) This gentleman also expresses a doubt about the possibility or advantage of fixing the scapula.

In Sir Astley Cooper's valuable work is recorded a case of compound dislocation of the shoulder, which was under the care of Messrs. Saumarez and Dixon, of Newington, and was cured by ankylosis. (P. 450.) Such an accident must be treated on the same principles as other severe compound dislocations.

For the purpose of preventing the head of the bone from slipping out of its place again, the arm should be kept for some days quiet, the elbow bandaged close to the side, and supported in a sling. Sir Astley Cooper recommends a cushion to be put into the axilla and a stellate bandage and sling to be applied. (*On Dislocations*, p. 432.) After the reduction of a dislocation, which has happened downward, the facility of a fresh displacement is said to depend very much upon the extent, to which the tendon of the subscapularis muscle has been lacerated. (*Sir A. Cooper's Surgical Essays*, part i. p. 7.)

Pott and Sir Astley Cooper are of opinion, that the narrowness of the opening in the capsular ligament can never create any impediment to the reduction. But Desault and Hey (*Pract. Obs.* p. 301. ed. 2.), entertained the opposite opinion, and hence the former was an advocate for moving the head of the bone about very freely, with the view of lacerating the capsule more extensively. Messrs. Logan and Hey, of Leeds, sometimes succeeded with slight extension, and gentle motion of the bone in various directions. This practice answered in several cases, where the head of the humerus had passed far under the pectoral muscle. (See *Hey's Surgery*, p. 311. ed. 2.)

Mr. C. White, of Manchester, also believed, that the reduction was sometimes prevented by the head of the bone not being able to get through the laceration in the capsule again. He succeeded in reducing some cases, which he supposed to be of this nature, in the following manner:—Having screwed an iron ring into a beam at the top of the patient's room, he fixed one end of the pulleys to it, and fastened the other to the dislocated arm by ligatures attached to the wrist, placing the arm in an erect position. In this way, he drew up the patient, till his whole body was suspended; but, that too much force might not be sustained by the wrist, Mr. White at the same time directed two other persons to support the arm above the elbow. He now used to try with his hands to conduct the arm into its place, if the reduction had not already happened, as was sometimes the case. Occasionally a snap might be heard, as soon as the patient was drawn up; but the reduction could not be completed, till he was let down again, and a trial made with the heel in the armpit. When no iron ring was at hand, Mr. White used to have the patient raised from the ground by three or four

men, who stood upon a table. (*Cases in Surgery*, p. 95.)

There can be little doubt, that the success of Mr. C. White's plan was not owing to its action on the opening in the capsule, but depended upon another principle, first explained by Sir Astley Cooper, and mentioned in the foregoing column in italics, that it may receive due attention. Mr. Crampton takes a similar view:—"If it be true (says he) that, in some cases, the supraspinatus muscle, retaining its connection with the greater tubercle, is the cause of the resistance to the extending power. (*Sir A. Cooper on Dislocations*, p. 377.) it is obvious, that this resistance can be best overcome by raising the arm, and thus relaxing the opposing muscle. The process, which not unfrequently attends the method of reduction, first recommended by Mr. White, of Manchester, by drawing the arm directly upwards, in a line parallel to the axis of the trunk, is no doubt to be attributed to the relaxation which it effects of the supraspinatus and deltoid muscle. It is probable, also, that, in this position of the humerus, the head of the bone is in some measure unlocked from the neck of the scapula, against which it is, when dislocated downwards, strongly compressed by the contraction of the muscles." (*Crampton in Dublin Journ. of Med. Science*, vol. iii. p. 181.) Mr. Hey, also, sometimes adopted White's method for old dislocations, especially those under the pectoral muscle. The usefulness of raising the arm to lessen the pressure of the edge of the glenoid cavity against the neck of the humerus is likewise particularly pointed out by him. (*Pract. Obs. on Surgery*, p. 299., ed. 2.) According to Mr. Crampton, the practice was at one time common in Stevens's Hospital, as the large ring in the cross beam of the anti-room testifies. In relation to the merit of the first introduction of this plan, Mr. Crampton justly assigns it to Mr. Charles White:—"The British surgeon (he observes) will be a little surprised to find this method introduced as a new and important mode of reduction in the Hôtel-Dieu. M. Malgaigne, the gentleman, who introduced the practice to the notice of Dupuytren, stated, that the anatomy and pathology of this kind of dislocation had led him to adopt the method, before he was acquainted with the method of Mothe (White?). The method of Mothe, as stated by M. Malgaigne, consists in making extension, the arm being lifted up forcibly, and consequently shortened, instead of extending the limb in a depressed, or elongated position." (*Crampton, in Dublin Journ. of Med. Science*, vol. iii. p. 182.) M. Mothe's memoir was presented to the Academy of Surgery in 1785. Mr. White's paper was printed in 1764. It is but justice to M. Malgaigne to mention, that, Mr. Crampton has here supposed, that Mr. White's first suggestion of the practice, has not been admitted by M. Malgaigne. On the contrary, he states, that the anatomy and pathology of the shoulder-joint led him to adopt the practice, before he had become acquainted with White's observations, who had formerly resorted to it, though only in old dislocations. (See *Gaz. Méd. de Paris*, Sept. 1832.) He only proposed it also as "*une Méthode inusitée en France*." (See *Dupuytren Clin. Chir.* t. iii., p. 86.) I am glad to have had this opportunity of doing justice to M. Malgaigne, whose observations on many parts of surgery reflect the highest honour upon him: and even on this

subject, he comes off with reputation; for, though it was Mr. Charles White, that first adopted the practice, it was Sir Astley Cooper, and M. Malgaigne, who first gave a scientific description of the principles, on which its efficiency depends.

An important fact, noticed by M. Malgaigne, and exemplified at the Hôtel-Dieu, is, that after an old dislocation of the shoulder has been reduced, the arm may still remain longer than the other, and the head of the humerus rather more below the acromion. (See *Dupuytren, Clin. Chir.* t. iii. p. 90.) The circumstance is ascribed to the diminution of the depth and capacity of the glenoid cavity, and other pathological changes. But, whether such lengthening of the limb is observable after the reduction of every dislocation of the shoulder of some standing, M. Malgaigne admits to be a question, that has not yet been settled.

When the resistance of the muscles is very great, the means to be adopted are such as weaken the patient; bleeding, the warm bath, nauseating doses of tartarised antimony, opium, &c. Should the patient happen to be intoxicated at the time of his being first seen by the surgeon, the opportunity would be very favourable to reduction, as the muscles would then be capable of less resistance. Extension unremittingly, but not violently, continued for a length of time, will ultimately fatigue the resisting muscles, and overcome them with more safety and efficacy, than could be accomplished by any sudden exertion of force.

The swelling about the joint, brought on by the accident, usually disappears without trouble.

Another consequence, which seldom occurs, but which Desault saw twice, is a considerable emphysema, suddenly originating while powerful extension is made for the reduction of a dislocation of long standing. A tumour suddenly makes its appearance under the great pectoral muscle, and rapidly spreads towards the armpit, the whole of which it soon occupies. It reaches backward; and, in a few minutes, becomes as large as a child's head. A practitioner, unacquainted with this accident, might take it for an aneurism from a rupture of the axillary artery; but the elasticity of the tumour, its fluctuation, the situation where it first appears under the great pectoral muscle, and not in the axilla; the continuance of the pulse; and the unchanged colour of the skin, plainly denote that it is not a rupture of the artery. (*Œuvres Chir. de Desault*, t. i.) For dispersing the swelling, the lotio plumbi acetatis, and gentle compression with a bandage, are recommended.

PATHOLOGY OF DISLOCATIONS OF THE HUMERUS FROM THE GLENOID CAVITY OF THE SCAPULA.

I believe that the observation of Mr. Crampton is correct; that at the period, when Mr. Hey published the second edition of his *Practical Observations on Surgery*, in 1810, there was but one case on record, in which the actual state of the joint, in a recent dislocation of the shoulder, had been described and delineated. (Case by H. Thompson, in *Med. Obs. and Inq.* vol. ii. 1761.) Indeed, in this example, eighteen days had elapsed between the reception of the injury and the post mortem examination of the joint. In 1762, Professor Boerhaave gave the anatomy of several cases of unaltered dislocation of the humerus, but the

most recent was of two years' standing. (*Comm. de Humero Luxato; Ph. Crampton, in Dublin Journ. of Med. Science*, vol. iii. p. 43.) Hey once saw a compound dislocation of the os humeri, the head of the bone being pushed through the integuments in the axilla; and, in that case, the long tendon of the biceps was torn from its groove; and the tendons of the supraspinatus and infraspinatus separated from the bone, a large shell of which was also torn off. (See *Hey's Surgery*, p. 811. ed. 2.) Mr. H. Thompson's dissection is remarkable, as being the oldest on record, and the identical parts are now preserved in University College museum. The tendon of the long head of the biceps was found violently stretched. The head of the bone was lodged at the inner side of the neck of the scapula, below the root of the coracoid process, between the subscapularis and serratus magnus. A portion of the humerus, including the greater tubercle, was broken off; and, of course, the supraspinatus, infraspinatus, and teres minor, detached. The subscapularis was also torn from its attachment to the lesser tubercle; but both this muscle and the teres minor retained a connection with the periosteum and bone through their external fibres. The neck of the humerus was embraced behind by the subscapularis, and in front by the teres minor. Thompson suspected, that, in some cases, this might make a difficulty in the reduction; and hence, he was an advocate for raising the arm and turning it inwards, so as to relax the subscapularis. He also suspected, that the tendency to a return of the dislocation, sometimes exemplified, might depend on the extensive laceration of the capsular ligament, and the teres minor and subscapularis muscles. (See *Med. Obs. and Inq.* vol. ii.) Sir Astley Cooper dissected two cases of recent dislocation downwards. In one, on removing the integuments, a quantity of extravasated blood presented itself in the subcutaneous cellular tissue and that covering the axillary plexus of nerves, as well as between the muscles. The axillary artery and plexus of nerves were thrown out of their course by the dislocated head of the bone, which was pushed backwards upon the subscapularis muscle. The deltoid was drawn down by the head of the bone. The supraspinatus and infraspinatus were stretched over the glenoid cavity and inferior costa of the scapula. The teres major and minor had undergone but little change of position. The coraco-brachialis was uninjured. In the space between the axillary plexus and coraco-brachialis, the head of the bone appeared. The capsular ligament was torn along the whole of the inner side of the glenoid cavity, and the opening would have admitted a much larger body than the head of the humerus. The tendon of the subscapularis, covering the capsule, was also extensively torn. The opening of the ligament, through which the tendon of the long head of the biceps passed, was somewhat lacerated, but the tendon itself was not ruptured. The head of the os humeri was thrown on the inferior costa of the scapula, between it and the ribs; and the axis of its new situation was about an inch and a half below that of the glenoid cavity. The subject of the second examination was a woman, fifty years of age, who had had the dislocation in the axilla five weeks, and seemed to have died of violence used in the extension. The pectoralis major was slightly lacerated,

and blood effused; the supraspinatus was lacerated in several places; and the infraspinatus and teres minor torn, but less extensively. Some of the fibres, of the deltoid, and a few of those of the coraco-brachialis had also suffered; but none of the muscles were so much injured as the supraspinatus. The capsular ligament had given way in the axilla between the teres minor and subscapularis muscles; the tendon of the subscapularis was torn through at its insertion into the lesser tubercle; and the head of the bone rested upon the axillary plexus of nerves and the artery. Sir Astley Cooper next endeavoured to reduce the bone; but finding the resistance too great, he became anxious to ascertain its origin, and divided one muscle after another, cutting through the coraco-brachialis, teres major and minor, and infraspinatus; still the opposition was but little changed. He then conceived, that the deltoid muscle was the cause of failure, and relaxed it by elevating the arm. He next divided the deltoid, and then found the supraspinatus his great opponent, until he drew the arm directly upwards, when the head of the bone glided into the glenoid cavity. His inference is, therefore, that the deltoid and supraspinatus are the muscles, which most powerfully resist the reduction. He considers, also, that the best direction for the extension is that of a right angle with the body, or quite horizontally. "This dissection (says he) explains the reason, why the arm is sometimes easily reduced by raising it suddenly above the horizontal line, and placing the fingers under the head of the bone;" namely, because the muscles of opposition are relaxed. (See Sir Astley Cooper on Dislocations, p. 386—389. ed. 4.)

To these interesting cases, which illustrate many important points relative to the dislocation downward, Mr. Crampton has lately added two others; one of a recent dislocation downward; the other of a recent dislocation forwards under the pectoral muscle, on the sternal side of the coracoid process. In the first which occurred in 1808, a labouring man was brought into the county of Dublin Infirmary in a dying state from injuries received by the fall of a wall upon him. After death, which happened in about a couple of hours, the right shoulder-joint, which was dislocated, was carefully dissected, and a drawing made of it. On removing the integuments of the axilla, the cellular membrane, which was extensively encysted, formed a kind of cap, closely embracing the head of the os humeri, which was lodged on the inferior costa of the scapula, or rather on its neck. The head of the bone, in escaping from its socket, had pushed the teres minor downwards, and burst through the lower part of the subscapularis muscle, some of the fibres of which closely embraced the neck of the bone, while the bulk of the muscle was pushed upwards, and detached from the inner surface of the scapula. The short head of the biceps and the coraco-brachialis were forced to describe a curve outwards over the neck of the humerus on the sternal side, while the long head of the triceps crossed the neck of the bone obliquely on the dorsal side. The tendon of the long head of the biceps remained in its groove; but the sheath, in which it runs, was partially ripped up. The capsular ligament was completely torn from the lower part of the neck of the humerus to the extent of more than half its circumference.

The great nerves and blood vessels were forced to describe a curve backwards by the pressures of the head of the bone, which was in contact with them. The tendons of the supraspinatus, infraspinatus, and teres minor, were completely torn off from the humerus, carrying with them the surface of the greater tubercle. Mr. Crampton endeavoured to find out what would have caused, in this case, the chief opposition to the reduction, which of course could not be the muscles attached to the greater tubercle, which was broken off; and he found, that keeping the hand in the supine position created a difficulty by causing the biceps and triceps to get behind the head of the bone. How this position of the radius, however, could in any way affect the triceps, which is inserted into the olecranon, seems to me rather difficult to comprehend. (See Dublin Journ. of Med. Science, vol. iii. p. 44.)

With respect to the state of the parts, in the dislocation forwards, the head of the bone is thrown on the inner side of the neck of the scapula, between it and the second and third ribs. In an old case dissected by Mr. Key, and preserved in the museum at St. Thomas's Hospital, the head of the bone was thrown on the neck and part of the venter of the scapula, near the edge of the glenoid cavity, and immediately under the notch of the superior costa. Nothing intervened between the head of the humerus and scapula, the subscapularis being partly raised from its attachment to the venter. The head was situated on the inner side of the coracoid process, and immediately under the edge of the clavicle, without the slightest connection with the ribs. Indeed, this must have been prevented by the situation of the subscapularis and serratus magnus between the thorax and humerus. The tendons of all the muscles, attached to the tubercles, and the tendon of the biceps, were perfect. The glenoid cavity was completely filled up by ligamentous structure, to which the tendons of the muscles, attached to the greater tubercle, adhered by means of bands, while in the substance of those tendons a sesamoid bone had been formed to prevent the effects of friction in the motions of the arm. The newly formed socket reached from the edge of the glenoid cavity to about one third across the venter; and its surface was irregularly covered with cartilage. The form of the head of the bone was considerably altered, and the cartilage in many places absorbed. There was a complete new capsular ligament. The pectoralis minor must have passed over the neck of the bone. (See Ch. Aston Key, in Sir A. Cooper on Dislocations, p. 400. ed. 4.)

The only recorded dissection, perhaps, of the dislocation forwards in the recent state, is that published by Mr. Crampton. It is remarkable, also, as being an instance of primary dislocation forwards, the head of the bone having been thrown at once on the neck of the scapula, without previously passing into the axilla. The dislocation was unattended with the rupture of any muscle, or the separation of any tendon from its insertion into the bone. The head of the humerus was lodged on the cervix of the scapula at the root of the coracoid process, but extending nearly as far as the notch in the superior costa. It had passed out through a rent in the capsular ligament, over the upper edge of the tendon of the subscapularis, detaching this muscle from its connection with the venter of the scapula, and

pushing its fibres downwards, so that they formed a curve, which partly embraced the neck of the humerus. The supraspinatus and infraspinatus, were on the stretch, but not lacerated. The opening in the capsular ligament was produced by a separation of it from the interior side of the brim of the glenoid cavity from top to bottom, and bounded on the top by the tendon of the supraspinatus, and at the bottom, by the inferior edge of the tendon of the subscapularis. It was of sufficient extent, but no more, to permit the head of the bone to return easily through it. The interior part of the capsular ligament, corresponding to the axilla, was perfect. The great blood-vessels and nerves lay on the sternal side of the head of the humerus, the axis of which was scarcely a quarter of an inch higher, than that of the glenoid cavity. (See *Ph. Crampton, in Dublin Journ. of Med. Science*, vol. iii. p. 47.) The foregoing case settles the long-disputed question, whether the dislocation forwards is ever primitive?

When a dislocation remains long unreduced, the head of the bone towards the scapula becomes flattened, and it becomes furnished with a complete capsule. The glenoid cavity is filled up by a ligamentous substance, in which are found small portions of bone. A new articular cavity is formed on the inferior costa of the scapula. (See *Sir A. Cooper on Dislocations*, p. 389. ed. 4.)

I shall conclude the subject of luxations of the shoulder with the following singular observation, recorded by Baron Larrey:—

“Among the curious anatomical preparations, (says he) which I saw in the cabinet of the university of Vienna, there was a dissected thorax, shewn to me by Professor Prokaska, in which the whole orbicular mass of the head of the right humerus, engaged between the second and third true ribs, projected into the cavity of the chest. This singular displacement was the result of an accidental luxation, occasioned by a fall on the elbow, while the arm was extended and lifted from the side. The head of the humerus, after tearing the capsular ligament, had been violently driven into the hollow of the axilla, under the pectoral muscles, so as to separate the two corresponding ribs, and pass between them. The diameter of the head of the bone surmounted this obstacle, and penetrated entirely into the cavity of the thorax, pushing before it the adjacent portion of the pleura. Every possible effort was made in vain to reduce this extraordinary dislocation. The urgent symptoms, which arose, were dissipated by bleeding, warm bathing, and antiphlogistic remedies. The arm, however, remained at a distance from the side, to which condition the patient became gradually habituated; and, after several years of suffering and oppression, he at length experienced no inconvenience. The patient was about sixteen or seventeen, when he met with the accident; and he lived to the age of thirty-one, when he died of some disease, which had no concern with the dislocation. His physicians were anxious to ascertain the nature of this curious case, of which they had been able to form only an imperfect judgment. They were much surprised to find, upon opening the body, the head of the humerus lodged in the chest, surrounded by the pleura, and its neck closely embraced by the two ribs above specified. They were still more surprised to find, instead of a

hard spherical body covered with cartilage, only a very soft membranous ball, which yielded to the slightest pressure of the finger. The cartilagenous and osseous texture of the whole portion of the humerus, contained within the cavity of the chest, had entirely disappeared. Of the humerus, there remained only some membranous rudiments of its head, and a great part of these seemed to belong to the pleura costalis.” (*Mém. de Chir. Milit.* t. ii. p. 405—407.)

DISLOCATIONS OF THE ELBOW.

Notwithstanding the extent of the articular surfaces of the humerus and ulna, the strength of the muscles and ligaments surrounding the joint, and the mutual reception of the bony eminences, rendering the articulation a perfect angular ginglymus, a dislocation of both the radius and ulna from the humerus, sometimes happens. The ulna is most frequently luxated backward; sometimes laterally, and very rarely forward; which last displacement cannot occur without a fracture of the olecranon. Indeed, it is so uncommon, that neither Petit nor Desault ever met with it. The luxation backwards is facilitated by the small size of the coronoid process, which, when the humerus is forcibly pushed downwards and forwards, may slip behind it, and ascend as high as the cavity, which receives the olecranon in the extended state of the fore-arm.

Sir Astley Cooper's experience has made him acquainted with five different luxations of the elbow:—1. That of the radius and ulna backwards. 2. That of both these bones laterally. 3. That of the ulna alone. 4. That of the radius alone forwards. 5. That of the radius backwards. (*On Dislocations*, p. 467.)

In the luxation backwards, both the radius and ulna may ascend more or less behind the humerus; but the coronoid process of the ulna if not fractured, is carried above the articular pulley, and is lodged in the cavity destined to receive the olecranon. The head of the radius is placed behind and above the external condyle of the humerus. The annular ligament, which confines the superior extremity of the radius to the ulna, may be lacerated: in which case, even when the bones are reduced, it is difficult to keep them in their proper places, as the radius tends constantly to quit the ulna.

This accident takes place from a fall on the hand; for, when we are falling, we are led by a mechanical instinct to bring our hands forwards to protect the body. If, in this case, the superior extremity, instead of resting vertically on the ground be placed obliquely with the hand nearly in a state of supination, the repulsion which it receives from the ground will cause the two bones of the fore-arm to ascend behind the humerus, whilst the weight of the body pressing on the humerus, directed obliquely downwards, forces its extremity to pass down before the coronoid process of the ulna.

The fore-arm is in a state of half flexion, and every attempt to extend it produces acute pain. The situation of the olecranon, with respect to the condyles of the humerus is changed. The olecranon, which, in the natural state, is placed on a level with the external condyle, which is itself situated lower than the internal, is even higher than the latter. Posteriorly a considerable

projection is formed by the ulna and radius, and on each side of the olecranon a hollow appears. A considerable hard swelling is felt on the fore part of the joint, arising from the projection of the lower end of the humerus. The hand and fore-arm are supine, and the power of bending the joint is in a great measure lost. (*Sir Astley Cooper on Dislocations*, p. 468.)

The swelling which supervenes in twenty-four hours after the accident, may obscure the diagnosis; but, notwithstanding the assertion of Boyer, I believe the olecranon and internal condyle are never so concealed, that the distance between them cannot be felt to be increased. It is true, that the friction of the coronoid process against the humerus may cause a grating noise, similar to that of a fracture; and some attention is requisite to establish the diagnosis between a fracture of the head of the radius, and a dislocation of the fore-arm backwards. "This dislocation (says Sir Astley Cooper), is at first sometimes undiscovered, in consequence of the great tumefaction, which immediately succeeds the injury; but this circumstance does not prevent the reduction, even at the period of several weeks after the accident; for, I have known it thus reduced by bending the limb over the knee, even without great violence being employed." (*On Dislocations*, &c. p. 470.)

A luxation backward must be attended with serious injury of the surrounding soft parts. The lateral ligaments are constantly ruptured, and sometimes the annular ligament of the radius. In a case, dissected by Sir Astley Cooper, the annular ligament was entire. The biceps muscle was only slightly put upon the stretch; but the brachialis was excessively so. Probably the lower insertions of the biceps and brachialis internus would likewise be more frequently lacerated, by the violent protrusion of the head of the humerus forwards, were it not that their attachments are at some distance from the joint. This mischief, however, occasionally takes place. The lower end of the humerus, indeed, has been known not only to lacerate these muscles, but to burst the integuments, and present itself externally; an instance of which is recorded by Petit, and two such cases I saw during my apprenticeship at St. Bartholomew's. Boyer justly remarks, that it is difficult to conceive how, under these circumstances, the brachial artery and median nerve can escape. In fact, this vessel has sometimes been ruptured, and mortification of the limb been the consequence; but this injury of the artery, and the laceration of the muscles and skin, are rare occurrences. (*Mal. Chir.* t. iv. p. 215.) Nor, if the artery were wounded, would gangrene be invariably the result; for, if my memory is correct, an instance, in which the limb was saved, notwithstanding such a complication, used to be mentioned by Mr. Abernethy in his lectures, and I shall presently quote a similar fact from Cruveilhier.

The following method of reducing the case is advised by Boyer:—The patient being seated, an assistant is to take hold of the middle of the humerus, and make counter-extension, while another assistant makes extension at the wrist. The surgeon seated on the outside, grasps the elbow with his two hands, by applying the forefingers of each to the anterior part of the humerus, and the thumbs to the posterior, with which he presses on the olecranon, in a direction downwards and

forwards.—This method will generally be successful. If the strength of the patient, or the long continuance of the luxation, render it necessary to employ a greater force, extension is to be made with a towel applied on the wrist, and a cushion is to be placed in the axilla, and the arm and trunk fixed, as is done in cases of luxation of the humerus.

In Sir Astley Cooper's method, the patient sits in a chair. The surgeon places his knee on the inner side of the elbow, in the bend of the joint, and, taking hold of the patient's wrist, bends the arm. At the same time, he presses on the radius and ulna with his knee, so as to separate them from the os humeri. Thus the coronoid process is pushed out of the posterior fossa of the humerus; and whilst the pressure is kept up with the knee, the arm is to be forcibly, but slowly, bent, and the reduction is soon effected. According to the same authority, the bones may also be reduced by bending the arm over a bedpost, or by bending it, whilst it is engaged in the opening of the back of the elbow-chair in which the patient sits. (*On Dislocations*, p. 469.)

A bandage may afterwards be applied, in the form of a figure of 8, evaporating lotions used, and the arm kept in a sling. The swelling, which follows, is to be combated by antiphlogistic means.

At the end of seven or eight days, when the inflammation has subsided, the articulation is to be gently moved, and the motion is to be increased every day, in order to prevent an anchylosis, to which there is a great tendency.

In this luxation, the annular ligament, which confines the head of the radius to the extremity of the ulna, is sometimes torn, and the radius passes in front of the ulna. In such cases, pronation and supination are difficult and painful; though the principal luxation has been reduced. The radius may be easily replaced by pressing it from before backwards, and it is to be kept in its place by a compress, applied to the superior and external part of the fore-arm. The bandage and compress are to be taken off every two or three days, and the joint gently bent and extended, in order to prevent anchylosis.

In a modern publication, an instance of a dislocation of the heads of the radius and ulna backward is related, where the lower end of the humerus protruded through the integuments, and, as it could not be reduced, it was sawn off. The patient, a boy, recovered the full use of his arm. (*Evans, Pract. Obs. on Cataract, Compound Dislocations*, &c. p. 101, 1815.)

A luxation forwards should be treated as a fracture of the olecranon, with which it would be inevitably accompanied. Here, on account of the great injury done to the soft parts, it would also be right to bleed the patient copiously, and put him on the antiphlogistic regimen.

With respect to lateral luxations, either inwards or outwards, they are always incomplete, and easily discovered. In the case outwards, the coronoid process is situated on the back part of the external condyle. The projection of the ulna backwards is even greater, than in the dislocation of both bones directly backwards, and the radius forms a protuberance behind, and on the outer side of the os humeri. By moving the hand, the rotation of the head of the radius can be distinctly felt. In the lateral dislocation inwards, the ulna may be thrown

upon the internal condyle, so as to produce an apparent hollow above it, and the rotation of the head of the radius can be distinctly felt. Sometimes, when the ulna is thrown upon the internal condyle, it still projects backwards, as in the external lateral dislocation, in which circumstance, the head of the radius is in the posterior fossa of the humerus, and the outer condyle forms a considerable projection. (*Sir A. Cooper, Op. cit. p. 471.*) Boyer advises the reduction of lateral dislocations to be effected, by extending the humerus and forearm, and at the same time pushing the extremity of the humerus, and the heads of the ulna and radius, in opposite directions.

According to Sir Astley Cooper, in each of the lateral dislocations, the reduction may be performed, by bending the arm over the knee; but in a recent case, as one which he relates proves, he considers, that the business may be most readily accomplished by forcibly extending the arm; for when this is done, the biceps and brachialis draw the heads of the radius and ulna into their right places again. (*P. 472.*)

These luxations cannot be produced without considerable violence; but when the bones are reduced, they are easily kept in their place. It will be sufficient to pass a roller round the part, to put the fore-arm in a middle state, neither much bent nor extended, and to support it in a sling. But much inflammation is to be expected from the injury done to the soft parts. In order to prevent, or at least to mitigate it, the patient is to be bled and put on a low diet, leeches applied, and the articulation covered with the *lotio plumbi acet.* or an emollient poultice. It is scarcely necessary to repeat, that the arm is to be moved as soon as the state of the soft parts will admit of it. (*Boyer, Mal. des Os, t. ii.*)

A dislocation of the fore-arm backward is said to occur ten times as frequently as lateral luxations; and those forward are so rare, that no comparison whatever can be made. (*Œuvres Chir. de Desault, t. i.*)

All recent dislocations of the elbow are easily reduced, and as easily maintained so; for a displacement is prevented by the reciprocal manner in which the articular surfaces receive each other, and by their mutual eminences and cavities. This consideration, however, should not lead us to omit the application of a bandage in the form of a figure of 8, and supporting the arm in a sling.

Cruveilhier has published an engraving of the changes, which followed an unreduced dislocation of the elbow. The case is a dislocation of the bones of the fore-arm from the humerus backward. The head of the radius and the olecranon project behind the lower end of the humerus, which bone is maintained in the bent position by deposits of osseous matter, which extend in a pointed form to a considerable height. Extension and flexion of the elbow are both equally impossible; motion is restricted to a slight yielding, allowed by some disproportion between the lower end of the humerus and the capacity of the osseous

tion arises from the
as solidly together,
the humerus to which

it moulds itself, and ascending so high and a half above the end of the humerus. There are several perforations, or deficiencies in it, through which the humerus is perceptible. The coronoid process

of the ulna, which is blunted, is lodged in the fossa behind the humerus. "The case proves," says M. Cruveilhier, that, in the dislocation of the forearm from the humerus backward, the displacement backward is limited by the coronoid process meeting with the olecranal fossa of the humerus; that there must be a more or less considerable laceration of the brachialis muscle; and that the tendon of the biceps must generally remain entire, and make a tense chord, constituting a limit to the displacement forwards. If the violence occasioning a dislocation backwards, should be carried farther, not only may there be laceration of the brachialis, but also of the tendon of the biceps, the brachial artery, the veins, the median nerve, and even the skin, attended with protrusion of the bone. I have seen a case of this kind, in a lady who was thrown from her horse, and fell on the palm of her hand. When I arrived, a profuse hemorrhage from the artery had just ceased, in consequence of syncope. The dislocation having been reduced, I kept myself ready to secure the artery, but the bleeding did not return." The case terminated favourably. (*See Cruveilhier, Anat. Pathol. livr. ix. ch. iv. p. 8.*)

DISLOCATION OF THE RADIUS FROM THE ULNA.

The majority of writers on dislocations of the forearm have not separately considered those of the radius. The subject was first well treated of by Duverney. However, dislocations of its lower end remained unnoticed, until Desault favoured the profession with a particular account of them.

The radius, the moveable agent of pronation and supination, rolls round the ulna, which forms its support, by means of two articular surfaces; one above, slightly convex, broad internally, narrow outwardly, and corresponding to the little sigmoid cavity of the ulna, in which it is lodged; the other below, concave, semicircular, and adapted to receive the convex edge of the ulna. Hence, there are two joints, differing in their motions, articular surfaces, and ligaments.

Above, the radius in pronation and supination only moves on its own axis; below, it rolls round the axis of the ulna. Here, being more distant from the centre, its motions must be both more extensive and powerful, than they are above. The head of the radius, turning on its own axis in the annular or coronary ligament, cannot distend it in any direction. On the contrary, below, the radius, in performing pronation, stretches the posterior part of the capsule, and presses it against the immovable head of the ulna, which is apt to be pushed through, if the motion be forced. A similar event, in a contrary direction, takes place in supination. The front part of the capsule being rendered tense, may now be lacerated.

Add to this disposition, the difference of strength between the ligaments of the two joints. Delicate and yielding below, thick and firm above, their difference is very great. The upper head of the radius, supported on the smaller immovable articular surface of the ulna, is protected from dislocation in most of its motions

lower end, carrying along
the bones of the carpus, which
itself derive any solid stability from them.

Some instances of dislocation of the upper head of the radius suddenly produced by external causes, are recorded by Duverney; and the parti-

DISLOCATION.

culturs of another were transmitted to the French Academy of Surgery.

Examples have also occurred in the practice of Mr. Dunn, of Scarborough; Mr. Lawrence; and Mr. Earle. Sir Astley Cooper has seen six examples of the dislocation of the head of the radius forwards. Boyer says, that many instances are now known, in which the upper head of the radius was dislocated backwards; indeed, in opposition to what Desault has stated, he correctly asserts that dislocations of the lower joint between the radius and ulna are more rare, than those of the upper joint. The latter accident he had twice seen. (*Mal. Chir.* t. iv. p. 248.) Two other examples have been recently published by Mr. Collier, of Brackley. (See *Lond. Med. Gaz.* vol. xviii. p. 918.) In December 1830, I attended a boy about fifteen years of age, who fell down in attempting to leap over a post with his hands placed upon it, and forced the head of the radius upon the outside of the external condyle of the humerus.

Into the North London Hospital, a lad was admitted in 1836, the upper head of whose radius had been thrown considerably above the external condyle for some years; and the motions of whose elbow were but little impaired by the accident. I have also seen two or three instances in children of dislocations of the upper head of the radius from weakness, or relaxation of the annular ligament.

The displacement backwards is described as occurring more frequently in children, than adults. The reason of this circumstance is ascribed to the lesser firmness both of the ligaments and of the tendinous fibres of the extensor muscles, which fibres, in a more advanced age, contribute greatly to strengthen the external lateral ligament. In a child, also, the little sigmoid cavity of the ulna is smaller, and the annular ligament, extending round the head of the radius, is longer, and more apt to give way. Hence in a subject of this description, efforts, which may not at first produce a dislocation, if frequently repeated, cause a gradual elongation of the ligaments, a change in the natural position of the bones, and, at length, a degree of displacement as great as in a case of luxation, suddenly and immediately effected. (*Mal. Chir.* t. iv. p. 239.)

Another fact, mentioned by Boyer, is, that the dislocation of the upper head of the radius backwards is always complete, its articular surfaces being perfectly separated both from the lower end of the humerus, and from the little sigmoid cavity of the ulna. The usual cause of the accident is a pronation of the fore-arm, carried with great violence beyond the natural limits.

In a dislocation of the head of the radius backwards, the fore-arm is bent, and the hand fixed in the state of pronation. Supination can neither be performed by the action of the muscles, nor by external force; and every attempt to execute this movement produces a considerable increase of pain. The hand and fingers are moderately bent, and the upper head of the radius may be observed forming a considerable projection behind the external condyle of the humerus. In the case, which was mentioned to me by Mr. Lawrence, and in that which I attended in December 1830, the head of the radius lay upon the outside of the external condyle.

Sir Astley Cooper has never seen a dislocation

of the upper head of the radius backwards in the living subject; but a man was brought for dissection into the theatre of St. Thomas's Hospital, who had such a dislocation, which had never been reduced. The head of the radius was thrown behind the external condyle, and rather to the outer side of the lower extremity of the humerus. The fore part of the coronary ligament was torn through, as well as the oblique one, and the capsular was partially lacerated.

The reduction is to be accomplished, by extending the fore-arm and endeavouring to bring it into the supine posture, at the same time, that the surgeon tries to press with his thumb the head of the radius forwards, towards the lesser tubercle of the humerus, and into the little sigmoid cavity of the ulna again. Success is indicated by the patient being now able to perform the supine motion of the hand, and to bend and extend the elbow with freedom.

For the purpose of preventing a return of the displacement, and giving nature an opportunity of repairing the torn ligaments, measures must be taken to hinder the pronation of the hand. Boyer recommends, with this view, a roller, compresses, and a sling; but, it appears to me, that a splint, extending nearly to the extremity of the fingers, and laid along the inside of the fore-arm, with a pad of sufficient thickness to keep the hand duly supine, would be right, in addition to the sling, roller, &c.

As facts of pathological anatomy relating to this dislocation, Cruveilhier informs us, that he is acquainted with only the two cases, of which Sandifort has given engravings. (*Museum Anat.* ch. 103.) In both instances the head of the radius is luxated backward, and the radius and ulna cross at their upper part, as in extreme pronation, and are there ankylosed to one another. In one of these examples the head of the radius is diminished; the lesser articular surface of the humerus has disappeared, and been confounded with the trochlea, so as to correspond to the enlargement of the greater cavity of the ulna. The connection of the radius to the sigmoid cavity of the ulna extends a good way along the inner side of the coronoid process and front surface of the ulna. Directly below this connection, the radius is increased in size, and is much deformed. In consequence also of the lower end of the ulna having lost its relations to the corresponding cavity of the radius, it no longer exists. In the second example, the radius and ulna, where they cross, are soldered together; and the lower end of the ulna is considerably deformed, and its head converted into a mere tubercle; while the head of the radius, which is displaced outwards and backwards, is divided into two parts; one, still corresponding to the lesser articular surface of the humerus; the other not touching that surface except in extreme flexion of the joint.

Cruveilhier refers to a case reported in the *Journ. Hebdom. de Méd.* as a congenital dislocation of the upper head of the radius in each arm, and also allusion is made by M. Paillard to another instance of the same kind, which was met with many years ago by Dupuytren. Cruveilhier does not concur in regarding these cases as congenital; and adverts to the frequency of incomplete displacements of the head of the upper radius backwards in young children, owing to the imperfect

development of the lesser sigmoid of the ulna, the consequent looseness of the annular ligament, and the frequently forcible pronation of their hand, when held by it to keep such young subjects from falling. In Cruveilhier's *Livraison ix.* pl. 3. are given representations of an old unreduced dislocation of the head of the radius, which lies behind and to the outer side of the lower end of the humerus, and is lodged in a little cup of a fibrous structure, formed, as Cruveilhier suspects, at the expense of the anconeus, and its aponeurosis, or else of the remains of the external lateral and annular ligaments. The head of the radius has undergone a change of shape, and become convex and oblong. The neck is slender, and projected outwards, and the tubercle very diminutive.

Fig. 4. of the same plate illustrates the pathology of another unreduced dislocation of the upper head of the radius backwards, which, as well as in the foregoing example, lies on the same level as the apex of the olecranon, in consequence of an elongation of the head and neck of the bone, and not of its ascent. The tubercle of the radius, which is nearly effaced, and the insertion of the biceps, are on a level with the coronoid process of the ulna. There is a little cup of fibrous structure for the head of the bone, which last part has a thin investment of cartilage. The lesser sigmoid cavity of the ulna is obliterated. (See Cruveilhier, *Anat. Pathol. Livr. ix. Pl. 3., Fol. Paris 1829—1832.*)

In the dislocation of the head of the radius forwards, this part is thrown into the hollow above the external condyle, and upon the coronoid process of the ulna. According to Sir Astley Cooper, the fore-arm is slightly bent, but cannot be bent to a right angle, nor completely extended. When it is suddenly bent, the head of the radius strikes against the fore part of the os humeri. The hand is in the prone position, and, if rotated, the corresponding motion of the head of the radius can be felt at the upper and front part of the elbow joint. The coronary or annular, the oblique ligament, the front of the capsular, and a portion of the interosseous ligament, are torn.

Sir Astley Cooper refers the cause of this accident to a fall upon the hand, when the arm is extended; in which event, the radius receives the weight of the body, and is forced up by the side of the ulna, and thrown over the external condyle upon the coronoid process. In two of the cases recorded by him, the reduction could not be accomplished; in the third, it was effected during a syncope, by extending the fore-arm, while the olecranon rested on Sir Astley's foot. In the fourth, the patient was placed on a sofa, and his arm bent over the back of it, in which state, extension was made from the hand, without inclining the ulna. The sofa fixed the os humeri, and the reduction was accomplished in a few minutes. The chief things to be observed are, to let the extension act upon the radius alone, without the ulna, and during the extension to let the hand be supine. (*Dislocations, p. 474—477.*) In the latter posture, the fore-arm should also be kept by means of a splint, pad, and bandage, until the torn parts are healed.

OF THE LOWER END OF THE ULNA.

Desault gives the case of a lewdness, who dislocated the lower end of the ulna backwards, by a powerful pronation of her hand in twisting a wet

sheet. (*Boyer, Mal. Chir. t. iv. p. 249.*) Another case, much more rarely met with, is that in which the lower extremity of the ulna is dislocated forwards; for in the course of a long experience, Dupuytren had seen but two instances of it. One happened to an officer of the *gendarmerie*, whose horse fell with him, and the right fore-arm was injured between the horse's head and the ground. On presenting himself at the Hôtel-Dieu, about thirty-four hours after the accident, the fore-arm appeared very much swollen; the hand was in the midstate between pronation and supination; there was an unusual projection of the skin at the middle of the front of the wrist, while, at its inner part, the styloid process was not perceptible; and behind, instead of the customary prominence, formed by the head of the ulna, there was a depression. When the ulna was traced from the elbow to the hand, the direction of it was felt to be forwards and outwards, crossing over and above the lower end of the radius. As the latter bone continued free from displacement, the carpus did not project either backwards or forwards. No crepitus was distinguishable, and the prone and supine movements of the hand were entirely obstructed. (*Dupuytren, Clin. Chir. t. iv. p. 503—506.*) Sir Astley Cooper has not recorded any example of this rare dislocation of the end of the ulna forwards, which never presented itself to Desault but once, and that was in the dead body of a man, both of whose arms were dislocated, and of whom no particulars could be learnt. The end of the ulna was placed in front of the sigmoid cavity of the radius, and in contact with the os pisiforme, to which it was connected by a capsular ligament. (*Boyer, Mal. Chir. t. iv. p. 249.*) The latter writer has also recorded one instance of the accident. (*Vol. cit. p. 253.*)

The luxations of the lower head of the radius, described by Desault, are the same as those named by Sir Astley Cooper and Dupuytren dislocations of the lower end of the ulna from the radius; and differ from a luxation of the radius at the wrist, inasmuch as the hand is not thrown in the opposite direction to that of the radius, which bone is merely displaced from the convex articular surface of the ulna, the hand going along with it. This circumstance makes a material difference in the mode of reduction, with reference to the direction in which the hand is to be pushed. In the luxation of the lower end of the ulna backward the symptoms are, constant pronation of the fore-arm; an inability to perform supination, and great pain on its being attempted; an unusual projection at the back of the joint, in consequence of the protrusion of the little head of the ulna through the capsule; the position of the radius is more forward than natural; constant adduction of the thumb, which is almost always extended, and a half bent state of the fore-arm.

When the dislocation is forward, an assistant is to take hold of the elbow, and raise the arm a little from the body; while another is to support the hand and fingers.

The surgeon is to take hold of the end of the fore-arm with both his hands; one applied to the inside, the other to the outside, in such a manner, that the two thumbs meet each other in front of the limb, between the ulna and radius, while the fingers are applied to the back of the wrist. He is then to endeavour to separate the two bones from each other, pushing the radius backward and out-

ward, while the ulna is held in its proper place. At the same time, the assistant, holding the hand, should try to bring it into a state of supination and consequently the radius, which is its support. Thus pushed, in the direction contrary to that of the dislocation, by two powers, the radius is moved outward, and the ulna returns into the opening of the capsule, and into the sigmoid cavity.

Sir A. Cooper reduces a dislocation of the lower end of the ulna backward, by pressing the bone forwards, and maintains the reduction with splints, well padded, and a compress of leather over the end of the ulna. (*On Dislocations*, p. 505.)

If chance should present a dislocation of the lower end of the ulna forwards, the same proceedings, executed in the opposite direction, would accomplish the reduction. (See *Œuvres Chir. de Desault*, t. i.)

In one example of this very rare accident, which was under Dupuytren, counter-extension with the elbow bent to a right angle over a folded cloth, and extension, made from the wrist itself, failed to reduce the bone; but, as soon as Dupuytren made extension, from the hand and pressed this part strongly outwards, while, with both his thumbs, he propelled the ulna inwards and backwards, the reduction was effected. (*Dupuytren, Clin. Chir.* t. iv. p. 507.)

A protrusion of the small end of the ulna through the skin forwards must be excessively rare, owing to the strength of the ligaments, and the thickness of the integuments themselves, in this direction; but, in the dislocation backwards, the ligaments make less resistance, and the skin is almost close to the bone, so that, in this case, the protrusion is more likely to happen. If the dislocation were compound, ought the end of the bone to be sawn off, or amputation performed? Dupuytren is in favour of immediately reducing the end of the ulna, and making free incisions for the relief of the tension and strangulation likely to ensue. He would not saw off the end of the ulna—much less would he amputate. (*Clin. Chir.* t. iv. p. 510.) The free incisions, I think, would be early enough when the confinement of the inflamed parts by the fascia had actually come on, and threatened mischievous consequences.

Cruveilhier gives an engraving of a fore-arm, in which the radio-carpal articulation had been dislocated by the force of the contraction of the cicatrix of an extensive burn. The end of the radius was in front of the carpal bones. (See *Anat. Pathol. Mal. des Articulations*, Fol. Paris, 1829.—1832.) This example, however, does not affect the general accuracy of Dupuytren's observations, with regard to the excessive rarity of dislocation of this joint by external violence.

DISLOCATIONS OF THE WRIST.

The carpal bones are usually described as being capable of being luxated from the lower end of the radius forwards or backwards, inwards or outwards. The case backwards, which has been stated to be the most frequent, is facilitated by the direction of the convex articular surfaces of the scaphoid, lunar, and cuneiform bones, which slope more backwards than forwards. According to Sir Astley Cooper, the direction of the force determines the direction in which the carpal bones are thrown: thus, if a person, in falling, put out his hand to save himself, and fall upon the palm, a dislocation may happen,

the radius and ulna being forced forwards upon the annular ligament, and the carpal bones thrown backwards. A considerable swelling is produced by the radius and ulna on the fore part of the wrist, and a similar protuberance upon the back of the wrist by the carpus, with a depression above it, and the hand is bent back. When the carpal bones are dislocated forwards under the flexor tendons, and the radius and ulna backwards upon the posterior part of the carpus, the accident has been caused by a fall on the back of the hand. In each of these cases, two swellings are produced; one by the radius and ulna; the other, by the bones of the carpus. Sprains will often cause a great swelling over the flexor tendons, and give rise to the suspicion of a luxation, from which they may be known by the swelling being single, and its not having made its appearance directly after the injury.

Notwithstanding these statements, respecting dislocations of the wrist, Dupuytren invariably found, that these pretended accidents always turned out to be fractures of the radius near the articulation; and he was of opinion, that there is not a single unequivocal instance on record of a dislocation of the radio-carpal articulation. He had dissected numerous wrists, but never observed a luxation of them from a fall on the palm. The only cases, which he met with, were consequent to diseases of the articulation, or symptomatic of other lesions. (*Clin. Chir.* t. iv. p. 162.) Dupuytren quotes the following lines from a memoir on fractures of the fore-arm by Pouteau:—"Ces fractures sont le plus souvent prises pour des entorses, pour des luxations incomplètes, ou pour un écartement ou du cubitus, ou du radius à leur jonction vers le poignet." Desault likewise, in noticing fractures of the lower end of the radius, adverts to their having sometimes been mistaken for dislocations:—"At the present time (says Dupuytren) there can be no doubt about the frequency of fractures of the lower end of the radius, and about the impossibility, or at all events, the extreme rarity of dislocations." This celebrated surgeon dwells upon a variety of anatomical circumstances, which seem to account for the rarity of the latter kind of accident; and explains how in a fall upon the hand or front of the wrist, the force acts upon the radius, and is very likely to break its lower end, which, though thick, is of a soft spongy structure. The resistance to the dislocation forwards, made by the several flexor tendons, which pass under the annular ligament is also taken into the account. So considerable is the total resistance, when the wrist is very much extended, that Dupuytren was convinced, that a force of 2000 pounds would not overcome it. As for a dislocation backwards from a fall on the back of the hand, Dupuytren conceived, that there was effectual resistance made to its occurrence by the extensor tendons. So strong were Dupuytren's doubts of the possibility of a dislocation of the lower end of the radius forwards, that he was induced to examine very carefully the only case of it recorded with any details in modern times, namely that published by Professor Cruveilhier. (*Anat. Pathol. Mal. des Articulations*.) The subject was an adult female, about whom no information could be obtained. The fore-arm seemed shorter, than natural; the lower ends of the radius and ulna formed a considerable prominence under the skin; but the radius projected less than the ulna, and did not descend so

far. The upper extremity of the carpus was on a plane superior and anterior to that of the lower extremity of the bones of the fore-arm. The hand formed a right angle with the fore-arm, and inclined towards the radial side. Extension was impossible; but flexion could be carried much beyond a right angle. In the dissection, Cruveilhier found all the muscles of the arm in a state of atrophy, and especially, the radial and ulnar extensors and flexors, and the pronators and supinators. The upper row of carpal bones were remarkably altered in shape, and, with the exception of the pisiform bone, reduced in size by one-half. The second row was likewise altered, and, indeed, of the great and unciform bones the mere rudiments remained; while the upper part of the trapezium and trapezoid bones, which should correspond to the scaphoid, was diminished. The ulna, but slightly altered in shape, reached five or six lines beyond the lower end of the radius. The radius was shortened and deformed, principally at its lower end, which was large and irregular, and grooved on its posterior surface for the lodgment of the extensor muscles. From these and some other particulars, M. Cruveilhier concluded, that the accident had been a dislocation of the bones of the fore-arm backwards, or of the carpus forwards. On the contrary, Dupuytren suspected, that the case had been a fracture, which, from the atrophy of the carpal bones, had probably taken place in infancy. Amongst other considerations, which influenced Dupuytren in regarding the case as a fracture, was the shortened state of the radius; while the ulna, which was also luxated, and even less active than it, was half an inch longer than it. On the presumption of the case being a fracture, or a detachment of the epiphysis, every thing is readily explicable. The epiphysis of the radius was believed by Dupuytren to have been separated by a fall on the back of the hand, and the violence seemed to him to have thrown it with the carpus and hand forwards. The union of the epiphysis to the bone appeared to him to account for the unusual process, which supports the new articulation; and the ulna itself really dislocated, was longer than the radius, which, besides being broken, had been shortened by the displacement of the fragments. According to M. Malgaigne, the shortening of the radius, on the supposition of the case being a dislocation, was inexplicable.

Many years ago, a bricklayer was taken to the Hôtel-Dieu with several dangerous injuries received in a fall. His skull was fractured, and there was a good deal of deformity about the wrist. Some surgeons thought that there was a dislocation of the carpus backwards. On the contrary, Dupuytren pronounced the case to be a fracture of the inferior part of the fore-arm. The patient having died of the consequences of the injury of the head, the correctness of Dupuytren's diagnosis was verified in the post mortem examination. M. Marjolin was mistaken in a similar case, as was likewise proved by dissection.

Another source of occasional deception is a particular conformation of the wrist in certain classes of workmen, whose employments lead them to make sudden, violent, and repeated extensions. In consequence of these efforts, the ligaments of the wrist not infrequently become relaxed, so as to allow the bones to move more extensively than in the natural state. The carpus, being then not firmly fixed to the fore-arm, yields to the action of the

flexor muscles, and becomes displaced in front of the lower ends of the radius and ulna. Deformity, and some degree of weakness are the only inconveniences of this state of the wrist, which rarely obliges the individuals to discontinue work. (See *Dict. des Sciences Med.*) When a fracture of the lower end of the radius is mistaken for a dislocation, or neglected, the interosseous space becomes effaced; the fore-arm, instead of its proper flat form in this situation, acquires a cylindrical shape; and the movements of pronation and supination are destroyed. (*Dupuytren, Clin. Chir.* t. iv. p. 211.) I have seen two cases, within a recent period, where the epiphysis of the lower end of the radius was separated from the rest of the bone by a fall. Both the patients were boys, who had sustained other severe injuries. One died in the North London Hospital; and the joint, having been dissected, is preserved in University College museum.

If a dislocation of the radio-carpal joint were to be met with, gentle extension and counter-extension would be requisite, while the two surfaces of the joint should be made to slide on each other in a direction contrary to what they took when the accident occurred.

DISLOCATION OF THE CARPUS, METACARPUS, FINGERS, AND THUMB.

A simple dislocation of the carpal bones from each other seems almost impossible. The os magnum, however, is sometimes partially luxated from the deep cavity formed for it in the os scaphoides and os lunare. This displacement is produced by too great a flexion of the bones of the first phalanx on those of the second, and the os magnum forms a tumour on the back of the hand. (*Chopart, Boyer, Richerand.*) Chopart once met with a partial luxation of the os magnum. Boyer had seen several examples of the accident, which, he says, is more common in women than men; a circumstance which he imputes to the ligaments being looser in females, and to the bones of the carpus in them having naturally a greater degree of motion. The tumour increases, when the hand is bent, and diminishes, when it is extended. The case does not produce any serious inconvenience. If the wrist be extended, and pressure be made on the head of the os magnum, the reduction is easily accomplished; though a renewal of the displacement cannot be prevented, unless the extension and compression be kept up by means of a suitable apparatus, during the whole time requisite for the healing of the torn ligaments. As the inconveniences of the accident are slight, few patients will submit to any tedious, irksome treatment; and sometimes the surgeon is never consulted, till it is too late to think of replacing the bone.

Sir Astley Cooper has seen two cases of displacement of the os magnum in females; the accidents produced a weakness of the hand, and arose from relaxation of the ligaments. One example is also given of a dislocation of the os scaphoides, which was thrown backward upon the carpus, with the lower portion of the broken radius. (*On Dislocations*, p. 514, 515.) Compound dislocations of the carpal bones generally arise from gunshot violence, or other great mechanical injury. In these cases, it is sometimes necessary to take away the displaced bones altogether; and, too frequently,

the accident is complicated with so much additional mischief, as to require amputation.

The connection of the metacarpal bones with one another, and with those of the carpus, is so close, and the degree of motion so slight, that a dislocation can hardly take place. Thus, Sir Astley Cooper, in his vast experience, has never seen them dislocated, except by the bursting of guns, or by the passage of heavy carriages over the hand; cases frequently demanding amputation. (*On Dislocations*, p. 519.) The first metacarpal bone, which is articulated with the os trapezium, and admits of the movements of flexion, extension, abduction, and adduction, is capable of being luxated; but the accident is uncommon. Although, from the nature of the joint, between the first metacarpal bone and the trapezium, one might infer, that a dislocation is possible in four directions, some of these varieties must be very rare. The dislocation backwards is produced by the application of external force to the back of the metacarpal bone, which is violently bent, the case usually arising from a fall on the outer edge of the hand. The capsular ligament is lacerated, the extensor tendons of the thumb are pushed up, and the head of the bone slips behind the trapezium.

In the cases, which Sir Astley Cooper has seen, the metacarpal bone was thrown inwards, between the trapezium and the root of the metacarpal bone of the fore-finger, so as to form a protuberance towards the palm; the thumb was extended backwards, and it could not be brought towards the little finger. Considerable pain and swelling followed the accident. In the reduction, Sir Astley Cooper deems it best to make extension with the thumb inclined towards the palm, in order to lessen the resistance of the flexor muscles. Steady extension must be unremittingly kept up; and, if the reduction cannot be accomplished in this way, the same experienced surgeon considers it advisable "to leave the case to the degree of recovery, which nature will in time produce, rather than divide the muscles, or run any risk of injuring the nerves and blood-vessels." In a compound dislocation, produced by the bursting of a gun, the bone is to be reduced, the integuments brought together, and the part poulticed. When the muscles are severely torn, amputation of the thumb may be necessary, in which case Sir Astley Cooper recommends the removal of the articular surface of the trapezium with a saw. (*On Dislocations*, p. 488. ed. 4.) The cutting pliers would perhaps answer better.

The first phalanges of the fingers may be dislocated backwards off the heads of the metacarpal bones. A luxation forwards would be difficult; because the articular surfaces of the metacarpal bones extend a good way forwards, and the palm of the hand makes resistance to such an accident. According to Sir Astley Cooper, dislocation of the fingers more frequently happens between the first and second phalanges, than between the second and third; the second being thrown forward, towards the theca, and the first backwards. The reduction is effected by making extension with a slight inclination forward, so as to relax the flexor muscles. When reduction is impracticable by common means, or from the oldness of the dislocation, Sir Astley Cooper disapproves of the scheme of dividing the ligaments, in order to succeed. The mischief, which he has known arise

from injuries of tendons and ligaments, deters him from advocating the practice. (*On Dislocations*, p. 485, 486. ed. 4.)

The first phalanx of the thumb is often dislocated backwards, behind the head of the first metacarpal bone, in which case it forms a projection backwards, and remains extended, while the second phalanx is bent. The motion of this joint is lost, but that between the metacarpal bone and the os trapezium continues free.

This dislocation should be speedily reduced; for, after eight or ten days, it becomes irreducible. Sir Astley Cooper recommends the extension to be made, while the thumb is bent towards the palm, and the flexor muscles relaxed; and the following is his method of applying the extending force, which he adopts also for dislocations of the toes, thumb, and fingers in general:—"The hand is to be first steeped in warm water, for a considerable time, to relax the parts, as much as possible. Then a piece of thin wetted leather, (wash leather for instance), is to be put around the first phalanx, and as closely adapted to the thumb as possible. A portion of tape, about two yards in length, is then to be applied upon the surface of the leather in the knot, which is called by the sailors, the *claw-hitch*, for this becomes tighter as the extension proceeds. An assistant places his middle and fore-finger between the thumb and fore-finger of the patient, and makes the counter-extension, whilst the surgeon, assisted by others, draws the first phalanx from the metacarpal bone, directing it a little inwards, towards the palm of the hand. The extension should be supported for a considerable length of time, and if success does not attend the surgeon's efforts, it is right to adopt the following plan:—The leather and sailor's knot are to be applied as before directed, and a strong worsted tape is to be carried between the metacarpal bone of the thumb and the fore-finger. The arm is then to be bent around a bed-post, and the worsted tape fixed to it. A pulley is then to be hooked to the tape, which surrounds the first phalanx, and extension is to be made. This mode is almost sure to succeed." (*Sir A. Cooper*, Op. cit. p. 493. ed. 4.) In a luxation of the first bone of the thumb, which was too old to be easily reduced, and where the part was thrown behind the head of the metacarpal bone, Desault proposed cutting down to the dislocation, and pushing the head of the bone into its place with a spatula. Even in cases, which are quite recent, this kind of dislocation sometimes cannot be reduced without the utmost difficulty; and the different proposals which have been made, respecting this particular accident, by Mr. Evans, the late Mr. Hey, Sir C. Bell, and Boyer, deserve the notice of the surgical practitioner. On this subject, however, Sir Astley Cooper remarks, that he has seen too much mischief arise from injury to the tendons and ligaments, ever to recommend their division, in order to facilitate the reduction, when extension will not succeed. (*On Dislocations*, p. 523.) Dislocations of the thumb and little finger inwards, and that of the thumb outwards (which are possible cases), and luxations of the first phalanges of the other fingers backwards, and of their second phalanges forwards, are all reduced by making extension on the lower end of the affected thumb, or finger, and at the same time pressing the head of the bone towards its natural situation.

DISLOCATIONS OF THE BONES OF THE PELVIS.

Experience proves, that the bones of the pelvis, notwithstanding the vast strength of their ligaments, may be dislocated by violence: thus, the os sacrum may be driven forwards towards the interior of the pelvis; the ossa ilium may be displaced forwards and upwards; and the bones of the pubes may be totally separated at the symphysis, and an evident degree of moveableness occur between them. For the production of these accidents, however, the operation of enormous force is requisite; and, in fact, their usual causes are falls from a great height; the fall of a very heavy body against the sacrum, at a period when the body is fixed; and the pressure of the pelvis between a wall, or post, and the wheel of a carriage, or waggon. Hence, the dislocation is generally the least part of the mischief occasioned by such kinds of violence, and the case is often attended with concussion of the spinal marrow, injury of the sacral nerves, extravasation of blood in the cellular substance of the pelvis or cavity of the peritoneum, injury of the kidneys, and fracture of one or more of the bones of the pelvis. Sir A. Cooper has remarked, that some of these cases, complicated with fracture, are liable to be mistaken for dislocations of the thigh:—"When a fracture of the os innominatum happens through the acetabulum, the head of the femur is drawn upwards, and the trochanter somewhat forwards, so that the leg is shortened, and the knee and foot is turned inwards. Such a case, therefore, may be readily mistaken. If the os innominatum is disjoined from the sacrum, and the pubes and ischium are broken, the limb is slightly shorter than the other; but the knee and foot are not turned inwards. These accidents may generally be detected by a crepitus perceived in the motion of the thigh, when the surgeon applies his hand to the crista of the ilium, and there is greater motion, than in a dislocation of the thigh." (*Surgical Essays*, part i. p. 49.) In a subsequent article, I shall notice Mr. Earle's observations on this subject. See FRACTURE.

In addition to the complications, which may attend a dislocation of the bones of the pelvis, and arise immediately from the external violence, the case is always followed by inflammation, the consequences of which may be very serious, not only on account of the extent of the articular surfaces affected, but because such inflammation may extend to the peritoneum, and viscera of the abdomen and pelvis, of which I have myself seen instances.

Louis relates a case, in which the os ilium of the right side was separated from the sacrum, so as to project nearly three inches behind it. The accident was caused by a heavy sack of wheat falling on a labourer. (*Mém. de l'Acad. de Chir.* t. iv. 4to.)

In a case, recorded by Sir A. Cooper, the posterior part of the acetabulum was broken off, and the head of the thigh-bone had slipped from its socket; the fracture extended across the os innominatum to the pubes, the bones of which were separated at the symphysis nearly an inch asunder. The ilia were separated on each side, and the left os pubis, ischium, and ilium broken. (*Surgical Essays*, part i. p. 50.) In the same work may be observed another case of fracture of the body of the os pubis and ramus of the ischium, combined with a luxation of the right os innominatum from the

sacrum, and laceration of the ligaments of the symphysis of the pubes.

When these cases do not prove fatal from the direct effect of the great violence committed on many parts, or from peritonitis, the same unpleasant event sometimes follows rather later from suppuration of the articular surfaces taking place, and abscesses forming in the cellular tissue of the pelvis. (*Boyer, Mal. Chir.* t. iv. p. 147.)

A case, in which a dislocation of the left os innominatum upwards had a successful termination, was attended by Enaux, Heine, and Chaussier, and is published in a modern work. (*Mém. de l'Acad. des Sciences de Dijon.*) As the reduction could not be accomplished at first, antiphlogistic treatment was followed for some days, when new attempts to replace the bone were made, but could not be continued, as they caused a recurrence of pain and other bad symptoms. A third trial, made at a later period, was not more effectual; and all thoughts of reduction were then abandoned. After the patient had been kept quiet some time, though not so long as was wished, he quitted his bed, and began to walk about on crutches. I do not understand, however, as is asserted, how the weight of the body could now bring about the reduction, which had been previously attempted in vain. Be this as it may, the result was the patient's recovery. The fact clearly proves, as Boyer observes, that, in cases of this description, the most important object is not to aim at the reduction, but rather to oppose, by every means in our power, inflammation and its consequences. Frequently, the use of the catheter is necessary, and, sometimes an incontinence of urine, or the involuntary discharge of the feces, demands the strictest attention to cleanliness. In these cases, if the patient live any time, there is also another source of danger, consisting in a tendency to sloughing in the soft parts, on which the patient lies, and which, when they have been bruised, require still greater vigilance.

The os coccygis is not so easily dislocated as fractured. Boyer had seen it displaced in a man, who had extensive ulcerations, by which it was laid bare. There was an interspace of nearly two inches, between the sacrum and base of the os coccygis. In proportion as the man regained his strength, the bone recovered its right position, and at length united to the os sacrum, notwithstanding the action of the levatores ani, which are inserted into it. This case, however, was not an accidental luxation; but arose from the destruction of the ligaments by disease.

Authors mention two kinds of dislocation, to which the os coccygis is liable; one, inward; the other, outward. The first is always occasioned by external violence; the second, by the pressure of the child's head in difficult labours. Pain, difficulty of voiding the feces and urine, tenesmus and inflammation, sometimes ending in abscesses, which interest the rectum, are symptoms, said to follow such dislocations.

All schemes for the reduction are useless, as the bone will spontaneously return into its place as soon as the cause of displacement ceases; and the introduction of the finger within the rectum, and handling of the painful and injured parts, are more likely to increase the subsequent inflammation, and produce abscesses, than have any beneficial effect. The wisest plan is to be content with enjoining quietude, and adopting antiphlogistic measures.

DISLOCATION OF THE RIBS.

J. L. Petit believed such a case never occurred. Buttel related an instance, which he supposed to be a dislocation of the posterior extremity of the rib from the vertebrae; but Boyer clearly proved, that no true reasons existed for this opinion, and that the case was only a fracture of the bone, near the spine. (*Mal. Chir. t. iv. p. 123.*) Paré, Barbette, Juncker, Platner, and Heister, not only admit the occurrence of luxations of the ribs, but describe different species of them. Lieutaud extended the term luxations to cases, in which the head of the rib is separated by disease, the pressure of aneurisms, &c.

In a modern work may be read the particulars of a case, where all the ribs were dislocated from their cartilages, in consequence of the chest being violently compressed between the beam of a mill and the wall. In such a case there is no means of reduction, except the effect produced by forcible inspirations; nor are there any modes of relief, but bleeding, and the application of a roller round the chest. (*See C. Bell's Surg. Obs. p. 171.*)

DISLOCATIONS OF THE THIGH-BONE.

The head of the thigh-bone may be dislocated upwards on the dorsum of the ilium; upwards and forwards, on the body of the os pubis; downwards and forwards, on the foramen ovale; backwards, on the ischiatic notch; and, on very rare occasions, behind the tuberosity of the ischium. The dislocation upwards, and that downwards and forwards, are the most frequent.

The dislocation upwards, on the dorsum of the ilium, is attended with the following symptoms:—The limb is from one inch and a half to two inches and a half shorter than its fellow, the thigh a little bent, and carried inwards. The knee inclines more forwards and inwards than the opposite one; the leg and thigh are turned inwards, and the foot points in this direction; the toe resting, as Sir A. Cooper remarks, against the tarsus of the other foot. (*Surgical Essays, part iv. p. 27.*) There is an approximation of the trochanter major to the anterior superior spinous process of the ilium; and, at the same time, it is elevated and carried a little forwards. It is also less prominent, than that on the opposite side, and the natural roundness of the hip has disappeared. The natural length of the limb cannot be restored, without reducing the luxation, the foot cannot be turned outwards, without great difficulty, and any attempt to do so causes pain; but, the inclination of the foot inwards may be increased. Thus, in Dr. Scott's case, "Every attempt at rotation outwardly caused extreme pain in the groin, at the hip, and in the course of the sciatic nerve. When, however, with difficulty and much suffering to the patient, a certain degree of rotation was effected, the trochanter described a segment of a large circle." (*See Dublin Hospital Reports, vol. iii. p. 390.*)

When an attempt is made to draw the leg away from the other, it cannot be accomplished; but the thigh may be slightly bent across its fellow.

In general, a dislocation on the dorsum of the ilium is at once readily discriminated from a fracture of the neck of the thigh-bone, within the capsular ligament, by the rotation of the limb inwards; a position, which is unusual in a fracture of any

part of the os femoris. "In a fracture of the neck of the thigh-bone, the knee and foot are generally turned outwards; the trochanter is drawn backwards; the limb can be readily bent towards the abdomen, although with some pain; but, above all, the limb, which is shortened from one to two inches by the contraction of the muscles, can be made of the length of the other by a slight extension, and when the extension is abandoned, the leg is again shortened. If, when extended, the limb is rotated, a crepitus can often be felt, which ceases when rotation is performed under a shortened state of the limb. The fractured neck of the thigh-bone, within the capsular ligament, rarely occurs but in advanced age, and often is the effect of the most trifling accidents, owing to the absorption which this part of the bone undergoes at advanced periods of life. Fractures, external to the capsular ligament, occur at any age; but generally in the middle periods of life; and these are easily distinguished by the crepitus which attends them, if the limb is rotated and the trochanter is compressed with the hand. The position is the same as in fractures within the ligament. The proportion of fractures of the neck of the thigh-bone, which I have seen, is at least four cases to one of dislocation." (*Sir A. Cooper, Surg. Essays, part i. p. 28.*) The rotation of the limb inward, in cases of fracture of the neck of the thigh-bone, is uncommon, though sometimes met with: Sir Astley Cooper saw one example of it under the care of Mr. Langstaff.

To reduce this dislocation, the patient should be placed on his back upon a table firmly fixed, or a large four-posted bedstead. A sheet folded longitudinally, is first to be placed under the perineum; and one end being carried behind the patient the other before him, they are to be fastened to one of the legs, or posts of the bed. Thus the pelvis will be fixed, so as to allow the necessary extension of the thigh-bone to be made. Great care must be taken during the extension to keep the testicles, or the pudenda in women, from being hurt by the sheet passed under the perineum. The patient must be further fixed by the assistants.

In France, Germany, and Ireland, the extending force is applied to the inferior part of the leg, in order that it may be as far as possible from the parts which resist the return of the head of the bone into its natural situation. In this country, surgeons generally prefer making the extension by means of a sheet, or the strap of a pulley, fastened round the limb just above the condyles of the os femoris. The direction in which Sir A. Cooper makes the extension, is in the line made by the limb, when it is brought across the other thigh a little above the knee. As soon as the head of the bone has been brought on a level with the acetabulum by the assistants, who are making the extension, the surgeon is to force it into this cavity by pressing on the great trochanter; or by rotating the knee and foot gently outwards, as practised by Sir A. Cooper.

The extension should always be made in a gradual and unremitting manner: at first, gently, but afterwards more strongly; never violently. The difficulty of reduction arises from the great power and resistance of the muscles, especially the glutei and triceps, which will at length be fatigued, so as to yield to the extending force, if care be taken that it be maintained the necessary time, without the least intermission. Sometimes,

when there is difficulty in bringing the head of the bone over the lip of the acetabulum, Sir A. Cooper raises it by placing his arm under it near the joint.

The disappearance of all the symptoms, and the noise made by the head of the bone, when it slips into the acetabulum, denote that the reduction is effected. This noise, however, is not always made when pulleys are used or the patient is faint. The bone is afterwards to be kept from slipping out again, by tying the patient's thighs together with a bandage passed a little above the knees. The patient should be kept in bed at least three weeks; live low; and rub the joint with a camphorated liniment. Due time must be given for the lacerated ligaments to unite, and the sprained parts to recover; for premature exercise may bring on irremediable disease in the joint.

Mr. Hey sometimes made the extension in a right line with the trunk of the body; and, at the same time, directed the head of the bone outwards as well as downwards. A rotatory motion of the os femoris on its own axis, towards the spine, (the patient lying prone,) seemed to him likely to elevate the great trochanter, bring it nearer to its natural position, and direct the head of the bone towards the acetabulum. (*Hey's Practical Obs.* p. 313.) He has given a case, in which the reduction was accomplished on these principles; the pelvis being fixed by the patient being put astride the bed-post, with the limb on the outside of the bed. Dr. James Scott, of Dublin, in one instance combined Hey's method of fixing the pelvis, by placing the patient astride a bed-post, with extension from the ankle. (*See Dublin Hospital Reports*, vol. iii. p. 391.) However, as tartar emetic had been given, the success of the plan, after the failure of the common one, may have been rather owing to the influence of that medicine, than to any superiority of Hey's mode.

For the purpose of facilitating the reduction, surgeons often endeavour to produce a temporary faintness by a copious venesection, immediately before the extension is begun; a practice which, when the patient's state of health does not forbid it, is advisable, as materially lessening the resistance of the muscles. Sir A. Cooper gives it his general approbation, as well as the warm bath, and nauseating doses of tartarised antimony. After taking away from twelve to twenty ounces of blood, he places the patient in a bath heated to 100 degrees, and gradually raised to 110 degrees, until faintness is induced. While in the bath the patient is also to take a grain of tartarised antimony every ten minutes, until nausea is excited, when he is to be removed from the bath, put in blankets, and placed between two strong posts, in each of which a staple is fixed, or he may be placed on the floor, into which two rings may be screwed. Of Mr. Hey's plan, especially the direction of the limb in it, he entertains an unfavourable opinion, as little calculated to answer where the reduction has been at all delayed. (*On Dislocations*, p. 45.) In this sentiment I fully concur. In all cases of difficulty, the above-mentioned debilitating means, the intoxicating effect of a liberal dose of opium, and the use of pulleys for the reduction, deserve recommendation.

An instance of dislocation of the thigh-bone on the dorsum of the ilium, with fracture of the former bone, is recorded by Sir Astley Cooper:

the dislocation was not at first detected, and afterwards no attempt to reduce the bone was considered prudent:—"The probability is that dislocation, thus complicated with fracture, will generally not admit of reduction, as an extension cannot be made until three or four months have elapsed from the accident, and then only with strong splints upon the thigh, to prevent the risk of disuniting the fracture." (*On Dislocations, &c.* p. 62.)

Mr. C. H. Todd had an opportunity of dissecting the hip-joint of a man, after the femur had been dislocated, on the dorsum of the ilium, the patient having died on the day after the accident from an injury of the head. The luxation had been reduced. "On raising the the gluteus maximus, a large cavity, filled with coagulated blood, was found between that muscle, and the posterior part of the gluteus medius. This was the situation, which had been occupied by the dislocated extremity of the femur. The gluteus medius and minimus were uninjured. The pyriformis, gemini, obturatores, and quadratus, were completely torn across. Some fibres of the pectinealis were also torn. The iliacus, psoas, and adductors were uninjured. The orbicular ligament was entire at the superior and anterior part only, and it was irregularly lacerated throughout the remainder of its extent. The inter-articular ligament was torn out of the depression on the head of the femur. The bones had not sustained any injury." Mr. Todd conceives, that, when this dislocation takes place, the force is applied to the inferior and external part of the limb, the thigh being at the time in the state of demi-flexion; the head is thus pushed through the posterior and upper part of the orbicular ligament, passes under the posterior edge of the gluteus minimus, separating it from the pyriformis, and forms a cavity for itself under the gluteus maximus, or between the gluteus medius and minimus. (*See Dublin Hospital Reports*, vol. iii. p. 396—401.)

In an old unreduced partial dislocation on the dorsum of the ilium, dissected by Mr. Wallace, and of which he has published many interesting particulars, the posterior edge of the gluteus medius ran exactly over the head of the femur. The case had been attended with a fracture of the superior edge of the acetabulum. In consequence of the interruption of the natural movements of the limb, its muscles had become generally wasted, especially the rotators of it outwards, and the obturator internus had been transformed into a peculiar substance, resembling a mixture of fat and fibro-cartilage. It appeared to Mr. Wallace from what was noticed in this instance, that "nature does not appear to possess the power of forming articular cartilage in those accidental joints, which result from unreduced dislocations. The new articular surfaces are always covered by a lamina of bone, which resembles in appearance that ivory-like substance sometimes found on natural articular surfaces. As a cartilaginous surface cannot play easily on a bony surface, the original cartilage, which may have covered the head of the dislocated bone, becomes absorbed, and its situation occupied by the same kind of tissue, as that which forms the new surface, upon which the head of the bone may be applied. In accidental joints, the result of disuniting fracture, the ends of the bones appear to be covered by an articular cartilage of original formation; it corresponds in its character to the tem-

orary cartilage of bones, or, more properly speaking, it is bone in a state of imperfect formation." (*W. Wallace, in Trans. of King's and Queen's College, Ireland*, vol. v. p. 250.) The usual change in the shape of the unreduced head of the femur is noticed by this gentleman: in the case, adduced by him, one remarkable circumstance was the considerable elevation of the pelvis on the injured side; a fact, which seems not to agree with a common description of the cause of the opposite kind of obliquity in the position of the pelvis in disease of the hip. With respect to the changes, which take place in the head of a dislocated bone, and the kind of accidental joint which often follows, Sir Astley Cooper has adverted to certain differences depending on the texture, whether muscular, or osseous, on which the head of the bone is lodged.

Dr. James Scott had an opportunity of dissecting a hip, in an example of dislocation of the femur, upwards and backwards, where the patient had died, in consequence of a laceration of the intestines, forty-eight hours after the accident, and forty hours after the reduction. Amongst other particulars, the following are recorded:—"The gluteus maximus being raised from its origin, a considerable extravasation was found in the loose cellular tissue under the gluteus medius. A cavity, capable of containing a pullet's egg, was also brought into view. This cavity was situated directly where the great ischiatic nerve passes under the pyriform muscle; it contained fluid blood; its boundaries were the pyriformis above, the sciatic nerve before (supposing the body upright), the trochanter major and insertion of the gluteus medius external and posterior. Here the displaced head of the bone had been lodged. The fleshy substance of the gemini and quadratus muscles was found torn across. The pyriformis and obturator internus were perfect. The internal and upper part of the capsular ligament was ruptured; the external portion remained unbroken." The ligamentum teres was torn from its insertion into the dimple of the head of the femur, but not itself ruptured. The same fact was exemplified in Mr. Todd's case. The brim of the acetabulum at the upper part was fractured, to the extent of about an inch; and the fragment lay loose, and nearly unconnected. A fracture also traversed the acetabulum.

A case is recorded by Sir Astley Cooper, where a portion of the edge of the acetabulum was broken off. Dr. James Scott, thinks it probable, that, in many instances of dislocation upwards, the brim of the acetabulum is fractured, and to this circumstance he ascribes the occasional tediousness of the recovery after reduction. (*See Dublin Hospital Reports*, vol. iii. p. 389.) Probably, if the head of the femur had been replaced soon after the occurrence of the injury, it would have been exceedingly difficult to maintain it in this state; but, as Mr. Wornald has remarked, the difficulty would have depended upon the size of the portion of the acetabulum broken off.

Luxations downwards and forwards, upon the obturator foramen, are the next in frequency to those upon the dorsum of the ilium. The accident is facilitated by the great extent to which the abduction of the thigh can be carried, and by the weakness of the orbicular ligament, which in this direction is torn through. According to Sir Astley Cooper, "The dislocation in the foramen

ovale happens whilst the thighs are widely separated, during which the ligamentum teres is upon the stretch; and when the head of the bone is thrown from the acetabulum, the ligament is torn through before it entirely quits the cavity." (*On Dislocations*, &c. p. 65.) It seems also that the pectinalis and adductor brevis muscles are sometimes lacerated. (*See Case*, vol. cit. p. 66.) The head of the bone is thrown between the obturator ligament, and obturator externus muscle.

The symptoms are as follows:—"The injured limb is two inches longer than its fellow, the head of the femur being lower than the acetabulum; the trochanter major, which is less prominent than natural, is removed to a greater distance from the anterior superior spinous process of the ilium, and the thigh is flattened in consequence of the elongation of the muscles. A hard round tumour, formed by the head of the femur, is felt at the inner and superior part of the thigh, towards the perineum. The leg is slightly bent; and the foot, though widely separated from the other, is generally turned neither outwards nor inwards; but, there may be a little variation in this respect, in different instances. Hence, Sir A. Cooper prefers as the diagnostic symptoms, the bent position of the body, caused by the psoas and iliacus muscles being on the stretch; the separated knees; and the increased length of the limb. (*Essays*, part 1. p. 37.) The latter symptom alone is a sufficient indication of the case not being a fracture.

In general, dislocations on the obturator foramen, are easy of reduction. The pelvis having been fixed, the extension is to be made downwards and outwards, so as just to dislodge the head of the bone. The muscles then generally draw it into the acetabulum, on the extending force being gradually relaxed, if the upper part of the bone be pulled outward, with a bandage, and the ankle be at the same time inclined inwards. Thus the limb is used as a lever, with very considerable power.

Mr. Hey says, that "in this species of dislocation (downwards and forwards), as the head of the bone is situated lower than the acetabulum, it is evident, that an extension made in a right line with the trunk of the body, must remove the head of the bone farther from its proper place, and thereby prevent, instead of assisting, reduction. The extension, he conceives, ought to be made with the thigh at a right angle, or inclined somewhat less than a right angle, to the trunk of the body. When the extension has removed the head of the bone from the external obturator muscle, which covers the great foramen of the os innominatum, the upper part of the os femoris must then be pushed or drawn outwards; which motion will be greatly assisted by moving the lower part of the os femoris at the same moment, in a contrary direction; and, by a rotatory motion of the bone upon its own axis, turning the head of the bone towards the acetabulum." (*Hey*, p. 316.)

The thigh-bone is sometimes luxated upwards and forwards on the pubes. The whole limb is turned outwards, and cannot be rotated inwards: it is shortened by one inch; the trochanter major is nearer the anterior superior spinous process of the ilium than natural; the head of the bone forms a tumour in the groin above the level of Poupart's ligament, on the outer side of the femoral artery and vein, where it can be perceived

to move when the thigh-bone itself is moved. By the stretching of the anterior crural nerve, which lies over the neck of the bone, (see *A. Cooper, on Dislocations*, p. 95.) great pain, numbness, and even paralysis, are liable to be produced. The knee is generally carried backwards. Sir A. Cooper remarks, that there is a slight flexion of the limb forwards and outwards. (*Surgical Essays*, part i. p. 45.)

The head of the bone felt in the groin, and the impossibility of rotating the limb inward, distinguish this case from a fracture of the neck of the bone.

In the reduction, Sir A. Cooper recommends the extension to be made in a line behind the axis of the body, so as to draw the thigh-bone backwards; and, when such extension has been continued some time, a napkin is to be put under the upper part of the bone, and its head lifted over the pubes and edge of the acetabulum.

In the dislocation of the thigh backwards on the ischiatic foramen, the head of the bone is placed on the pyriformis muscle, between the edge of the bone which forms the upper part of the ischiatic notch and the sacrospinous ligament, being behind the acetabulum, and a little above the level of the middle of that cavity. The limb is generally not more than half an inch shorter than its fellow; and the knee and foot are turned inwards, but not nearly in so great a degree as in the dislocation on the dorsum of the ilium. The thigh inclines a little forward, the knee is slightly bent, and the limb is so fixed, that flexion and rotation are in a great measure prevented.

Sir A. Cooper considers this dislocation as the most difficult, both to detect and reduce: difficult to detect, because the length of the limb, and the position of the knee and foot, are but little changed; difficult to reduce, because the head of the bone is placed deeply behind the acetabulum, and requires to be drawn over the edge of the socket, as well as towards it. In thin subjects, a hard tumour is felt at the posterior and inferior part of the buttock, and the great trochanter is removed further from the spine of the ilium.

The pelvis being fixed, the extension is to be made downwards and forwards, across the middle of the other thigh, so as to dislodge the head of the bone, while the surgeon, with a napkin, placed just below the trochanter minor, pulls the upper part of the femur towards the acetabulum. In this case pulleys are preferable for making the extension.

A dislocation on the tuber ischii is exceedingly uncommon. The particulars of such a case were published a few years ago by Mr. Keate. A gentleman's horse fell with him into a ditch, and he lay under the animal for some time. It seems that, during his efforts to release himself, the head of the femur, which had been first thrown upon the obturator foramen, was forced behind the tuberosity of the ischium, where it could be plainly felt. The limb was lengthened and everted. In the reduction, the head of the bone was brought first on the obturator foramen, and thence into the acetabulum, without any particular difficulty. (*See Lond. Med. Gaz.*) But it appears, from a case lately recorded, that the head of the femur may be primarily dislocated downwards and backwards upon the tuberosity of the ischium. A man, leaped from a third-story window; and

died, in about an hour, from the injuries which he received. One of the thighs was considerably shortened and inverted; forming about half a right angle with the body. The shaft of the femur, crossing the symphysis pubis, was immovably fixed in this situation. "Twelve hours after death (says Mr. Wornald) I commenced the dissection by reflecting the gluteus maximus, when I found some of the fibres of the gluteus medius and minimus ruptured at their posterior edge. The pyriformis and the gemelli were also partially torn; but the four portions of the tendon of the obturator internus, which pass through the lesser sacro-sciatic notch, were drawn out, and separated from their connections with the muscular fibres. The head of the femur presented itself through a rent of the capsule, opposite to the upper part of the tuber ischii, above the quadratus, so that the great ischiatic nerve was somewhat displaced, and pressed against the tuber ischii." The head of the bone lay under the outer edge of the gluteus maximus. Mr. Wornald expresses his belief, that, if this man had been in a state to admit of an attempt at reduction, it might have been accomplished, without any unusual difficulty, by fixing the pelvis, and employing extension in the direction of the shaft, and everting the limb, so as to bring the head of the femur opposite the rent in the capsule. (*See Lond. Med. Gaz.* for 1836, 1837. p. 657.) The position of the limb in this case seems to have been very different from what it was in the case of secondary displacement of the head of the femur behind the tuber ischii, recorded by Mr. Keate.

Mr. Wornald has published the following case, in which there was a dislocation of the head of the femur, with displacement of a portion of the cotyloid ligament, without rupture of the ligamentum teres:—In the summer of 1829, a man about forty years of age, was admitted into St. Bartholomew's Hospital, for pneumonia, of which he died. On examining his body, Mr. Wornald noticed, that the left lower extremity was somewhat everted, a little separated from the right, and shortened to the extent of half an inch: and, on dissection, the head of the femur was found resting upon the ilium, between the acetabulum and the anterior inferior spine, in a cavity formed partly by a growth of bone and partly by what seemed to Mr. Wornald to be the upper portion of the original cotyloid ligament; the acetabulum was contracted, and filled up by a fibrous substance. The ligamentum teres was entire, elongated, and flattened.* Fourteen years before the patient died, he had met with the injury of his hip by a fall from a ladder; but eventually recovered from the accident, and was able to follow the employment of carrying out beer. Mr. Wornald thinks it probable, that a portion of the acetabulum had been separated, as well as the cotyloid ligament. (*See Lond. Med. Gaz.* for 1836, 1837. p. 658.)

Since this sheet was sent to the press, I have perused some interesting remarks on an unusual dislocation of the thigh-bone, by Mr. Travers, junior. It was produced by a fall into the hold of a ship. The "buttock is flattened; the trochanter is felt rather below, and to the outer side of the anterior and superior spinous process of the ilium. The neck of the bone lies apparently between the two anterior spinous processes, so that, when the patient is erect, the limb appears slung or suspended from this point. The head of the bone

cannot be felt; it is invested by an abundance of bony matter, &c. There is complete eversion, slight mobility, and imperfect progression with the aid of a crutch." (See *Med. Chir. Trans.* vol. xx. p. 113.) A similar case has been recorded by Mr. Morgan. (See *Guy's Hospital Reports*.) Mr. Travers, junior, refers also to Mr. Bransby Cooper's instance, published in this last work, of a partial dislocation upwards; and he mentions two preparations in the Museum of St. Bartholomew's Hospital, exhibiting the head of the dislocated femur in new and unusual situations, not merely backwards, but downwards. "In the first, which was removed one week after the receipt of the injury, the head of the bone is seen resting upon the sciatic spine, and lesser sciatic opening. The lower border of the cervix femoris being partially in contact with the upper and outer edge of the tuberosity, the small rotator muscles are lacerated. The lesser glutei, and pyriform muscles are entire at their place of insertion." In this case, a fracture of the os innominatum traverses the bottom of the acetabulum. The trochanter lies considerably higher, than the head of the bone. In the second specimen, the bone had been reduced, but the rent is manifest at the back and outer part of the capsule, through which the head of the bone had passed to, and been found moveable upon, a spot corresponding to the root of the spine of the ischium. Mr. Travers, junior, infers from these cases, that, in addition to the four kinds of luxations of the head of the femur usually described, we must now admit the possibility of other rarer displacements of it, where it assumes a position either directly above or below the acetabulum.

The subject of congenital, or original, dislocations of the thigh-bone, was first taken up by Palletta (*Adversaria Chirurgica Prima; et Exercitatio de Claudicatione Congenita*, &c. ab. Ed. Sandifort edit. 8vo. Lugd. 1788.) Delpsch afterwards made some observations upon it (*De l'Orthomorphie*, &c. 2 tomes, 8vo. 1828); but the most important article, yet extant on congenital, or original, dislocations of the hip, is that by the celebrated Dupuytren. (See *Répertoire Gén. d'Anat.* t. ii.; also *Clin. Chir.* t. iii. art. 8.) Cruveilhier has given the engraving of a skeleton, in which, amongst other peculiarities, is exhibited a congenital displacement of the thigh-bones. (*Anat. Pathol.* livr. ii. pl. 2.) The case consists in a displacement of the head of the femur from the acetabulum to the dorsum of the ilium, existing from birth, and appearing to be the result of a want of depth, or of the incomplete formation of the acetabulum, rather than of any accident or disease. The displacement corresponds to that termed upwards and outwards, and would appear sometimes to prevail in certain families. (See *Clin. Chir.* t. iii. p. 216.) According to Dupuytren, the characters of this dislocation are; a shortening of the limb; an ascent of the head of the bone upon the external fossa of the ilium; a projection of the great trochanter; a retraction of almost all the muscles of the upper part of the thigh towards the crista of the ilium, where they form round the head of the femur a kind of cone, the base of which is in the os ilium, and the apex at the great trochanter. The tuberosity of the ischium, quitted by these muscles, is nearly uncovered. The limb is rotated inwards, and consequently the heel and ham are turned outwards,

and the knee and toes inwards. The position of the thigh is oblique from above downwards, and from without inwards; which obliquity is greater, the older the individual is, and the wider the pelvis. Hence, there is a tendency in the thigh-bones to cross one another below. There is a meagreness of the limb, and especially of its upper part, out of all proportion to the trunk and upper extremities.

The separate movements of limbs, with this conformation, are generally very limited, and, in particular, those of abduction and rotation. As the patient is standing still, one is struck with the want of proportion between the upper and lower parts of this body, with the imperfection of his lower limbs, and the attitude which he assumes. The trunk is fully developed, while the lower extremities are short and slender, as if they belonged to another person. This appearance of the lower limbs is rendered still more conspicuous by the breadth of the pelvis. One is also struck with the projection of the great trochanters. The upper part of the trunk inclines a good way back, while the lumbar portion of the spine advances far forwards, and is very much excavated behind. The pelvis is placed almost horizontally on the thigh-bones; and the ground is only touched with the point of the foot. It appears from Dupuytren's observation, that a person, with congenital dislocation of the hips, runs and jumps, with less difficulty than he walks. When he is placed upon his back, the signs of the malformation diminish, and are nearly effaced; because, in this posture of repose, the muscles no longer draw the thigh-bones upwards, and the weight of the upper parts of the body ceases to press the pelvis down between the heads of those bones. In this posture, the limbs may be lengthened, or shortened, with perfect facility; and this from one to three inches, according to the age and stature of the individual, and the extent of displacement. These changes in the length of the limb, are not only made with great ease, but without any pain; so as to prove the absence of every kind of disease, as well as of a cavity proper for receiving and retaining the head of the bone.

In twenty-six cases, met with by Dupuytren, the luxation existed on both sides, with the exception of two or three. Most of the individuals, who have had the infirmity, have been females; and, in the above twenty-six, there were only three or four males. (*Clin. Chir.* t. iii. p. 251.)

Of course, the treatment can be but palliative. As the weight of the trunk aggravates the displacement, repose may be useful; but it is not necessary to keep the patient in the recumbent position; because, in the sitting posture, there is no stress upon the thigh-bones, the body resting entirely on the tuberosities of the ischia. Let these individuals, therefore, choose a profession, which will keep them a good deal in the sitting posture. Dupuytren also commends cold bathing, and a bandage, or belt, round the pelvis, by which the trochanters may be combined and kept steadily at a uniform height. (See *Dupuytren Op. et vol. cit.* art. 8.) Besides the sources of information already quoted, I refer to *Caillard Billonière sur les Luxations originelles, ou Congénitales des Femurs*, 8vo. Paris, 1828; John North, in *Med. Chir. Trans.* vol. 19. *Relatée Lafondé; sur les Principales Différences du Corps Humain*, &c. 2 vols. 4to.

Paris, 1819; and to W. Coulson on *Disease of the Hip-joint*, p. 68. 4to. Lond. 1837.

DISLOCATIONS OF THE PATELLA.

The patella may be luxated outwards, or even inwards, when violently pushed in this direction. It is also liable to a displacement upwards, in consequence of its ligament being sometimes ruptured by the action of the extensor muscles. It is most frequently thrown on the external condyle, where it produces a projection; and this circumstance, with an incapacity of bending the knee, is evidence of the nature of the injury. (Sir A. Cooper, *Surgical Essays*, part i. p. 66.) The accident is most common in persons, whose knees incline inwards; a condition that accounts for the tendency of the patella to be drawn outwards by the action of the extensor muscles. The dislocation inwards, which is much less frequently met with, is produced either by a fall upon a projecting body, which strikes the outer edge of the patella, or by the foot being turned inwards at the time of the fall.

In each case, if there be no previous morbid relaxation of the parts, a portion of the capsular ligament will be torn. (A. Cooper, on *Dislocations*, &c. p. 179.) When the extensors of the leg have been completely relaxed by position, the reduction is, for the most part, easily accomplished by pressing the patella towards its right place with one or both thumbs. In a case, under Mr. George Young, success could not be obtained, except by extending the leg, and placing the heel on the surgeon's shoulder, who, with the limb thus fixed, was enabled to make the requisite pressure on the patella advantageously with both his thumbs. Owing to a lax state of the ligament of the patella, or other predisposing causes, the bone is sometimes difficultly kept in its proper situation, unless a roller be applied. The inflammatory affection of the joint is to be opposed by bleeding, purging, and the use of the lotio plumbi subacetatis. The joint must be kept quiet a few days, and then gently moved in order to prevent stiffness. When the relaxation of the ligaments is such, that a relapse is likely to ensue from slight causes, a laced kneecap, with a strap and buckle, above and below the patella, should be worn as recommended by Sir Astley Cooper. (On *Dislocations*, p. 181.) The luxation of the patella upwards, from a rupture of its ligament, is a case followed by a considerable degree of inflammation. Hence, Sir Astley Cooper particularly recommends early depletion, the use of evaporating lotions from four to seven days, and then a roller to the foot and leg. The leg is to be kept extended by means of a splint behind the knee; a leather strap is to be buckled round the lower part of the thigh, and to it, on each side, another is buckled, which extends from the sole of the foot, and is carried up each side of the leg. Thus the patella is kept down, and an opportunity is afforded for the ligament to unite. In a month, the knee may be gently moved every day. (On *Dislocations*, p. 182.)

DISLOCATIONS OF THE KNEE.

The upper head of the tibia may be luxated forward, backward, or to either side. Complete dislocations are exceedingly rare; because the articular surface of the condyles of the femur is so extensive, that the tibia cannot be entirely removed

from it, without a prodigious laceration of the ligaments, tendons, and all the rest of the soft parts.

The condyles of the femur are disposed in such a manner, that, in the extreme flexion of the leg, the articular cavities of the upper head of the tibia are still in contact with those bony eminences; and this circumstance, together with the resistance made by the ligament of the patella, the patella itself, and the tendon of the extensor muscles of the leg, renders a sudden dislocation of the tibia backwards so difficult, that Boyer seems even to question the possibility of the accident, notwithstanding the case recited by Heister. (*Traité des Mal. Chir.* t. iv. p. 366.) That this accident, however, sometimes really happens, no longer admits of dispute: the case is noticed by Sir A. Cooper as producing the following appearances:—A shortened state of the limb; a projection of the condyles of the os femoris; a depression in the situation of the ligament of the patella; and a bending of the leg forwards: which last statement differs from that of Boyer, who declares, that the leg is bent to a very acute angle, and cannot be extended again. (*Mal. Chir.* t. iv. p. 369.) It appears further, from the particulars of the example of this accident seen by Dr. Walshman, that the dislocation may even be complete, the head of the tibia being thrown behind the condyles of the femur into the ham. The tendinous connection of the patella to the rectus muscle was ruptured; and, probably, without a laceration of that tendon, or of the ligament of the patella, such a degree of displacement could scarcely have happened. (*Surgical Essays*, part ii. p. 74.)

But, if a sudden dislocation of the tibia from the femur backwards is uncommon, the same remark cannot be made respecting a displacement in that direction, gradually produced by the effects of disease. Several cases of the latter kind have fallen under my own observation.

A dislocation of the head of the tibia forwards, from the condyles of the femur, cannot happen, without the greatest difficulty; for the accident would be likely to be attended with a laceration of the lateral, crucial, and oblique, or posterior ligaments, all which tend to prevent the leg from being too far extended; and in addition to all this injury, Boyer calculates, that the heads of the gastrocnemius, the popliteus, and the extensor tendons of the leg, would be immoderately stretched, and even torn. However, it deserves notice, that, in one compound luxation of the knee, where the os femoris was thrown behind the outer side of the head of the tibia, the external condyle being dislocated backwards and outwards, and the internal one thrown forwards upon the head of the tibia, the dissection proved, that "neither the sciatic nerve, the popliteal artery and vein, the lateral, nor the crucial ligaments were ruptured." (Sir A. Cooper, on *Dislocations*, p. 197.) Both heads of the gastrocnemius were lacerated, and the back portion of the capsular ligament extensively torn. In 1802, an instance of a luxation of the tibia forwards was seen in Guy's Hospital. According to Sir Astley Cooper, while the tibia projects forward the thigh-bone is depressed, and thrown somewhat laterally as well as backwards. The os femoris makes such pressure on the popliteal artery, as to prevent the pulsation of the anterior tibial artery on the instep; and the patella and tibia are

drawn forwards by the rectus muscle. (*Surgical Essays*, part ii. p. 73.)

Dislocations inwards or outwards, though more frequent than the foregoing cases, are still to be considered as rare, and are always incomplete. In the dislocation inwards, the condyle of the os femoris is thrown upon the external semilunar cartilage, and the tibia projects at the inner side of the joint, so as at once to disclose the nature of the accident; and a depression may be felt under the external condyle. Such a case was brought into the North London Hospital in the autumn of 1836; and was easily reduced by Mr. Hallam, then one of the house surgeons. In the luxation of the head of the tibia outwards, the condyle of the os femoris is thrown upon the inner semilunar cartilage, or, as Sir Astley Cooper says, rather behind it. In both these cases, this gentleman believes, that the tibia is rather twisted upon the os femoris, so that the condyle of the latter bone is thrown somewhat backwards, as well as outwards, or inwards.

I have stated, that lateral luxations of the tibia from the femur are almost always incomplete; but, the possibility of a complete dislocation inwards seems to be established by the 402d Obs. of Lamotte.

Whenever the tibia is dislocated from the femur, the accident has generally happened either while some force was operating upon that bone, at a period when the femur was fixed and immoveable, or else while the thigh-bone was propelled, or twisted with great violence, while the leg itself was firmly fixed.

These accidents are all easily reduced by making gentle extension, and pushing the head of the tibia in the proper direction. The grand object, after the reduction, is to avert inflammation of the knee, and promote the union of the torn ligaments. The first demands the rigorous observance of the antiphlogistic plan—bleeding, leeches, low diet, opening medicines, and a cooling evaporating lotion; both require the limb to remain perfectly motionless. With respect to splints, I conceive, that their pressure would be objectionable. As soon as the ligaments have grown together, and the danger of inflammation is over, which will be in about three weeks, the joint should be gently bent and extended every day, in order to prevent stiffness. Liniments will afterwards be of service.

I have next to notice the cases, which were first described by the late Mr. Hey, and are named by Sir A. Cooper *partial luxations of the thigh-bone from the semilunar cartilages*. Mr. Hey observes, that the disorder may happen either with or without contusion. When no contusion has occurred, or the effects of it are removed, the joint, with respect to shape, appears uninjured. If there is any difference from its usual appearance, it is that the ligament of the patella seems rather more relaxed than that of the sound limb. The leg is readily bent, or extended by the hands of the surgeon, and without pain to the patient: at most, the degree of uneasiness, caused by this flexion and extension, is trifling. But, the patient himself cannot freely bend, nor perfectly extend the limb in walking; and he is compelled to walk with an invariable and small degree of flexion. Yet, though the leg is stiff in walking, it may be freely moved, while the patient is sitting down.

Mr. Hey ascribed this complaint to any causes

which had the effect of hindering the condyles of the os femoris from moving truly in the hollow formed by the semilunar cartilages, and articular depressions of the tibia; an unequal tension of the lateral, or crucial ligaments; or some slight derangement of the semilunar cartilages. (*Pract. Obs.* p. 333. ed. 2.) Sir A. Cooper says, the most frequent cause of the accident is the point of the foot, while averted, striking against any projection, when pain is immediately felt in the knee, and the patient becomes incapable of perfectly extending the leg. He has also known the case produced by a person suddenly turning in bed, and the clothes not suffering the foot to turn as quickly as the rest of the body. A sudden twist of the knee inwards may also displace the semilunar cartilages.

Sir A. Cooper gives the following explanation of the case:—The semilunar cartilages are united to the tibia by ligaments, which, when relaxed, allow the cartilages to be easily pushed from their natural situation by the condyles of the femur, which then come into contact with the head of the tibia; and now, upon an attempt being made to extend the leg, a complete movement of this kind is prevented by the edges of the semilunar cartilages. (*Surgical Essays*, part ii. p. 76.) In several examples recorded by Mr. Hey, a cure was effected by placing the patient upon an elevated seat, extending the joint, while one hand was placed above the knee, and then suddenly moving the leg backwards, so as to make as acute an angle with the thigh as possible. (*Pract. Obs.* p. 337, &c.) This manœuvre seems to have the effect of restoring the semilunar cartilages to their natural position. Sometimes, however, it will not answer; and, in one such case, mentioned by Sir A. Cooper, the patient used to accomplish the reduction by sitting upon the ground, and then bending the thigh inwards and pulling the foot outwards. A knee-cap laced tightly, and furnished with a strong leather strap just below the patella, was requisite in this instance for preventing a return of the displacement. In another case, subject to frequent relapses, these were at length hindered by a bandage with four rollers attached to it, which were tightly applied above and below the patella. (*Sir A. Cooper, Surgical Essays*, part ii. p. 77.)

Compound dislocations of the knee generally demand immediate amputation.

DISLOCATIONS OF THE FIBULA.

According to Sir A. Cooper, luxations of the upper head of the fibula, from relaxation of the ligaments, are more frequent than those from violence. The head of the bone is thrown backwards. The bone is easily replaced, but immediately slips behind the tibia again. When the case is attended with disease, repeated blisters are recommended; and, afterwards, a strap to confine the bone in its natural situation. (*Surg. Essays*, part ii. p. 105.) In other instances, a roller, a compress applied over the head of the fibula, and a splint along this bone, would be proper. (*Boyer, Mal. Chir.* t. iv. p. 374.) The latter author has seen a displacement of the whole fibula upwards, accompanying a dislocation of the foot outwards. This case must be exceedingly unfrequent, as it is resisted not only by the ligaments of the upper joint of the fibula, but also by

these very strong ligamentous bands, which bind the malleolus externus to the astragalus and os calcis. In all the cases which I have seen, the pressure of the astragalus, when driven outwards, has broken the fibula. In the instance mentioned by Boyer, the double luxation of the fibula was readily reduced, by rectifying the position of the foot, and bringing the astragalus into its proper place again with respect to the tibia.

DISLOCATION OF THE FOOT.

The tibia may be dislocated from the astragalus inwards, or outwards; forwards, or backwards; and either of these luxations may be complete or incomplete. The dislocation inwards is the most common; the foot being thrown outwards, and its inner edge resting upon the ground, while the fibula is broken about two or three inches above the ankle. Upon dissection, as Sir A. Cooper observes, the end of the tibia is found resting upon the inner side of the astragalus; and, if the accident has been produced by a jump from a considerable height, the lower end of the tibia, where it is connected to the fibula by ligament, is split off, and remains attached to the latter bone. The broken end of the fibula itself is carried down upon the astragalus, occupying the natural situation of the tibia. The malleolus externus remains in its natural situation, with two inches of the fibula, and the piece of the tibia, which is split off. The capsular ligament, attached to the fibula, and the three strong fibular tarsal ligaments, are uninjured. (*Surgical Essays*, part ii. p. 107.)

One thing very essential to be understood in this case, is, that the fracture of the fibula is here the first mischief, without which the dislocation could not have happened. The fibula may easily be fractured without any luxation of the foot, but the above-described dislocation can never take place unpreceded by a fracture of the fibula; and, grave and serious as the displacement of the joint is, it is always a secondary event. (*Dupuytren, Annuaire Méd. Chir.* 1819. p. 3.)

It was to this particular case, joined with the fracture of the fibula, that Mr. Pott drew the attention of surgeons, as affording a striking example of the benefit derived from relaxing the muscles: I mean the instance, in which, "by leaping or jumping, the fibula breaks within two or three inches of the lower extremity. When this happens, the inferior fractured end of the fibula falls inwards towards the tibia; that extremity of the bone which forms the outer ankle is turned somewhat outward and upward; and the tibia having lost its proper support, and not being of itself capable of preserving its true perpendicular bearing, is forced off from the astragalus inwards; by which means, the weak bursal, or common ligament of the joint, is violently stretched, if not torn, and the strong ones, which fasten the tibia to the astragalus and os calcis, are always lacerated; thus producing, at the same time, a perfect fracture and a partial dislocation, to which is sometimes added a wound in the integuments, made by the bone at the inner ankle. By this means, and indeed as a necessary consequence, all the tendons which pass behind or under, or are attached to the extremities of the tibia and the fibula, or os calcis, have their natural direction and disposition so altered, that, instead of perform-

ing their appointed actions, they all contribute to the distortion of the foot, and that by turning it outward and upward."

When this accident is accompanied, as it sometimes is, with a wound of the integuments of the inner ankle, and that made by the protrusion of the bones, the danger and difficulties of the case are seriously increased.

"By the fracture of the fibula, the dilatation of the bursal ligament of the joint, and the rupture of those which should tie the end of the tibia firmly to the astragalus and os calcis, the perpendicular bearing of the tibia on the astragalus is lost, and the foot becomes distorted; by this distortion the direction and action of all the muscles already recited are so altered, that it becomes (in the usual way of treating this case) a difficult matter to reduce the joint; and, the support of the fibula being gone, a more difficult one to keep it in its place after reduction. If it be attempted with compress and strict bandage, the consequence often is a very troublesome, as well as painful ulceration of the inner ankle, which very ulceration becomes itself a reason why such a kind of pressure and bandage can be no longer continued; and if the bone cannot be kept in its place, the lameness and deformity are such as to be very fatiguing to the patient, and to oblige him to wear a shoe with an iron, or a laced buskin, or something of that sort, for a great while, or perhaps for life.

"All this trouble, pain, difficulty, and inconvenience, are occasioned by putting and keeping the limb in such position as necessarily puts the muscles into action, or into a state of resistance, which in this case is the same. This occasions the difficulty in reduction, and the difficulty in keeping it reduced; this distorts the foot; and by pulling it outward and upward, makes that deformity which always accompanies such accident: but if the position of the limb be changed; if, by laying it on its outside, with the knee moderately bent, the muscles forming the calf of the leg, and those which pass behind the fibula, and under the os calcis, are all put into a state of relaxation and non-resistance, all this difficulty and trouble do in general vanish immediately; the foot may easily be placed right, the joint reduced, and by maintaining the same disposition of the limb, everything will in general succeed very happily, as I have many times experienced." (*Pott*.)

I think the profession are much indebted to Sir A. Cooper, for his application of terms to dislocations of the ankle, which are liable to no mistake, or confusion. Thus, when he speaks of a dislocation of the tibia inwards or outwards, backwards or forwards, the case spoken of is immediately known. On the contrary, when authors write about dislocations of the ankle, or foot, in any named direction, their meaning may be various and misinterpreted. We find this exemplified in Dupuytren's valuable memoir on fractures of the lower end of the fibula; for, instead of terming the above case, a dislocation of the foot outwards, as the generality of writers have done, he thinks it should be named a dislocation of the foot inwards, on account of the direction in which the astragalus is carried. (*Annuaire Méd. Chir.* p. 3. 1819.)

With respect to the treatment of the preceding case, Dupuytren admits that Pott's method easily effects a reduction, though incapable of maintain-

ing it, and consequently he prefers a method of treatment, which will be explained in the part of the article FRACTURE, relating to fractures of the fibula. Sir A. Cooper adopts Pott's principles; but gives one essential piece of advice, which is, that the splint upon which the outer part of the limb rests, may have a foot-piece, "to give support to the foot, prevent its eversion, and preserve it at right angles with the leg. If much inflammation succeeds, leeches are to be applied to the parts, and the constitution will require relief by taking blood from the arm." (*Surgical Essays*, part ii. p. 108.)

When the tibia is dislocated outwards, the internal lateral ligaments are always ruptured, or pulled away from the bones, and the inner malleolus broken previously to the fracture of the fibula. On a part of this statement, however, Dupuytren and Sir A. Cooper differ, as the latter mentions, that the deltoid ligament remains unbroken. In some cases, he says, the fracture is not confined to the malleolus, but passes obliquely through the articular surface of the tibia, which is thrown forwards and outwards upon the astragalus, in front of the malleolus externus. Sometimes, the astragalus is fractured, and the lower extremity of the fibula broken into several splinters. He states, also, that when the fibula is not broken, the external lateral ligaments are ruptured. The foot is thrown inwards, its outer edge resting upon the ground; while a considerable projection is made by the malleolus externus under the skin. The accident is generally caused by the passage of the wheel of a carriage over the leg, or a violent twist of the foot inwards in jumping, or falling. (*Sir A. Cooper*, vol. cit. p. 113.)

The reduction is accomplished by relaxing the muscles of the calf, making extension in the axis of the leg, and pressing the lower head of the tibia inwards towards the astragalus. "The limb is to be laid upon its outer side, resting upon a splint with a foot-piece, and a pad is to be placed upon the fibula just above the outer angle, and extending a few inches upwards, so as in some measure to raise that portion of the leg, and prevent the tibia and fibula slipping from the astragalus, as well as lessen the pressure of the malleolus externus upon the integuments." (*Surg. Essays*, part ii. p. 113.) Sir A. Cooper also enjoins paying the strictest attention to hindering the foot from being twisted inwards, or pointed downwards.

A complete dislocation of the lower head of the tibia forwards cannot happen without the tibia being first broken, and either the base of the malleolus internus fractured, or its point torn away. The foot being then acted upon by the extensor and flexor muscles, and unrestrained by the malleoli and their ligaments, yields to the powerful operation of the muscles of the calf; the astragalus passing behind the tibia, while this projects forward under the tendons and skin of the instep. (*Dupuytren, Annuaire Méd. Chir.* p. 187. 4to. Paris, 1819.) The foot of course is much shortened, the heel lengthened, and firmly fixed, and the toes point downwards. Upon dissection, the tibia is found to rest upon the upper surface of the os naviculare, and os cuneiforme internum. The anterior part of the capsular ligament is torn through; the deltoid ligament is only partially lacerated; and the three ligaments of the fibula

remain unbroken. (*Sir A. Cooper*, vol. cit. p. 109.)

This case is much more difficult of reduction than the instance in which the foot is thrown inwards; and the cause is owing to the powerful manner in which the muscles resist the extension of the parts, and placing them in their natural position again. As Dupuytren observes, it is true that such resistance may be lessened by relaxing the muscles, and drawing the patient's attention from his limb; plans, which fully answer for the reduction of the above-mentioned case; yet, in that now under consideration, they are insufficient, and here a greater effort is required to bring the foot from behind forwards, and to place the astragalus under the tibia. And, a still greater difficulty is to keep the parts reduced during the time necessary for the fibula and torn ligaments to be firmly united. In fact, the upper surface of the astragalus, which is convex from behind forwards, is so slippery, that it is hard to make the tibia rest securely on the articular pulley of that bone, which is itself incessantly acted upon by the extensor muscles of the leg, so as to have a tendency to slip behind the lower head of the tibia. In addition, therefore, to the bent posture, Dupuytren deems it necessary here to employ an apparatus, which propels the foot forward, and the lower head of the tibia backwards. (*Annuaire Méd. Chir.* p. 188.)

Sir A. Cooper prefers keeping the limb upon the heel, resting upon a pillow. A splint, with a suitable pad, and a foot-piece, is to be applied to each side of the leg, care being taken to keep the foot well supported at a right angle with the leg. (*Surgical Essays*, part ii. p. 110.)

I have no doubt that placing the limb on M'Intyre's apparatus, as done at the North London Hospital; is quite as good a method of treating all dislocations of the ankle, with fracture of the fibula, as any yet proposed, not excepting even that of Dupuytren; which will be noticed in the article FRACTURE.

Besides the complete dislocation of the tibia forwards, a partial case is sometimes met with, where one half of the articular surface of the bone rests upon the os naviculare, and the other on the astragalus. According to Sir A. Cooper, the fibula is broken; the foot appears but little shortened; nor is there any considerable projection of the heel. The foot points downwards; it cannot be put flat on the ground, and is nearly stiff; and the heel continues drawn up. The accident, if not detected and rectified in its early stage, afterwards admits of no relief; the change in the state of the muscles, and the position in which the fibula has united, not suffering any reduction, even though great force be employed.

Dislocations of the tibia, forwards or backwards, are not common: during fifteen years, Dupuytren has scarcely met with two or three cases; though he has seen some hundreds of lateral dislocation. It must be obvious to every body, says he, that when the foot is violently bent, or extended, many powerful muscles resist the movement in question, and prevent the mischief, with which the articulation is threatened. (*Annuaire Méd. Chir. des Hôpitaux de Paris*, p. 34.) A luxation of the tibia from the astragalus backwards, Sir A. Cooper has never had an opportu-

nity of observing; a proof of the rarity of the accident.

A luxation of the astragalus, either simple, or complicated with a laceration of the integuments, as Mr. Hey has remarked, is an accident which does not often occur. Above, the astragalus is articulated with the tibia and fibula; below, it is united, by means of a capsular ligament, to the os calcis; while, in front, it is connected to the os naviculare by a capsular, and broad internal lateral ligament. Thus situated, it is evident, that its displacement is not likely to happen with great frequency; yet this observation must be received only as a comparative one; for, the cases of dislocation of the astragalus, now upon record, are rather numerous.

When a dislocation of the lower head of the tibia is combined with one of the astragalus from the os calcis, and os naviculare, and the ligaments, which kept these bones together, are nearly destroyed, while a considerable portion of the astragalus itself protrudes through the wound in the integuments, if it be judged prudent to attempt the preservation of the limb, it is best perhaps to imitate Desault, Ferriand, Trye, and Evans, and extract the astragalus altogether.

A luxation of the astragalus, unattended with a wound in the skin, is a serious and embarrassing accident; for, in general, the reduction is so difficult, that it is not many years since the case was deemed a ground for amputation. (See *Goock's Chir. Cases, &c.*) When the displacement in question happens, the astragalus is generally thrown forwards upon the os naviculare, forming a tumour on the instep, and inclining a little either to the outer or inner side of the foot. In many cases of this description, the reduction is found to be impracticable. Here, as Boyer

argues, the impediment does not depend upon the head of the bone being constricted in the narrow opening of the capsule; but rather upon the impossibility of making the extending force, and the pressure of the surgeon's hands, operate with much effect upon the displaced bone. However, an example is recorded by Desault, where the reduction was accomplished by dividing the skin, and then extending the incision through a part of the ligaments. In the *Journ. de Chir.* another case is also related of a simple dislocation of the astragalus from the os calcis, and os naviculare, where the reduction was easily performed by common means. Boyer conceives it probable, that, in these cases, most of the ligaments, uniting the astragalus to the os calcis, and os naviculare were ruptured, and that the first of those bones was therefore sufficiently moveable to admit of being replaced by the pressure of the fingers. But, the luxated astragalus may be so wedged between the tibia, os calcis, and os naviculare, that its reduction is impossible, as Boyer has actually seen. In the case, here referred to, things were left to take their course, except that every possible means was employed to keep off inflammation. The result was, that the skin covering the projection of the astragalus at the inner and upper part of the foot, sloughed, and amputation was at length deemed necessary. (*Med. Chir. t. iv. p. 401.*) A similar example is recorded by Sir Astley Cooper. (*On Dislocations, p. 360.*) In another case, pressure was made with a tight bandage on the prominence of the astragalus, and

the soft parts over it became gangrenous; yet, a recovery followed without amputation, all the projecting portion of the astragalus having gradually come away in fragments. (*Hey's Pract. Obs. p. 384. ed. 2.*) In an instance published, by Dupuytren, a person dislocated the astragalus by alighting with great violence upon the heel, the bone being driven forwards by the pressure which it had sustained between the tibia and os calcis, so as to form a protuberance under the skin of the instep. As the reduction was found impracticable, a cut was made down to the displaced bone, with the intention of extracting it; but, Dupuytren found that he could not remove it so readily as he expected; nor could he replace it; and it was not till after a tedious operation that he succeeded in taking it away. The difficulty arose from the upper surface of the bone being turned downwards, while the back projection of what was naturally the lower part of it took hold of the tibia in the manner of a hook. (*Annuaire Méd. Chir. des Hôpitaux de Paris, 1819. p. 28.*)

In another publication, two cases of dislocation of the astragalus are related. One was a simple luxation of the astragalus inwards, the os calcis, and rest of the foot being thrown outwards. The reduction was easily performed by fixing the knee, then extending the foot gently and directly from the leg, by laying hold of the heel with one hand, and placing the other on the dorsum of the foot; and lastly, by pressing the foot inwards, whilst counter-pressure was made with the knee upon the opposite side of the lower extremity of the tibia. The other instance, alluded to, was a compound luxation, in which the astragalus was displaced outwards, and the other tarsal bones thrown inwards. Reduction was accomplished, first by bending the leg so as to relax the muscles, and then by extending the foot, as above explained, and rotating it outwards. (*Sir A. Cooper, Surgical Essays, part ii. p. 207.*)

Until Mr. B. Phillips recorded two instances of complete dislocation of the astragalus backward, no account of such a displacement had been published. One case happened in a gentleman, who threw himself from a carriage, in consequence of the horses becoming unmanageable, and he alighted on his feet, but immediately fell. A projection presented itself first above the os calcis; the tendo Achillis was pressed backwards by the displaced astragalus; and, at one point, had reached to so near the surface, that vesication was produced directly over it. There was no fracture of the tibia, or fibula; the tibia was slightly displaced forwards upon the foot, and the os calcis retained its natural position. The reduction was found impracticable; but, in the end, an articulation was formed between the bones of the leg and the os calcis, and the patient was able to walk nearly upright. The second example occurred in a gentleman, who, as he was running with great rapidity after a cricket-ball, placed his foot in a gutter. "The toe rested upon the further side of this gutter, while the heel was jammed directly into it, and he fell forward. The appearances were very similar to those of the preceding case. Some attempts at reduction having proved ineffectual, and the foot being much swollen, Mr. Phillips declined to repeat them, and treated the case with leeches, quistude, &c. In the end, scarcely any lameness re-

mained; though at the time when the particulars were written, the patient was obliged to wear a shoe, the hinder part of which was constructed so as not to make pressure on the projecting astragalus. (See *Lond. Med. Gazette*, vol. xiv. p. 596.)

By heavy weights falling upon the foot, a dislocation is sometimes produced at the transverse joint between the astragalus and os calcis behind, and the os naviculare and os cuboidei in front.

Sir A. Cooper has twice seen the os cuneiforme internum dislocated, and, in both cases, the head of the bone naturally connected to the os naviculare projected inwards and somewhat upwards, being drawn in this direction by the action of the tibialis anticus muscle. In neither instance was the reduction accomplished; and, in one, the patient had so trivial a lameness, that the functions of the foot were expected to be in time perfect again. (*Surgical Essays*, part ii. p. 209.) With regard to the treatment, Sir Astley Cooper recommends, first, confining the bone in its place with a roller, kept wet with spirits of wine and water, and, when the inflammation is subdued, he directs a leather strap to be buckled round the foot, so as to maintain the bone in its right situation. (*On Dislocations*, p. 384.)

The phalanges of the toes are sometimes dislocated, and the first bone of the great toe is frequently luxated from the first metatarsal bone; but, I am not aware, that these cases are attended with any particular difficulty in the reduction, like some dislocations of the thumb.

On the subject of Dislocations, consult *A. Flach*, de Luxatione Ossis Femoris rarioris, frequentiore Colli fractura, Disp. Argent. 1783. *H. Linguel*, Questio, &c. An in Humeri Luxatione Ambipotius quam Scala, Janna, Polyspastisque iteratio renovata? Paris, 1732. *G. C. Reichel*, Diss. de Epiphysium ab Ossium Diaphysi Ductio, Lips. 1759. *J. L. Petit*, Traité des Maladies des Os, 1725; et Traité des Mal. Chir. 1783. *Duvernoy*, Traité des Maladies des Os. *Richerand*, Nosographie Chir. t. 3. p. 193, &c. edit. 4. *Olivres* Chir. de Desault, par Bichat, t. 1. *Pott's* Remarks on Fractures and Dislocations, 1775. *Kirkland's* Obs. upon Pott's General Remarks on Fractures, &c. *White's* Cases in Surgery. Medical Obs. and Inquiries, vol. ii. *Brownfield's* Chir. Cases and Obs. 1773. *J. F. P. Castella*, Sur les Fractures du Pécéré, Landshut, 1808. *Sir C. Bell*, A System of Operative Surgery, 1809. *J. Horseship*, Practical Observations on Surgery and Morbid Anatomy, 8vo. Lond. 1816. *Cutbush*, Systema Chirurgiæ Medicinæ, t. ii. *Desault's* Journ. de Chirurgie. *Boyer*, Traité des Mal. Chir. t. iv. Paris, 1814. *Tyge's* Illustrations of some of the Injuries to which the lower Limbs are exposed, &c. 4to. Lond. 1802. *Mothé*, Mélanges de Chir. &c. Paris, 1812, 1827. *H. Hey*, On Dislocations and Internal Derangement of the Knee-joint, in Pract. Obs. in Surgery, ed. 2. *Duvernoy*, sur la Fracture de l'Extrémité inférieure du Pécéré, les Luxations, et les Accidents, qui en sont la Suite, in Annuaire Médico-Chir. des Hôpitaux de Paris, 1809, & in Leçons Orales de Clin. Chir. t. i. p. 189. De la Luxation des Vertèbres et des Maladies, qui la simulent, Op. cit. t. i. p. 379; also des Luxations de l'Humerus, Op. cit. t. iii. p. 77; de la Luxation Originelle des Femurs, Op. cit. t. iii. p. 205. De la Fracture de l'Extrémité inférieure de l'Humerus simulant la Luxation du Coude en arrière, Op. cit. t. iii. p. 393. Des Fractures de l'Extrémité inférieure du Radius simulant les Luxations de Polgnet, Op. cit. t. iv. p. 161. Des Luxations de l'Extrémité inférieure du Cubitus, Op. cit. t. iv. p. 503. *Rust*, in Magaz. für die Gesamte Heilkunde, t. x. *Ph. Crampton*, on the Pathology of Dislocations of Shoulder in Dublin Journ. of Med. Science, No. 7. and 8. *Dr. James Scott*, On Dislocation of Hip, with manner of Reduction and Appearances on Dissection; Dublin Hospital Reports, vol. 3., p. 389. *C. H. Todd*, Dissection after recent Dislocation, Op. cit. vol. iii., p. 395. *Wm. Wallace*, Dissection of a Dislocated Hip, Trans. of King's and Queen's College of Physicians, vol. v., p. 250. *Thos. Wornall*, in Lond. Med. Gaz. for 1836-37. *J. F. Malgaigne*, Gaz. Méd. de Paris, 1 Sept. 1832; and in Mém. de l'Acad. Royale de Médecine, t. 5. p. 143. *G. F. D. Evans*, on Cataract, Closed Pupil, Amp. at the Shoulder, &c. and Compound Dislocations,

8vo. Wellington, 1815. *Astragalus removed*; shattered end of the fibula sawn off; protruded lower end of the humerus similarly removed; a compound dislocation of the shoulder-joint, and head of the metacarpal bone of the thumb, dislocated, in two instances, towards the palm, and, on account of the difficulty of reduction, exposed by an incision, and sawn off. *Sir Astley Cooper*, Bart., in Surgical Essays; and Treatise on Dislocations and Fractures of the Joints, a work which abounds in practical information, and does infinite credit to the talents and industry of its experienced author. *J. Cruveilhier*, a spontaneous Dislocation of the first vertebra from the second, and of the occiput; in Anat. Pathol. Livr. 25. Fol. Paris, 1836.

DISTICHIA, or DISTICHIASIS, (from $\delta\iota\varsigma$, twice, and $\sigma\tau\iota\chi\omicron\varsigma$, a row). A double row of eyelashes, the innermost ones of which irritate the eye. The pseudo-cilia, which grow in distichiasis, seldom occupy the whole length of the eyelid; but are mostly scattered about between the natural place of the cilia and the Meibomian apertures. (See TRICHIASIS.)

DURA MATER, FUNGUS TUMOURS OF. The disease arises gradually, in the form of a tumour, which makes its way through the bones of the cranium, and insensibly blends itself with the integuments, which seem, as it were, to make a part of it. Fungous tumours of the dura mater may originate spontaneously at any part of this membrane; but they are particularly apt to grow on the surface, which is adherent to the upper part of the skull, or to its basis. They are firm, indolent, and chronic, seeming as if they were the consequence of slow inflammation, affecting the vessels, which supply the dura mater, and inosculate with those of the diploe. It is very difficult to determine, whether the disease begins in the dura mater, or the substance of the bone itself. The general belief, however, is that the bone is affected secondarily, and that the disorder originates in the dura mater. The patient, the subject of the first case, related by M. Louis, imputed the complaint to a fall, which he had met with four or five months previously, and in which the head itself had not received any violence; but, from this time, he experienced a stunning sensation, which continued till he died. The cranium and dura mater were found both equally diseased. Though this case may tend to prove, that fungous tumours of the dura mater may form spontaneously, yet, it is not the less confirmed by a vast number of cases, that this affection more frequently follows blows on the head, than any other cause. Hence, a slow kind of thickening of the dura mater is produced, which ends in a sarcomatous excrescence; the formation of which always precedes the destruction of the bone. In the memoir, published by M. Louis in the fifth volume, 4to. of those of the Royal Academy of Surgery, there is a very interesting case, illustrating the nature of the present disease.

The subject was a young man, aged twenty-one, who had a considerable tumour on the left side of the head, which was taken for a *hernia cerebri*. (See this Article.) The swelling had begun in the region of the temple, and had gradually acquired the magnitude of a second head. The external ear was displaced by it, and pushed down as low as the angle of the lower jaw. At the upper part of the circumference of the base of the tumour, the inequalities of the perforated bone, and the pulsations of the brain, could be distinctly felt. Some parts of the mass were elastic and hard; others soft and fluctuating. A plaster, which had been applied, brought on a suppuration at some points,

from which an ichorous matter was discharged. Shiverings and febrile symptoms ensued, and the man died in less than four months, in the year 1764. On dissection, a sarcomatous tumour of the dura mater was detected, together with the destruction of the whole portion of the skull, corresponding to the extent of the disease.

When a tumour of this nature has decidedly formed, it makes its way outward through all the parts, soft or hard, which are opposed to it. The swelling, in becoming circumscribed, is partly blended with the dura mater, and its pressure produces an absorption of such parts of the skull, as oppose its enlargement. It unexpectedly elevates itself externally, confounding itself with the scalp, and presents itself outwardly in the form of a preternatural, soft, yielding swelling, which even sometimes betrays an appearance of a decided fluctuation, or a pulsation, which may make it be mistaken for an aneurismal tumour. When once the swelling has made its exit from the cavity of the cranium, it expands on every side under the integuments, which readily make way for its growth. The scalp becomes distended, smooth, and cedematous over the extent of the tumour, and lastly it ulcerates. The matter, discharged from the ulcerations, is thin and sanious: the outer part of the tumour is confounded with the integuments and edges of the skull, on which it rests, so that, in this state, it is easy to mistake the tumour for one, whose base is altogether external. While the swelling thus increases in size externally, it also enlarges internally. The latter change takes place, in particular, while the opening in the cranium is not large enough to admit the whole mass of the tumour, which then depresses the brain, and lodges in an excavation, which it forms for itself. But this cavity quickly diminishes, and becomes reduced almost to nothing, as soon as the tumour projects outwardly. The tables of the skull are absorbed to let the swelling arrive externally; but, it is remarked, that the internal, or vitreous table, is always found much more extensively destroyed, than the external one. Sometimes, new bony matter is found deposited around the opening in the cranium.

It is asserted, that, whatever may be the situation of a fungous tumour of the dura mater, the outer layer of this membrane, upon which the disease forms, is alone altered, the inner layer and the pia mater being always unchanged. (*Lassus, Pathologia Chirurgicale*, tom. i. p. 501. éd. 1809.)

In one of these cases, detailed by Walther, the inner layer of the dura mater was quite natural, though one-half of the tumour, which was large, was within the skull, where it had formed for itself a deep excavation in the posterior lobe of the brain. And, what is remarkable, notwithstanding this latter change, the patient, the day before her death, retained all her intellectual faculties, and the power of voluntary motion. (*Journ. für Chirurgie von C. Graefe und Ph. v. Walther*, b. i. pp. 64, 65., 8vo. Berlin, 1820.)

According to surgical writers, fungous tumours of the dura mater have been caused by contusions on the skull, falls on the buttocks, concussions of the head or whole body, lues venerea, scrofula, inveterate rheumatism, &c. The three last of the alleged causes, however, seem to be little better than mere conjecture.

Even children of the most tender years are liable

to the disease. M. Louis has related, that a child, two years of age, died of a fungous of the dura mater, which had produced a swelling above the right ear, attended with a destruction of a portion of the parietal and temporal bones. (*Mém. de l'Acad. de Chirurgie*, tom. v. 4to. p. 31.)

Though the common opinion is, that these fungi grow entirely from the dura mater, Sandifort asserts, that the vessels of the diploe have a considerable share in their production. (*Descriptio Musei Anat. Acad. Lugd. L. i. p. 152.*)

A similar belief was entertained by Heister and Kaufmann, and is espoused by Siebold and Walther, the latter imputing the disease to a simultaneous affection of the vessels of the dura mater, and pericranium, attended with an absorption of the earthy part of the bone. (*Journ. für Chr. von C. Graefe, &c.* p. 91—93.) M. Chelius has written an essay, in which a distinction is established between tumours commencing in the bone, and others beginning in the dura mater itself. (See *Archives de Méd.*; Murs, 1832.)

The existence of a fungous tumour of the dura mater cannot be ascertained, so long as there is no external change. The effects, produced, may originate from so many causes, that there would be great risk of a gross mistake in referring them to any particular ones. This is not the case, when there is an opening in the skull. Then a hardness, felt from the very first at the circumference of the tumour, denotes that it comes from within. When the swelling is carefully handled, such a crackling sensation is perceived, as would arise from touching dry parchment stretched over the skin. On making much pressure, pain is occasioned, and sometimes a numbness in all the limbs, stupefaction and other more or less afflicting symptoms. The tumour, in some measure returns inward, especially, when not very large, and gradually rises up and outward again, when the pressure is discontinued. Sometimes there is pain; at other times, there is none; which may be owing to the manner, in which the tumour is affected by the edges of the bone, through which it passes. The pain is often made to go off by compression, but returns as soon as this is taken off. The tumour has an alternate motion, derived from the pulsation of the brain, or of the large arteries at its base. This throbbing motion has led many practitioners to mistake the disease for an aneurism, as happened in the second case, related in the memoir of M. Louis. When the tumour is pushed sideways, and the finger carried between it and the edge of the bone, through which the disease protrudes, the bony edge may be felt, touching the base of the swelling, and more or less constricting it. This symptom, when distinguishable, added to a certain hardness and elasticity, and sometimes a facility of reduction, forms a pathognomonic mark, whereby fungous tumours of the dura mater may be discriminated from herniæ of the brain, external fleshy tumours, abscesses, exostosis, and other affections, which at first sight resemble them.

Probably, however, some variety prevails in different instances; for, in the cases recorded by Walther, there was no pulsation, strictly so called, but merely an obscure movement, or an alternate distension and flaccidity, arising from the influx of blood into the vessels of the diseased mass; the tumours could not be pushed within the cranium

in the slightest degree; nor did the attempt cause any of the effects usually observed to proceed from pressure on the brain. No aperture could be felt in the skull, much less could the irregular edges of the bone around the tumour be distinguished. (*Journ. für Chir. b. i. p. 57—61, &c. 8vo. Berlin, 1820.*)

Whatever movements also were perceptible in the swellings, Walther is convinced could not be communicated to them by the pulsations of the subjacent brain; because they were wedged, as it were, in an aperture in the skull, and adherent to the dura mater beneath them, and to the superincumbent periosteum, so that, even in the dead subject, they did not admit of being pushed in the least outwards without difficulty, and the employment of strong pressure. (Vol. cit. p. 57.)

Indeed, this tight constriction of the tumour not only explains why stupor, paralysis, &c. were not brought on in these particular examples by external pressure, but also why the edges of the hole in the skull could not be felt; and the small size of the same opening, in relation to the magnitude of the swelling, fully accounts in my opinion for the circumstance of the swelling not sinking inwards under pressure. But, I am far from being convinced with Walther, that fungi of the dura mater are in their nature always irreducible (see vol. cit. p. 82.); a belief, which he grounds upon the connection of the diseased mass with the vessels of the diploe; its constriction by the bone; and its expansion under, as well as above, the cranium. Here I think Walther is as wrong in saying, that none of these fungi can possibly be reduced, as others would be in asserting that it is their invariable character to be reducible. These differences must chiefly depend upon the size of the swelling, in relation to that of the aperture in the skull.

Generally speaking, fungous tumours of the dura mater are very dangerous, as well on account of their nature, as of the difficulty of curing them in any certain manner, and of the internal and external disorder, which they may occasion. Such as have a pedicle, the base of which is not extensive; which are firm in their texture, without much disease in the surrounding bone, are moveable, not very painful, and in persons, who are in other respects quite well, are in general reputed to be the least perilous. These are the cases, in which a cure may be attempted, with a hope of success, though the event is always exceedingly doubtful.

When the contrary of what has been just related occurs, when the disease is of long continuance, and the brain already affected, nothing favourable can be expected.

Compression is the most simple means of cure, and that which has naturally occurred to such practitioners, as have mistaken the disease for an aneurism, or a hernia cerebri. The efficacy of this method has been further misconceived, because the tumour, when not very large, has sometimes been partly, or even wholly reduced, without any bad consequences. This had no little share in leading to errors, concerning the true character of the disease. But, as might be conceived, this reduction only being attended with temporary success, and having no effect whatever on the original cause of the affection, the symptoms returned, and the tumour rose up again, the moment the compression was discontinued. There is a fact in the memoir

of M. Louis, which seems to evince, that good effects may sometimes be produced by compression judiciously employed. A woman, brought to the brink of the grave by the symptoms, occasioned by a tumour of the above kind, having rested with her head, for some time, on the same side as the tumour, found the swelling so suddenly reduced, without any ill effects, that she thought herself cured by some miracle. Compression artfully kept up, by means of a piece of tin, fastened to her cap, prevented the protrusion of the tumour again. The pressure, however, not having been always very exact, the symptoms every now and then recurred, while the tumour was in the act of being depressed again, and they afterwards ceased, on the swelling having assumed a suitable position. The symptoms were, doubtless, occasioned by the irritation, which the tumour suffered, in passing the inequalities around the opening, through which it protruded. The patient lived in this state nine years, having every now and then fits of insensibility, in one of which, attended with hiccough and vomiting, she perished.

As compression cannot be depended upon, the following safer method may be tried:—It consists in exposing the tumour with a knife, which is certainly preferable to caustics, the action of which is very tedious and painful, and can never be limited or extended with any degree of precision. A crucial incision may be made through the scalp covering the tumour, and the flaps dissected up, and reflected, so as to bring all the bony circumference into view. Then with trephines repeatedly applied, or with what would be better, Mr. Hey's saws, all the margin of the bone should be carefully removed. Now, if it be true, that the vessels of the diploe are chiefly concerned in the supply of the diseased mass, we see that this source of its growth must be destroyed by the foregoing proceeding.

The tumour, thus disengaged on all sides, may be cut off with a scalpel; and such arteries as bleed much should be tied. Then, instead of applying caustic, as sometimes advised, perhaps, it would be better to remove every part of both layers of the dura mater immediately under the situation of the excrescence. By this means, and the removal of the surrounding bone and diploe, all chance of the regeneration of the tumour would be prevented. In attempting the excision of a fungous of the dura mater, it is certainly an interesting point to know, whether the tumour has an intimate vascular connection with the diploe, and pericranium, as asserted by Siebold, Walther, and some other respectable authorities; though the importance of the information on this subject to the practitioner is somewhat lessened by his being aware, that it is necessary always to begin with sawing away the bone in the immediate vicinity of the diseased mass. In the dissection of one case, Walther found the pericranium thickened for a considerable extent around the disease, and closely connected with the tumour by vessels. (Vol. cit. p. 100.)

When the tumour is sarcomatous, and its pedicle small and narrow, as sometimes happens, one should not hesitate to cut it off.

This method is preferable to tying its base with a ligature; a plan which could not be executed, without dragging, and seriously injuring the dura mater; and the fatal effects of which I saw exemplified in one case that occurred many years ago in

St. Bartholomew's Hospital, and was operated upon by the late Mr. Ramsden. Excision is also preferable to caustics, which cause great pain, and very often convulsions. In performing the extirpation, we should remove the whole extent of the tumour, and, if possible, its root, even though it may extend as deeply as the internal layer of the dura mater. This step must not be delayed, for the disease will continue to increase, so as to affect the brain, become incurable, and even mortal. It is to such decision, that we must impute the success, which attended the treatment of the Spaniard Avalos, of whom Marcus Aurelius Severinus makes mention. The above nobleman was afflicted with intolerable headaches, which no remedy could appease. It was proposed to him to trepan the cranium, an operation to which he consented. This proceeding brought into view, under the bone, a fungous excrescence, the destruction of which proved a permanent cure of the violent pains, which the disease had occasioned. It is not mentioned in this case, whether the internal layer of the dura mater was healthy, or not; but there is foundation for believing, that if the extirpation of these tumours be undertaken in time, and bold measures be pursued, as in the instance just cited, success would often be obtained. Indeed, reason would support this opinion; for, when the disease is not extensive, it is necessary to expose a much smaller surface of the dura mater.

It appears to me, however, that trepanning can never be warrantable, unless the disease be indicated by some external changes. I saw my late master, Mr. Ramsden, trepan a man for a mere fixed pain in one part of the head, on the supposition, that there was a tumour under the bone; but no tumour was found, and the operation caused inflammation of the dura mater, and proved fatal.

No doubt, in some cases, the hemorrhage will be considerable, as was exemplified in the instance in which Walther made an incision at the base of one of these fungi, in order to ascertain its nature: two pints of blood being lost from several vessels of large size ere they could be secured; and the further use of the knife discontinued.

M. Louis has described other tumours, which grow from the surface of the dura mater, when this membrane has been denuded, as after the application of the trephine. They only seem to differ from the preceding in not existing, before the opening was made in the skull. Tumours of the dura mater should not be confounded with hernia cerebri. (See this Article.)

See, on the preceding subject, *Mém. sur les Tumeurs, fungueuses de la Dure-Mère*, par M. Louis, in *Mém. de l'Acad. de Chir. t. v. 4to. Encyclopédie Méthodique, Partie Chir. art Dure-Mère. J. P. Kaufmann, de Tumeur Capitis fungoso post Carlem Cranli exorta. Helms. 1713. Lassus, Pathologie Chir. t. i. p. 497 ed. 1809. J. and C. Wenzel, über die Schwammigen Auswüchse auf der aussern Hirnhaut. Fol. Mainz. 1811. Ph. v. Walther, in *Journ. für Chir. von C. Graefe, &c. b. i. p. 55. c. 8vo. Berlin, 1820. Professor Chelius, in Archives de Méd. Mars, 1832.**

For inflammation of the dura mater, see HEAD, INJURIES OF.

DYNAMOMETER. An instrument, employed by M. Malgaigne for measuring the degree of extension made with pulleys in the reduction of dislocations. (See *Mém. de l'Acad. R. de Méd. t. v. p. 143.*) It will serve also to measure the force exerted in lithotripsy.

EAR, DISEASES OF.

An organ, so valuable and necessary to the perfection of our existence, as the ear, should have all the resources of surgery exerted for the preservation of its integrity, and the removal of the diseases, with which it may be affected. What, indeed, would have been our lot, if nature had been less liberal, and not endued us with the sense of hearing? As Leschevin has observed, we should then have been ill qualified for the receipt of instruction; a principal inlet of divine and human knowledge would have been closed; and there being no reciprocal communication of ideas, our feeble reason could never have approached perfection. Even our life itself being as it were dependent upon all such bodies as surround us, would have been incessantly exposed to dangers. The eyesight serves to render us conscious of objects, which present themselves before us, and, when we judge them to be hurtful, we endeavour to avoid them. But, to say nothing of our inability to look on all sides at once, our eyes become of no service to us, whenever we happen to be enveloped in darkness. The hearing is then the only sense, that watches over our safety. It warns us, not only of every thing, which is moving about us, but likewise of noises, which are more or less distant. Such are the inestimable advantages, which we derive from this organ. Its importance, when healthy, makes it worthy of the utmost efforts of surgery, when diseased. (See *Méd. sur les Sujets proposés pour le Prix de l'Acad. Royale de Chirurgie, t. ix. pp. 111, 112. éd. 12mo.*)

It is not many years since the diseases of the ear were a subject, on which the greatest ignorance and the most mistaken opinions prevailed; and, indeed, how could any correct pathological information be expected, while anatomists had not given a complete and accurate description of the organ itself? Also, notwithstanding what has now been made out, respecting disorders of the ear, it is generally admitted, that they still require much further investigation. Though Duverney, Valsalva, Morgagni, &c. dispelled some of the darkness, which covered this branch of surgery, they left a great deal undone. Since their time, science has been enriched with the valuable discoveries of Cotunni, Meckel, Scarpa, and Compagti; the two first of whom demonstrated, that the labyrinth is filled with a limpid fluid, and not (as was pretended) with confined air; while the two last distinguished anatomists favoured the public with the first very accurate description of the parts composing the labyrinth, especially, the semicircular canals.

In 1763, the French Academy of Surgery offered a prize for the best essay on diseases of the ear, and two years afterwards, the honour was adjudged to that of Leschevin, senior surgeon of the hospital at Rouen. This memoir is still of great value, few modern treatises being more complete. The most useful contributors to our stock of information on the pathology of the ear, subsequently to M. Leschevin, have been Ritter, and Lenten (*Ueber das schwere Gehör, Leipz. 1794*); Trampel (*Arnemann's Magaz. b. ii. 1798*); Pfingsten (*Vieljährige Erfahrung ueber die Gehörfehler, Kiel, 1802*); Alard (*Sur le Catarrhe de l'Oreille, 8vo. Paris, 1807, édit. 2.*); Sir A. Cooper (*Phil. Trans. 1802*); Portal (*Anat. Méd.*

1803); J. C. Saunders (*Anat. and Dis. of the Ear*, 1806); Boyer (*Mat. Chir.* t. vi.); Itard (*Traité des Mal. de l'Oreille*, 8vo. 2 tomes); Saissy, in an essay, which received the approbation of the Medical Society of Bourdeaux; Rosenthal in a short, but sensible tract on the pathology of the ear (see *Journ. Complém.* t. vi. 1820); and Krämer in a treatise recently published.

But, notwithstanding the laudable endeavours of so many men of eminence, the pathology of the internal ear, and the treatment of its diseases, are far, I may say, very far from a high state of improvement. To further advances, indeed, some discouraging obstacles present themselves: the auditory apparatus is extremely complicated; the most important parts of it are entirely out of the reach of ocular inspection; the anatomy of the organ is perhaps not yet completely unravelled; the exact uses and action of several parts of it, anatomically known, are still involved in mystery; the opportunities of dissecting the ear in a state of disease are neither frequent, nor duly watched; and even when they are taken, and when vestiges of disease, or imperfection are traced to particular parts of the organ, the utmost difficulty is experienced in drawing any useful practical conclusion, because the natural uses of those parts, and the precise manner in which they contribute to the perfection of the ear are not known to the most enlightened physiologists. We are here nearly in the same helpless dilemma as a watchmaker would be, were he in examining the interior of a watch, to find parts broken and out of order, the exact uses of which, in the perfection of the instrument, he had not first studied and comprehended. In fact, the physiology of the ear is but imperfectly understood; and, as Rosenthal remarks (*Journ. Complém.* t. vi. p. 17.) if, notwithstanding the progress made in optics, and the complete knowledge of the structure of the eye, a perfect explanation has not yet been given of the phenomena of this organ, as an instrument of vision, we cannot wonder, that, with far more circumscribed information about acoustics, and the greater difficulty of unravelling the structure of the ear, so little progress should have been made in the physiology of the latter organ. Were it practicable in acoustics to arrive at that precision and certainty, which would enable us to establish laws in the theory of sound, as fixed as those which relate to light, this void in physiological science might perhaps be obviated. But, Rosenthal justly argues, that hitherto the approach to perfection has not been made, and this notwithstanding the learned and valuable labours of Chladni. (*Akustik*. 4to. Leipz. 1802.) Some facts, however, are admitted to be well ascertained, and the researches of Autenrieth and Kerner (*Reil's Archiv. für die Physiol.* t. ix. p. 313—376.) are honourably mentioned; for, though they only elucidate the function of the conductor part of the ear, they are of unquestionable importance to the medical practitioner. It is clearly proved, that the difference in the length and breadth of the meatus auditorius, the form of the membrana tympani, and the make of the cavity of the tympanum, modify sound; that is to say, that the differences of structure of the auricle and meatus auditorius externus which merely receive and concentrate the sonorous undulations, as those emanate from a vibrating body, can only influence

the degree of force, or weakness of the sound; while, on the contrary, the differences of structure in the membrane and cavity of the tympanum are not limited to this effect, but the greater or less tension of the one, and the more or less considerable capacity of the other, appear to alter in a greater or lesser degree the particular character of the sound. (*Journal Complém.* t. vi. p. 20.)

1. Wounds and Defects of the external Ear.

The external ear, which is a sort of instrument calculated for concentrating the undulations or waves of sound, may be totally cut off, without deafness being the consequence. For a few days after the loss, the hearing is rather hard; but the infirmity gradually diminishes, the increased sensibility of the auditory nerve compensating for the imperfection of the organic apparatus. (*Richerand, Nosogr. Chir.* t. ii. p. 122. éd. 2.)

Dr. Hennen says, that he has met with a case, where the external ear was completely removed by a cannon-shot, and yet the sense of hearing was as acute as ever. (*Principles of Military Surgery*, p. 348. éd. 2.) Another case, recorded by Wepfer, also proves, that a total loss of the auricle may not cause any material injury of hearing, for the patient of whom he speaks had had the whole of the external ear destroyed by ulceration, and yet could hear as well as before the loss. (*Kritter und Lentin über das schwere Gehör*, p. 19. Leipz. 1794.) However, if we are to credit the statement of other writers, the recovery is generally far less complete. Thus Leschevin notices, that they who have lost the external ear, or have it naturally too flat, or ill-shaped, have the hearing less fine. The defect can only be remedied by an artificial ear, or an ear-trumpet, which, receiving a large quantity of the sonorous undulations, and directing them towards the meatus auditorius, thus does the office of the external ear. (*Prix de l'Acad. Royale de Chir.* t. ix. p. 120. édit. 12mo.)

Wounds are not the only causes, by which the external ear may be lost: its separation is sometimes the consequence of ulceration, and sometimes the effect of the bites of horses and other animals. In cold climates, it is frequently frozen, and afterwards attacked with inflammation and sloughing. When the external ear is not totally separated from the head, the surgeon should not despair of being able to accomplish the reunion of it. This attempt should always be made, however small a connection the part may have with the skin; for, in wounds of this kind, the efforts of surgery have occasionally succeeded beyond all expectation.

Wounds of the external ear, whatever may be their size and shape, do not require different treatment from that of the generality of other wounds. The reunion of the divided part is the only indication, and it may be in most instances easily fulfilled by means of methodical dressings. Such writers, as have recommended sutures for wounds of the ear (says Leschevin), have founded this advice upon the difficulty of applying to the part a bandage, that will keep the edges of the wound exactly together. The cranium, however, affords a firm and equal surface, against which the external ear may be conveniently fixed. Certainly, it is not more easy to secure dressings on the nose than the ear; and yet cases are recorded, in which the cartilaginous part of the nose was wounded, and almost entirely separated, and the union was

effected without the aid of sutures. (See *Mém. de M. Pibrac sur l'Abus des Sutures*, in *Mém. de l'Acad. de Chir.* tom. iii.)

In wounds of the ear, then, we may conclude, that sutures are generally useless and unnecessary. As examples may occur, however, in which the wound may be so irregular and considerable as not to admit of being accurately united, except by this means, it should not be absolutely rejected. An enlightened surgeon will not abandon altogether any curative plans; he only points out their proper utility, and keeps them within their right limits. When sticking plaster, simple dressings, and a bandage that makes moderate pressure, appear insufficient for keeping the edges of a wound of the ear in due contact, the judicious practitioner will not hesitate to employ sutures.

When a bandage is applied to the external ear, it should only be put on with moderate tightness, since much pressure gives considerable uneasiness, and may induce sloughing. In order to prevent those disagreeable effects, Leschevin advises us to fill the space behind the ear with soft wool or cotton, against which the part may be compressed without risk. (*Op. cit.* p. 119.)

Baron Boyer remembers a medical student, who was compelled by an ulcer on the sacrum to lie for a long time on his side, in which posture the pressure on the ear caused a slough of the antihelix, and after the separation of the dead part, an aperture, large enough to receive the end of the little finger, was left in the pinna or auricle.

In the application of sutures to the ear, the ancients caution us to avoid carefully the cartilage, and to sew only the skin. They were fearful, that pricking the cartilage would make it mortify, "*ce qui est souvent-fois arrivé*," says Paré. But, notwithstanding so respectable an authority, as Leschevin has remarked, the moderns make no scruple about sewing cartilages. In wounds of the nose, Verduc expressly directs the skin and cartilage to be pierced at once, and the success of the plan is put out of all doubt by a multitude of facts. The same treatment may also be safely extended to the ear.

In this section, a few malformations of the external ear require notice. Sometimes the orifice of the meatus auditorius is diminished by the tragus, antitragus, and antihelix being depressed into it. Here the excision of these wrongly formed eminences has been recommended, as a surer means of perfecting the sense of hearing, than the use of any tube, or dilating instruments. The tragus has been known to project considerably backwards, and to apply itself most closely over the orifice of the meatus, which was also a mere slit, instead of a round opening. In one case of this description, relief was obtained by the introduction of tubes, calculated to maintain the tragus in its proper position. (*Dict des Sciences Méd.* t. xxxviii. p. 23.)

Sometimes the outer ear is entirely wanting. Thus Fritelli has given an account of a child in this condition, whose physiognomy at the same time strongly resembled that of an ape. (*Ottolachi Giorn. di Med.* t. iii. p. 80.) Oberteuffer has also recorded an example of a total deficiency of the auricles in an adult, who yet heard very well. (*Starke's Neues Archiv.* b. ii. p. 638.) J. P. Meckel, *Handbuch der Pathol. Anat.* b. i. p. 400. (Leipz. 1812.)

I remember a child, which was exhibited many years ago in London, as a curiosity; it was entirely destitute of external ears, and no vestiges of the meatus auditorii could be seen, these openings being completely covered by the common integuments. Yet the child could hear a great deal, though the sense was certainly dull and imperfect. I recollect, that the circumstance of the patient hearing so well as he did, was what excited considerable surprise. I do not recollect, however, at the present time, the degree in which this sense was enjoyed, and several other circumstances, such as the child's age, power of speech, &c. The example is interesting, inasmuch as it proves, that even a deficiency of the auricles, combined with an imperforate condition of both ears, may be unattended with complete deafness, provided the internal and more essential parts of these organs are sound and perfectly formed.

Baron Boyer attended a young man, the lobule of one of whose ears extended in a very inconvenient manner over the cheek: the redundant portion was removed with a pair of scissors, and the wound soon healed.

The auricle, not being a very irritable part, is not often inflamed, and when it is so, the affection is generally of an erysipelatous character. Portal has seen the part nearly an inch thick; and he takes notice of the prodigious thickness, which the lobe of the ear sometimes acquires in women who wear heavy ear-rings, which keep up constant irritation. Small encysted and adipose swellings occasionally grow under the skin of the external ear, and demand the same treatment as swellings of the same nature in other situations. (See Tympanus.) Lastly, the external ear is frequently the seat of scrofulous, and other ill-conditioned ulcers. These cases generally require cleanliness, alterative medicines, and to be dressed with the ung. zinci, or the ung. hydrarg. nitrat. or a solution of the nitrate of silver; and sometimes, when the sores resist for a long time the effects of medicine and the usual dressings, they will soon heal up, if the treatment be assisted with a blister, or seton, kept open on the nape of the neck. (See *Dict. des Sciences Méd.* t. xxxviii. p. 28, 29.)

2. Of the Meatus Auditorius, and its Imperfections.

This is the passage, which leads from the cavity of the external ear, called the concha, down to the membrane of the tympanum. It is partly cartilaginous, and partly bony, and has an oblique winding direction, so that its whole extent cannot be easily seen. There are circumstances, however, in which it is proper to look as far as possible into the passage. Such is the case, when the surgeon is to extract any foreign body, to remove an excrescence, or to detect any other occasion of deafness. Fabricius Hildanus gives a piece of advice upon this subject, not to be despised; namely, to expose the ear to the rays of the sun, in order to be enabled to see the very bottom of the passage.

Mr. Buchanan recommends the patient to be placed upon a low seat, with the ear exposed to the rays of the sun. The surgeon should then lay hold of the auricle with the left hand, by placing the thumb in the concha, and with the index and middle finger of the same hand placed behind the cartilage, take hold of the cavity, and pull it outwards and upwards, so as to elongate the cartilagin-

ous part of the meatus. With the help of a slightly curved probe, by which the tragus is to be drawn a little outwards, and the diameter of the tube increased, the whole of the meatus and membrana tympani may then be distinctly seen. (See *Buchanan's Illustrations of Acoustic Surgery*, p. i.) When the assistance of sunshine cannot be obtained, and in the evening, Mr. Buchanan finds great advantage from the use of an ingenious kind of lantern, which he has invented for examining the ear, and which he terms an *inspector auris*. When it is used, the room is darkened, and the focus from the lantern directed into the meatus.

The surgical operations, practised on the meatus auditorius, are confined to opening it, when preternaturally closed, extracting foreign bodies, washing the passage out with injections, and removing excrescences.

The case which we shall next treat of, is the imperforation of the meatus auditorius externus, a defect with which some children are born.

When the malformation exists in both ears, it generally renders the subject dumb, as well as deaf, for, as he is incapable of imitating sounds, which he does not hear, he cannot of course learn to speak, although the organs of speech may be perfect, and in every respect rightly disposed. In this case, the surgeon has to rectify the error of nature, and (to use the language of Leschevin) he has to give, by a double miracle, hearing and speech to an animated being, who, deprived of these two faculties, can scarcely be regarded in society as one of the human race. How highly must such an operation raise the utility and ex-
of surgery in the estimation of the world!

When the meatus auditorius externus is merely closed by an external membrane, the nature of the case is evident, and the mode of relief equally easy. But, when the membrane is more deeply situated in the passage, near the tympanum, the diagnosis is attended with increased difficulty, and the treatment with greater trouble.

If the preternatural membrane be external, or only a little way within the passage, it is to be divided with a bistoury; the small flaps are to be cut away; a tent, of a suitable size, is to be introduced into the opening; and the wound is to be healed *secundum artem*, care being taken to keep it constantly dilated, until the cicatrization is completed.

When the obstruction is deeply situated, we must first be sure of its existence, which is never ascertained, or even suspected, till after a long while. It is not till after children are past the age, at which they usually begin to talk, that any defect is suspected in the organ of hearing, because, until this period, little notice is taken, whether they hear or not. As soon as it is clear, that this sense is deficient, the ears should always be examined with great attention, in order to discover, if possible, the cause of deafness. Sometimes, the infirmity depends upon a malformation of the internal ear, and the cause does not then admit of detection. The most convenient method of making the examination is to expose the ear, which is about to be examined, to the light of the sun. In this situation, the surgeon will be able to see beyond the middle of the bony part of the meatus, if he places his eye opposite the orifice of the passage, and takes care to efface the curvature of the cartilaginous portion of the canal, by draw-

ing upward the external ear. If the passage has been carefully cleansed, before the examination, the skin, forming the obstruction, may now be seen, unless it be immediately adherent to the tympanum.

When the preternatural septum is not closely united to the tympanum, its destruction should be attempted, and hopes of effecting the object, either suddenly or gradually, may reasonably be entertained. According to Leschevin, the particular situation of the obstruction is the circumstance, by which the surgeon ought to be guided in making a choice of the means for this operation. If the membranous partition is so far from the tympanum, that it can be pierced without danger of wounding the latter part, there can be no hesitation in choosing the plan to be adopted. In the contrary state of things, Leschevin is an advocate for the employment of caustic, not only on account of the risk of injuring the tympanum with a cutting instrument, but, also, because, if the puncture were ever so well executed, a tent could not be introduced into it, so as to prevent it from closing again.

In the first case, a very narrow sharp-pointed bistoury should be used: after its blade has been wrapped round with a bit of tape to within a line of the point, it is to be passed perpendicularly down to the preternatural membrane, which is to be cut through its whole diameter. The instrument being then directed first towards one side, then the other, the crucial incision is to be completed. As the flaps, which are small and deeply situated, cannot be removed, the surgeon must be content with keeping them separated by means of a blunt tent. The wound will heal just as favourably as that occasioned in removing the imperforation of the concha, or outer part of the meatus auditorius. (*Pria de l'Acad. de Chir.* p. 124—126. t. ix.) In the second case, that is to say, when the risk of wounding the tympanum leads us to prefer the employment of caustic, the safest and most commodious way of putting the plan in execution would be that of touching the obstruction, as often as circumstances may require, with the extremity of a bougie armed with the *argentum nitratum*. In the intervals of the applications, no dressings need be introduced, except a bit of clean soft cotton, for the purpose of absorbing any discharge which may take place within the passage.

It is manifest, that if the whole, or a considerable part of the meatus auditorius externus were wanting, the foregoing measures would be insufficient. The following observations of Leschevin merit attention:—"I do not here allude to cases, in which a malformation of the bone exists. I know not, whether there are any examples of such an imperforation; but, it is clear, that it would be absolutely incurable. I speak of a temporal bone perfectly formed in all its parts, and the meatus auditorius of which, instead of being merely lined by a membrane, as in the natural state, is blocked up by the cohesion of the parietes of this membrane throughout a certain extent of the canal; just as the urethra, rectum, or vagina, is sometimes observed to be not simply closed by a membrane, but by a true obliteration of its cavity.

"Such a defect in the ear may be congenital, and it may also arise from a wound, or ulceration, of the whole circumference of the meatus auditorius externus, this canal having become closed by the

adhesion of its parietes, on cicatrization taking place.

"Such an imperforation, whether congenital or accidental, must certainly be more difficult to cure than the examples treated of above; but," says Leschevin, "I do not for this reason believe, that the case ought to be entirely abandoned. Yet, I would not have the cure attempted in all sorts of circumstances. For instance, if the defect only existed in one ear, and the other were sound, I would not undertake the operation, because, as the patient could hear tolerably well on one side, the advantages which he might derive from having the enjoyment of the other ear, would not counter-balance the pain and bad symptoms occasioned by such an experiment, the success of which is extremely uncertain. I would not then run the risk of making a perforation, except in a case of complete deafness; and I propose this means only as a dubious one, upon the fundamental maxim, so often laid down, that it is preferable to employ a doubtful remedy, than none at all.

"With respect to the mode of executing this operation," says Leschevin, "the trocar seems the most eligible instrument. I would employ one, that is very short, and the point of which is bluntish, and only projects out of a cannula as little as possible. This construction would indeed make the instrument less adapted to pierce any thing; but, still, as the parts to be perforated are firm, their division might be accomplished sufficiently well; and the inconvenience of a trivial difficulty in the introduction of the trocar is comparatively much less than that which would attend the danger of wounding with a sharper point the membrane of the tympanum. I would plunge the point of the instrument into the place, where the opening of the meatus auditorius externally ought naturally to be, and which would be denoted, either by a slight depression, or at all events by attending to the different parts of the ear, especially the tragus, which is situated directly over this passage. I would push in the trocar gently, in the direction of the canal formed in the bone, until the point of the instrument felt as if it had reached a vacant space. Then, withdrawing the trocar, and leaving the cannula, I would try, whether the patient could hear. I would then introduce into the cavity of the cannula itself a small, rather firm tent, of the length of the passage, or a small bougie. By means of a probe, I would push it to the end of the cannula, which I would now take out, observing to press upon the tent, which is to be left in. The rest of the treatment consists in keeping the canal pervious, making it suppurate, and healing it with common applications. One essential caution, however, would be that of keeping the part dilated long after it had healed; otherwise, it might close again, and a repetition of the operation become necessary. This happened to Heister, as he himself apprises us, and it occurred to Boonhuysen in treating imperforations of the vagina.

"If the cohesion of the parietes of the meatus auditorius externus were to extend to the tympanum inclusively, the operation would be fruitless; but, as it is impossible to ascertain this circumstance, before the attempt is made, the surgeon would incur no disgrace by relinquishing the operation, and giving up the treatment of an incurable disease. If, then, after the trocar were

introduced to about the depth of the tympanum, the situation of which must be judged of by our anatomical knowledge, no cavity were met with, the operation should be abandoned; and if, in these circumstances, any one were to impute the want of success to the inefficacy of surgery, or the unskillfulness of the surgeon, he would act very unfairly.

"It is also plain, that such an operation could cure a congenital deafness, only inasmuch as it might depend upon the imperforation; for, if there should exist, at the same time, in the internal ear, any malformation, destructive of the power of the organ, the remedying of the external defect would be quite useless." (Leschevin, in *Prix de l'Acad. de Chirurgie*, tom. ix. p. 127—132.)

We find, that this author entertains a great dread of wounding the tympanum, and certainly he is right in generally insisting upon the prudence of avoiding such an accident. It will appear, however, in the sequel of this article, that under certain circumstances, puncturing the tympanum has been successfully practised as a mode of remedying deafness. The operation, however, demands caution; for, if done so as to injure the connection of the malleus with the membrana tympani, the hearing must ever afterwards be very imperfect.

3. Unusual Smallness of the Meatus Auditorius Externus.

Imperforation is not the only congenital imperfection of the meatus auditorius; this passage is occasionally too narrow for the admission of a due quantity of the sonorous undulations, and the sense is of course weakened. Leschevin mentions that Al. de La Metrie found this canal so narrow in a young person, that it could hardly admit a probe. What has been observed concerning the imperforation, is also applicable to this case. If it depends upon malformation of the bone, it is manifestly incurable; but, if it is owing to a thickening of the soft parts, within the meatus, hopes may be indulged of doing good by gradually dilating the passage with tents, which should be increased in size from time to time, and, lastly, making the patient wear, for a considerable time, a tube, adapted to the part in shape. (Leschevin, in *Prix de l'Acad. de Chirurgie*, t. ix. p. 132.)

Mr. Earle has published a case, in which the diameter of the meatus auditorius was considerably lessened by a thickening of the surrounding parts, and especially of the cuticle, attended with a discharge from the passage, and great impairment of hearing. A cure was effected by injecting into the passage a very strong solution of the nitrate of silver, which, in a few days, was followed by a detachment of the thickened portions of cuticle. This evacuation was assisted by throwing warm water into the passage. (See *Med. Chir. Trans.* vol. x. p. 411, &c.) Boyer was consulted for a deafness, arising from a malformation, which consisted of a flattening of the meatus, its opposite sides being for some extent in contact. The patient was advised to wear in the ear a gold tube of suitable shape, by which means he was enabled to hear perfectly well.

4. Faulty Shape of the Meatus Auditorius Externus.

Anatomy informs us, that this passage is naturally oblique, and somewhat winding; and natural

philosophy teaches us the necessity of such obliquity, which multiplies the reflections of the sonorous waves, and thereby strengthens the sense. This theory, says Leschevin, is confirmed by experience; for, there are persons, in whom the meatus auditorius is almost straight, and they are found to be hard of hearing. If there is any means of correcting this defect, it must be that of substituting, for the natural curvature of the passage, a curved and conical tube, which must be placed at the outside of the organ, just like a hearing trumpet. The acoustic instrument, invented by Deckers, which is much more convenient, might also prove useful. (*Op. cit.* p. 133.)

5. Extraneous Substances, Insects, &c. in the Meatus Auditorius Externus.

Foreign bodies met with in this situation are inert substances, which have been introduced by some external force; insects, which have insinuated themselves into the passage; or the cerumen itself, hardened in such a degree, as to obstruct the transmission of the sonorous undulations. Worms, which make their appearance in the meatus auditorius, are always produced subsequently to ulcerations in the passage, or in the interior of the tympanum, and very often such insects are quite unsuspected causes of particular symptoms. In the cases of surgery, published in 1778, by Acrel, there is an instance confirming the statement just offered. It is the case of a woman, who, having been long afflicted with a hardness of hearing, was suddenly seized with violent convulsions, without any apparent cause, and soon afterwards complained of an acute pain in the ear. This affection was followed by a recurrence of convulsions, which were still more vehement. A small tent of fine linen, moistened with a mixture of oil and laudanum, was introduced into the meatus auditorius, and, on removing it the next day, several small round worms were observed upon it, and, from that period, all the symptoms disappeared. To this case, we shall add another from Morgagni:—A young woman consulted Valsalva, and told him, that when she was a girl, a worm had been discharged from her left ear; that another one, about six months ago, had also been discharged, very much like a small silkworm in shape. This event took place after very acute pain in the same ear, the forehead and temples. She added, that since this, she had been tormented with the same pains, at different intervals, and so severely, that she often swooned away for two hours together. On recovering from this state, a small worm was discharged, of the same shape as, but much smaller than, the preceding one, and she was now afflicted with deafness and insensibility on the same side. After hearing this relation, Valsalva no longer entertained any doubt of the membrane of the tympanum being ulcerated. He proposed the employment of an injection, in order to destroy such worms as yet remained. For this purpose, distilled water of St. John's wort, in which mercury had been agitated, was used. In order to prevent a recurrence of the inconvenience, Morgagni recommends the affected ear to be closed up when the patient goes to sleep, in autumn and summer. If this be not done, flies, attracted by the suppuration, enter the meatus auditorius, and, while the patient is unconscious, deposit their eggs in the ear. Acrel, in speaking

of worms, generated in the meatus auditorius, observes, that there is no better remedy for them; than the decoction of *ledum palustre*, injected into the ear, several times a day. However, as this plant cannot always be procured, an infusion of tobacco in oil of almonds may be used, a few drops of which are to be introduced into the ear, and retained there by means of a little bit of cotton. This application, which is not injurious to the lining of the passage, is fatal to insects, and especially to worms. When caterpillars, ants, earwigs, and other insects, have insinuated themselves into the meatus auditorius, they may be removed with a piece of lint, smeared with honey; and when they cannot be extracted by this simple means, they may sometimes be taken out with a small pair of forceps. In general, however, the most safe and expeditious practice for the removal of small insects, peas, beads, and other extraneous bodies, from the meatus auditorius, is to throw tepid water into the passage with a proper syringe, by which means they are forced out with the fluid. When the bead, or globular substance is small, (according to Mr. Buchanan) the best mode of extraction will be by means of the syringe, and injection of tepid water. For this purpose, the point of the syringe ought to be pressed gently against the edge of the meatus, so that it may occupy as little of the diameter of the tube as possible, and when the injection arrives at the membrana tympani, the regurgitation will force the bead, or other substance outwards. If this be rather large, it may perhaps remain at the entrance of the meatus, whence it ought to be extracted by means of a pair of forceps. (See Buchanan's *Illustrations of Acoustic Surgery*, p. 40.)

In May, 1829, I was called to a child about two years and a half old, into one of whose ears a pebble, and into the other a French bean, had been pushed by another child, and remained there for ten months, causing complete deafness and extreme suffering. By throwing tepid water forcibly into the ear, I soon dislodged these foreign bodies, which lay close against the tympanum, entirely hidden by the swollen state of the lining of the ear, indurated wax, and dried discharge. With a bent probe their extraction was then readily effected. Several surgeons, previously consulted, had failed in their endeavours to remove the substances by other methods.

The presence of foreign bodies in the ear often occasions the most extraordinary symptoms, as we may see in the fourth observation of Fabricius Hildanus, Cent. 13. After four surgeons, who had been successively consulted, had in vain exerted all their industry to extract a bit of glass from the left ear of a young girl, the patient found herself abandoned to the most excruciating pain, which soon extended to all the side of the head, and which, after a considerable time, was followed by a paralysis of the left side, a dry cough, suppression of the menses, epileptic convulsions, and, at length, an atrophy of the left arm. Hildanus cured her, by extracting the piece of glass, which had remained eight years in her ear, and had been the cause of all this disorder. Although the extraction must have been very difficult, it does not appear that Hildanus found it necessary to practice an incision behind the ear, as some authors have advised, and amongst them Duverney, who has quoted the foregoing case. We must agree with Leschevin,

that such an incision does not seem likely to facilitate the object very materially; for, it must be on the outside of the extraneous substance, which is in the bony part of the canal. The incision enables us, in some measure, to avoid the obliquity of the passage, as Duverney has observed; but it is not such obliquity of the cartilaginous portion of the canal, that can be a great impediment; for, as it is flexible, it may easily be made straight, by drawing the external ear upward. Hence, Fabricius ab Aquapendente rejected this operation, first proposed by Paulus Ægineta; and it is justly disapproved of by Leschevin. (*Prix de l'Acad. de Chir.* t. ix. p. 147. édit. 12mo.)

Sabatier relates a case, in which a paper ball, which had been pushed into the meatus auditorius, made its way by ulceration into the cavity of the tympanum, where an abscess formed, which communicated with the interior of the cranium. (*Dict. des Sciences Méd.* t. vii. p. 8.)

6. Meatus Auditorius obstructed with thickened, or hardened Cerumen.

The cerumen, secreted in the meatus auditorius by the sebaceous glands, frequently accumulates there in large quantities, and becoming harder and harder, at length acquires so great a degree of solidity as entirely to deprive the patient of the power of hearing. Galen has remarked, *e numero eorum quæ meatum obstruunt, sordes esse quæ in auribus colligi solent*. This species of deafness is one of those kinds, which are the most frequent and, at the same time, the most easy of cure. Formerly injections, either with simple olive oil, or oil of almonds, were recommended. The injection was retained by a piece of cotton, and when there was reason to believe that the matter was sufficiently softened, an attempt was made to extract it by means of a small scoop-like instrument. Various experiments were made by Haygarth, at Chester, in 1769, from which it appears that warm water is preferable to oil. The water dissolves the mucous matter, which connects together the truly ceruminous particles, and which is the cause of their tenacity; other applications only succeeding by reason of the water which they contain.

The lodgment of hard pellets of wax, if neglected, may ultimately produce ulceration of the tympanum, and other serious mischief. Thus, in one case, Ribes and Chaussier found the handle of the malleus separated from its head, partly destroyed, and covered with the hardened cerumen that had made its way into the tympanum. (See *Dict. des Sciences Méd.* t. xxxviii. p. 30.)

"The symptoms (says Mr. Saunders) which are attached to the inspissation of the cerumen are pretty well known. The patient, besides his inability to hear, complains of noises, particularly a clash or confused sound in mastication, and of heavy sounds, like the ponderous strokes of a hammer.

"The practitioner is led by the relation of such symptoms to suspect the existence of wax; but he may reduce it to a certainty by examination.

"Any means capable of removing the inspissated wax may be adopted; but syringing the meatus with warm water is the most speedy and effectual, and the only means necessary. As the organ is sound, the patient is instantaneously relieved." (*Anatomy of the human Ear, with a*

Treatise on its Diseases, by J. C. Saunders, 1806. p. 27, 28.)

In order to throw an injection into the ear with effect, a syringe, capable of holding from four to six ounces, should be employed; and the fluid injected with a good deal of force, care being taken to let it enter in the natural direction, and not against one of the sides of the passage. The surgeon must also avoid pressing the pipe too deeply into the ear, so as to hurt the tympanum. As the fluid regurgitates with considerable rapidity, a small basin is to be held close up to the ear at the time of using the syringe, so as to catch the water, and hinder it from wetting the patient's clothes; for the surer prevention of which a napkin is also to be laid over the shoulder. In general it is necessary to throw the water into the ear six or seven times, or more, ere the pellets of wax are loosened, and entirely brought out; and sometimes, the injections will not completely succeed the first day on which they are employed. The evening before the syringe is to be used, a little sweet oil may be dropped into the ear.

7. Imperfect Secretion of Wax.

When the wax is deficient in quantity, Mr. Buchanan recommends warmth and stimulant applications. He advises two drops of the following mixture to be introduced into the meatus auditorius, every night at bedtime:—R. Acid. Pyrologn. Spir. Ætheris Sulphur. Ol. Cerebint. a a M. One table-spoonful of the following medicine is also to be taken at the same time:—R. Tinct. Colchici 3iij. Aq. distillat 3 vj. M. If costiveness prevail, the pills: rhei. comp. are to be given. (See *Buchanan's Acoustic Surgery*, p. 60.)

When the quality of the secretion requires improvement, the meatus is to be frequently washed out, and a little of the infusion of quassia with rhubarb and magnesia given once or twice a day. The warm bath is to be occasionally used at bedtime, and the following powder exhibited:—R. Hydrag. Submur. gr. ij. Pulv. Ipecac. comp. 3j. ft. Pulv. Hora decubitus sumend. In cases where the ear is preternaturally dry, and the cuticle of the meatus peels off, the ensuing injection is to be used every second or third day. R. Acid. Pyrologn 3ij. Aquæ distillatæ 3 vi. ft. lotio; or the vapour of a mixture of equal parts of distilled water and pyrologneous acid introduced three times a week into the meatus with the aid of a glass retort. A little cotton should afterwards be put into the ear. (See *Buchanan's Acoustic Surgery*, p. 62.)

8. Discharges from the Meatus Auditorius.

Purulent discharges from the ear either come from the meatus auditorius externus itself, or they originate from suppuration in the tympanum, in consequence of blows on the head, abscesses after malignant fevers, the small-pox, or the venereal disease. In such cases, the little bones of the ear are sometimes detached, and escape externally, and complete deafness is most frequently the consequence. However, in a few instances, total deafness does not always follow even this kind of mischief, as I myself have witnessed on one or two occasions. There is greater hope when the disorder is confined to the meatus; as judicious treatment may now avert the most serious consequences.

In Acrel's surgical cases, there is a case relative to the circumstance of which we are speaking. Suppuration took place in the meatus auditorius externus, in consequence of acute rheumatism, which was followed by vertigo, restlessness, and a violent headach. The matter discharged was yellowish, of an aqueous consistence, and acid smell. The meatus auditorius was filled with a spongy flesh. On introducing a probe, our author felt a piece of rough bone, which he immediately took hold of with a pair of forceps, and extracted. From the time when this was accomplished, the discharge diminished; and, with the aid of proper treatment, the patient became perfectly well.

The meatus auditorius, like all other parts of the body, is subject to inflammation. This is frequently produced by exposure to cold. It is hardly necessary to say, that generally topical bleeding and antiphlogistic means are indicated. The meatus auditorius should also be protected from the cold air, particularly in the winter season, by means of a piece of cotton.

Mr. Saunders observes, "When the means employed to reduce the inflammation have not succeeded, and matter has formed, it is generally evacuated, as far as I have observed, between the auricle and mastoid process, or into the meatus. If it has been evacuated into the meatus, the opening is most commonly small, and the spongy granulations, squeezed through a small aperture, assume the appearance of a polypus. Sometimes the small aperture, by which the matter is evacuated, is in this manner even closed, and the patient suffers the inconvenience of frequent returns of pain from the retention of the discharge. When the parts have fallen into this state, it will be expedient to hasten the cure by making an incision into the sinus, between the auricle and mastoid process."

"It occasionally happens, that the bone itself dies in consequence of the sinus being neglected, or the original extent of the suppuration. The exfoliating parts are the meatus externus of the os temporis, or the external lamina of the mastoid process." (P. 24, 25.)

In some examples of purulent discharge from the ear, and particularly in scrofulous patients, Mr. Buchanan employs alterative medicines, as calomel, the tincture of iodine, and the compound rhubarb pills of the *Edinb. Pharmacopœia*. He also sometimes has recourse to the pyroligneous injection. (See *Illustrations of Acoustic Surgery*, p. 93, &c.) Some additional cases in favour of the efficacy of iodine, in certain forms of deafness, may be found in Dr. Manson's work. (See *Medical Researches on the Effects of Iodine*, 8vo. London, 1825.)

9. Excrescences in the Meatus Auditorius.

Though the membrane, lining the meatus auditorius, is very delicate, it is not the less liable to become thickened, and to form polypous excrescences. As such tumours are ordinarily firmer in their texture than polypi of the nose, they are sometimes not so easily extracted with forceps. When they are situated near the external orifice, and admit of being taken hold of with a small pair of forceps, or a hook, and drawn outwards, they may easily be cut away. Sometimes the excrescences, instead of being adherent by a narrow neck, have a broad base, which occupies a considerable extent

of the passage. In such cases, the use of escharotics has been proposed; but, they cannot be used without risk of injuring the tympanum. Mr. Buchanan prefers the practice of removing polypi of the meatus with forceps, and afterwards touching the part from which they grew with the ung. hydrarg. nitrat. or tinct. ferri muriati. (*Acoustic Surg.* p. 74.) He also recommends washing out the passage every day with the injection, R. Acid. Pyrolign. ʒij. Aq. distillatæ ʒvj. ft. lotio. I lately attended a lady, who had a round smooth tumour growing from the membrana tympani, to which it was attached by means of a long pedicle. It nearly filled the meatus, and was attended with a discharge. With the assistance of Mr. Morton, of University College, I cut through its pedicle, removed it, and then applied the nitrate of silver. But, in a few weeks, it grew again, and it was once more removed with the same result. I next intended to twist it off; but, it was attacked with inflammation, and sloughed away. I do not at present know whether it is growing again.

10. Herpes of the Meatus Auditorius.

An herpetic ulcerous eruption sometimes affects the meatus auditorius and auricle, producing considerable thickening of the skin, and so great an obstruction of the passage, that a good deal of deafness is the consequence. Mr. Saunders remarks, that, in this case, "the ichor, which exudes from the pores of the ulcerated surface, inspissates in the meatus, and not only obstructs the entrance of sound, but is accompanied with a great degree of fetor. This disease is not infrequent. I have never seen it resist the effect of alterative medicines," the use of injections containing the oxymuriate of quicksilver, and the application of the unguentum hydrargyri nitrati. Mr. Saunders exhibited calomel as the alterative, and in one instance, employed a solution of the argentum nitratum as an injection. (P. 25, 26.) When the disease is obstinate, a seton should be made on the nape of the neck, or a blister be applied behind the ear. The tincture of iodine should also be tried.

11. Affections of the Tympanum.

The ear is sometimes affected with a puriform ichorous discharge, attended with a loss of hearing, proportionate to the degree of disorganisation which the tympanum has sustained. Frequently, on blowing the nose, air is expelled at the meatus auditorius externus; and, when this is the case, it is evident that the discharge is connected with an injury, or destruction of the membrana tympani. However, when the Eustachian tube is obstructed with mucus, or matter, or when it is rendered impervious, and permanently closed by inflammation, the membrana tympani may not be perfect, and yet, it is clear, no air can in this state be forced out of the external ear in the above manner. An examination with a blunt probe, or with the eye, while the rays of the sun fall into the passage, should therefore not be omitted. If the membrane have any aperture in it, the probe will pass into the cavity of the tympanum, and the surgeon feel that his instrument is in contact with the ossicula.

In this manner, the affection may be discriminated from an herpetic ulceration of the meatus auditorius externus. The causes are various: In

scarlatina maligna, the membrana tympani occasionally inflames and sloughs; all the ossicula are discharged, and, if the patient live, he often continues quite deaf. An earach, in other words, acute inflammation of the tympanum is the most common occasion of suppuration in this cavity, in which, and the cells of the mastoid process, a good deal of pus collects. At length the membrana tympani ulcerates, and a large quantity of matter is discharged; but, as the secretion of pus still goes on, the discharge continues to ooze out of the external ear.

Instead of stimulating applications, inflammation of the tympanum demands the rigorous employment of antiphlogistic means. Unfortunately, it is a too common practice, in this case, to have recourse to acrid spirituous remedies. Above all things, the repeated application of leeches to the skin behind the external ear, and over the mastoid process, should never be neglected. As soon as the inflammation ceases, the degree of deafness, occasioned by it, will also disappear. This, however, does not always happen.

When an abscess is situated in the cavity of the tympanum, Mr. Saunders thinks that the membrana tympani should not be allowed to burst by ulceration, but be opened by a small puncture. (P. 31.) However, unless there were the strongest ground for believing, that the Eustachian tube were impervious, this advice, I think, ought not to be followed, more especially as the symptoms are generally too vague to afford any degree of certainty in the diagnosis.

Sometimes the disease, of which we are treating, is more insidious in its attack: slight paroxysms of pain occur, and are relieved by slight discharges. The case goes on in this way, until, at last, a continual discharge of matter from the ear takes place. The disorder in its tendency is destructive to the faculty of hearing, and it rarely stops until it has so much disorganised the tympanum and its contents, as to occasion total deafness. Hence, Mr. Saunders insists upon the propriety of making attempts to arrest its progress,—attempts which are free from danger; and he censures the foolish fear of interfering with the complaint, founded on the apprehension, that bad constitutional effects may originate from stopping the discharge.

If the case be neglected, the tympanum is very likely to become carious; before which change, the disease was considered by Mr. Saunders, to be mostly curable.

Mr. Saunders divides the complaint into three stages:—1. A simple puriform discharge. 2. A puriform discharge complicated with fungi and polypi. 3. A puriform discharge with caries of the tympanum. As the disease is local, direct applications to the parts affected are chiefly entitled to confidence. Blisters and setons may also be advantageously employed. Mr. Saunders's practice consisted in administering laxative medicines and fomenting the ear, while inflammatory symptoms lasted, and afterwards injecting a solution of the sulphate of zinc, or acetate of lead.

In the second stage, when there were fungi, he removed or destroyed them with forceps, afterwards touched their roots with the argenteum nitratum, or injected a solution of alum, sulphate of zinc, argenteum nitratum.

Writers describe a relaxed state of the membrana tympani, as a cause of deafness. If, says

a late author, after a discharge from the meatus auditorius externus, or cavity of the tympanum, or a dropsy of the latter cavity, the hearing remains hard, there is reason to suspect, that the infirmity may depend upon relaxation of the membrane of the tympanum, or paralysis of the internal muscle of the malleus. This suspicion will be strengthened, if the deafness should increase in damp, and lessen in dry, weather; and particularly, if it be found, that the hearing is benefited by introducing into the ear dry warm tonic applications, such as the smoke of burning juniper-berries, or other astringent vegetable substances. The decoction of bark, used as an injection, is also said to have done good.

The relaxation of the tympanum, alleged to proceed from a rupture of the muscle of the malleus, is deemed incurable; but it is not so with the case, which depends upon paralysis of this muscle. Heroic tonic injections into the tympanum, through the Eustachian tube, are recommended. (*Dict. des Sciences Méd.* t. xxxviii. p. 50.) Electricity, stimulating liniments, gurgles, a blister, or the external use of strychnia, might also be tried.

Imperfect hearing is supposed sometimes to arise from preternatural tension of the membrane of the tympanum, indicated by the patient hearing better in wet than dry weather, and by his hearing what is spoken in a low tone, near his ear, better than any thing said in a loud manner. The opinions, delivered by writers on the causes of this affection, are only uncertain conjectures. The local treatment recommended consists in injecting into the meatus auditorius emollient decoctions, or warm milk, or introducing into the passage a dossil of soft cotton, dipped in oil of sweet almonds. Nothing certain is known respecting the proper constitutional treatment, as must be clear from our ignorance of the causes of this form of disease of the ear.

Hardness of hearing appears sometimes to be caused by a chronic thickening of the membrane of the tympanum; and it is alleged, that there are cases of this description, which proceed from syphilis, and require mercury. An issue in the arm nearest the affected ear, the tincture of iodine, and emollient and slightly stimulant injections, are likewise commended. When the tympanum was so considerably thickened, that there was no chance of restoring it to a healthy state, Portal questioned whether it might not be advisable to make a small opening in it? (*Précis de Chir. Pratique*, t. ii. p. 430.) This operation, which is said to have been first suggested by Cheselden, will be considered in the ensuing section.

Morgagni found the cavity of the tympanum intersected by numerous membranes, which impeded the movements of the ossicula. (*Epist. an. vi.* § 4.)

Meckel does not mention any example of a deficiency of all the ossicula. (*Handb. des Pathol. Anat.* b. i. p. 402.) Mersanni, however, found the incus wanting. (*Bonet Sepulch.* t. i. sect. 19. obs. 4. § 1.) Caldani, the malleus and incus. (*Epist. ad Haller*, t. vi. p. 142.) The latter case was unattended with any bad effect on the hearing; the first with deafness. In a deaf child, three years of age, Bailly found the ossicula of only $\frac{1}{2}$ their proper size. (*Bonet Sepulch.* t. i. sect. 19. obs. 4. § 3.) In an example, where the fenestra rotunda was obstructed, Cotunni found the ossicula twice

as large as natural. (*De Labyrinthi Auris contentis*, § 72., and *Meckel's Handb. des Pathol. Anat.* b. i. p. 402.) A case, in which all the ossicula were wanting, is on record. (*See Dict. des Sciences Méd.* t. xxxviii. p. 114.)

12. Obstruction of the Eustachian Tube.

This is often a cause of a considerable degree of deafness, because it is necessary for perfect hearing, that air should be conveyed from the mouth through this passage into the cavity of the tympanum, which now can no longer happen.

A degree of deafness generally attends a severe cold, which is accounted for by the Eustachian tube being obstructed with thickened mucus. Mr. Saunders tells us, that the obstruction most frequently arises from syphilitic ulcers in the throat, or sloughing in the cynanche maligna. The deafness comes on when such sores are healed, that is, when the obstruction is complete. The descent of a nasal polypus into the pharynx, and enlarged tonsils, have also been known to close the tube. (P. 42.)

When the Eustachian tube is obstructed, the patient cannot feel the membrana tympani crackle, as it were, in his ear, on blowing forcibly with his nose and mouth stopped. Previous ulceration, or disease, of the throat will sometimes facilitate the diagnosis.

When the Eustachian tube is obstructed with mucus, it has been proposed to employ injections, which are to be thrown, by means of a syringe and catheter, into the guttural orifice of that canal. This operation will be presently described.

Sir A. Cooper had noticed, that hearing was only impaired, not lost, when suppuration in the tympanum had injured, and even destroyed the membrana tympani, and that the degree of deafness by no means equalled what resulted from an obstruction of the Eustachian tube. Hence, when the tube was permanently obliterated, he conceived, that a small puncture of the membrana tympani might be the means of enabling the patient to hear. This gentleman reports four cases, in which the experiment was made with success.

The operation consists in introducing an instrument, resembling a hydrocele trocar, but curved, into the meatus auditorius externus, and pushing it through the anterior and inferior part of the membrana tympani; a place rendered most eligible, on account of the situation of the chorda tympani and manubrium of the malleus, parts which should be left uninjured. The instrument must not be introduced far, lest it wound the vascular lining of the tympanum, and cause a temporary continuance of the deafness, by an effusion of blood. When the puncture is made, in proper cases, and in a judicious manner, hearing is immediately restored. A small hole in the membrana tympani now conveys the air into the cavity of the tympanum, answering the same purpose as the Eustachian tube.

The surgeon will be able to operate with more ease, if he take care to lessen the curvature of the meatus auditorius by drawing upward the external ear.

There is some chance of a relapse in consequence of the opening closing up. This consideration led Richerand to propose making the aperture with caustic, so as to destroy a part of the membrane. (*Nosogr. Chir.* t. ii. p. 132. éd. 2.)

This suggestion is not likely to be adopted on account of the inconveniences of applying caustic within the ear. Mr. Saunders is an advocate for making the opening large. However, perhaps the best method of doing the operation both effectually and safely is that lately described by Mr. Buchanan of Hull, the chief peculiarity of whose mode consists in *drilling* the perforation. The quadrangular point of his perforator cuts the fibres of the membrana tympani across; they retract; the wound assumes an oval shape; and there is less danger of its closure again, than after the common plan of making a single puncture. "A room (says Mr. Buchanan) with a window fronting the south, should be chosen for the place of the operation; and the patient placed on a low seat, so that the rays of the sun may fall into the meatus. The manubrium, or handle of the malleus will then be distinctly seen, pointing downwards and inwards; occupying the superior half of the membrana tympani. The surgeon being seated on a high chair, should lay his left hand on the head of the patient, and, with the right, take hold of the instrument in the same manner as he would a pen when writing: he should then cautiously and steadily enter the point of the perforator into the membrana tympani, about half-way between the centre and its lower edge, and, with the thumb and index finger, give the instrument half a turn one way, and then half a turn the other, and in this manner gently push the point about a line through the membrane." (*See Engraved Representation of the Anatomy of the Ear*, p. 33.) Mr. Saunders, by puncturing the tympanum, instantaneously restored the hearing of one patient, who had been deaf thirty years in consequence of the destruction of a part of his palate by syphilis. (P. 45.) In an instance where a young man had been deaf for eight years, apparently from obstruction of the Eustachian tube by swellings and disense about the throat, Parioisse also restored the hearing directly, by perforating the anterior and inferior part of the tympanum. (*Opusculum de Chir.* p. 309. 8vo. Paris, 1806.) The practice has also been successfully adopted by Michaelis in one case, and Hunold has tried it in a vast number of examples, two-thirds of which succeeded. (*Dict. des Sciences Méd.* t. 38. p. 63.) Sir A. Cooper's cases are in the *Phil. Trans.* for 1802.

Puncturing the membrana tympani has been attended with some degrees of success in France, where it has been tried by Itard, Celliez, and Maunoir, &c. It is not to be dissembled, however, that it is liable to failure. Dubois performed the operation in four instances, without success. (*Richerand, Nosogr. Chir.* t. ii. p. 132.)

In most cases the patients benefited are said to have experienced pain just after the trocar was withdrawn. The organ, not being accustomed to sound, had become so extremely sensible, that it could not bear the gentlest impression of the sonorous vibrations; and the patient's first request, after the perforations had been made, was, that persons near him, might speak softly. This excessive tenderness of the sense gradually subsides.

The two principal objections made to the foregoing practice, are the risk of injuring that part of the tympanum, which is connected with the malleus, and the tendency of the puncture to heal up again. (*See Dict. des Sciences Méd.* t. xxxviii. p. 57.; *Maunoir in Journ. de Méd.* t. xiii.; *Saba-*

tier, *Traité d'Anatomie*, t. ii. p. 186.) The author of the article *Oreille* in the latter dictionary, who cannot, however, be deemed at all partial to the operation, delivers the following judgment concerning it:—1. It is the only operation, which is likely to answer, where the tympanum is cartilaginous or ossified, and the rest of the organ is sound. 2. It will be attended with some success, where the Eustachian tube is closed, and this defect cannot be otherwise removed. 3. It will be useless where the cavity of the tympanum is filled with matter, which is too thick to escape through the puncture. 4. When deafness depends on paralysis of the auditory nerve. 5. When the infirmity arises from inflammation of the ear or nervous irritation. 6. Or from fevers, the Eustachian tube being pervious.

Wathen, Boyer, Itard, Buchanan, and the latest surgeons, who have considered the operation of injecting fluids into the Eustachian tube, agree, that it is more easily performed by passing the tube through one of the nostrils, than the mouth. The patient being seated on rather a low chair, with his head supported upon the breast of an assistant, standing behind him, the surgeon takes a probe, which is bent towards its end to an angle of about 135° , and he introduces it, with the end turned downwards, along the floor of the nostril, and, when it has reached the pharynx, a circumstance denoted by its descent behind the soft palate, a rotatory movement outwards to the extent of a quarter of a circle is given to it, and the handle is inclined downwards and inwards. The instrument's becoming fixed denotes its entrance into the Eustachian tube. (See Ph. F. Blandin in *Dict. de Méd. et de Chir. Pratiques*, t. xii. p. 280.) Wathen's instruments are described in *Phil. Trans.* 1794; those of Boyer in *Traité des Mal. Chir.* t. vi. p. 391; those of M. Itard, which deserve particular notice, in his *Traité des Mal. de l'Oreille*; and those of another modern advocate for this operation, in *Dict des Sciences Méd.* t. xxxviii. p. 108. The latter author, after stating how his tubes, which are four French inches in length, and shaped somewhat like an italic S, are introduced, enumerates the following as the advantages derived from their employment. 1. Fluid applications may be conveyed into the Eustachian tube, the cavity of the tympanum, and the mastoid cells, and deeply seated obstinate ulcerations within these parts cured. 2. The same parts can be cleared from any mucus by which they are obstructed. 3. Blood extravasated within the tympanum, from blows on the head, can be washed out. 4. Chalky substances, which sometimes form in the tympanum, may be brought out in the same manner. 5. Through the tube a stilet can be passed into the Eustachian tube, so as to perforate a congenital septum, or any cicatrix, obstructing the entrance of that passage. 6. When the sensibility of the auditory nerve is dull, the effect of fluids, thrown into the tympanum, can be tried. (See also T. Buchanan's *Engraved Representation of the Anatomy of the Human Ear*, p. 28. fol. Hull, 1823.)

13. Of perforating the Mastoid Process.

Of all the cases of deafness for which Arnemann and others have recommended this operation, that attended with an abscess and caries of this process is the only one, in which the practice is now at all

sanctioned. An instance is related by Jasser, in which the carious surface of the right mastoid process was exposed by an incision, and an opening detected with a probe. An injection was thrown into the aperture with a syringe, when, to the astonishment of Jasser and his patient, the fluid gushed out of the right nostril. The plan was repeated for a few days, and at the end of three weeks, the part was healed, and the hearing greatly improved. This success induced Jasser to make a perforation in the left mastoid process, the ear on that side being deaf, and to employ the injection, which was also discharged from the left nostril. The hearing, however, was not so completely restored in this as it had been in the right ear; but the wound healed up without any exfoliations. (*Journ. de Méd. Fev.* 1793.) The idea of perforating the mastoid process was suggested long before the time of Jasser. Riolan, in various parts of his works, mentions the propriety of making a small perforation in several cases of deafness, and tinnitus aurium, attended with obstruction of the Eustachian tube. Rolfincius also advised a similar opening to be made in the mastoid process with a trocar, in cases of dropsy of the cavity of the tympanum and of the mastoid cells. Jasser, however, was the first who actually made the experiment, and his example was followed by Hagstroem, whose attempt did not succeed, the completion of the operation having been interrupted by profuse hemorrhage, and no benefit done to the hearing. The injections also appear to have caused, in this instance, alarming symptoms, violent pains in the head, loss of vision, sense of suffocation, and syncope. The fluid entered the mastoid cells, without any of it issuing, either by the nostrils or mouth. (*Op. cit.*)

The operation was successfully tried by Löffler. The injection did not pass into the mouth, yet the hearing was restored, though it was lost again when the wound closed. Hence a new opening was made, and kept from healing by means of a piece of catgut. The patient was afterwards able to hear when his mouth was open.

The perforation of the mastoid process was not approved of by Morgagni; indeed, it must often fail, as both Morgagni and Hagstroem have observed, on account of complete bony partitions preventing all communications between the mastoid cells; and sometimes the mastoid process, instead of being cellular, is perfectly solid, an instance of which is recorded by A. Murray. In children, the mastoid cells are but imperfectly developed, and the operation may bring on caries, necrosis, erysipelas, &c. (See Blandin in *Dict. des Méd. et de Chir. Pratiques*, t. xii. p. 281.)

14. Diseases of the Labyrinth.

These are much more diversified than might, at first, be supposed, and, if we admit the two doubtful cases, said to depend upon the state of the lymph of Cotunni, there are not less than seven different species of disease affecting the labyrinth:—1. Disease of the fenestra ovalis, and fenestra rotunda, as ulceration, thickening, &c. 2. Malformation of these apertures. 3. Malformation of the labyrinth. 4. Inflammation of the nervous membrane, which lines its cavities. 5. Alteration of the liquor of Cotunni. 6. Deficiency of the same fluid. 7. Affections of the nerve of hearing.

No doubt deafness (and that kind of it which so

frequently foils the most skilful men) often arises from an insensible state of the portio mollis of the auditory nerve, or of the surfaces on which its filaments are spread. This affection is analogous to amaurosis, or gutta serena, in which, though every part of the eye may seem to possess its natural structure, sight is lost, because the rays of light only strike against a paralytic, or insensible retina. Mr. Saunders dissected the ears of two deaf patients with the greatest care, but could not discover the least deviation from the natural structure. In the commencement of deafness from a paralytic affection of the auditory nerve, Sir A. Cooper remarked, that the secretion of cerumen was diminished, and, when the deafness became worse, was totally suppressed. And another particular symptom of paralysis of the auditory nerve, pointed out by the same author, is the patient's inability to hear the sound of a watch placed between the incisor teeth.

With respect to the causes of a paralytic affection of the auditory nerve, they are mostly buried in great obscurity, and some of them probably depend upon congenital imperfection of the nerve, or brain itself. It seems, however, that a part of the causes to which we allude, act mechanically, as an extravasation of blood, a steatoma, or an exostosis; while others operate on the ear by sympathy, as is the case when deafness is produced by the presence of worms in the bowels.

Mr. Saunders remarks, that all the diseases of the internal ear may be denominated nervous deafness; the term, in this sense, embracing every disease, the seat of which is in the nerve, or parts containing the nerve. Nervous deafness is attended with various complaints in different cases, noises in the head of sundry kinds, the murmuring of water, the hissing of a boiling kettle, rustling of leaves, blowing of wind, &c. Other patients speak of a beating noise corresponding with the pulse, and increased by bodily exertion, in the same degree as the action of the heart. (Saunders, p. 47.)

According to this author, there is a syphilitic species of nervous deafness, attended with a sensation of some of the above peculiar noises; and one case is related, in which the hearing was completely restored, in five weeks, by a mercurial course.

Mr. Saunders relieved several cases of nervous deafness by confining patients to low diet, giving them calomel freely, repeated doses of sulphate of soda, or magnesia, sometimes twice, sometimes thrice, a week, or according to circumstances, and applying blisters behind the ears at intervals of a week. The plan requires perseverance.

Electricity has been highly recommended for the cure of nervous deafness, though the prospect of benefit from it must entirely depend upon the nature of the cause of the infirmity. It is allowed to be sometimes useful in cases of incomplete paralysis of the auditory nerve; but it cannot be of any service where the Eustachian tube, the cavity of the tympanum, or the mastoid cells, are obstructed. It is set down as hurtful, when the patients are very irritable, and subject to vertigo, bleeding from the nose, great determination of blood to the head, &c. (*Dict. des Sciences Méd.* t. xxxviii. p. 124.) The evidence in favour of the efficacy of galvanism, is still more scanty and questionable.

Whether, in certain cases of deafness from torpor of the auditory nerve, the introduction of tonic injections into the cavity of the tympanum, through the Eustachian tube, will answer in the manner stated by a late writer, future experience must determine. (*Dict. des Sciences Méd.* t. xxxviii. p. 120, 121.) The effect of the tincture of iodine, blisters, mercury, and the external use of strychnia, are means often deserving a fair trial.

This article, I think, may be usefully concluded with a few general, but sensible, observations on the various kinds of deafness, made by a modern writer. According to Professor Rosenthal, all the disorders of the sense of hearing may be comprised under three principal forms.

1. Deafness (*Surditas, Cophosis*), in which the faculty of hearing articulated sounds is completely annihilated.

2. Hardness of hearing (*Dysacia*), in which this faculty is so diminished, that articulated sounds cannot be heard, without the assistance of a particular apparatus.

3. Alteration, or diminution of hearing (*Paracusis*), in which the faculty of hearing articulated sounds, in the natural way, is imperfect for want of precision.

1. Deafness, Rosenthal distinguishes into two degrees; the first of which is marked by an absolute impossibility of hearing at all; the second, by a power of still distinguishing certain sounds, as whistling, the vowels, &c. The first is usually congenital, and a cause of dumbness.

The discrimination of these two degrees, Rosenthal considers of great importance in practice, and especially in institutions for the deaf and dumb; because the exceedingly fine sense of touch, with which dumb persons are sometimes gifted, is apt to be mistaken for the faculty of hearing. This fact is illustrated by some interesting experiments made by Pfingsten on deaf and dumb persons. (*Vielfährige Erfahrung über die Gehörfehler der Taubstummen*, Kiel, 1802. p. 32.) A deaf and dumb girl, who was at needlework in a room near the house door, regularly gave notice whenever the door was opened, or shut. As the door was furnished with a little bell, which rang loud enough whenever the door moved to be plainly heard in the neighbouring room, and with the exception of this noise, no other impulse nor shock could be distinguished, Pfingsten was surprised at the circumstance. Desirous of ascertaining how the girl really knew about the movements of the door, he caused the bell to be rung with great force without the door being opened: the child was perfectly unconscious of the noise. The bell was afterwards kept still, while a person opened and shut the door so softly, that Pfingsten himself could not hear it; yet, the child instantly gave warning, that somebody had entered. The inference was, that the chair, on which she sat, communicated to her legs and back a certain impulse, which made her conscious of the motion of the door.

The dissection of the ears of deaf and dumb persons has evinced some facts, explanatory of the cause of the loss of hearing. Amongst other things, it appears, that complete deafness, whether congenital or acquired, more frequently depends upon morbid alterations of the soft parts, than upon any irregularity in the formation of the bones. Thus, in the body of a person, who had been deaf and dumb while living, Hoffmann found

the auditory nerve diminished in size, while every other part of the organ was perfectly natural. Arneemann found the nerve harder than common. Dr. Haighton met with an instance, in which the vestibulum was filled with a caseous substance. (*A Case of original Deafness, in Mem. of the Med. Society, vol. iii. p. 1—15.*) Duverney and Sandifort found the auditory nerve strongly compressed by a sciatoma. In one case, Itard found every part of the ear apparently so natural, that the deafness could not be ascribed to paralysis of the nerve. In another, the infirmity depended upon obstruction of the passages. In a third, the cavity of the tympanum, and the vestibulum, contained small portions of calcareous matter. He has also seen the tympanum filled with a thick yellow lymph, or a thin fluid enclosed in membranous cells. In the dissection of the body of a deaf and dumb person, Rosenthal noticed amongst other remarkable circumstances, a greater hardness of the auditory, than of the facial nerve, and preternatural firmness of the medulla oblongata; thickening of the membrane of the tympanum; the bony roof of the cavity of the tympanum not thicker than paper; and just over the junction of the malleus with the incus, the bony substance was so absorbed, that an appearance like that of membrane alone remained. The mastoid cells, cavity of the tympanum, and the Eustachian tubes, contained a limpid yellow fluid. In the tympanum, the periosteum was thickened, forming small cells, around the ossicula, which were of their natural structure. Nothing particular was remarked in the labyrinth.

In a small proportion of instances, the above degree of deafness has been traced to anomaly in the structure of the solid parts. Thus, Mundini found the cochlea composed of only one circle and a half. (*Opusc. Acad. Bonon. 1791. t. vii. p. 422.*) Valsalva found the stapes adherent to the fenestra ovalis (*De Aur. Humanâ, cap. 11.*); and Reimarus relates a case in which the ossicula were entirely wanting. (*Kunstrebe der Thiere, p. 57.*)

Mr. Edward Cock has examined the temporal bones of five children, who died of strumous diseases of the thoracic and abdominal viscera, in the Asylum for the Deaf and Dumb. In three instances, one or both ears were the seat of scrofulous ulceration, affecting the tympanum and meatus externus, with partial destruction of the membrana tympani. In one case, the cavity of the tympanum, together with the mastoid cells, was completely filled with the thick cheesy deposit of scrofula, whilst a similar affection pervaded the whole cancellated structure of the petrous bone. The connexions of the ossicula were destroyed, but the bones themselves remained entire. In all the cases, examined by Mr. Cock, the petrous portions of the temporal bones exhibited more than the usual varieties of size and shape. In some, the bone was so deficient in particular spots, as barely to cover the internal cavities, whilst, in others, there was a preternatural osseous development. In one instance, the petrous bone of a child, twelve years old, exceeded in size, hardness, and compactness of structure, that of an adult. One malformation, discovered in two cases, consisted in a partial deficiency of two of the semi-circular canals. Their extremities opening into the vestibule, were perfect, but the central portions were impervious, or rather did not exist at all. In one case the scdla tympani was terminated

at its larger extremity by a bony septum, which separated it from the tympanum, and occupied the situation of the membrane of the fenestra rotunda. With the exception of these malformations, and the scrofulous affections of the tympanum, already mentioned, which were probably of recent occurrence, no deviation from the healthy state could be discovered in either of the five subjects examined. The Eustachian tubes were pervious; the bones, muscles, and membranes entire and natural; the labyrinths were filled with their transparent fluid; and the auditory nerve presented no peculiarity. The chorda tympani existed in each of the cases; but the integrity of all its little filaments, passing into the tympanum, and requiring a microscope for their dissection, could not be vouched for. (*E. Cock in Med. Chir. Trans. vol. xix. p. 152.*) In a case, dissected by Mr. Dalrymple, the aqueduct of the vestibule was large enough to admit a small probe; and, in a later examination of the ear of a child, who died in the Asylum for the Deaf and Dumb, Mr. Cock could find no vestige of the fenestra rotunda on either side, the usual situation of the membrane being occupied by solid bone. The temporal bones were exceedingly large, though soft and spongy. The cavities were extraordinarily capacious, and the Eustachian tubes three or four times larger, than common. On one side, the aqueduct of the vestibule readily allowed the passage of a large bristle; but, on the other side, the canal could not be traced through the bone, although its two extremities were more than usually expanded. In one tympanum, suppuration had taken place. (*E. Cock, ib.*)

In the first degree of deafness above described, which, when congenital, must excite suspicion of serious malformation of the organ, and abolition of the nervous influence, and when acquired, indicates a complete injury of the functions of the nerve, the prognosis, as Rosenthal observes, must be unfavourable. Nor can it be otherwise in the second congenital degree of the disease, though only a partial imperfection of the organ and nerve can here be supposed. On the other hand, when the latter degree is acquired, there is more prospect of relief, because merely a partial alteration in the soft parts is to be suspected.

2. *Hardness of hearing.* Rosenthal also distinguishes several degrees of, what is termed, hardness of hearing. In the first, the patient cannot hear a distant noise, and especially high tones; but he can perceive, though, it is true, not in a very distinct manner, articulated sounds, when the voice is a good deal raised. In the second degree, he hears and distinguishes both high and low tones very well, and also words, but only when the voice is somewhat raised.

These two cases are better understood, inasmuch as it is tolerably well ascertained, that the immediate cause of the infirmity is some alteration in that part of the organ, which serves as a conductor for the vibrations of sound, or else an increased sensibility of the nerve, all the internal ear being in other respects right.

Amongst alterations of the conducting parts of the organ, Rosenthal comprehends:

1. A total obliteration of the meatus auditorius externus, its imperforation, or complete absence. These cases may almost always be detected by a superficial examination, the patient only hearing

when some solid bodies are placed between his teeth, while his dull perception of sounds does not appear to be much lessened when the ear is covered.

2. Diseases of the cavity of the tympanum, as inflammation of its membranous lining, caries of its parietes, or collections of blood, pus, or other fluid, in its cavity. Rosenthal thinks there can be no doubt, that inflammation and suppuration in the tympanum are much more frequent, than is generally supposed, the former affection being often mistaken for a slight attack of rheumatism. In dissecting aged subjects, he has frequently found the membrane of the tympanum thickened and opaque, and he could only impute this appearance to previous inflammation.

After detailing a case illustrative of the symptoms of inflammation within the tympanum, and a few observations on caries and collections of fluid in that cavity, Rosenthal notices the *hardness of hearing, connected with nervous irritability*, in the treatment of which case, he insists upon the advantage that would result from a knowledge of the particular species of morbid excitement prevailing in the patient. But, as nothing very certain can be made out on this point, and only conjectures can arise from dissections of bodies, that the affection consists either in a determination of blood to the part, or in a partial paralysis of the auditory nerve, the exact nature and form of which are quite incomprehensible, it is absolutely necessary to attend solely to the diagnosis of the nervous affection in general. This diagnosis will be facilitated, 1st, If the patient has been previously very sensible to the impression of certain tones, or sound in general; 2dly, If the power of hearing has been lost all on a sudden, without any mark of inflammation; 3dly, If the affection coincides with other nervous disorders.

3. Alteration or Diminution of Hearing.

Between the most perfect hearing, congenital or acquired, and this point of diminution of the faculty of hearing, Rosenthal observes, there are a many degrees, the cause of which is the more difficult to comprehend, as the circumstances of structure, which enable every part to perform its functions with freedom and perfection, are not yet made out. If, says he, it were in our power to determine what is truly the regular structure of each part, we should then be furnished with a means of judging correctly of the anomalies of function, the changes in which would be indicated quite as clearly, as in the eye, by shades of organisation, absolutely in the same way as we judge of the modifications, which the image of objects must undergo at the bottom of the ocular mirror, by the greater or less convexity of the cornea, or lens, or the consistence of the other humours.

In the present state of physiological and pathological knowledge of the ear, therefore, Rosenthal conceives, that little can be attempted with respect to a scientific classification of these cases of altered, or diminished hearing. As the cavity of the tympanum and its contents are the parts, which have principal influence over the intensity of sound, and a great share in the propagation of articulated sounds, their faulty condition must here be chiefly the subject for consideration. And, amongst their numerous defects, traced by dissection, and already specified in the foregoing columns, Rosenthal particularly calls the attention of the reader,

1. To alterations of the membrane of the tympanum, whether proceeding from congenital malformation, or situation, or from thickening, ossification, perforation, or laceration of the same part.

2. The lodgment of fluid in the cavity of the tympanum, more frequently produced, than is commonly supposed, by obstruction of the Eustachian tube. In most new-born infants, Rosenthal has also found the cavity of the tympanum filled with a thick, almost gelatinous fluid, which for some days is not absorbed, and is probably the cause of the indifference, evinced by new-born children, to sounds, which are even so intense as to be offensive to the ears of an adult.

3. Alterations of the membrane of the fenestra rotunda, such as its imperfect formation, or erroneous situation, its thickened state, &c.

But, it is remarked by Rosenthal, that as the difference in the intensity of sound may occasion a modification in the sensations of the ear, the merely conducting parts of the auditory apparatus must not be forgotten, as the external ear and the meatus auditorius externus, which regulate the quantity of sonorous waves striking the auditory nerve. However the malformations of the meatus and the state of the ceruminous secretion within it, are observed by Kritter and Lentin (*Ueber das schwere Gehöre*, l. xix. Leipz. 1794.) to have more effect on the hearing, than defects of the auricle itself, the whole of which, as we have stated, may be lost without any material deafness being produced. Lastly, Rosenthal calls our attention to the nervous action, or influence, which, whether too much raised, or depressed, may equally render the hearing dull; and some useful information may for the most part be derived from attending to the patient's general sensibility.

See Journ. Complén. t. vi. p. 21. &c. *Duverney*, De l'Organe de l'Ouille, 12mo. 1683. *P. Kennedy*, A Treatise on the Eye, and on some of the Diseases of the Ear, 8vo. Lond. 1713. *A. D. Dicerni*, Questio, &c. an abaque Membrane Tympani Apertura topica infixa in Concham possunt, Paris, 1748. *Leschovm*, Mémoires sur la Théorie des Maladies de l'Oreille, et sur les Moyens que la Chirurgie peut employer pour leur Curation, in Prix de l'Acad. de Chir. t. ix. p. 111. &c. éd. 12mo. *J. D. Arncmann*, Bemerkungen über die Durchbohrung des Processus Mastoideus in gewissen Fällen der Taubheit, 8vo. Göt. 1792. *G. R. Trampel*, Von den Krankheiten des Ohres, in *Arncmann's* Magazin für die Wundarzneiwissenschaft, b. ii. p. 17. &c. 8vo. Göt. 1798. *Richerand*, Nosogr. Chir. t. ii. p. 135. &c. 6dit. 4. *A. Cooper*, in the Phil. Trans. for 1802. *Saunders*, on the Anatomy and Diseases of the Ear, 1806. *Desmonceaux*, Traité des Maladies des Yeux et des Oreilles, t. i. p. 84. 6dit. 1809. *J. Wright*, An Essay on the Human Ear, its Anatomical Structure, and incidental Complaints, 8vo. Lond. 1817. Dict. des Sciences Méd. art. Oreille, t. xxxviii. 8vo. Paris, 1819. *Rosenthal*, Essai d'une Pathologie de l'Organe de l'Ouille, in Journ. Complémentaire du Dict. des Sciences Méd. t. vi. p. 17. 8vo. Paris, 1820. *J. M. G. Bard*, Traité des Maladies de l'Oreille et de l'Audition, 2 tom. 8vo. Paris, 1821. *T. Buchanan*, An Engraved Representation of the Anatomy of the Human Ear, fol. Hull, 1823. Also Illustrations of Acoustic Surgery, 8vo. 1825. *Manson's* Med. Researches on Iodine, 8vo. Lond. 1825. For an account of malformations of the organ, see *Meckel's* Handbuch der Pathol. Anat. b. i. p. 400. &c. 8vo. Leipz. 1812. *Ph. F. Blandin*, in Dict. de Méd. et de Chir. Pratiques, t. xii. art. Oreille. *J. Ch. Roche*, Op. vol. cit. art. Otitis, Deleau, Mémoires sur la Perforation du Tympan, 8vo. Paris, 1822. Id. l'Art de Sonder la Trompe d'Eustache, 8vo. Paris, 1826. *Edward Cock*, in Med. Chir. Trans. vol. xix. p. 152. *J. Thurnam*, Examination of the Organs of Hearing in a Case of congenital Deafness, vol. cit. p. 162. *Todd*, in Anat. of Organs of Hearing. *Wilhelm Kramer*, Die Erkenntnis und Heilung der Ohrenkrankheiten; 8vo. Berlin, 1836. *W. W. Chester*, on the Structure of the Ear and Deafness, 12mo. Lond. 1836.

ECCHYMOSIS (from *ἐκχύνω*, to pour out),

A swelling, attended with a livid or blue colour of

the skin, and produced by blood extravasated in the cellular tissue.

The causes of ecchymosis are falls, blows, sprains, &c. which occasion a rupture of the small vessels on the surface of the body, and a consequent effusion of blood, even without any external breach of continuity. Ecchymosis is one of the symptoms of a contusion. (See *CONTUSION*.) A considerable ecchymosis may originate from a very slight bruise, when the ruptured vessels are capable of pouring out a large quantity of blood, and particularly when the parts contain an abundance of loose, cellular substance. In general, ecchymosis does not make its appearance immediately after the blow, or sprain, and sometimes not till several hours after the application of the violence; at least, it is not till this time that the black, blue, and livid colour of the skin is most conspicuous. A black eye, which is only an ecchymosis, is always more disfigured six or eight hours after the receipt of the blow, than at an earlier period.

A common ecchymosis will generally yield to discutient lotions, and purgatives. The best topical applications are vinegar, the lotio muriatis ammoniac; spirit. vin. camph. and the liquor ammon. acet.

The object is to prevent inflammation, and to promote the absorption of the extravasated fluid.

I have seen such success attend the practice of dispersing collections of extravasated blood, by means of absorption, that I consider the plan of evacuating it by an incision seldom necessary. When an opening is made, and air is admitted, the portion of blood, which cannot be pressed out, soon putrefies, and extensive inflammation and suppuration are the frequent consequences. A man, in going down one of the staircases, at the King's Bench, fell, and suffered a contusion over the sacrum, where a tumour, from effused blood, soon formed, almost as large as his head. The blood was completely absorbed in a few weeks, without any suppuration having taken place. Mild antiphlogistic treatment, cold evaporating lotions, and purgatives, were the only means employed. A man was brought into the North London Hospital, Oct. 1. 1836, with a lacerated wound of the scrotum, protrusion of both testes, a fracture of the right femur in its upper third, and a copious extravasation of blood from external violence applied to the left hip. The quantity of blood, effused after a time, was calculated to be not less than three or four quarts. I scarcely expected to succeed in dispersing the whole of it; yet, in about two months, every particle of it was absorbed.

The quick and powerful action of the absorbent vessels in removing extravasations of blood, can now be no longer called in question, when we daily see it proved in modern practice, that the largest aneurismal swellings are thus speedily diminished and removed, after the operation of tying the arteries, from which such tumours arise.

I wish, however, the preceding observations merely to convey a general condemnation of the practice of opening swellings containing extravasated blood: for no surgeon is more assured than I am, that there are particular exceptions, in which the plan is highly proper and necessary. Thus, whenever a case of extensive ecchymosis, or a large tumour of extravasated blood, either excites

suppuration, or creates excessive pain from distention, it is better to practise a free opening. So it sometimes happens, in aneurism, that the skin breaks after the artery has been tied, and some of the blood escapes; but the remainder putrefies, and soon becomes blended with purulent matter in the sac. Here the making of a free incision for the discharge of the irritating contents of the swelling, with due attention to every caution, delivered in the article *ANEURISM*, will often be followed by beneficial effects.

ECTHYMA (*ἰχθυμιάσην*, *exhalo*, or from *ἰχθύς* to break with fury). A term, employed by the ancients, and revived by Willan, to denote an inflammation of the skin, principally characterised by large or phlyzaceous pustules of the skin, in one or several regions of the body. The term *phlyzaceous* was applied by Willan to pustules, which are large, elevated on a hard circular base, of a bright red colour, and succeeded by a thick indurated scab, of a dark colour.

ECTROPION (from *ἐκτρέπω*, to turn). An eversion of the eyelids.

One case is produced by an unnatural swelling of the lining of the eyelids, which not only pushes their edges from the eyeball; but also presses them so forcibly, that they become everted: another, arises from a contraction of the skin of the eyelid, or its vicinity, by which means the edge of the eyelid is first removed to some distance from the eye, and afterwards turned completely out, together with the whole of the affected eyelid.

The morbid swelling of the lining of the eyelids, which causes the first species of ectropium (putting out of present consideration a similar affection incidental to old age), arises mostly from a congenital laxity of this membrane, afterwards increased by obstinate chronic ophthalmies, particularly that of a scrofulous nature, in relaxed, unhealthy subjects; or else the disease originates from the small pox affecting the eyes.

While the disease is confined to the lower eyelid, as it most commonly is, its lining may be observed rising in the form of a semilunar fold, of a pale red colour, like the fungous granulations of wounds, and intervening between the eye and eyelid, which latter it in some measure everts. When the swelling is occasioned by the lining of both the eyelids, the disease assumes an annular shape, in the centre of which the eyeball seems sunk, while the circumference of the ring presses, and everts the edges of the two eyelids so as to cause both great uneasiness and deformity. In each of the above cases, on pressing the skin of the eyelids with the point of the finger, it becomes manifest, that they are very capable of being elongated, and would readily yield, so as entirely to cover the eyeball, were they not prevented by the intervening swelling of their membranous lining.

Besides the considerable deformity, which the disease produces, it occasions a continual discharge of tears over the cheek, and, what is worse, a dryness of the eyeball, frequent exasperated attacks of ophthalmia, incapacity to bear the light, and, lastly, opacity and ulceration of the cornea.

The second species of ectropium, or that arising from a contraction of the integuments of the eyelids, or neighbouring parts, is not unfrequently a consequence of puckered scars, produced by the confluent small-pox, deep burns, or the excision of cancerous, or encysted tumours, without sav-

ing a sufficient quantity of skin; or, lastly, the disorder is the effect of malignant carbuncles, or any kind of wound attended with much loss of substance. Each of these causes is quite enough to bring on such a contraction of the skin of the eyelids, as to draw these parts towards the arches of the orbits, so as to remove them from the eyeball, and turn their edges outward. No sooner has this circumstance happened, than it is often followed by another one equally unpleasant, namely, a swelling of the internal membrane of the affected eyelids, which afterwards has a great share in completing the eversion. The lining of the eyelids, though trivially everted, being continually exposed to the air, and irritation of extraneous substances, soon swells, and rises up, like a fungus. One side of this fungus-like tumour covers a part of the eyeball; the other pushes the eyelid so considerably outward, that its edge is not unfrequently in contact with the margin of the orbit. The complaints, induced by this second species of ectropium, are the same as those brought on by the first; and, in both cases, when the disease is inveterate, the fungous swelling becomes hard and callous.

In the first species of the disease, the skin of the eyelids and adjoining parts, is not deformed with scars; and by pressing the everted eyelid with the point of the finger, the part would with ease cover the eye, were it not for the intervening fungous swelling. But, in the second, besides the obvious cicatrix and contraction of the skin of the eyelids or adjacent parts, when an effort is made to cover the eye with the eyelid, by pressing upon the latter part with the point of the finger, it does not give way, so as completely to cover the globe, or it does not move in the least from its unnatural position, by reason of the integuments of the eyelids having been so extensively destroyed, that their margin is adherent to the arch of the orbit.

Mr. Guthrie enumerates a case, depending on chronic inflammation, accompanied with contraction of the integuments of the eyelid, but without any manifest cicatrix. It is described as usually taking place after a long continuance of *lippiudo*, and proceeding from the excoaration, contraction, and hardening of the skin, "the result of the passage of the vitiated secretions over it, and which, by dropping on it, increase the irritation." (*Operative Surgery of the Eye*, p. 50—55.) This form of the disease, is rarely attended with such a thickening of the inner membrane of the eyelid, as to need removal with the knife or scissors; for it subsides with the removal of the complaint. (P. 60.)

According to Scarpa, the cure of ectropium cannot be accomplished with equal perfection in both its forms, the second species being, in some cases, absolutely incurable. For, as in the first species of ectropium, the disease only depends upon a morbid thickening of the internal membrane of the eyelids, and the treatment merely consists in removing the redundant portion, art possesses many efficacious means of accomplishing what is desired. But, in the second species, the chief cause of which arises from the loss of a portion of the skin of the eyelids or adjacent parts, which loss no known artifice can restore, surgery is not capable of effecting a perfect cure. The treatment is confined to remedying, as much as possible, such complaints as result from this

kind of eversion, and this can be done in a more or less satisfactory manner, according as the loss of skin is little or great. Cases, in which so much skin is deficient, that the edge of the eyelid is adherent to the margin of the orbit, Scarpa abandons as incurable. How far the case can be rectified, he thinks, may always be estimated by remarking to what point the eyelid admits of being replaced, on being gently pushed with the end of the finger, towards the globe of the eye, both before and after the employment of such means as are calculated to effect an elongation of the skin of the eyelid; for, it is to this point, and no further, that art can reduce the everted part, and permanently keep it so replaced.

When the first species of ectropium is recent, the fungous swelling of the lining of the eyelid not considerable, and, consequently, the edge of the eyelid not much turned out, and in young subjects (for in old ones the eyelids are so flaccid, that the disease is irremediable), Scarpa prefers destroying the fungous surface of the internal membrane of the eyelid by the repeated application of the *argemum nitratum*. Mr. Guthrie touches the fungous portion of the conjunctiva every four days, with a probe dipped in sulphuric acid, and gently applies every day, or every second day, the sulphate of copper, at the same time not omitting some minor remedies, which he also employs in cases proceeding from contraction of the skin independent of any cicatrix, and which I shall presently notice. (*Operative Surgery of the Eye*, p. 70.) In recent cases, where the patient is weak and irritable (or a child), Beer commences the treatment with simply applying every day the tincture of opium, which, after a time, is strengthened by the addition of naphtha. To the relaxed conjunctiva he afterwards applies escharotic eye-salves, and lastly, the nitrate of silver, and muriate of antimony. When the part is hard and callous, the caustic is preceded by scarifications. (*Lehre*, &c. b. ii. p. 136.)

For remedying the inveterate form of the first species of the disease, Beer and Scarpa are advocates for cutting away the whole of the fungous swelling closely from the inside of the eyelid. The following is Scarpa's description of the operation:—

The patient being seated, with his head a little inclined backward, the surgeon, with the index and middle finger of his left hand, is to keep the eyelid steadily everted; and holding a small pair of curved scissors with convex edges, in his right, he is completely to cut off the whole fungosity of the internal membrane of the eyelid, as near as possible to its base. The same operation is then to be repeated on the other eyelid, should that be affected with the same disorder. If the excrescence should be of such a shape, that it cannot be exactly included within the scissors, it must be raised with a forceps, or a double hook, and dissected off at its base, by means of a small bistoury with a convex edge. The bleeding stops of itself, or as soon as the eye has been bathed with cold water. The surgeon is then to apply two small compresses, one put on the upper, the other on the lower arch of the orbit, and over these the uniting bandage, in the form of the monocolus, or so as to compress and replace the edges of the everted eyelids, in order to make

them cover the eye. On the first removal of the dressings, which should take place in twenty-four or thirty hours after the operation, the surgeon will find the whole, or almost the whole of the eyelid, in its natural position. The wound on the inside of the eyelid, should then be washed twice a day with simple water or barley-water. If, towards the end of the cure, it should assume a fungous appearance, or the edge of the eyelid seem to be too distant from the eyeball, the wound on the inside of the eyelid must be rubbed several times with the *argentum nitratum*, for the purpose of destroying a little more of the membranous lining, so that, when the cicatrization follows, a greater contraction of it may take place, and the edge of the eyelid be drawn still nearer the eye.

In England, the excision of the fungous thickened portion of the conjunctiva, has mostly been relinquished for the employment of caustic. The difficulty of dissecting off every particle of the fungus renders the practice of excision less certain, than the treatment with caustic. Scarpa confesses its occasional failure, and the necessity of then having recourse to the latter plan. Demours also lets the employment of caustic follow the use of the knife. (*Mal. des Yeux*, p. 98.) In ectropium from a relaxed fungous state of the conjunctiva, the consequence of purulent ophthalmia, Dr. Vetch begins with a light careful application of the *argentum nitratum* to the whole granulated villous surface. The everted part is then to be returned, and secured in its place with a compress, and straps of plaster and a bandage. Every time the eye is cleaned, the same things are to be repeated, and, in the course of a few days, the tendency to protrude will disappear. (*On Diseases of the Eye*, p. 228.)

In the species of ectropium produced by an accidental contraction of the skin of the eyelids, or neighbouring parts, Scarpa observes, that, if a contraction of the integuments has proved capable of everting the eyelid, the excision of a piece of the internal membrane of the part, and the cicatrix which will follow, must also be capable, for the same reason, of bringing back the eyelid into its natural position. But, since nothing can restore the lost skin, the shortened state of the whole eyelid, in whatever degree it exists, must always continue, even after any operation the most skillfully executed. Hence the treatment of the second species of ectropium, will never succeed so perfectly as that of the first, and the replaced eyelid will always remain shorter than natural, in proportion to the quantity of integuments lost. It is true, that, in many cases, the eversion seems greater than it actually is, in regard to the small quantity of skin lost or destroyed; for, when the disease has once begun, though the contraction of the skin may be trivial, in consequence of the little quantity of it deficient, still the swelling of the lining of the eyelid, which never fails to increase, at last brings on a complete eversion of the part. In these cases, the cure may be accomplished with such success, as is surprising to the inexperienced; for, after the fungous swelling of the internal membrane of the eyelid has been cut off, and the edge of the part approximated to the eyeball, the shortening of the eyelid, remaining after the operation, is so trivial, that it may be considered as nothing, in comparison with the deformity and inconvenience occasioned by the

ectropium. Whenever, therefore, the retraction of the skin of the everted eyelid, and the consequent shortness of it, are such, as not to prevent its rising again and covering the eye, if not entirely, at least moderately, Scarpa directs the surgeon to cut away the internal membrane of the everted eyelid, so as to produce a loss of substance on the inside of it. In inveterate cases of ectropium, in which the lining of the eyelids has become hard and callous, Scarpa applies to the everted eyelid for a few days before the operation, a soft bread and milk poultice.

The division of the cicatrices, which have given rise to the shortening and eversion of the eyelid, as Scarpa observes, does not procure any permanent elongation of this part, and consequently it is of no avail in the cure of the present disease. Fabricius ab Aquapendente, who well knew the inutility of making a semilunar cut in the skin of the eyelids, for the purpose of remedying their shortness and eversion, proposes, as the best expedient, to stretch them with adhesive plasters applied to them and the eyebrow, and tied closely together. Whatever advantage may result from this practice, the same degree of benefit may be derived from using, for a few days, a bread and milk poultice, afterwards oily embrocations, and, lastly, the uniting bandage, so put on as to stretch the shortened eyelid in an opposite direction to that produced by the cicatrix; a practice, which Scarpa thinks should always be carefully tried, before the operation is determined upon.

The surgeon, with a small convex-edged bistoury, is to make an incision of sufficient depth into the internal membrane of the eyelid, along the tarsus, carefully avoiding the situation of the puncta lachrymalia. Then, with a pair of forceps he should raise the flap of the divided fungous membrane, and continue to detach it, with the bistoury, from the subjacent parts, all over the inner surface of the eyelid, as far as where the membrane quits this part, to be reflected over the front of the eye, under the name of *conjunctiva*. The separation being thus far accomplished, the membrane is to be raised still more with the forceps, and cut off with o scissors, at the lowest part of the eyelid. The compresses and bandage to keep the eyelid replaced, are to be applied as above directed. On changing the dressings, a day or two after the operation, the eyelid will be found, in a great measure, replaced, and the disfigurement which the disease caused, greatly amended. The operation is rarely followed by bad symptoms, such as vomiting, violent pain, and inflammation. However, should they occur, the vomiting may be relieved by means of an opiate clyster, and, as for the pain and inflammation attended with great tumefaction of the eyelid operated upon, these complaints may be cured by applying a poultice, or bags filled with emollient herbs, at the same time employing internal antiphlogistics, until the inflammation and swelling have subsided, and suppuration has commenced on the inside of the eyelid, on which the operation has been done. After this, the treatment is to consist in washing the part twice a day, with water or barley-water, and lastly, in touching the wound a few times with the *argentum nitratum*, in order to keep the granulations within certain limits, and to form a permanent cicatrix, proper for maintaining the eyelid replaced.

Juengken describes a plan, which has been adopted by Jaeger himself, and was practised a hundred years ago by Platner (*Instit. Chir.* § 582.), and even recommended a century before this author, by our countryman, Bannister. Heister and Dionis notice it still more circumstantially. (See *Middlemore on Dis. of the Eye*, vol. ii. p. 787.) It consists in detaching the everted eyelid from the cheek, or superciliary ridge, at every point, excepting the angles, by introducing a sharp-pointed double-edged knife, through the conjunctival surface, near the inner angle, bringing it out through the skin, and conveying it across to the outer angle. A portion of the thickened conjunctiva, or a triangular piece of the lid, may be first removed, if necessary. The detached lid is then to be accurately fixed, in contact with the globe, and the skin of the cheek drawn towards the eye, and kept in that position with adhesive plaster, compresses, and bandage. (*Handbuch*, &c. p. 696.) Dieffenbach makes an incision through the skin and orbicularis, nearly parallel to the edge of the lower lid, beginning two or three lines from one angle, and terminating at the same distance from the other. It is one line from the edge of the lid at its two ends, and two or three lines in the middle. He turns up the small flap of skin, and dissects through the lid to the conjunctiva, which he divides to the extent of the external wound. With a hook, he draws the external margin of the divided conjunctiva into the wound of the skin, and keeps it and the integuments together with sutures. (See *Chir. Erfahrungen über die Wiederherstellung Zerstorter Theile*, &c. von J. F. Dieffenbach, p. 127. Berlin, 1830.)

In cases in which the eversion is considerable, Sir W. Adams never found the simple excision of the fungus sufficient to effect a radical cure, and he therefore tried a new mode of operating. In his first attempts, he employed a small curved bistoury, the point of which he carried along the inside of the eyelid, at its outer angle, downwards and outwards, as far as the point of reflection of the conjunctiva would admit. He then pushed it through the whole substance of the everted eyelid and its integuments, and cut upwards through the tarsus, making an incision nearly half an inch in length. With a curved pair of scissors, he next snipped off a piece of the edge of the tarsus, about one-third of an inch in width, and he afterwards removed with the same instrument the whole of the diseased conjunctiva. When the bleeding had ceased, Sir W. Adams passed a needle and ligature through the whole substance of the two divided portions, and brought them as accurately into contact as possible. Finding, however, that too much integument had been left at the lower part of the incision, he employed, in future operations, instead of the scalpel, a pair of straight scissors, with which he cut out an angular piece of the lid, resembling the letter V, with its broad interval towards the ciliary edge of the lid. Latterly, Sir W. Adams found it advantageous to leave about a quarter of an inch of the lid adjoining its external angle; and after shortening the part as much as necessary, he brought the edges of the incision together with a suture. (See *Practical Obs. on Ectropium*, &c. p. 4 and 5. Lond. 1812.)

That this operation will cure the ectropium,

caused by the contraction of cicatrices, or produce great improvement, the experience of Mr. Travers confirms. (*Synopsis of the Diseases of the Eye*, p. 235.) Mr. Guthrie also acknowledges, that it may be highly useful in the ectropium from the contraction of a cicatrix. (*On the Operative Surgery of the Eye*, p. 71.) The contracted scar must be divided, in addition to the other proceedings.

In the form of ectropium, arising from a hardened and contracted state of the integuments of the eye, but without any cicatrix, the indications seem to Mr. Guthrie to be; 1st, To relieve the contraction of the skin externally; 2dly, To restore and retain the eyelid in its proper situation, until the unnatural curvature of the cartilage has been overcome, and the chronic inflammation removed. For fulfilling the first indication, he recommends washing the external parts with warm water, so as to leave the skin as clean as possible. It is then to be carefully dried, and repeatedly anointed with the ung. zinci, for three or four days. Being thus protected from the irritation, it becomes softer, and in a favourable state to yield to mild extension. For accomplishing the second indication, Mr. Guthrie applies the sulphuric acid; the eyelid having been cleansed so as to prevent its slipping, the conjunctiva is to be gently wiped dry, and everted as much as possible, so that the part where it begins to be reflected over the eyeball may be seen. An assistant is to raise the upper eyelid a little, and the patient to look upwards. The blunt end of a common silver probe is then to be dipped in the sulphuric acid, and rubbed over the conjunctiva, so that every part of it may be touched with the acid. The round point of the probe is to be carried as far as where the membrane begins to be reflected over the eyeball, but no further. The punctum lacrymale, caruncle, and semilunar fold, are to be avoided; but, the external angle, as well as every other part, except what is reflected over the eye, is to be carefully rubbed. The acid will turn the touched portion of the conjunctiva white; and in order to prevent the acid from affecting the eyeball, a stream of water is now to be directed over the eyelid with an elastic gum syringe. If the conjunctiva should not be turned sufficiently white, the application may be repeated. The use of the acid is to be repeated every fourth day; "and, when applied in the manner directed, it does not cause a slough, but a general contraction of the part, which is, however, only perceptible after two or three applications, by its effect in inverting the lid, which gradually begins to take place. After six or eight applications, the cure will be more than half accomplished, and, in most cases of this species of eversion, the thickening of the conjunctiva will have subsided." The ung. zinci is to be constantly applied to the skin, and the ung. hydrarg. nitr. in the proportion of one part to four or six of the ung. cetacei, to the edge of the eyelid. After the eyelid has returned two-thirds of the way towards its natural position, the intervals between the applications of the acid must be longer, lest the contraction within the eyelid be carried too far, and an inversion of it produced. After the eversion has been cured, the lippitudo may yet partly remain, and demand the use of the ung. hydrarg. nitr. or other gentle stimulants.

See *Scarpa*, Osservazioni sulle Malattie degli Occhi; ed. 5. cap. vi. *Richter's Anfangsgr. der Wundarzneikunst*, b. ii. p. 473., &c. *Pellier*, Recueil d'Obs. sur les Maladies des Yeux. Sir *W. Adams*, Pract. Observ. on Ectropium, or Eversion of the Eyelids, with a Description of a new Operation for the Cure of that Disease; on the Modes of forming an artificial Pupil; and on Cataract, 8vo. Lond. 1812. *M. Bordenave*, Mémoire dans lequel on propose un nouveau Procédé pour traiter le renversement des Paupières, in Mém. de l'Acad. Royale de Chirurgie, t. xiii. p. 156. et seq. édit. 12mo. It was in this memoir, that the proposal of removing a portion of the inside of the eyelid for the cure of ectropium was first made. *P. J. Roux*, Parallèle de la Chirurgie Anglaise avec la Chirurgie Française, p. 289—292. Paris, 1815. *G. J. Beer*, Lehre von den Augenkrankheiten, b. ii. p. 133. &c. 8vo. Wien, 1817. *Benj. Travers*, Synopsis of the Dis. of the Eye, p. 234. 356. &c. 8vo. Lond. 1820. *Demours*, Traité des Mal. des Yeux, p. 98. *G. J. Guthrie*, Lectures on the Operative Surgery of the Eye, 8vo. Lond. 1823. *Wm. Lawrence*, On Diseases of the Eye, p. 349, 8vo. Lond. 1833. *Wm. Mackenzie*, On Dis. of the Eye, p. 207. ed. 2. 8vo. Lond. 1833. *R. M. D. Demore* on Dis. of the Eye, vol. i. p. 120.; vol. ii. p. 782. 8vo. Lond. 1835.

ECZEMA, or **ECZÉMA**, (from *ἐκζέω*, to boil out,) is characterised by an eruption of small vesicles on various parts of the skin, usually close, or crowded together, with little or no inflammation round their bases, and unattended by fever. It is not contagious. (*Bateman's Synopsis*, p. 250. col. 3.) There are several varieties of this disease, the most remarkable of which is the *eczema rubrum* from the irritation of mercury. This form is attended with quickened pulse and a white tongue; but the stomach and sensorium are not materially disturbed. (See *MERCURY*.)

EFFUSION, in surgery, means the passage of any fluid out of the vessel, or viscus, naturally containing it, and its lodgment in another cavity, the cellular tissue, or the substance of parts. Thus, when the chest is wounded, blood is sometimes effused from the vessels into the cavity of the pleura; in false aneurism, the blood passes out of the artery into the cellular tissue; in retention of urine, this fluid after a time, flows from the bladder and urethra into the cellular tissue of the perineum and scrotum; and, when great violence has been applied to the skull, blood is often effused upon, or in the substance of, the brain. Effusion also sometimes signifies the separation of fibrine, or a serous fluid from the vessels by the process of secretion, or some action of the vessels analogous to it. (See *EXTRAVASATION*.)

ELECTRICITY. Among the aids of surgery, electricity once held a conspicuous and important situation. It has, however, met with a fate, not unusual with remedies too much cried up and too indiscriminately employed; that of having fallen into an undeserved degree of neglect. Whatever its effects may be on the system, it certainly possesses this advantage over other topical remedies, that it may be made to act on parts very remote from the surface. Electricity, as a topical remedy, for surgical diseases is chiefly tried in amaurosis, deafness, some chronic tumours, and abscesses, weakness from sprains, or contusions, paralysis, &c. In suspended animation, electricity is sometimes an important auxiliary for the restoration of the vital functions. (See *J. Curry's Obs. on Apparent Death*, &c. ed. 2. 1815.)

ELEVATOR. An instrument for raising depressed portions of the skull. Besides the common elevator, now generally preferred by all the best operators, several others have been invented; as, for instance, the tripod elevator, and another,

which was first devised by J. L. Petit, and afterwards improved by M. Louis.

EMBROCATION. (See *LINIMENTUM*.)

EMBRYOTOMIA. (from *ἐμβρυον*, the fœtus, and *τέμνω*, to cut.) The operation of cutting into the womb, in order to extract the fœtus. (See *CÆSAREAN OPERATION*.)

EMPHYSEMA. (*ἐμφύσημα*, from *φυσάω*, to inflate.) A swelling produced by the presence of atmospheric air, or of any other gaseous fluid, which has insinuated itself into, or been formed in, the cellular tissue. Emphysematous swellings are divided into two classes; one, the *traumatic*, in which they originate from a wound of some part of the organs of respiration; and another, the *idiopathic* or *spontaneous* where they proceed either from chemical decomposition, or from secretion or internal pathological causes, the nature of which is obscure. In the latter class have been arranged *emphysema of the lungs*, a subject, on which the researches of *Laennec* threw important light; and certain cases, where, in consequence of inflammation, gas is found under the mucous membrane of the digestive canal. (See *L. J. Bégin* in *Dict. de Méd. et de Chir. Pratiques*, t. vii. art. *Emphyseme*.)

With regard to *traumatic emphysema*, or that originating from a breach in the air-passages, sometimes it arises from a manifest, or concealed wound of the lungs, bronchi, trachea, or larynx; sometimes it follows a rupture of the air cells, or passages, by the air itself. One common cause is a fractured rib, by which the air vesicles of the lungs are wounded, so that the air escapes from them into the cavity of the thorax. But, as the rib, at the moment of its being fractured, is pushed inwards, and wounds the pleura, which lines the ribs and intercostal muscles, part of the air most commonly passes through the pleura, into the cellular tissue, on the outside of the chest, and thence is diffused through the same over the whole body, so as to inflate it sometimes in an extraordinary degree.

Emphysema is frequent after a fractured rib, because there is a wide laceration of the lungs, and no exit for the air; it is less frequent in large wounds with a knife, or broad sword, because the air has an open and unimpeded issue; it is again more frequent in deep stabs with bayonets, or small swords; and it often follows gunshot wounds of the chest, particularly those in which the ribs are splintered. (See *J. Bell on Wounds of the Breast*, p. 265.)

If the lungs be deeply or extensively wounded by a portion of broken rib, or sternum, as there is in such a case no passage for the air outwards through any external wound in the chest, emphysema is very likely to arise, and to proceed to a dangerous degree.

Emphysema has also been known to arise from a rupture of the larynx and trachea, produced by a blow, or kick, as is exemplified in the case reported by Dr. L. O'Brien. (See *Edin. Med. and Surg. Journ.* No. lxxii.)

The emphysematous swelling, wheresoever situated, is easily distinguished from cedema, or anasarca, by the crepitation which occurs on handling it, or a noise, like that which takes place on compressing a dry bladder half filled with air. The tumour is colourless and free from pain. It does not of itself descend into depending parts,

though by pressure it may be made to change its situation. It is elastic, that is to say, it may be pressed down, but it rises up again as soon as the pressure is discontinued. The swelling never retains the impression of the end of the finger, or, in the language of surgery, never *pits*. The part is not heavy. The tumour first makes its appearance in one particular place; but soon extends, and causes an extraordinary distension of the skin. (*Richter's Anfangsgr. der Wundarzn.* b. i. p. 451.)

In bad cases, the patient complains of a considerable tightness of the chest, with pain, chiefly in the situation of the injury, and great difficulty of breathing. This obstruction of respiration gradually increases, and becomes more and more insupportable. The patient soon finds himself unable to lie down in bed, and cannot breathe, unless when his body is in the upright posture, or he is sitting a little inclined forward. In vain, he endeavours to articulate a few words; at each inspiration, a fresh column of air escapes from the breach in the lung, and renders his condition worse. Together with these symptoms, there is sometimes bloody expectoration, announcing a deep penetration of the lungs. (See *Case by Dupuytren, in Clin. Chir.* t. i. p. 117.) The countenance becomes red and swollen. The pulse, at first weak and contracted, becomes afterwards irregular. The extremities grow cold; and, if the patient continue unrelieved, he soon dies suffocated.

The diagnosis is not always free from obscurity, especially when emphysema is deeply seated, without any external tumour. An accumulation of air in one of the cavities of the pleura, however, is attended with an elevation and expansion of the ribs on the injured side; a clear sound on percussion; and excessive difficulty of breathing. In one example, where the fifth and sixth ribs were broken, there was, in addition to other symptoms already enumerated, an internal hissing sound at each expiration. (*Bégin, Dict. de Méd. et de Chir. Pratiques*, t. vii. p. 117.) For other symptoms and signs of the presence of air in the cavities of the pleura, see PNEUMO-THORAX.

The wound of the pleura and intercostal muscles may sometimes be too small to suffer the air to get readily into the cellular tissue, and inflate it; but may confine a part of it in the cavity of the thorax, so as to compress the lungs, prevent their expansion, and cause the same symptoms of tightness of the chest, quick breathing, and sense of suffocation, which the serous fluid does in hydrops pectoris or matter in empyema. (*Hewson, in Med. Obs. and Inq.* vol. iii.)

To understand, why the air passes at all out of the wound of the lungs, we must advert to the manner, in which inspiration and expiration are naturally carried on. In the perfect state, the surface of the lungs always lies in close contact with the membrane lining the chest, both in inspiration and expiration. The lungs themselves are chiefly passive organs, and incapable, by any action of their own, of expanding and contracting, so as to maintain their external surface always in contact with the inside of the thorax, which is continually undergoing an alternate change of dimensions. Every muscle, that has any share in enlarging and diminishing the capacity of the chest, must contribute to the effect of adapting

the volume of the lungs to the cavity in which they are contained, so long as there is no communication between the cavity of the pleura, and the external air. In inspiration, the thorax is enlarged in every direction; the lungs are expanded in the same way; and the air, entering through the windpipe into the air-cells of these organs prevents the occurrence of a vacuum.

But, when a free communication exists between the atmosphere and inside of the chest, in consequence of a wound, no sooner is this cavity expanded, than the air naturally enters it at the same time, and for the same reasons, that the air enters the lungs through the trachea, and the lung itself remains proportionally collapsed. When the thorax is next contracted, in expiration, the air is compressed out of the lung, and also out of the sac of the pleura, through the external wound, if there be a direct one; in which circumstance, the emphysematous swelling is never extensive.

But, in the case of a fractured rib, attended with a breach in the pleura costalis, pleura pulmonalis, and air-cells of the lungs, there is no direct communication between the cavity of the chest and the external air; in other words, there is no outward wound in the parietes of the thorax. There is, however, a preternatural opening formed between the air-cells of the lungs and the cavity of the chest, and also another one between the latter space, and the general cellular tissue of the body, through the breach in the pleura costalis. The consequence is, that when the chest is expanded in inspiration, air rushes from the wound in the surface of the lungs, and insinuates itself between them and the pleura costalis. The lungs collapse in proportion, and the place which they naturally occupied, when distended, is now occupied by the air. When, in expiration, the dimensions of the chest are every where diminished, the air, now lodged in the sac of the pleura, cannot get back into the aperture in the collapsed lung, because this is already full of air, and is equally compressed on every side, by that which is confined in the thorax. Were there no breach in the pleura costalis, this air could not now become diffused; the muscles of inspiration would next enlarge the chest, remove the pressure from the surface of the wounded lung, more air would be sucked out of it, as it were, into the space between the pleura costalis and pleura pulmonalis, and this process would go on, till the lungs of the wounded side were completely collapsed. But, in the case of a fractured rib, or narrow stab, in which there is also a breach in the pleura costalis, without any free vent outward, for the air, which gets out of the lung into the cavity of the pleura, as soon as the expiratory powers lessen the capacity of the chest, this air, not being able to pass back through the breach in the collapsed lung, is forced through the laceration, or wound, in the pleura costalis, into the cellular tissue.

It is through the communicating cells of this structure, that the air becomes most extensively diffused over the whole body, in proportion as the expiratory muscles continue in their turn to lessen the capacity of the chest, and pump the air, as it were, through the breach in the pleura costalis, immediately after it has been drawn out of the wound of the lung in inspiration. (See *John Bell on Wounds of the Breast, and Halliday on Emphysema*, 1807.)

When organised adhesions exist between the pleura costalis and pleura pulmonalis, so as to establish a continuity of textures between the surface of the lungs, and the parietes of the chest, the comprehension of the mechanism of emphysema is, as Dupuytren remarks, assuredly perfectly simple. The air then passes directly from the interior of the lungs into new-organised cellular texture, and thus gets through the parietes of the injured side into the subcutaneous cellular tissue. When there are no adhesions, a part of the air escapes, during inspiration, from the opening in the surface of the lung, and then becomes diffused in the surrounding textures and the cavity of the pleura. Thence, it is forced in all directions, as Dupuytren conceives, both by the alternate movements of expansion and contraction of the chest in respiration, and by the effect of its own elasticity; and it is made to enter progressively the cellular tissue of all the internal and external organs. Thus, if the quantity of air, drawn out of the lung, is considerable, it passes not only into the parietes of the chest and belly, the upper and lower extremities, the interior of the scrotum, the neck and head, but also into the cavity of the pleura, the two mediastina, the pericardium itself, and even into the interlobular cellular tissue of the lungs themselves. (See Dupuytren, in *Clin. Chir.* t. i. p. 113. 119.) In some cases, emphysema is the principal disorder; in others, it is only one of secondary importance, and sometimes not readily ascertained. An example, illustrating this fact, is given by Dupuytren, where the upper fragment of a broken sternum had penetrated the pericardium, and torn the right ventricle of the heart; and where a considerable quantity of bloody serum and of black blood itself was effused in the right cavity of the pleura; the fourth, fifth, and sixth ribs broken; and their cartilages separated from the sternum. (*Ib.* p. 120.) A case, published by M. Littré, well illustrates the enormous distention of the cellular tissue, occasionally produced: on the chest, the swelling was eleven inches thick; on the belly, nine; on the neck, six; and four on other parts. (See *Mém. de l'Acad. des Sciences*, 1713.)

To prove that the confinement of air in the chest is the cause of the dangerous symptoms attending emphysema, Hewson adverts to the histories of some remarkable cases, published by Littré, Mery, W. Hunter, and Cheston. (See *Mém. de l'Acad. Royale des Sciences*, for 1713; *Med. Obs. and Inquiries*, vol. ii.; and *Pathological Inquiries*.) The same eminent man made several experiments on animals, tending to prove that air in their chests produced great difficulty in breathing, such as occurs in emphysema; and, in one case, which he examined after death, air was actually discharged on puncturing the thorax.

While none of the symptoms denote the extension of emphysema to internal organs; and the quantity of air does not exceed a few cubic inches, the patient is not in danger, so far as this disorder is concerned. But the case is very different, when the air has passed not only into all the subcutaneous cellular tissue, but also into that of the internal organs of the chest, and even those of the abdomen; and when, besides such distention of the cellular tissue generally, there is likewise an accumulation of air in the great serous cavities. (See Dupuytren, *Clin. Chir.* t. i. p. 112.)

The passage of air into the subcutaneous, or intermuscular cellular tissue, occurs, not only as a complication of fractures, or penetrating wounds of the chest, but in any region adjacent to the air passages, or cavities. M. Carré has published an instance of air ascending the nasal duct, and rupturing one of the lachrymal canals, when the patient blew his nose. (See *Mém. de Méd. Milit.*) One case of emphysema of the eyelids from a presumed fracture of the horizontal plate of the ethmoid bone, or os unguis, and another from a supposed laceration of the pituitary membrane, used to be related by Dupuytren in his lectures. He also gives the particulars of an emphysema of the temporal region from a fracture of the frontal sinus. In all these examples of emphysema from injury of the upper parts of the respiratory apparatus, the surgeon will notice, in addition to the crepitation, &c., a sudden increase of the swelling whenever the patient coughs, or blows his nose. (Vol. cit. p. 123—130.) Here the treatment consists in bleeding, cold astringent lotions, and the avoidance of every thing calculated to make the air escape through the breach into the cellular tissue.

The object of Mr. Hewson's paper is to recommend making an opening in the chest, for the purpose of giving vent to the air confined in that cavity, just as is done for the discharge of pus, in empyema, or of a serous fluid, in hydrops pectoris.

In wounds of the lungs, says this author, whether occasioned by fractured ribs, or other causes, when symptoms of tightness and suffocation come on, so far should we be from dreading the emphysematous swelling of the cellular tissue, that we should rather consider it as a favourable symptom, showing that the air is not likely to be confined in the thorax; and so far should we be from compressing the wound to prevent the inflation, or emphysema, that we should rather dilate it (if not large enough already) or perform paracentesis thoracis. We may judge of the necessity of this operation from the violence of the symptoms, such as the oppressed breathing, &c. For when these are not considerable, and the air passes out of the chest with sufficient freedom, the operation is then unnecessary.

If the disease is on the right side, the best place for performing the operation, says Mr. Hewson, will be on the fore part of the chest, between the fifth and sixth ribs; for, there the integuments are thin, and, in the case of air, no depending drain is required. But, if the disease is on the left side, it will be more advisable to make the opening between the seventh and eighth, or eighth and ninth ribs, in order that we may be sure of avoiding the pericardium. As large penetrating wounds are inconvenient on account of the air entering by the aperture in such a quantity as to prevent the expansion of the lungs, a small wound will be eligible, especially as air does not require a large one for its escape. Mr. Hewson recommends dissecting cautiously with a knife, in preference to the coarse and hazardous method of thrusting in a trocar.

There is one error in Hewson's paper, for which he has been justly criticised by John Bell; viz. the idea, that it is possible and proper to make the collapsed lung expand by making an opening in the chest. Bromfield and B. Bell imbibed the same erroneous opinion, and proposed plans for

exhausting the air and expanding the lung. It is certain that it is impracticable to make the collapsed viscus expand, until the breach of it is closed, and this closure is greatly promoted by the quiet state, in which the collapsed lung remains; a state, also, the most favourable for the stoppage of any bleeding from the pulmonary vessels.

The true object then of making an opening in the thorax, when the symptoms of suffocation are violent, is not to obtain an expansion of the lung on the affected side, nor to take the pressure of the air from it; but, to remove the pressure caused on the opposite lung by the distention of the mediastinum, and, at the same time, to diminish the pressure of the air on the diaphragm. The lung on the affected side must continue collapsed, and it is most advantageous that it should do so. The opposite lung is that, which for a time must of itself carry on respiration, and it is known to be fully adequate to the function, provided the quantity of air, on the other side of the chest, does not produce too much pressure on the mediastinum, and diaphragm.

Mr. John Bell concludes his remarks on this subject, with advising the following practice:—

1st. When the crackling tumour begins to form over a fractured rib, small punctures should be made with the point of a lancet, as in bleeding; and if the point be struck deep enough, the air will rush out audibly. But, as (supposing the lung is not adherent to the inside of the chest) this air was in the thorax, before it came into the cellular tissue, it is plain, that the thorax is still full, and that the lung of that side is already collapsed and useless, and must continue so. The purpose, therefore, of making these scarifications, and, especially, of making them so near the fractured part, is not to relieve the lungs, but merely to prevent the air spreading more widely beneath the skin.

2dly. If the air should have spread to very remote parts of the body, as to the scrotum, and down the thighs, it will be easier to make small punctures in those parts, to let out the air directly, than to press it along the whole body, till it is brought up to the punctures made on the chest, over the wounded part.

3dly. If, notwithstanding free punctures, and pressing out the air in this way, it is found by the oppression, that either air, or blood, is accumulating within the cavity of the thorax, so as to oppress, not the wounded lung only, which was of course collapsed and useless from the first, but the diaphragm, and through the diaphragm to affect also the sound lung; then a freer incision must be made, through the skin and muscles, and a small puncture should be cautiously made through the pleura, in order to let out the air, or blood, confined in the thorax. (*John Bell, Op. cit. p. 278.*)

I believe, with Dupuytren, that making cuts, or punctures in the skin, will be of little service where emphysema is attended with urgent symptoms depending upon the accumulation and confinement of air in internal cavities and organs, though the practice may answer the purpose of preventing the further diffusion of air in the subcutaneous cellular tissue by affording an outlet for it. Hence, if the case be not too far advanced, or joined with complications beyond the reach of surgery, Dupuytren was not adverse to the plan. (*See Clin. Chir. t. i. p. 117.*)

Sometimes the necessity for puncturing the pleura is rendered obvious by the oppressed state of the breathing, and other urgent symptoms of pneumo-thorax; but, from the extreme distension of the integuments it is difficult to ascertain on which side the operation should be performed. In one instance upon record, an incision was made between the sixth and seventh ribs on the left side; every symptom became immediately worse, and death followed in a quarter of an hour. The *post mortem* examination shewed, that the operation had been performed on the wrong side. (*See Halliday on Emphysema.*) In traumatic cases, or those from fractured rib, I think that such difficulty is not likely to happen; the wound, or fracture being a guide.

In all these cases, copious and frequently repeated venesection is generally proper.

After a few days, the wound in the collapsed lung, is closed by the adhesive inflammation, so that air no longer passes out of it into the cavity of the chest, and the outer wound may therefore be healed. What air is already there is ultimately absorbed, and the lung, expanding in proportion, resumes its original functions.

The application of a bandage round the chest is sometimes practised for the relief of emphysema; and its utility, when the ribs are broken, has been highly spoken of by Mr. Abernethy. "Pressure by bandage (says he) not only hinders the air from diffusing itself through the cellular substance, but serves to prevent it from escaping out of the wounded lung; and, of course, facilitates the healing of the wound, which would be prevented by the constant transmission of air. Its early application, therefore, will often prevent a very troublesome symptom, whilst, at the same time, by keeping the fractured bones from motion, it greatly lessens the sufferings of the patient." (*Abernethy's Surgical Works, vol. ii. p. 179.*) When emphysema is complicated with a fractured rib, the latter injury is unquestionably a reason in favour of a bandage. But, whether the pressure of the roller will be useful, or hurtful, with respect to the emphysema itself, or the state of the lungs and respiration, may be questionable. As for its tendency to resist the diffusion of air in the cellular tissue, this circumstance does not appear to me important; because the air, thus diffused, much as it disfigures the patient, is nearly harmless, at least so long as the great serous cavities, and the interlobular texture of the lungs remain uninflated; a danger, also, which no bandaging has any tendency to prevent. Neither will a bandage have so much effect in hindering the diffusion of air, as scarifications, with this important additional consideration, that punctures, or small incisions, made over the broken rib, prevent the spreading of the air, by letting it escape, while a bandage can only do so by more or less resisting its escape from the cavity of the pleura; which mode of operation in some cases would dangerously interfere with the continuation of respiration by the lung of the opposite side. At the same time, I believe, that when the air extravasated within the injured side of the chest is not in such quantity as to oppress the sound lung, and a rib is broken, a bandage will generally afford great relief. Indeed, it is but justice to Mr. Abernethy to state, that he does not recommend the employment of a bandage in all cases of emphysema. "Patients (says he)

will not always be able to wear a bandage, when one lung is collapsed, particularly if any previous disease has existed in the other, as it equally confines the motions of the ribs on both sides, and as every possible enlargement of the chest becomes necessary for the due admission of the air into the lung, which still executes its functions. Under these circumstances, if the emphysema continues (and its continuance must always denote that the wound in the lung is not closed), I should esteem it the best practice to make a small opening into the chest, so that the external air might have a free communication with that cavity; and then the injured lung must remain motionless till its wound is healed, and the mediastinum, will, in every state of the thorax, preserve its natural situation." (*Abernethy*, vol. cit. p. 183.) In the case recorded by *Cheston*, the patient on having a compress and bandage applied, exclaimed that he could not endure it.

When emphysema was combined with a fractured rib, and not any urgent compression of the lungs by air in the cavity of the pleura, *Dupuytren* used to bleed, apply to the injured side compresses wetted with a resolvent lotion, and then surround the chest with a bandage, so as to suspend the action of the external muscles of respiration, and oblige the patient to breathe entirely by the diaphragm, the principle insisted upon by *Abernethy*. In this manner, the union of the fracture was promoted; and, as was believed, the causes of emphysema opposed. The possibility of a person breathing wholly by the diaphragm seemed proved to *Dupuytren* by what happens in injuries of the upper part of the spinal chord, when all the external muscles are struck with paralysis. (*Clin. Chir.* t. i. p. 115.) When, however, the respiration was dangerously interrupted by the accumulation of air in the pleura, *Dupuytren* abstained from applying a bandage, which, he conceived to be only likely to augment the patient's sufferings. (*See Clin. Chir.* t. i. p. 117.)

The utility of a free incision, and scarifications, is well illustrated in a case recorded by *Larrey*. The emphysema arose from a wound of the lungs by a lance. The whole body was prodigiously swelled; the integuments so distended, that the limbs were inflexible, the eyes buried; and the lips so enlarged that nothing could be introduced into the mouth. The pulse and respiration were scarcely perceptible, and the voice feeble and interrupted. The lance had entered obliquely under the lower angle of the scapula; and though the external and internal orifices of the wound were not parallel, the surgeon had applied adhesive straps, and closed the external one. Hence, the air, as it escaped from the lungs, distended the cellular tissue. *Larrey* immediately removed the dressings; and, with a bistoury made the openings in the pleura and skin parallel. Cupping glasses were then applied over the wound, and quickly filled with air and blood. The lips of the wound were now brought together, and kept so with a suitable bandage. Cupping glasses and scarificators were applied to various parts of the body, and, in others, incisions were made with a scalpel. The patient recovered. (*See Mém. de Chir. Militaire*, t. iv.)

In emphysema, dependent upon over distention and rupture of the air cells, and the escape of air into the interlobular tissue of the lungs, and thence,

through the mediastinum, into the common cellular tissue, the best practice is that of diminishing the violence of the respiratory efforts, by which the air is forced at each respiration into the mediastinum. With this view, copious venesection should be employed, for the double purpose of relieving the pulmonary congestion, and of diminishing the mass of circulating fluid; for, by lessening the quantity of blood for oxygenation, we also lessen the necessity for taking in so large a supply of air for the purpose, and, in the same proportion, diminish the efforts made by the muscles of respiration to dilate and contract the thorax. Opium should be employed with the same intent; and the antiphlogistic regimen enforced. (*See Townsend in Cyclop. of Pract. Medicine*, art. Emphysema; and *Laennec on Dis. of the Chest*, ed. by *Forbes*.)

Emphysema has been known to arise from the bursting of a vomica, and ulceration of the surface of the lungs; but, the air, which escapes cannot pass into the cavity of the thorax, because the inflammation, which precedes the abscess and ulceration of the air-cells, closes those which are adjacent, and produces an adhesion of the edges of the vomica, or ulcer, to the inner surface of the chest, so as entirely to separate the two cavities. *Palfyn* and *Dr. Hunter* met with cases, in which emphysema originated from abscesses of the lungs, attended with adhesion to the pleura and ulcerations in the situation of such adhesion. In these instances, the pus having made its way through the pleura and intercostal muscles, the air escaped through the same track, and passed into the cellular tissue on the outside of the chest.

A violent effort of respiration has sometimes produced a certain degree of emphysema, which first makes its appearance about the clavicles, and afterwards spreads over the neck and adjacent parts. The efforts of labour have been known to occasion it. (*Medical Communications*, vol. i. p. 176.; *Blackden, in Med. Facts and Experiments*, vol. ii.; *Wilmers Obs. in Surgery*, p. 143.; and *Halliday on Emphysema*.)

Dr. Johnson, of Dublin, met with six examples of this in his practice. In general, the emphysematous swelling is confined to the neighbourhood of the throat, where it first makes its appearance; but it may spread to a vast extent, and even to the very tips of the fingers. In whooping cough, emphysema may be produced as proved by the observations of *Drs. Johnson, Mackintosh, and Beattie*. (*See Cyclop. of Pract. Med.* art. Emphysema.) I agree with the writer of this article in thinking it highly probable, that many cases of emphysema supposed to be spontaneous, really proceed from a rupture of the air-cells of the lungs. Thus, besides the emphysema, which sometimes appears on the sides of the thorax when much force is employed to reduce a dislocation of the humerus, which was believed by *Desault* to depend upon a rupture of the air-cells, caused by the violent efforts, which the patient makes to hold his breath during the reduction of the dislocation, the emphysematous swellings, which are noticed occasionally, in hysteria, may admit of similar explanation, the air being forced through the cellular tissue of the lung and mediastinum by the violent efforts at expiration made during the paroxysm, while the glottis is spasmodically constricted. (*Townsend, ib.*)

Louis described an emphysema, which, on account of its cause, and the indication furnished by it to the practitioner, is highly important. It took place in a young girl, who died suffocated from a bean falling into her windpipe; and he considers it, though not correctly, as a pathognomonic symptom of such an accident, concerning the existence of which it is so essential not to commit any mistake. (See *TRACHEOTOMY*.) It made its appearance on both sides of the neck, above the clavicles, and came on suddenly, on the third day after the accident. The inspection of the body proved, that the lungs and mediastinum were also in an emphysematous state. The retention of the air, confined by the foreign body, produced, says Louis, at each attempt to expire, and, especially, when the violent fits of coughing occurred, a strong propulsion of this fluid towards the surface of the lung, into the spongy substance of this viscus. Thence, the air passed into the cellular texture, which unites the surface of the lung to the pleura pulmonaris; and, by communications from cells to cells, it caused a prodigious swelling of the cellular tissue, between the two layers of the mediastinum. The emphysema, increasing, at length made its appearance above the clavicles. This tumefaction of the lung, and surrounding parts, in consequence of air getting into their spongy and cellular texture, is an evident cause of suffocation, and the swelling seems so natural an effect of the presence of a foreign body in the trachea, that one can hardly fail to think it an essential symptom, though no author has made mention of it. (*Mém. de l'Acad. de Chir.* t. iv. in 4to.) The emphysematous swelling, sometimes formed in the axilla, in the reduction of a dislocated shoulder was accounted for by Desault and Bichat, on the same principle as the foregoing case, viz. a rupture of one of the air-cells, by the patient's efforts to hold his breath during the reduction of the bone.

The example, lately recorded by Dr. Ireland, as one of idiopathic emphysema following pneumonia, bears so strong a resemblance to the case above cited from M. Louis, that I cannot refrain from suspecting, that it may have been one of the same nature. (See *Trans. of the King's and Queen's College of Physicians*, vol. iii. art. 4.)

An emphysematous swelling of the head, neck, and chest, has also been noticed in typhoid fevers. Dr. Huxham relates an instance of this sort, in a sailor of a scorbutic habit. (*Medical Obs. and Inquiries*, vol. iii. art. 4.) Another example in a case of bilious fever, is on record. (See *London Med. Repository*, No. 73.) A case of spontaneous emphysema is likewise described by Dr. Baillie. (See *Trans. for the Improvement of Med. and Chir. Knowledge*, vol. i. p. 202.)

A curious example of what has been called a spontaneous emphysema, is reported by Mr. Allan Burns:—"The patient was a strong athletic man, who, about six years previous to his application at the Royal Infirmary, had received a smart blow on the neck from the keel of a boat. This injury was soon followed by the formation of a firm tense tumour, on the place which had been hurt. The swelling increased very slowly, during the five years immediately succeeding its commencement; but, during the sixth, it received a very rapid addition to its bulk. At this time, it measured nearly six inches in diameter, seemed to be

confined by a firm and dense covering, and the morbid parts had an obscure fluctuation. From the first to the last, the tumour had been productive of very little pain.

"Judging from the apparent fluctuation, that the tumour was encysted, it was resolved, at a consultation, to puncture the swelling, draw off its contents, and then pass a seton through it. By plunging a lancet into it, only a very small quantity of blood, partly coagulated, and partly fluid, was discharged; a quantity so trifling, that, after its evacuation, the size of the tumour was not perceptibly reduced. A seton was passed through the swelling. At this time the man was in perfect health.

"About ten hours after the operation, the patient was seized with extremely violent rigors, followed by heat, thirst, pain in the back, excessive pain in the tumour, and oppressive sickness.

"An emetic was prescribed; but, instead of producing vomiting, it operated as a cathartic. To remove the irritation, the seton was withdrawn. The pain in the tumour, however, and the general uneasiness continued to increase, and thirty hours subsequent to making the puncture, air began to issue from the track of the seton; and afterwards the cellular membrane of the neck, and of the other parts of the body in succession, became distended with a gaseous fluid. In the course of a few hours, after the commencement of the general emphysema, the man died.

"Twelve hours after death, when the body was free from putrefaction, it was inspected. The emphysema was neither increased nor diminished since death; and some idea may be formed of its extent, when the scrotum was distended to the size of the head of an adult. Even the cavities of the heart, and the canals of the blood-vessels, contained a considerable quantity of air. We could discover no direct communication between the tumour and the trachea or lungs, although such was carefully sought for." (*A. Burns on the Surgical Anatomy of the Head and Neck*, p. 51—53.)

From such cases, we may infer, that from the mere rupture of a few of the bronchial cells, occasioned by irregular action of the lungs, or by some other internal cause, a spontaneous diffusion of air may take place in the cellular tissue. Such examples are dependent on the same cause as emphysema from injury of the lungs; only the rupture of the bronchial cells in the former cases is less obvious.

Emphysema frequently attends gangrene, especially the humid. Here, however, the air is the product of putrefaction, and the disorder has not the smallest connection with any injury, or disease, of the lungs. In one instance of gangrene from an external cause, Dr. Hunter found, that he could as easily mark the progress of the mortification from day to day by the emphysema, as by the change of colour in the integuments. (See *Med. Obs. and Inq.* vol. ii.) Gangrene, when accompanied by emphysema, is observed to have a great disposition to spread. (See *James on Inflammation*, p. 96.)

A remarkable case is recorded by Dr. Duncan, in which several emphysematous tumours were formed in succession over the chest and neck, in consequence of communications formed by ulceration between the lung and common cellular tissue. (See *Edinb. Med. Chir. Trans.* vol. i.) Or

the air may first get into the cavity of the pleura, so as to occasion pneumo-thorax, and afterwards pass into the cellular tissue through an ulceration of the pleura costalis. (See *Halliday, Op. cit.*) emphysema has been known to arise from the passage of air from the alimentary canal, through a rupture of its parietes. (*Haller, Opuscula Pathol. Obs.* 31. t. iii.) A violent contusion of the abdomen has produced in this way an extensive emphysema. (See *Archive's Gén. de Med.*) In ruminating animals, in consequence of the fermentation of their food, the accident is not uncommon. (See *Obs. sur les Animaux Domestiques, par MM. Chabert et Husard.*)

C. EMPYEMA. De Emphysemate, Haller, Disp. Chir. ii. 667. Haller, 1733. H. A. Nics, De Miro Emphysemate, 4to. Duisb. ad Rhén. 1751. *Hewson's* Paper in Medical Obs. and Inquiries, vol. iii. Mém. de l'Acad. Royale des Sciences, for 1713. Dr. W. Hunter, in Med. Obs. and Inquiries, vol. ii. *Cheston*, in Pathological Inquiries. *Abernethy's* Surgical Works, vol. ii. *Bichter*, von der Windgeschwulst, in Anfangsgr. der Wundarzneikunst, b. 1. p. 451, &c. *John Bell*, On Wounds, edit. 3. Edin. 1812. *Halliday* on Emphysema, 1807. *Allan Burns*, On the Surgical Anatomy of the Head and Neck, p. 52. &c. Trans. of a Society for the Improvement of Medical and Chir. Knowledge, vol. i. p. 262. *Wibmer's* Observations in Surgery, p. 143. F. C. Waitz, De Emphysemate, 4to. Lips. 1803. *Lassus*, Pathologie Chir. t. ii. p. 321, &c. édit. 1809. Dict. des Sciences Méd. t. xii. p. 1, &c. Dict. de Méd. et de Chir. Pratiques, art. Emphyseme. *Townsend*, in Cyclopaedia of Pract. Med. art. Emphysema. *J. Hennen*, Principles of Military Surgery, p. 376. edit 2. 8vo. Edin. 1820. C. Bell, Surgical Obs. vol. i. p. 161. &c. *Laennec*, On Dis. of the Chest, ed. by Forbes, ed. 3. *Dupuytren*, Clinique Chir. t. i. p. 110. 8vo. Paris, 1832.

EMPLASTRUM AMMONIACI CUM ACETO. R. Ammoniaci purif. ℥ij. Acidi Acetici, ℥ij. Ammoniacum in aceto liquefactum evaporatum in vase ferreo ad emplastrum crassitudinem.

EMPLASTRUM AMMONIACI SCILLITICUM. R. Gummi ammoniaci, ℥j. Aceti Scillitici, q. s. ut fiant emplastrum, quo pars affecta tegatur. Mr. Ford found this plaster useful in some scrofulous affections. It may be rendered more stimulating by sprinkling it with squills. (*Ford on the Hip-joint*, p. 59.) It was recommended by Swediaur; *London Medical Journal*, vol. i. p. 198.

EMPLASTRUM AMMONIACI CUM HYDRARGYRO. Discutient.

EMPLASTRUM AMMONIACI CUM CUCUTA. R. Gum. ammon. ℥ij. Extracti Conii, 3ij. Liq. Plumb. acet. ʒj.

Dissolve the ammoniacum in a little vinegar of squills, then add the other ingredients, and boil them all slowly to the consistence of a plaster. Discutient.

EMPLASTRUM AMMONIÆ. R. Sapon. ʒij. Emplastr. Plumbi. ʒss. Ammon. mur. ʒj.

The two first articles are to be melted together, and when nearly cold, the muriated ammonia, finely powdered, is to be added. This plaster stimulates the skin, excites the action of the absorbents, and disperses many chronic swellings and indurations.

EMPLASTRUM CANTHARIDIS. (See *Blister*.)

EMPLASTRUM GALBANI COMPOSITUM. Properties discutient.

EMPLASTRUM HYDRARGYRI. L. P. Properties discutient.

EMPLASTRUM PLUMBI. L. P. The common adhesive, or sticking plaster.

EMPLASTRUM SAPONIS. The plaster

commonly applied to fractures, bruised parts, and various indurations of a chronic nature.

EMPHYEMA (from *ἐν*, within, and *πύω*, pus, or matter). A collection of purulent matter in the cavity of the chest.

The ancients made use of the word, "empyema," to express every kind of internal suppuration. It was *Ætius*, who first restricted the term to collections of matter in the cavity of the pleura, or membrane lining the chest; and all the best modern surgeons invariably attach this meaning alone to the expression.

The operation for empyema properly means the making of an opening into the thorax, for the purpose of discharging matter collected in the cavity of the pleura, though the phrase with several writers denotes making an incision into the chest, in order to let out any effused, or confined fluid, whether matter, blood, or a serous fluid. It is not always easy, however, to determine, *a priori*, the precise nature of the fluid, collected in the chest. Thus, in a case of empyema of two months' standing, occasioned by the bursting of a tubercular abscess of the lung into the pleura, the fluid was observed by Dr. Townsend to present all the characters of genuine pus; while, in another case, where the effusion was produced by a similar cause, and assumed the same chronic form, paracentesis gave issue to a fluid as transparent and colourless as water. (See *Cyclop. of Pract. Med.* art. *Empyema*.)

Acute and chronic abscesses not unfrequently form in the cellular tissue between the pleura and the ribs and intercostal muscles. A swelling occurs between two of those bones; the skin does not undergo any change of colour; a fluctuation is distinguishable, and sometimes extensive oedema.

With respect to abscesses, formed in the cellular tissue, connecting the pleura costalis to the intercostal muscles, they rarely burst into the chest, the pleura being considerably thickened. However, in order to keep them from spreading extensively, as well as to obviate any possibility of their breaking inwards, the best rule is to make an early, and, if possible, a depending opening. The motions of respiration then both promote the exit of the matter, as well as the contraction of the cavity, in which it was lodged; and the disease, if unattended with caries, generally terminates favourably.

It often happens, however, that the ribs are carious, and then the cure is more tedious and difficult. A modern writer, indeed, informs us that, when the inside of the rib is extensively carious, or when the caries is near the junction of the bone to the spine, the fistula is incurable. (*Lassus, Pathologie Chir.* t. i. p. 128. édit. 1809.) On the other hand, another surgeon of vast experience recommends us to endeavour to separate the diseased bone, either by cutting it away or employing the trepan. (*Pelletan, Clinique Chir.* t. iii. p. 253.) Were a part of a diseased rib to admit of being sawn away, Mr. Hey's convex saw would be a more proper instrument for the purpose than a trepan.

An abscess of the preceding kind may be so situated, and attended with such a pulsation, as greatly to resemble an aneurism of the origin of the aorta. An interesting case of this description is detailed by Pelletan (*Clinique Chir.* t. iii. p. 254.), and another was seen by Boyer. (*Mal. Chir.* t. vii. p. 333.)

When the surface of the lungs, and that of the pleura costalis have become adherent to each other, in the situation of the abscess, so as to constitute what is termed *encysted empyema*, the pus, disposed by a law of nature to make its way to the surface of the body, generally occasions ulceration of the intercostal muscles, and collects on the outside of them. An abscess of this kind comes on with a deep-seated pain in the part affected; an cedematous swelling, which retains the impression of the finger; and a fluctuation, which is at first not very distinct, but, from day to day, becomes more and more palpable, and, at length, leads the surgeon to make an opening.

If this be not done when the fluctuation becomes perceptible, the abscess may possibly insinuate itself into the cavity of the pleura, in consequence of the adhesion being in part destroyed by ulceration. Sabatier affirms, that the case may take this course, even when the abscess has been punctured, and while a free external opening exists; and this experienced surgeon has adduced a fact in confirmation of such an occurrence. (See *Méd. Opératoire*, tom. ii. p. 249.)

In a few instances, the surface of the lung ulcerates, and the matter is voided from the trachea. But, in the majority of examples, the pus makes its way outwards through the pleura costalis. If inflammation occurs in the anterior mediastinum, and ends in suppuration, the abscess may possibly burst into neither of the cavities of the chest, but make its way outwards, after rendering the sternum carious, as happened in the example recorded by Van Swieten. (*Comment on Boerhaave's 895th Aphorism.*)

But though, collections of matter in the anterior mediastinum are influenced by the general law, whereby abscesses in general tend to the surface of the body, and though it be true, that they rarely burst into the cavity of the pleura, the contrary may happen, as is proved by the 9th case in La Martinière's memoir on the operation of trepanning the sternum. Here the event was the more unexpected, as there was already an external opening in the abscess.

External injuries, such as the perforation of the sternum with a sword (*Vanderwiel, Obs. 29., Cent. 1.*), a contusion, a fracture, or a caries of this bone, may give rise to an abscess in the anterior mediastinum. Galen has recorded a memorable example, where the abscess was the consequence of a wound of the fore part of the chest. After the injury, which was in the region of the sternum, seemed quite well, an abscess formed in the same situation, and being opened, healed up. The part, however, soon inflamed, and suppurated again. The abscess could not now be cured. A consultation was held, at which Galen attended. As the sternum was obviously carious, and the pulsation of the heart was visible, every one was afraid of undertaking the treatment of the case, since it was conceived, that it would be necessary to open the thorax itself. Galen, however, engaged to manage the treatment without making any such opening, and he expressed his opinion that he should be able to effect a cure. After the removal of a portion of the bone, the heart was quite exposed (as is alleged), by reason of the pericardium having been destroyed by the previous disease. The patient experienced a speedy recovery.

J. L. Petit met with an abscess in the anterior

mediastinum, in consequence of a gun-shot wound in the situation of the sternum. The injury had been merely dressed with some digestive application; no dilatation, nor any particular examination of the wound had been made. The patient, after being to all appearance quite well, and joining his regiment again, was soon taken ill with irregular shiverings, and other febrile symptoms. Petit probed the wound, and found the bone affected. As there was a difficulty of breathing, he suspected an abscess either in the diploe, or behind the sternum, and, consequently, he proposed laying the bone bare, and applying a trepan. The operation afforded an outlet for some sanious matter, and, as soon as the inner part of the sternum had been perforated, a quantity of pus was discharged. The patient was relieved, and afterwards recovered. (*Petit, Mal. Chir. t. i. p. 80.*)

Another instance, in which an abscess behind the sternum was cured by making a perforation in that bone opposite the lower part of the cavity, in which the matter collected, is recorded by De la Martinière. (*Mém. de l'Acad. de Chir. t. xii. édit. 12mo.*)

When, in consequence of inflammation, an abscess forms deeply in the substance of the lungs, the pus more easily makes its way into the air-cells, and tends towards the bronchi, than towards the surface of the lungs. In this case, the patient spits up purulent matter. When the opening, by which the abscess has burst internally, is large, and the pus escapes from it in considerable quantity at a time, the patient is in some danger of being suffocated. However, if the opening be not immediately large, and the pus, which is effused, be not too copious, a recovery may ensue. Abscesses in the substance of the diaphragm, and collections of matter in the liver, may also be discharged by the pus being coughed up from the trachea, when the parts affected become connected with the lungs by adhesions, and the abscesses of the liver are situated on its convex surface. When the collection of matter in the liver occupies any other situation, the abscess frequently makes its way into the colon, and the pus is discharged with the stools. Several cases of this kind are related by authors: Sabatier has recorded two (*Méd. Opératoire*); Le Dran makes mention of others; and Pemberton (*Diseases of the Abdominal Viscera*, p. 36.) relates additional instances of a similar nature.

I shall now proceed to the consideration of empyema strictly so called. Sometimes it is a consequence of a penetrating wound of the chest; occasionally it proceeds from the bursting of one or more *unicæ*; in a few examples, it arises from the particular way in which abscesses of the liver burst (*Journ. de Méd. t. iii. p. 47. Morgagni, epist. xxx. art. 4.*); but, in the greater number of instances, originates from pleuritic inflammation, either acute or chronic. (*Bayer, Mal. Chir. t. vii. p. 352.*) Empyema more rarely takes place in both than in one cavity of the pleura.

Sometimes firm adhesions intersect the purulent effusion, and divide the sac of the pleura into distinct compartments. Dr. Townsend examined the body of a patient, who died of empyema in the Whitworth Hospital, and in whom the effusion was contained in three compartments, so perfectly distinct from each other, that, if paracentesis had

been performed, only one of the three separate collections would have been discharged. (See *Cyclop. of Pract. Medicine*, art. *Empyema*.) In all cases, the purulent, or thinner fluid of empyema may be said to be principally, if not entirely, a morbid secretion from the pleura; and even where pus, or other matter is introduced from another source, as from the rupture of a pulmonary, or hepatic abscess, the collection of fluid, which constitutes the empyema consequent thereon, does not consist so much of the matter of the abscess, as of the morbid secretion from the pleura, which the irritation caused by the presence of that matter, produces. (Townsend, *ib.*)

In cases of empyema, the pleura is almost constantly lined by a coating of adventitious matter, which gives the interior of the chest much more the appearance of the walls of a large abscess, than of a cavity lined by a serous membrane. The adventitious membrane is susceptible of inflammation, ulceration, and gangrene, and when the latter change occurs, the detachment of the slough may form an outlet for the empyema. The adventitious membrane of serous tissues is also capable of transformation into fibrous, cartilaginous, or osseous tissues, and is liable to the development of tubercles in it. These are generally small and numerous, and mostly follow chronic pleuritis. Sometimes, however, they form numerous and rapidly. (See *Andral, Clinique Méd.* t. ii.)

When empyema arises from thoracic inflammation, pleuritis, or pneumonia, the symptoms characterising it, are always preceded by those of the disease, of which the effusion of pus upon the diaphragm is the effect. Inquiry must, therefore, be made whether the patient has pleurisy, or peripneumony, the symptoms of which have lasted longer than a fortnight; and whether, after a transient amendment, there have been frequent shiverings, followed by a low continued fever, with nightly exacerbations. Now these first circumstances justify the belief, that the inflammatory disorder has terminated in suppuration, and that the symptoms afterwards experienced depend upon effusion of matter in the chest. Some of these arise from the mechanical action of the pus upon the lungs, heart, and parietes of the chest, and belong also to other effusions in the thorax; the rest may be said to be the effects of ulceration and suppuration of the parts on the animal economy, and, therefore, particularly belong to empyema.

First, of the common symptoms, respiration is difficult, short, and frequent; the patient suffers great oppression, and experiences a sense of suffocation, and of weight upon the diaphragm. He cannot move about, even for a short time, without being quite out of breath, and threatened with syncope. He has an almost incessant, and very fatiguing cough, which is sometimes dry, sometimes attended with expectoration. (Boyer, *Mal. Chir.* t. vii. p. 356.)

Few writers of the last century have described the symptoms of empyema with more discrimination and accuracy than Mr. Samuel Sharp. He remarks, that it has been almost universally taught, that, when a fluid is extravasated in the thorax, the patient can only lie on the diseased side, the weight of the incumbent fluid on the mediastinum becoming troublesome, if he places himself on the

sound side. For the same reason, when there is fluid in both cavities of the thorax, the patient finds it most easy to lie on his back, or to lean forwards, in order that the fluid may neither press upon the mediastinum, nor the diaphragm. But, it is noticed by Mr. Sharp, that, however true this doctrine may prove in most instances, there are a few, in which, notwithstanding the extravasation, the patient does not complain of more inconvenience in one posture than another, nor even of any great difficulty of breathing. (See *Le Dran's Obs.* 217., and *Marchetti*, 65.)

On this account, observes Mr. Sharp, it is sometimes less easy to determine when the operation is requisite, than if we had so exact a criterion, as we are generally supposed to have. But, says he, though this may be wanting, there are some other circumstances, which will generally guide us with a reasonable certainty. He states, that the most infallible symptom of a large quantity of fluid in one of the cavities of the thorax, is a preternatural expansion of that side of the chest, where it lies; for, in proportion as the fluid accumulates, it will necessarily elevate the ribs on that side, and prevent them from contracting so much in expiration as the ribs on the other side. This change is said to be most evident, when the surgeon views the back of the chest. (Boyer, vol. cit. p. 357.) Mr. Sharp also refers to *Le Dran's Obs.* 211. vol. i. in order to prove, that the pressure of the fluid on the lungs may sometimes be so great, as to make them collapse, and almost totally obstruct their function. When, therefore, says Mr. Sharp, the thorax becomes thus expanded, after a previous pulmonary disorder, and the case is attended with the symptoms of suppuration, it is probably owing to a collection of matter. The patient, he observes, will also labour under a continual low fever, and a particular anxiety from the load of fluid.

Besides this dilatation of the cavity by an accumulation of the fluid, the patient will be sensible of an undulation, which is sometimes so evident that a bystander can plainly hear it in certain motions of the body. Mr. Sharp adds, that this was the case with a patient of his own, on whom he performed the operation; but, the fluid, in this instance, he says, was very thin, being a serous liquid, rather than pus. Sometimes, when the practitioner applies his ear close to the patient's chest, while this is agitated, a noise can be heard, like that produced by shaking a small cask, not quite full of water. (See *Dr. Archer's Case*, in *Trans. of the Fellows, &c. of the King's and Queen's College of Physicians in Ireland*, vol. ii. p. 2.) In this instance, the fluid resembled whey.

According to the same author, it will also frequently happen, that though the skin and intercostal muscles are not inflamed, they will become oedematous in certain parts of the thorax; or, if they are not oedematous, they will be a little thickened; or, as Boyer states, the intercostal spaces are widened, and, when the empyema is considerable, instead of being depressed, as they are in thin persons, they project beyond the level of the ribs. (*Mal. Chir.* t. vii. p. 367.) These symptoms, joined with the enlargement of the thorax, and the preceding affection of the pleura or lungs, seem unquestionably to indicate the propriety of the operation. But, observes Mr.

Sharp, amongst other motives to recommend it upon such an emergency, this is one, that if the operator should mistake the case, an incision of the intercostal muscles would neither be very painful, nor dangerous. (See *Critical Inquiry into the present State of Surgery*, sect. on EMPYEMA.)

"The difficulty of lying on the side, opposite to the collection of pus," says Le Dran, "is always accounted a sign of an empyema. This sign, indeed, is in the affirmative; but, the want of it does not prove the negative; because, when there is adhesion of the lungs to the mediastinum, the patient may lie equally on both sides." (*Le Dran's Obs.* p. 108. edit. 2.) The explanation of this circumstance, offered by Le Dran, is, that when the cyst, in which the matter is contained, is between the mediastinum and the lungs, the mediastinum gradually yields to the volume of the pus, in proportion as it is formed, and the cyst in which it is contained becomes dilated; "whence habitude becomes a second nature." Whereas, in an empyemal person, in whom the lung is not adherent to the mediastinum, and who lies on the side opposite to that on which the collection of pus is situated, the mediastinum is on a sudden loaded with an unusual weight of fluid. (P. 111.)

Richerand contends, that the difficulty of breathing, which patients with extravasated fluid in the chest, experience in lying upon the side, opposite to that on which the disease is situated, never originates, as has been commonly taught and believed, from the fluid pressing upon the mediastinum and opposite lung. "I have (says he) produced artificial cases of hydrothorax, by injecting water into the thorax of several dead subjects, through a wound made in the side. This experiment can only be made on subjects, in which the lungs are not adherent to the parietes of the chest. In this way, from three to four pints of water were introduced. I then cautiously opened the opposite side of the chest: the ribs and lungs being removed, the mediastinum could be distinctly seen, reaching from the vertebra to the sternum, and supporting, without yielding, the weight of the liquid, in whatever position the body was placed.

"It is evident then, that patients, with thoracic extravasations, lie on the diseased side, in order not to obstruct the dilatation of the sound side of the respiratory organs, one part of which is already in a state of inaction. It is for the same reason, and in order not to increase the pain by the tension of the inflamed pleura, that pleuritic patients lie on the diseased side. The same thing is observable in peripneumony: in a word, in all affections of the parietes of the chest." (*Nosogr. Chir.* t. iv. p. 168, 169. edit. 2.)

There may be some truth in the foregoing statement; but the experiments are far from being conclusive, with respect to the assertion, that, in empyema, hydrothorax, &c. the fluid on one side of the chest does not compress the opposite lung. In the first place, the quantity of fluid is frequently much larger, than that which Richerand injected. Secondly, although the mediastinum may not be apt to yield at once to the weight of a liquid suddenly injected into one side of the thorax; yet, it may do so by the gradual effect of disease. Thirdly, many of the phenomena of empyema seem adverse to Richerand's inference.

In opposition to Richerand's view, Dr. Townsend argues, that we have direct proof of the influence of the weight of the fluid; for, in pneumothorax with empyema, the patient can generally lie on the sound side, so long as the effusion is principally gaseous; but, as the proportion of ponderable fluid increases, decumbiture on the sound side becomes impossible. In like manner, in cases of empyema, the dyspnoea is generally greatly aggravated by this posture; but, when the fluid has been discharged, the patient is immediately able to lie on the sound side, though the necessity for its free dilatation continues as great as ever, the diseased side being still in a state of inaction. Thus, in a case of empyema, with pneumo-thorax, where paracentesis was performed, the patient could lie on the sound side on the night after the fluid was drawn off, though it was ascertained by auscultation, that the side was then filled with air. (See *Dublin Hospital Reports*, vol. v.; and *Townsend in Cyclopaedia of Practical Medicine*, art. *Empyema*.)

When empyema is double, the patient can seldom lie in the horizontal position; but remains seated, and with the trunk inclined forward.

Although surgeons should be aware, that patients with empyema can sometimes lie in any position, without particular aggravation of the difficulty of breathing, yet, it ought to be distinctly understood, that the generality of patients cannot place themselves on the side opposite to that, on which the collection of pus is situated, without their respiration being very materially obstructed. Another circumstance, also, which deserves to be mentioned while we are treating of the symptoms of empyema, is, that the oedema of the integuments is sometimes not confined to the thorax, but extends to more remote parts, on the same side of the body as the collection of matter. Both the foregoing remarks are confirmed by an interesting case, published by Mr. Hey.

Sept. 3. 1788, Mr. Hey was desired to visit John Wilkinson, who had been ill ten days of the influenza. The patient was found labouring under a fever, attended with cough, difficulty of breathing, and pain in the left side of the thorax. He was bled once; blisters were repeatedly applied to the chest; and he took nitre and antimonials, with a smooth liniment to allay his cough. "He was repeatedly relieved by these means, especially by the application of the blisters; but repeatedly relapsed. At last, he became so ill, that he breathed with the utmost difficulty, and could not lie on the right side, without danger of immediate suffocation."

Mr. Hey found the patient in the state just now described on the 17th. of September. "His face and especially his eyelids were a little swollen on the left side." The left side of the thorax was larger than the right, and its integuments were cedematous. Upon pressing the intercostal muscles, they felt distended; they yielded a little to a strong pressure, but rebounded again. The abdomen, especially at its upper part, appeared to be fuller than in the natural state. (See *Hey's Practical Obs. in Surgery*, p. 476.) This last symptom is also particularly noticed by Boyer. (*Mat. Chir.* t. vii. p. 357.)

Another remarkable symptom, which is occasionally produced by collections of matter in the chest, is an alteration in the position of the heart.

I have seen a patient in St. Bartholomew's hospital, who had so large a quantity of matter in the left bag of the pleura, that it completely displaced the heart, which pulsed against the inside of the chest, at a considerable distance to the right of the sternum. This man's life might perhaps have been saved, had paracentesis thoracis been performed in time. Some suspected an aneurism from the throbbing on the right of the sternum: and the case was not fully understood till after death, when the body was opened. A little attention to the symptoms, however, might have convinced any man of moderate understanding, that it was an empyema, and that making an opening, for the discharge of the matter, afforded the only rational chance of preserving life. There had been pain and inflammation in the chest, followed by shiverings; there was very great difficulty of breathing; the heart, which previously used to beat in the usual place, no longer did so; but now pulsed on the right side of the thorax.

That the heart should be displaced in this manner by any large collection of fluid in the right cavity of the thorax, one would naturally expect. Baron Larrey has related a highly interesting case, where the heart was not only pushed considerably to the right of the sternum, but its action was so much impeded by the derangement of its position, that the pulse in the large arteries was thereby rendered extremely feeble. In this instance, also, the diaphragm had descended so low down, as to force some of the small intestines into the cavity of the pelvis. (*Mém. de Chir. Militaire*, t. iii. p. 447., &c.) Pelletan has recorded an example, in which a collection of fluid in the left cavity of the chest, displaced the heart, the pulsations of which were perceptible betwixt the third and fourth ribs of the right side, near the sternum. (*Clinique Chir.* t. iii. p. 276.) Boyer speaks of one case, in which the displacement of the heart was so extensive, that its pulsations were felt near the right axilla. (*Traité des Mal. Chir.* t. vii. p. 357.) In the anatomical collection at Strasburg, is a preparation exhibiting the displacement of the heart into the right side of the chest, by matter in the left pleura, the left lung being nearly annihilated. (*Lobstein, Compte de son Museum Anat.* p. 39. 8vo. 1820.) When empyema is on the right side, the change in the heart's position is not in general so remarkable; yet, with the stethoscope, it will generally be found to pulsate considerably to the left of its natural situation. In two cases, referred to by Dr. Townsend, the pulsation was distinctly felt in the axilla between the fourth and fifth ribs. (*Cyclopædia of Pract. Med. art. Empyema*.) The heart is sometimes thrust downward by collections of fluid in the chest, and its pulsation is distinguishable in the epigastrium. (*Hodgson on the Diseases of Arteries and Veins*, p. 95.) In cases of extensive empyema, even the liver has been pressed down into the right iliac fossa (*Stoll, Ratio Medendi*). The descent of the diaphragm, by thrusting the abdominal viscera before it, may cause an appearance as if the liver were enlarged. Of this, an instance is recorded by M. Roux, the true nature of which was detected by Bichat, who cured the patient by paracentesis. (*Euvr. Chir. de Desault*, t. iii.)

When the cavity of the pleura contains fluid, and the surgeon strikes the thorax repeatedly, with the ends of his fingers, a dull sound is produced,

quite different from what would occur, were the chest in its natural state. Besides this dulness of sound on percussion, the respiratory murmur is absent on the diseased side, which remains perfectly motionless. In the opposite lung, puerile respiration is distinguishable, accompanied with violent action of the respiratory muscles.

The symptoms of empyema are frequently equivocal. Panarolius opened a man, whose left lung was destroyed, at the same time that the thorax contained a considerable quantity of pus. Although the patient had been ill for two months, he had suffered no difficulty of breathing, and had had only a slight cough. Le Dran met with a case of nearly the same kind. A patient, who had been for three days affected with a considerable oppression, and an acute pain on the left side of the chest, got somewhat better. He felt no material difficulty of breathing, on whatever side he lay. The only thing, which he complained of, was the sense of a fluctuation in his thorax, and a little obstruction of his respiration, when he was in a sitting posture. These symptoms did not seem sufficiently decided to justify the operation, and it was delayed. The febrile symptoms continued, with cold sweats, and the patient died on the eighth day. Five pints of pus were found collected in the chest. (See *Le Dran's Obs. in Surgery*, p. 109, 110. edit. 2.)

The symptoms more particularly depending upon empyema itself, that is to say, upon disease and suppuration within the chest, are nearly the same as those, which accompany all large deep-seated abscesses. The fever, attending the thoracic inflammation, which ends in suppuration, gradually diminishes, but does not entirely cease. On the contrary, it soon changes into hectic, attended with flushings of the cheeks, heat of the palm of the hands, and exacerbations every evening, and after meals. In the night, the upper parts of the body are covered with perspiration; the patient is tormented with insatiable thirst: his appetite fails; his debility becomes extreme; he is subject to frequent fainting fits; diarrhoea ensues; and the finger nails become curved, shining, and of the yellow tinge observable all over the body. At length, the utmost emaciation, and the facies Hippocratica, come on, frequently attended with dilated pupils, and enfeebled vision, and indicating the approach of death.

As the operation of empyema, and some other particulars, relating to this subject, are treated of in another part of this Dictionary (see PARACENTESIS OF THE THORAX), it will only be necessary for me here to subjoin a list of works, which may be advantageously consulted for information on empyema.

A. Vater et J. E. Mutilek, Empyema, e vomica pulmonis, rupta in cavitate pectoris dextram effusa, indeque pulmo hujus lateris compressus penitusque ab officio remotus, Wittenb. 1731. (*Halter, Disp. ad Morb.* 2. 4031.) *Sharp's Critical Enquiry into the Present State of Surgery*, sect. on Empyema. *Le Dran's Obs. in Surgery*. *J. L. Petit, Maladies Chirurgicales*, t. i. chap. iii. *Werner's Cases in Surgery*, chap. vi. edit. 4. *Mém. sur l'Operation du Trépan au Sternum*, par M. de la Martinière, in *Mém. de l'Acad. Royale de Chirurgie*, t. xii. p. 242. edit. 12mo. *J. G. Van Mecke, De Empyemate*, Feneramund. 1783. *Sabatier, Médecine Operatoire*, t. ii. p. 247, &c. edit. 1. *Andouard, De l'Empyeme*, Cure Radicale obtenue par l'Operation, &c. 8vo. Paris, 1808. *Plajani, Collezioni d'Osservazioni*, &c. di Chirurgia, t. iii. p. 185, &c. 8vo. Roma, 1802. *Richerand, Nosogr. Chir.* t. iv. sect. des Maladies de l'Appareil respiratoire. *Hey's Practical Obs. in Surgery*, ed. 3. *Laessus, Pathologie*

Chir. t. i. p. 122. &c. *Larrey*, Mém. de Chirurgie Militaire, t. iii. p. 442.; et t. iv. p. 356. &c. *Pelletan*, Clinique Chir. t. iii. p. 236. &c. *J. Ilcnen*, Principles of Military Surgery, p. 384, &c. ed. 2. 8vo. Edinb. 1820. *Boyer*, Mal. Chir. t. vii. p. 351, &c. 8vo. Paris, 1821. *Andral*, Précis d'Anatomie Pathol. Also, Clinique Méd. t. ii. Archer, in Trans. of Dublin Association, &c. vol. ii. *Lacméc*, on Diseases of the Chest, ed. by *Forbes-Duncan*, in Ed. Med. Chir. Trans. vol. i. *Graus* and *Stokes*, in Dublin Hospital Reports, vol. v. Edinb. Med. Journ. No. 93. *Townsend*, art. Empyema, in Encyclopædia of Practical Medicine, part. 7.

ENCANTHIS (from *en*, and *κάνθος*, the angle of the eye), at its commencement, is a small, soft, red, and sometimes rather livid, excrescence, which grows from the caruncula lachrymalis, and, at the same time, from the neighbouring semi-lunar fold of the conjunctiva. The inveterate encanthis is ordinarily of considerable magnitude; its roots extend beyond the caruncula lachrymalis, and semilunar fold, to the membranous lining of one or both eyelids. The patient experiences very serious inconvenience from its interposition between the commissure of the eyelids, which it necessarily keeps asunder. Thus, indeed, it keeps up a chronic ophthalmia, impedes the action of the eyelids, and, in particular, prevents the complete closure of the eye. Besides, partly by compressing, and partly by displacing the orifices of the puncta lachrymalia, it obstructs the free passage of the tears into the nose.

According to Scarpa, this excrescence, on its first appearance, is commonly granulated, like a mulberry, or is of a ragged and fringed structure. Afterwards, when it has acquired a certain size, one part of it represents a granulated tumour, while the rest appears like a smooth, whitish, or ash-coloured substance, streaked with varicose vessels, sometimes advancing as far over the conjunctiva, covering the side of the eye next to the nose, as where the cornea and sclerótica unite. In this advanced state, the encanthis constantly interests the caruncula lachrymalis, the valvula semilunaris, and the membranous lining of one, or both eyelids. In addition to the roots, which in such circumstances connect the excrescence with the caruncula lachrymalis, the semilunar fold, and the conjunctiva of the globe of the eye, the encanthis emits an appendage, or prominent firm elongation, along the inside of the upper, or lower eyelid, in the direction of its edge. The middle, or body, of the encanthis divides near the cornea, as it were, like a swallow's tail, to form two appendages, or elongations, one of which extends along the inner surface of the upper eyelid by the margin of which it is covered, while the other shoots, in a direction from the internal towards the external angle, along the inside of the lower eyelid, which also conceals it beneath its edge.

The body of the encanthis, or that middle portion of the whole excrescence, which reaches from the caruncula lachrymalis, and semilunar fold, inclusively, over the conjunctiva almost to the junction of the sclerótica with the cornea, sometimes forms a prominence, as large as a small nut or chestnut. At other times, it is of considerable size, but depressed, and broken down, as it were, at its centre. Still, however, the body of the encanthis preserves that granulated appearance, which prevailed at first; while one, or both the appendages, on the inside of the eyelids, appear rather like a fleshy than a granulated substance,

Sometimes, the encanthis assumes a cancerous malignancy, evinced by the dull red, leaden, or (as *Beer* says) the bluish-red colour of the excrescence; by its excessive hardness, and the lancinating pains, which occur in it, and extend to the forehead, the whole eye-ball, and the temple, especially, when the tumour has been slightly touched; by the propensity of the excrescence to bleed; and by the partial ulcerations on its surface, which emit a fungous substance, and a thin, and exceedingly acrid discharge. The disease is constantly attended with epiphora, and preceded by a scirrhus induration of the caruncle. The eyeball, and neighbouring bones, which are of a spongy texture, soon participate in the disease, and the lower eyelid becomes everted. (*Beer*, *Lehre von den Augenkr.* b. ii. p. 187., 188.) This form of encanthis only admits of palliative treatment; unless, indeed, an effort be made to extirpate it entirely, together with the whole of what is contained in the orbit, and, even then, the event is dubious.

Beer joins *Scarpa* in the statement that the operation rarely proves successful, and adds, that it is always followed by an incurable weeping, and a considerable eversion of the lower eyelid. (Vol. cit. p. 189.) Fortunately, the truly cancerous encanthis is uncommon; Mr. Guthrie has not seen it: (*Operative Surgery of the Eye*, p. 117.) and Mr. Travers, who was surgeon to the London Eye Infirmary several years, never met with an instance of it. (*Synopsis of Diseases of the Eye*, p. 103.)

The benign encanthis, how large soever it may be, is always curable by extirpation. Those instances, which are small, incipient, and granulated, like a mulberry, or of a fringed structure, which originate either from the caruncula lachrymalis, or the semilunar fold of the conjunctiva, or from both these parts together, and even in part from the internal commissure of the eyelids, may be raised by means of a pair of hook forceps, and cut off from the whole of their origin, closely to their base, with the curved scissors with convex edges. In cutting out an encanthis of small size, care should be taken not to remove, together with that portion of the excrescence which originates from the caruncula lachrymalis, any more of this latter body, than what is absolutely necessary for the precise eradication of the disease, in order that no unremediable weeping may be occasioned.

When the little excrescence has been detached from all its roots, says *Scarpa*, the eye must be washed several times with cold water, in order to cleanse it from the blood, and then it is to be covered with a piece of fine linen, and a retentive bandage. On the 5th, 6th, or 7th day, the inflammation arising from the operation entirely ceases, and the suppuration from the wound is accompanied with the mucous appearance already described. The little wounds are then to be touched with a piece of alum, scraped to a point like a crayon, and the zinc collyrium is to be injected into the affected eye several times a day. If these means should not bring about the wished-for cicatrization, but, on the contrary, the small wounds situated on the caruncula, and internal commissure of the eyelids, should become stationary, and covered with proud flesh, the *argenticum nitratum* ought to be applied to them.

Excision is equally applicable to the inveterate encanthis, which is of considerable size, and broken down at its body, or which forms a prominence, as large as a nut, or chestnut, with two fleshy appendages extending along the inner surface of one or both eyelids. The application of a ligature to such an excrescence ought never to be regarded as a method of cure; for the large, inveterate encanthis never has a sufficiently narrow neck to admit of being tied. On the contrary, when the tumour is voluminous, its roots, invariably, extend to the caruncula lachrymalis, the semilunar fold, and the conjunctiva covering the eyeball, oftentimes nearly as far as the cornea. In this state, also, the encanthis has one or two fleshy appendages, which reach along the membranous lining of one or both eyelids. Hence, though the ligature were to produce a separation of the body of the encanthis, one or both the appendages would still remain to be extirpated. The second operation could only be accomplished with the knife. In this disease, there is no foundation for the fear of hemorrhage, to which the advocates for the ligature attach so much importance; for, cases are recorded of considerable, inveterate encanthis being removed, without the least untoward occurrence from loss of blood. To these, Scarpa observes, he could add a great number of his own, so that no doubt can now be entertained on this point.

When the encanthis is large, and inveterate, with two extensive fleshy elongations, one on the inside of the upper eyelid, and the other on that of the lower one, we are to proceed in the following manner. The patient being seated, an assistant is to turn out the inside of the upper eyelid, so as to make one of the appendages of the encanthis project outward. By means of a small bistoury, a deep incision is next to be made into the elongation, in the direction of the margin of the eyelid; and then having taken hold of, and drawn it forwards with a pair of forceps, we are to separate it, throughout its whole length, from the inside of the upper eyelid, proceeding from the external, towards the internal angle of the eye, as far as the body, or middle of the encanthis. We are then to do the same to the lipomatous appendage on the inside of the lower eyelid. Afterwards the body of the encanthis is to be elevated, if possible, with a pair of forceps; but when this instrument will not answer the purpose, a double hook must be employed. This middle portion is now to be detached, partly with the bistoury, and partly with the curved scissors, from the subjacent conjunctiva, on the globe of the eye, from the semilunar fold, and from the caruncula lachrymalis; dividing the substance of this last part more or less deeply, according to the depth and hardness of the large inveterate encanthis. Here it is proper to state distinctly, that when we have to deal with an old, large tumour of this nature, deeply rooted in the caruncula lachrymalis, it is not regularly in our power to preserve a sufficient quantity of the substance of this part, to prevent the tears from dropping over the cheek, after the wound is healed.

The eye is to be repeatedly washed with cold water.

The rest of the treatment, consequent to the extirpation of a large encanthis, is almost the same as what was explained in speaking of the

small incipient case. Bathing the eye very frequently in the lotion of mallows, and employing anodyne, detergent collyria, are the best local means, until the mucous appearance, preceding suppuration, has taken place on the surface of the wound. Then we may have recourse to mild astringent ointments and collyria. The mildest topical applications are generally the best, both in the first stage of suppuration, as well as afterwards, particularly, when, together with the encanthis, a considerable piece of the conjunctiva, covering the eyeball towards the nose, and intimately connected with the body of the excrescence, has been removed.

One enlargement of the lachrymal caruncle admits of cure by the application of leeches, repeated scarifications, and the nitrate of silver. (See *Midlemore on Diseases of the Eye*, vol. ii. p. 546.)

Consult *Scarpa sulle Malattie degli Occhi*, ed. cap. 12. *Richter, Anfan*, p. 473, &c. edit. 1802. *G. J. Beer, Lehre von den Augenkr.* b. ii. p. 187, 8vo. Wien, 1817. *H. Travers, A Synopsis of the Dis. of the Eye*, p. 103, &c. *G. J. Guthrie, Lectures on the Operative Surgery of the Eye*, 8vo. Lond. 1823. p. 117, &c. *R. Maddimore, On Dis. of the Eye*, vol. ii. p. 545, 8vo. Lond. 1835. *Wm. Mackenzie on Dis. of the Eye*, ed. ii. p. 264, 8vo. Lond. 1835.

ENCEPHALOCLE. (From *ἐνκεφαλος*, the brain, and *κῆλη*, a tumour.) A hernia of the brain. (See *HERNIA CEREBRI*.)

ENCYSTED TUMOURS. (See *TUMOURS*, *ENCYSTED*.)

ENEMA. The following are some of the most useful glysters employed in the practice of surgery.

Cathartic.

- R. Decocti hordei ℥j.
Sodæ muriatis ʒj. — Misce.
- R. Decocti avenæ ℥j
Olei olivæ ʒij.
Magnesiæ sulphatis ʒj. — Misce.

Anodyne.

- R. Mucilaginis amyli, Aquæ distillatæ sing. ʒij. Tincturæ opii guttas xl. — Misce.
- R. Olei olivæ ʒiv. Tincturæ opii guttas xl. — Misce.

The two latter are particularly useful, when great irritation exists about the rectum, bladder, or urethra. They have great effect in diminishing spasmodic affections of this canal and neck of the bladder. Hence they are often employed in retention of urine, in which cases their total quantity should not exceed two, or three ounces, which will be more likely, than a larger quantity, to remain within the bowel a sufficient time to let the anodyne qualities of the opium have the desired influence.

Tobacco,

Employed in cases of strangulated hernia.

- R. Nicotianæ ʒj. Aq. ferventis lbj. The plant is to be macerated ten minutes, and the liquid then strained for use. One half should be first injected, and soon afterwards the other, unless the glyster operate with dangerous violence, as it sometimes does in particular constitutions.

ENTEROCLE. (From *έντερον*, the bowels, and *κῆλη*, a tumour.) A hernia, the contents of which are intestine.

ENTERO-EPIPOCLE. (From *έντερον*, the bowels, *ἐπίπλοον*, the omentum, and *κῆλη*, a tu-

mour.) A hernia, the contents of which are both intestine and omentum.

ENTROPIUM. (From *εν* and *τρέπω*, to turn.) An inversion of the eyelids. (See *TRICIASIS*.)

EPIGLOTTIS SHOT AWAY. The practice of Baron Larrey furnishes a curious example, in which the epiglottis of a French soldier was shot off at the battle of Alexandria, on the 21st of March, 1801. The ball entered at the angle of the jaw, crossed the throat obliquely, and came out at the opposite side of the neck. The base of the tongue was grazed, and the epiglottis shot away; the patient spit it up after the accident, and showed it to the surgeon who first saw him.

The patient was not in much pain; but, his voice was hoarse, feeble, and scarcely audible.

When he first attempted to swallow, he was seized with a convulsive suffocating cough, attended with vomiting. Annoyed by thirst, which the extreme heat of the weather and the irritation of the wound excited, he incessantly repeated his attempts to drink; but, always with the same result. Four days were passed in this deplorable condition. He already experienced violent complaints in his stomach; continual loss of sleep; he had a small accelerated pulse; and was beginning to look thin.

If the patient had been abandoned to the resources of nature, he would have died in the course of a few days. The most urgent indication was to appease the hunger and thirst. An elastic gum tube was introduced into the pharynx, and by means of it, the patient was given some drink, which relieved him much, and afterwards some rich broth. The patient was fed in this manner for six weeks, at the end of which time he was able, without the assistance of the tube, to swallow thick panada, and thickened rice, made into little balls. The power of speech and deglutition in time became more perfect; in consequence, as Larrey imagines, of an enlargement of the arytenoid cartilages, and an expansion of that part of the base of the tongue which lies next to the glottis having formed a sort of substitute for the epiglottis. (*Mém. de Chir. Militaire*, t. ii. p. 145—149.)

The foregoing case illustrates the utility of elastic gum tubes for conveying nourishment and medicines down the œsophagus in some wounds of the throat. All practitioners should be duly impressed with the necessity of having such instruments always at hand. The patient, whose case is above recited, owed his preservation altogether to this means, without which he must have been starved to death.

In the 4th vol. of the above work, p. 247, is recorded another case, in which a gunshot wound, that took away the epiglottis, and broke the os hyoides, was successfully treated.

EPIPIHORA. (From *ἐπιφέρω*, to carry with force.) By this term is meant an accumulation of tears on the anterior part of the eye; in consequence of which, the person affected is not only under the necessity of frequently wiping them away, but vision is injured by the morbid refraction, which they produce of the rays of light that enter the pupil. *Stillicidium lachrymarum* is distinguished by modern writers from epiphora: the cause of stillicidium lies in some obstacle to the absorption and conveyance of the tears from the

lacus lachrymarum into the sac. Epiphora, on the other hand, consists in a superabundant secretion of tears, and is a disease of the secreting, not of the excreting, parts, of the lachrymal organs. (See *W. M. McKenzie's valuable Essay on the Diseases of the Lachrymal Organs*, p. 47. 8vo. Lond. 1819; and *Beer, Lehre von den Augenkr.* b. ii.)

EPIPOCELE. (From *ἐπίπλοον*, the omentum, and *κύημα*, a tumour.) A hernia, formed by a protrusion of the omentum. (See *HERNIA*.)

EPULIS. (From *ἐπι*, upon, and *ὕλη*, the gums.) A small tubercle on the gums. It is sometimes cancerous. The best plan of cure is to extirpate it with a knife.

ERETHISMUS. (From *ἐρεθίζω*, to irritate.) The state of irritation, attending the early stage of acute diseases. Mr. Pearson has described a state of the constitution produced by mercury acting on it as a poison. He calls it the *mercurial erethismus*, and mentions, that it is characterised by great depression of strength, anxiety about the præcordia, irregular action of the heart, frequent sighing, trembling, a small, quick, sometimes intermitting pulse, occasional vomiting, a pale contracted countenance, a sense of coldness; but the tongue is seldom furred, nor are the vital and natural functions much disturbed. In this state, any sudden exertion will sometimes prove fatal. Mr. Pearson advises, with a view of preventing the dangerous tendency of this affection, the immediate discontinuance of the use of mercury; and exposing the patient to a dry cool air. The incipient erethismus may often be averted by the camphor mixture and large doses of ammonia, if mercury be also left off. Sarsaparilla is also beneficial, when the stomach will bear it. (*Pearson on Lues Venerea*, p. 156, &c. edit. 2.)

ERYSIPELAS. (From *ἐρύω*, to draw; and *πέλας*, adjoining.) St. Anthony's fire; so called, from its tendency to draw the neighbouring parts into the same state, or its propensity to spread. Sometimes the term is believed to be derived from *ερύρρε*, red, and from *πέλος*, the skin.

Erysipelas may be defined to be a cutaneous inflammation, attended with redness, which disappears, and leaves a white spot for a short time after being touched with the end of the finger; and the affection, which is irregularly circumscribed by a defined line, is characterised by a remarkable propensity to spread.

The part is generally of a bright red colour, clear, and shining. The disorder is not accompanied by throbbing; and a burning heat and tingling are felt, rather than acute pain. If the skin alone be affected, there is hardly any perceptible swelling, and no tension; "yet some difference is perceived between the sound and the inflamed part by passing the finger over it." In many instances, vesications arise; a circumstance which led Dr. Willan to include the disease in the order *Bulle*. However, if we mean this arrangement to extend to what is named *local*, or *accidental erysipelas*, as well as to the *idiopathic* forms of the disorder, there cannot be a doubt of its inaccuracy, many examples of erysipelas from local irritation being characterised neither by fever nor vesications.

Desault preferred the division of erysipelas into *phlegmonous*, *bilious*, and *local*. (*Chir. Journ.* vol. ii.) Mr. Pearson divided the complaint into

three forms, viz. *phlegmonous*, *adematous*, and *gangrenous*. (*Principles of Surgery*, chap. x.) Burserius notices, 1. The *idiopathic*, or *primitive* erysipelas, or that which arises spontaneously from an internal cause, unpreceded by any other disease. 2. *Symptomatic* or *secondary* erysipelas, depending on another affection, by which its progress is completely influenced. 3. *Accidental* erysipelas, or that which is casually excited by some external manifest cause. *Instit. Med. Prac.* t. ii. c. 2. 8vo. Lips. 1798.)

The division adopted by Mr. Lawrence is into *erythema*, *simple*, *adematous*, and *phlegmonous erysipelas*. By erysipelas he understands "inflammation of the skin, either alone, or in conjunction with that of the subjacent adipous and cellular tissues. Like other inflammations (he says), it varies in degree. When it affects the surface of the skin, which is red, not sensibly swelled, soft, and without vesication, it is called *erythema*. *Simple erysipelas* is a more violent cutaneous inflammation, attended with effusion into the cellular substance; and generally with vesication: *phlegmonous erysipelas* is the highest degree of the affection, involving the cellular and adipous membrane, as well as the skin, and causing suppuration and mortification of the former." (See *Med. Chir. Trans.* vol. xiv. p. 2.) When erysipelas, however, is defined to be inflammation of the skin, a peculiar kind of inflammation must be implied; for the skin, like all other parts, is often the seat of common inflammation.

In *phlegmonous erysipelas*, termed by Dupuytren *diffuse phlegmon*, (*Clin. Chir.* t. ii. p. 289.) the skin is more raised than in the simple form of the complaint, the swelling is harder and deeper, and of a darker colour. The redness has often a brownish, or dark livid tint; and the discolouration is sometimes irregular, giving to the part a marbled appearance. The tumefaction is more considerable than in simple erysipelas, the whole depth of the adipous and cellular textures being loaded with effusion, so that the arm or leg appears of twice the natural size. The sensation of heat and pain is aggravated in a very severe degree, and may be accompanied with throbbing. The swollen part at first yields slightly to the pressure of the finger, but subsequently becomes tense and firm. Vesications, often minute and miliary, form on the surface, with purulent contents; but, sloughing of the cellular tissue soon comes on, and the febrile symptoms are aggravated. According to Mr. Lawrence's observations, these dangers are not attended with increased swelling, elevation, and pointing, as in phlegmon; on the contrary, there is rather a diminution of tension, a subsidence, and a feel of softness in the part. A similar account is given by Dupuytren, who states, that, when the disorder has reached the period when phlyctenæ have formed, and the cellular tissue becomes thickened and indurated, the symptoms appear for two, three, or four days to be stationary; and an inexperienced surgeon is even led to hope for the resolution of the inflammation, while the danger is really great, and suppuration already exists. (*Solid. Chir.* t. ii. p. 311.) Experience alone can teach the practitioner to distrust this deceitful stage, and not to neglect to practise timely punctures or incisions. In fact, as Dupuytren

observes, in two or three days, if the disease be allowed to make progress, the skin separates from the subjacent parts, and breaks, or the phlyctenæ give way; a dark-coloured serosity flows out; and white, or sometimes black sloughs are visible under the skin, which extend with rapidity. (*Clin. Chir.* t. ii. p. 312.) At first, the cellular texture contains a whey-like or whitish serum. The fluid gradually becomes yellow and purulent, and we often find it presenting all the characters of good pus, and very thick. The serum is diffused through the cells at an early period, and a mixture of serum and pus often fills a considerable portion of the cellular texture, without any distinct boundary. Frequently matter is deposited in small separate portions, forming a kind of little abscesses, which often run irregularly in the cellular texture. This texture turns gray, yellowish or tawny, and sometimes appears like a dirty spongy substance filled with a turbid fluid: thus losing its vitality altogether, it is converted into more or less considerable fibrous shreds, of various size and figure, which come away soaked with matter like a sponge. The integuments over a large slough of this kind, being deprived of their vascular supply, become livid, and often lose their vitality. The suppurating and sloughing processes go on to a great extent when an entire limb is affected, sometimes completely detaching the skin, and often separating it through a large space; occasionally penetrating deeper, passing between the muscles, causing inflammation of them, suppuration between them, and often sloughing of the tendons. When the substance of a limb is thus generally inflamed, the joints do not escape; inflammation of the synovial membranes, effusion of matter into the joint, and ulceration of the cartilages take place. (See *Hutchinson's Practical Obs.* p. 115. ed. 2; and *Bibl. Med.* Sept. 1827. p. 331.) Dupuytren refers to cases, in which a quart of matter was discharged daily, and to one fatal instance in the Hôtel Dieu, where the whole leg was stripped of the skin and cellular tissue, and the tibia and patella denuded. (See *Clin. Chir.* t. ii. p. 314.) If, however, the patient should recover after tedious suppurations and discharge of sloughs, the parts, which have been inflamed, are so changed in structure, and skin, fascia, muscles, tendons, and bones, are so materially agglutinated and fixed, after the extensive destruction of the connecting cellular texture, that the motions of the part are permanently and seriously injured. (See *Lawrence, in Med. Chir. Trans.* vol. xiv. p. 12.)

The attack of phlegmonous erysipelas, and especially of the spontaneous form of it, is announced by a greater or less degree of shivering, which is followed by heat, and febrile disturbance. The fever, though of the continued type, has paroxysms and remissions, two or three times a day. A slight uneasiness in the skin is often felt twenty-four or thirty six hours before the shivering takes place. The skin afterwards assumes a rose colour, which is not uniform, but has a winding appearance; and in this stage, whether the case is to be simple or phlegmonous erysipelas, would be difficult to prognosticate, were it not for a degree of œdema in the subcutaneous cellular texture, and the pitting caused by the pressure of the finger. Afterwards the symptoms increase, the fever is redoubled, and the finger,

strongly pressed upon the skin, no longer makes an impression or hollow in it; but, on the contrary, feels a considerable resistance; the redness, which is intense, assumes a darker, or even a purplish colour; the skin becomes shining; phlyctenæ arise; the cellular tissue is dense and indurated; the urinous and other secretions are diminished, altered, or suppressed; and the patient is in a constipated, sleepless, and extremely agitated state. (See *Dupuytren in Clin. Chir. t. ii. p. 310.*)

In simple *erysipelas*, the skin is preternaturally red and shining, having a light or rosy tint in the early stage and slighter cases of the affection; whence, in some languages, it has received the popular appellation of the *rose*; whilst, in other instances, it is of a bright scarlet, or even a deep and livid red. The colour disappears on pressure, returning as soon as the pressure is removed. If the skin alone be affected, there is hardly any perceptible swelling, and no tension; yet some difference is perceived between the sound and the inflamed part, by passing the finger over it. *Erysipelas*, however, is found by Mr. Lawrence to be seldom confined to the skin, except in the slightest cases; effusion soon takes place into the cellular texture, causing a soft swelling; and this may be considerable, together with much tension and a shining surface, when a large part of the body, or an entire limb, is involved. The inflamed part is hot and painful; at first, a stinging or itching is felt, which soon becomes a sharp, smarting, and burning sensation, with acute pain on pressure. The pain is not so intense and unremitting as in *phlegmon*; nor is it attended with throbbing. This kind of inflammation often ends by resolution; the redness and other symptoms disappearing, and the skin recovering its natural state, with or without desquamation of the cuticle. Frequently serous effusion takes place from the inflamed surface, elevating the cuticle into smaller or larger vesicles, or into bullæ like those produced by blisters; or raising it by a soft, yellow, jelly-like deposit, which remains slightly adherent to both the cutis and cuticle. The contents of the vesicles or bullæ, are transparent, sometimes nearly colourless, but more commonly yellowish; sometimes they consist of a thin pus; or they may exhibit a bloody or livid discoloration. The fluid loses its clearness, becoming thicker, opaque, and whitish, or yellowish. The cuticle gives way; the fluid escapes, and incrustations form, which soon fall off, leaving the skin sound; or they may lead to superficial ulcerations. *Erysipelas* sometimes produces gangrene; but this is a comparatively rare occurrence. So long as this inflammation is confined to the skin, it does not produce suppuration; and the affection of the cellular structure is too slight for that termination in most cases of simple *erysipelas*. It may, however, become more severe at one point; and thus we occasionally see the formation of abscess under the skin towards the decline, or after the disappearance, of the general *erysipelatous* redness. This inflammation generally attacks a considerable surface of the skin, the inflamed part being irregularly circumscribed by a defined line. It spreads quickly to the neighbouring skin, declining and disappearing in the part first affected. Thus, we commonly see the various stages of *erysipelas* existing together

at the same time in different parts of the skin; the portion last affected is red and swelled; another part is vesicated; while others exhibit incrustation and desquamation. Sometimes it leaves the part first affected to appear in a distant situation. Its origin, development, and complete termination, seldom take place in one and the same spot. The neighbouring absorbent glands are frequently inflamed, and red streaks are sometimes seen leading to them. (See *Lawrence, in Med. Chir. Trans. vol. xiv.*)

A little before the appearance of the redness, and sometimes during several previous days, the patient experiences considerable indisposition; loses his appetite; has shiverings and violent pain in his head, accompanied sometimes with vomiting, and always with weakness and dejection. Frequently bilious complaints occur, attended with a bitter taste in the mouth, and fetid eructations from the stomach. The tongue is moist, and covered with a yellow mucus. The patient afterwards has a dry parched skin; constipation; an accelerated pulse; thirst, and other common symptoms of fever. Blood drawn from a vein exhibits in a greater or less degree the inflammatory character. "Often, particularly when the head is the seat of *erysipelas*, the sensorium is principally affected, and symptoms are of the kind called nervous, such as pain and oppression of the head, sleepiness, coma, or delirium. The tongue in such cases becomes dry and brown; but, according to Mr. Lawrence, this state of the organ is often owing principally to the circumstance of the patient breathing entirely through the mouth; the pulse is rapid and feeble, and there is great loss of muscular strength; in short, the symptoms at length are those called typhoid. In other cases, the circulation and the nervous system are not much affected; but, there is pain in the epigastric region, foul tongue, with bad taste in the mouth, nausea, and constipation; that is, so many indications of disordered stomach and intestinal canal, to which, as its cause, the local affection must be referred." (*Med. Chir. Trans. Obs. xiv. p. 6.*) This last form of the complaint has been termed by Desault and others, *bilious erysipelas*. In *phlegmonous erysipelas* which is attended with phlyctenæ, the urinary and other secretions are altered and diminished, or even quite suppressed. Constipation prevails; the patient is sleepless; and the general derangement is excessive. Mr. Lawrence represents *phlegmonous* as differing from simple *erysipelas*, merely in the higher degree and deeper extent of the inflammation, which not only occupies the whole thickness of the skin, and subjacent adipous and cellular tissues, but soon proceeds in the latter to suppuration and sloughing, the skin itself being often involved secondarily in the mortification. Other writers, however, regard as examples of *phlegmonous erysipelas*, cases, which perhaps would not be comprehended in the above view; and, in fact, the exact line, that should divide one form of *erysipelas* from another, does not always admit of being drawn. The affected part, which is at first firm, becomes softer, when diffused suppuration and matter mixed with sloughs are under the skin. Experience proves that the seat of *phlegmonous erysipelas* is in the skin and cellular substance, and that the disease does not generally extend beneath the fascia.

Mr. Lawrence differs from Mr. Harrison, in having always found the aponeuroses unaffected in examination after death, and seen no symptoms referrible to such an inflammation during life. "They may indeed become involved in the disease when it is violent, and they must suffer partially when it extends to the intermuscular cellular texture, but they are not primarily affected in these cases, while, in the majority of instances, they do not suffer at all." (*Med. Chir. Trans.* vol. xiv. p. 16.)

According to several writers, the seat of erysipelas in the greater number of cases is the very surface of the cutis; its most vascular and nervous part. (*Dict. des Sciences Méd.* t. xiii. p. 255.) Perhaps it may be true, that simple erysipelas commences here, and is most intense; yet, the affection generally extends more deeply, and affects the subjacent cellular tissue, particularly in cases of phlegmonous erysipelas, which is even believed by Dupuytren to be the texture in which it begins. The researches of Mr. Lawrence have taught him, as already noticed, that erysipelas is seldom confined to the skin, except in the slightest cases; effusion soon takes place into the cellular texture, causing a soft swelling; and this may be considerable together with much tension and a shining surface, when a large part of the body, or an entire limb, is involved. (*See Med. Chir. Trans.* vol. xiv. p. 3.) The affection of the cellular tissue, however, is very different from what happens in phlegmonous inflammation. In true erysipelas, healthy pus is rarely found enclosed in a circumscribed cavity; and when there is any secretion of purulent matter, a feel is communicated, on compressing the part, almost like that which a sponge would give. In such cases, the cellular tissue is frequently gangrenous.

Excepting cases on the lower extremity, phlegmonous erysipelas frequently ends in resolution; but, in the lower limbs, it has a great tendency to suppuration. Here the cellular tissue has as great a disposition to suppurate, as that of the eyelids or the scrotum. This consequence, when it happens, is always productive of a great deal of mischief; for the pus collects not in one cavity or mass, but numberless distinct points, and large flakes of the cellular tissue perish. Thus, Dupuytren observes, that he has often taken out some portions of it, which were six or seven inches in length. Nor is this all; for the skin frequently assumes a dark purple colour, and sloughs, rather from defect of nutrition than from inflammation. As is remarked by this eminent surgeon, such mortification of the skin is very common in the leg, where the nutrient arteries, the tibial and peroneal, being deeply placed, only communicate with the integuments by small ramifications, and where the destruction of the cellular tissue occasions a destruction of almost all those slender vessels. But, on the head, this kind of mortification is exceedingly rare, though phlegmonous erysipelas in that situation is remarkably common. This difference is ascribed by Dupuytren, to the distribution of the temporal, frontal, and occipital arteries, which lie close under the skin, between it and the aponeurosis of the occipito-frontalis muscle. Hence, the supply of blood to the skin is not much interrupted, even though the cellular tissue under that aponeurosis become the seat of suppuration in phlegmonous erysipelas. In fact,

Dupuytren had never seen but one example in which the skin of the head mortified in consequence of phlegmonous erysipelas. (*See Dupuytren, in Clin. Chir.* t. ii. p. 295.) The rarity of the termination of phlegmonous erysipelas of the face in suppuration, is noticed by Bateman. (*Synopsis, &c.* p. 127.)

Every surgeon is well aware, that one cause of erysipelatous inflammation, is a fever of a determinate and peculiar nature, one feature of which is the invariable production of this kind of inflammation upon the surface of the body.

With respect to the causes of erysipelas, it is the opinion of Mr. Lawrence, that no difference prevails on this point between erysipelas and other inflammations. "The habitual excitement of the vascular system, or the long-continued disturbance of the stomach, alimentary canal, and liver, consequent on intemperance and excess, lay the foundation of inflammation generally, and it depends on individual peculiarity, or on local causes, whether the skin or other parts shall be the seat of the disease. In most cases of erysipelas, the bilious and digestive systems are more or less actively disordered, such disorder appearing sometimes to produce the cutaneous affection, sometimes to be excited sympathetically by it. Hence Desault established the denomination of *bilious*, in contradistinction to *phlegmonous*, erysipelas; on which division it may be observed, that the symptoms called bilious are commonly found also in phlegmonous cases." (*Med. Chir. Trans.* vol. xiv. p. 36.) Erysipelas may arise from external irritants of all kinds; from heat, or cold; blisters, issues, setons, caustics, or other acrid matters applied to the skin; from wounds, punctures, bruises, surgical operations, and all kinds of injury. The mechanical or chemical irritation of wounds, ulcers, or other local diseases, will cause it. "Neglect of previous preparation, inattention to diet, injudicious modes of dressing, continued exercise of the affected part, and an imprudent degree of general exertion, are frequent causes of erysipelas after operations and wounds, and in the course of ulcers and other local affections. When these several points are properly attended to, we shall not be much troubled with traumatic and hospital erysipelas. Irritating plasters, a heating load of dressings, and tight bandaging, are common causes of erysipelas, whether in the case of wounds, or operations. Light applications, and keeping the parts cool, are simple but effectual preventives. The most frequent source, however, of this affection, after accidents or operations, is improper diet, that is, indulgence in animal food, or fermented liquors." (*Lawrence*, vol. cit. p. 38.) Another very common source of erysipelas after wounds, is the indiscriminate use of sutures.

In most cases, erysipelas would seem to be intimately dependent on the state of the constitution. Thus, persons in the habit of drunkenness, and other kinds of intemperance, and who, in a state of intoxication, meet with local injuries, often have erysipelatous inflammation in consequence of them. Other subjects, who lead more regular lives, experience, when they meet with similar injuries, healthy phlegmonous inflammation.

A further proof, that erysipelas is mostly de-

pendent on constitutional causes, is, that the affection is particularly frequent in autumn, or in any season when hot weather is succeeded by cold and wet.

Erysipelas attacks both sexes; but women are thought to be rather more subject to it than men; and the reason for this circumstance, generally mentioned, is the greater delicacy and tenderness of the skin in females. But it would be quite as rational to suspect their weaker and more irritable constitutions, and their sedentary mode of life. In lying-in hospitals, and other charities for the reception of children, new-born infants are often afflicted with a species of erysipelas, which begins in the umbilical region, and thence extends to the pudenda. This case, which sometimes terminates in gangrene, and proves fatal, has been ascribed by some writers to injury done to the naval-string during labour, and by others to the bad air frequently allowed to accumulate in establishments of the above description; a cause, which too often renders complaints, which are at first trivial, ultimately fatal.

Sometimes the complaint is scarcely cured in one place; when it makes its appearance in another; and when this tendency is evinced in a great degree, the case is termed *erysipelas ambulans, vel erraticum*. La Motte has published a striking instance of this form of the disease. A child, between nine and ten years of age, was attacked with erysipelas of the scalp, forehead, and ears, which afterwards extended to the neck and then to the shoulders, while the scalp and face became free from it: in proportion as the disease spread downwards, all the upper parts got well, so that, in the end, there was no portion of the surface of the body which had escaped, even down to the fingers and toes, the parts last of all affected. (*Obs. Chir.*)

An uncommon variety of disease is an *universal erysipelas*. No disorder is more subject, than the present, to relapses; but a remarkable thing, sometimes attending the return of the complaint, is its being sometimes strictly *periodical*. In chlorotic women, the erysipelatous attack is occasionally made every month just at the period when the menses should take place. (*Hoffman.*) This periodical nature of erysipelas has been observed in men: Larrey knew two male patients, one of whom used to be attacked with erysipelas twice a year at the time of the equinox; the other had only one attack annually, which was wont to happen in the beginning of the spring. My friend, Mr. Maul of Southampton, once informed me of an erysipelas, which was both periodical and universal, affecting a lady several times at intervals of two years.

The doctrine is occasionally entertained, that erysipelas may be propagated by contagion. (*Wells, in Trans. for the Improvement of Med. and Surg. Knowledge, vol. ii. art. 17. 1800. A. Riberti, Sulla Gangrena Contagiosa, o Nosocomiale; con alcuni Cenni sopra una Resipela Contagiosa. 8vo. Torino, 1821. Arnott, in Med. Phys. Journ. vol. xvii. Drs. M'Dowel and Brereton, in Dubl. Journ. of Med. Science, vol. vi. p. 176.*) But, as Dr. Bateman has truly remarked, such cases are, at all events, extremely rare, and perhaps never happen in well-ventilated and cleanly houses. (*Synopsis, &c. p. 131.*) In places of the

opposite description, the infection of many individuals to each other might be explained by the operation of the same exciting causes upon them all, without any supposition of contagion. This part of the subject, however, is yet unsettled: Mr. Lawrence believes, that erysipelas of the face may be traced in some instances to contagion (see *Med. Chir. Trans. vol. xiv. p. 39*); though, in another part of the same paper, he pronounces the doctrine to be at least doubtful. To Dr. Tweedie the proofs of its truth appear, however, to be satisfactory; and, in support of this view, he refers to the papers of Dr. Wells, Dr. Stevenson, (*Edinb. Med. Chir. Trans. vol. ii.*) Dr. Gibson (*ib. vol. iii.*) Mr. Arnot (*Lond. Med. and Physical Journ. March, 1827*), see *Cyclop. of Practical Med. art. Erysipelas*. The following statement is made by Dr. Brereton, in favour of the opinion, that erysipelas may sometimes be contagious, at least in hospitals. The cases were in the temporary Fever and Dysentery Hospital in Keven Street, Dublin, in 1826 and 1827. The wards were extremely well ventilated and large. "On paying my daily visit, I observed one of the patients, who had been admitted with fever some days previously, to be formidably attacked with erysipelas. On the following day, I found the patient in the next bed seized with it. On the third day, two patients in the adjoining beds were similarly attacked. I then became seriously of opinion, that the disease was contagious, but, resolved not to have those already affected, removed until I had tried the result of another day. On the following morning, I found three more in like manner, labouring under the disease: and what made it more remarkable, they were all similarly attacked in the head and face. I had them immediately put into another ward, where there were no patients; they all recovered; and no more erysipelas afterwards appeared." (*See Dubl. Journ. of Med. Science, vol. vi. p. 176.*)

I think we must agree with Mr. Lawrence, that "a consideration of the origin, development, and effects of erysipelas, whether local or general, leads us irresistibly to the conclusion, that the nature of the affection is inflammatory. In its four leading characters, of redness, swelling, heat, and pain, and in its effects, of effusion, suppuration, and sloughing, it agrees with what is called common or phlegmonous inflammation; while the general disturbance, preceding and accompanying the local affection, is often exactly alike in the two cases. Erysipelas then is merely a particular modification of cutaneous, or cutaneous and cellular inflammation. If we were to class these according to their natural affinities, we should place erysipelas between the exanthemata and phlegmon. It is less diffused than the former, — not so circumscribed as the latter. The exanthemata are confined to the skin; erysipelas affects both skin and cellular structure; while phlegmon has its original seat in the latter, the skin being secondarily involved.

"The difference between erysipelas and phlegmon, however, is not merely in the original seat, or degree of the disturbance: there is also a difference in kind. We may, indeed, say, generally, that phlegmon is a more violent inflammation than erysipelas, but sloughing of the cellular substance is more frequent in the latter than the former. The most striking and important distinction between the two affections is, that inflammation is confined to one spot in phlegmon, and is distinctly

circumscribed in its seat, while it is diffused in erysipelas, and spreads without limit. This difference seems to depend on the adhesive character of the inflammatory process in the former; the substance called coagulating, coagulable, or organisable lymph, effused around the inflamed part, forms a boundary between it and the sound portion, which is altogether wanting in erysipelas. In the latter, the effusion is serous; hence, when matter is formed, it is not confined to one spot, but becomes extensively diffused in the cellular tissue." (*Med. Chir. Trans.* vol. xiv. p. 17., &c.) These views correspond to those given by Mr. Hunter, whose original remarks on erysipelas are particularly valuable both to the pathologist and the practical surgeon.

Like phlegmonous inflammation, erysipelas may be excited by any local irritation. Like other inflammations, it may end in suppuration, though of a less perfect sort, than that in which phlegmon ends, the pus being rarely contained in a circumscribed cavity. The pulse, in phlegmonous erysipelas, is frequent, hard, sometimes full; and when the patients are bled, their blood has the same appearance, and is covered with the same kind of inflammatory crust, as the blood taken away in other kinds of inflammation.

Mr. Lawrence does not agree with some medical authors, amongst whom may be placed John Hunter, who regards erysipelas as a distinct species of inflammation, and capable of affecting various parts of the body as well as the skin. Some writers he says, have referred to erysipelas certain inflammations of the conjunctiva, mouth, and fauces; of the respiratory and alimentary mucous surfaces; of the serous membranes in the head, chest, and abdomen, and of the brain, abdominal and thoracic.

The distinguishing characters of erysipelas, Mr. Lawrence refers to the peculiarities of the cutaneous and cellular structures in which it occurs, and he therefore infers that such an affection cannot exist in parts so differently organised as serous membranes, and the viscera. When the remarks of some of these writers are carefully considered, it seems as if their meaning were only, that erysipelas is connected with a particular state of constitution, in which the inflammation, where-soever situated, would have a tendency to spread rapidly and extensively. If, however, the frequent extension of the inflammation to the mucous membrane of the cheek, in erysipelas of the face, and even its extension in some of these cases, by the Eustachian tube into the tympanum, as ascertained by Dupuytren by *post mortem* examination; and if an erysipelatosus affection of the rectum, as described by Sir Benjamin Brodie; (See *Lond. Med. Gaz.*) be positive occurrences, then a mucous membrane, as well as the skin, must undoubtedly be admitted to be susceptible of erysipelas.

TREATMENT OF ERYSIPELAS.

Simple erysipelas not exceeding a certain degree of severity, yields to mild purgatives, and a light vegetable diet, with which remedies practitioners usually conjoin diaphoretics and the saline mixture. Whether bleeding is right, or not, in this species of erysipelas, is a point, on which different sentiments prevail. I believe, however, that venesection, in the milder forms of the complaint, is now generally allowed to be as unnecessary as it is urgently re-

prevalent notion, that it is unnecessary to repeat bleeding in erysipelas so frequently as is done in other inflammatory diseases. We ought to be guided, however, in this respect, by the violence and extent of the inflammation, the state of the pulse, and other symptoms, never forgetting the patient's age, strength, and other important considerations. Another common belief is, that the patient will bear bleeding better in the country, and in an open, pure air, than in a large city, and, especially, in an hospital. And, it is remarked, that unless there be a considerable tendency to delirium, or coma, blood-letting can seldom be repeated with advantage, at least in large towns. (*Pearson's Principles of Surgery. Bateman's Synopsis*, p. 132. ed. 3.) Instead of this practice, the latter author recommends local bleeding and blistering, but not upon, or very near, the diseased surface, whereby he avoids producing troublesome sores, the frequency of which, in former times, after taking blood from erysipelatosus parts, led Mr. B. Bell to pronounce a general condemnation of the method. I ought to observe, in relation to the above-mentioned fear of bleeding patients freely in large cities, that it is an hypothesis which seems to be declining, many experienced and judicious surgeons having actually rejected it as unfounded; and so far as my observations extend, I have no hesitation in stating my opinion, that the abstract consideration, whether a person be living in town or country should not regulate the use of the lancet, which ought to be decided by other more important circumstances in the case. Alexander of Tralles, and Paré, had a high opinion of the beneficial effects of plenty of fresh, cool air in erysipelas; but good air is generally beneficial in all diseases, and, perhaps, not more so in erysipelas than other disorders.

Mr. Lawrence thinks, that as erysipelas resembles other inflammations in its causes, symptoms, and effects, it should be treated on the same principles; that is, on the antiphlogistic plan. Venesection, local bleeding, purging, and low diet are the first measures, to which saline and diaphoretic medicines may be afterwards added. He says, the earlier these means are employed the better: vigorous treatment in the beginning seems to him most calculated to shorten the attack, and prevent the disease from spreading beyond its original seat. At the same time, he admits, that as the skin and cellular texture are of secondary importance, it is not so urgently necessary to arrest inflammation in them, as in the vital organs; neither does the same reason for very active treatment exist as in affections of the eye, where a slight change of structure may seriously impair the utility of the organ essential to our comfort and pleasure; but the extensive suppuration and mortification, which erysipelas sometimes produces, may render a limb, in a great measure, totally useless, or may even destroy life. "The disposition of erysipelas to terminate by resolution, is another reason against resorting indiscriminately to active depletion. In many cases, the disease passes through a certain course, and ends spontaneously: it is sufficient to put the patient on low diet, to clear the alimentary canal, and then to use mild aperients and diaphoretics. When it proceeds, as it often does, from an unhealthy condition of the alimentary canal, the removal of the internal disorder leads to the cessation of the local complaint. It must, however,

be observed, that venesection is sometimes useful both in curing the internal cause and in promoting the termination by resolution." Mr. Lawrence afterwards observes, that he does not mean to recommend that measures equally active, and, in particular, that bleeding, whether general or local, are to be employed in all cases. In young persons, in the robust, and those of full habit; in instances where the pulse is full and strong, or where there is headach and white tongue; in erysipelas of the head, attended with symptoms denoting affection of the sensorium, and more especially in the very beginning of the affection, venesection will be proper; and it may be necessary to bleed largely, to repeat the evacuation, or to follow venesection by local abstraction of blood. Under such circumstances, the other parts of the antiphlogistic plan must also be employed, that is, the alimentary canal should be cleared by an active purgative, which may be followed by salines and antimonials, with the occasional use of milder aperients, and low diet should be enjoined. As Mr. Lawrence adds, nothing can be more different from such a case, than that of an elderly person, with a small and feeble pulse, in the advanced stage of the disease. The interval between these extremes is filled by numerous gradations, requiring corresponding modifications of treatment. The antiphlogistic plan itself embraces a wider range in point of degree; from blood-letting local and general, with purging, vomiting, the free use of mercury and antimony, and low diet, to the exhibition of a mild aperient, with some saline medicine. Mr. Lawrence believes, that the treatment of erysipelas, like that of any other inflammation, should be modified according to the age, constitution, previous health, and habits of the patient, and the period of the complaint. "In asserting generally that the antiphlogistic treatment is proper, I speak (says he) of the beginning of the disease, when the original and proper character of the affection is apparent; and I am decidedly of opinion, that, in some shape or degree, such treatment will always be beneficial in that stage. In many instances, active antiphlogistic measures are of the greatest service in lessening the severity, both of the local and general symptoms. In others, the administration of calomel with aperients, and of diaphoretics with low diet, will be sufficient. When the affection occurs in old and debilitated subjects, the powers of life are soon seriously impaired, and our efforts must be directed rather towards supporting them, than combating the local affection. I have often seen such subjects, labouring under erysipelas of the face in its advanced stage, with rapid and feeble pulse, dry and brown tongue, recovered, under circumstances apparently desperate, by the free use of bark and wine." The same writer deems local bleeding sufficient in the milder cases of erysipelas, and often necessary in the more severe ones, as an auxiliary measure. Cupping, when practicable, he sets down as more efficacious than leeches, though objectionable on account of the painful state of the skin. Leeches, he remarks, when applied to the sound skin of some individuals, produce an effect analogous to erysipelas, but they exert no such influence over the inflamed skin, to which they may be applied freely and safely. In order to produce any decided benefit, he thinks that they should be applied in large numbers.

The authorities, which may be cited in favour

of the treatment of erysipelas on antiphlogistic principles, are Sydenham; (*Obs. circa Morborum Acut. Hist. &c.* sect. 6. c. 6.) Cullen; (*Works by Thomson*, vol. ii. p. 188.) Richter; (*Anfangsgr. der Wundarz.* vol. i. § 188.) Vogel; (*Handb.* vol. iii. p. 348.) J. P. Frank; (*De Cur. Hominum Morbis*, lib. iii. p. 64.) Dr. Duncan, junior. (*Edin. Med. Journ.* vol. xix.) Several of these writers consider bleeding more particularly proper when erysipelas is seated on the head and face.

As Mr. Lawrence has noticed, high authorities may also be brought forward against the use of the lancet in erysipelas, and most of them are comparatively of modern date. Some of them not only object to evacuations of all kinds, but recommend tonics and stimuli, such as bark, ammonia, and wine. Dr. Fordyce declares, that he always found bleeding and evacuations hurtful, and Peruvian bark the best remedy. "It should be exhibited (he says) in substance, if the patient's stomach will bear it, and in this disease it will almost always bear it, and in as great a quantity as the patient's stomach will bear, which is commonly to the quantity of a drachm every hour!" (*Trans. of a Society for the Improvement of Chir. Knowledge*, vol. i. p. 293.) Some animadversions on the practice of giving bark in this manner will be found in our preceding columns. (See CINCIONA.) Dr. Wells is also an advocate for the treatment recommended by Fordyce. With regard to Cullen, he only sanctioned it when the case was attended with typhoid symptoms.

After the inflammation has been checked by antiphlogistic means, the surgeon should not be in too great a hurry to prescribe tonics, stimulants, and a full diet. "Medical practitioners in general (says Mr. Lawrence) are anxious to begin the strengthening plan; they seem to have the fear of debility constantly before their eyes, and lose no time in directing the employment of bark, and recommending animal food, with beer or wine. In this way relapses are frequently produced; the inflammation and fever are renewed; further local mischief is caused, and recovery is retarded." (*Med. Chir. Trans.* vol. xiv. p. 69.) When it is doubtful whether stimuli should be employed or not, he deems subcarbonate of ammonia the best medicine. Bark comes next in order to it, and the sulphate of quinine is the most eligible preparation. Wine is sometimes necessary; but, Mr. Lawrence thinks it should be given sparingly. (See *Med. Chir. Trans.* vol. xiv.)

The proposal to treat erysipelas by compression with bandages, as adopted by Bretonneau and Velpeau, has proved in this country very unsuccessful. (See *Duncan*, in *Edin. Med. Chir. Trans.* vol. i. p. 543; *Lawrence*, in *Med. Chir. Trans.* vol. xiv. p. 65.) The application of blisters to erysipelatous parts, can only be entitled to the briefest mention, even when viewed as represented by the French surgeons themselves. (See *Roche and Sanson*, *Nouveaux Elém. de Pathol. Méd.* *Chir.* t. i. p. 352.)

A large blister was sometimes applied by Dupuytren over a wound, and to the surrounding skin; and he found that the irritation and suppuration which were thus excited, occasionally succeeded in preventing phlegmonous erysipelas. (See *Clin. Chir.* t. ii. p. 320.)

Indeed, it was only for the prevention of the disorder that Dupuytren sanctioned this practice,

which, as he particularly explains, he was afraid of resorting to, after the disease had resisted bleeding and cold sedative lotions, because he had sometimes, though not often, seen sloughing produced by it. (*ib.* p. 322.) The application of the nitrate of silver in substance, or in the form of a lotion, so as to blacken the part, appears to have considerable power as a means of checking the peculiar action of the vessels, on which erysipelatous inflammation depends. It tends to repress the effusion of serosity in the cellular tissue; and, if applied beyond the erysipelas, will form an obstacle to its spreading in any particular direction. By forming a black line with it, the inflammation may thus be kept from running up the neck to the face and head. The use of nitrate of silver in erysipelas has been particularly insisted upon by Mr. Higginbottom. (*On the Use of Nitrate of Silver.*) In the early stages of erysipelas I have often employed it with advantage in the North London Hospital; but it should not be continued too long; for when it fails to lessen the distension of the cellular tissue with serosity, the fluid should be discharged by puncture or incision. Mr. Higginbottom directs the part to be first washed with soap and water, and then dried. The inflamed and surrounding skin is then to be moistened, and the nitrate of silver passed over it once, twice, or thrice, and more frequently, if rapid vesication be required. The part is then to be exposed to the air and kept cool.

Of the good effect of mercurial ointment as an application to erysipelas, I cannot speak from experience. Dr. M'Dowel has tried mercurial union, and makes a favourable report of it. In Mercer's Hospital, it was found also to have considerable power in checking the disease. Two, three, or four applications usually sufficed with other means. In most instances, the patients were salivated. (*See Dublin Journ. of Med. Science*, p. 6.)

In bilious erysipelas, or that originating with strongly marked gastric disorder, Desault gave, in the first instance, a grain of tartarised antimony dissolved in a considerable quantity of fluid. He had seen the symptoms entirely subside, although the medicine produced no other sensible alteration in the animal economy, than an increase of the insensible perspiration and urine. When the symptoms resisted these evacuations, he was obliged to have recourse once or twice, or even more frequently, to the emetic mixture. When the erysipelas was cured, and the bitterness in the mouth and fever had subsided, two or three purges of cassia and manna, with a grain of emetic tartar, were exhibited. As soon as the symptoms were mitigated, the diet of the patient was allowed to be more generous. In bilious erysipelas, Desault observed, that the cases of the patients, who had been bled previously to their admission into the hospital, were invariably the most obstinate.

When the tongue, without being red at its point and margins, was furred, and marks of gastric disorder prevailed, unattended with tenderness of the epigastrium, Dupuytren found emetics useful. (*Clin. Chir.* t. ii. p. 320.)

In cases of bilious erysipelas, many modern practitioners would be bolder with antimonials than Desault, first, by imitating Richter, and giving an emetic at the commencement of the

attack, and then by exhibiting more freely either antimonial powder, or tartarised antimony, with a dose or two of calomel.

In phlegmonous erysipelas, Desault was an advocate for bleeding in the beginning of the disorder, and this practice he followed up by the administration of tartarised antimony and evacuations.

In the beginning of phlegmonous erysipelas, Dupuytren likewise had recourse to general and local bleeding, emollient applications, or what he considered still more efficacious, cold sedative lotions. If inflammation of the cellular texture had begun, he not only practised these antiphlogistic measures, but repeated them. But if there was a narrow wound, seemingly attended with strangulation of the parts, he made a simple or crucial incision without delay. (*See Clin. Chir.* t. ii. p. 320.) While cold lotions are used, the inflamed parts are to be kept in an elevated position in order to lessen the swelling.

Mr. Lawrence recommends, in the early stage, venesection, and the application of leeches in large numbers to the inflamed part, together with antiphlogistic treatment generally, in order to prevent the full development of the affection. The bleeding of the leech-bites he directs to be encouraged by fomentations, and cold lotions afterwards to be applied. When, however, the inflammation is more advanced (he says), the latter should be exchanged for fomentations and poultices. My own experience in these cases leads me to refer very great efficacy to cold applications, which I find particularly useful in checking the effusion in the cellular tissue, averting gangrene, and stopping the progress of the disorder. In the case of a patient in Fleet-market, whom I attended with Mr. Lawrence and Mr. Bullin, and whose limb was so swollen as to be nearly twice its natural thickness from one end to the other, cold lotions, evacuations, leeches, and other antiphlogistic remedies, had a decided effect in giving ease, and preventing all occasion for the practice of extensive incisions. The abscesses were very limited; and two small incisions, made at different periods, for the discharge of the matter, answered every purpose. After the bowels have been emptied, Mr. Lawrence prescribes freely calomel and antimony, with saline medicines. The local abstraction of blood, he considers more serviceable in phlegmonous erysipelas, than venesection. The latter, therefore, he advises to be reserved for instances, in which the patient is young and plethoric, the pulse full and strong, or the head much affected.

When such practice is unavailing, Mr. Lawrence finds the plan of making incisions, through the inflamed skin and the subjacent adipous and cellular textures, the most powerful means of arresting the complaint. If this be not done, (he says), the inflammation will now pursue its course, both in the cellular texture and skin, in spite of bleeding, whether general or local; supuration and sloughing rapidly supervene; and these destructive processes soon extend over a large portion of a limb. It was with the view of preventing such consequences, that Mr. Lawrence, in imitation of Mr. C. Hutchison, tried the practice of making free, and even very extensive incisions in the inflamed parts.

In cases of *idiopathic* erysipelas, whether *phlegmonous* or *bilious*, external applications have been deemed useless or hurtful, by a large proportion of practitioners, amongst whom is Desault. In the early stage of this disease, Dr. Bateman found powdery substances, like flour, starch, chalk, &c. increase the heat and irritation, and afterwards, when the fluid of the vesications oozes out, such substances produce additional irritation, by forming with the concreting fluid hard crusts upon the tender surface. This practice is also condemned by Pearson. The only plan, perhaps, which is unobjectionable, as a means of allaying the irritation produced by the discharge from the vesication, is that advised by Dr. Willan, and which consists in fomenting or washing the parts from time to time with milk, bran and water, or a decoction of elder-flowers and poppy-heads. In the early stage of the inflammation, Dr. Bateman saw great relief derived from moderate tepid washing, or the application of the diluted liquor ammon. acet. (*Synopsis of Cutaneous Diseases*, p. 133. ed. 3.)

As for what is termed *accidental* erysipelas, or that caused by local irritation, applied directly to the skin, as from acrid substances, heat, friction, the sting of insects, &c. the removal of the cause, the employment of cold, or even ice-cold lotions, and other antiphlogistic means, are essentially necessary.

In *phlegmonous* erysipelas, if the inflammation continue in an unabated form beyond the seventh or eighth day, suppuration is to be apprehended. Here Boyer recommends the employment of emollient applications, and as soon as a fluctuation is distinguishable (or even what he terms "*un empatement purulent*") he advises the surgeon to make such incisions as may be necessary for the discharge of the matter. He also states, that the incisions should be made at several depending points. (See *Boyer, Traité des Mal. Chir.* t. ii. p. 22.) It appears from the observations of my friend Mr. A. C. Hutchison, formerly surgeon to the Naval Hospital at Deal, that seafaring men are very liable to phlegmonous erysipelas of the legs. The cause is ascribed to the irritation of the salt water, and the friction of their loose coarse trousers. In this description of patients, the disease frequently proceeds rapidly to the gangrenous state, and the consequence is the loss of many lives and limbs. Even when the danger of mortification is avoided, abscesses often occur, which spread between the muscles and under the integuments to a surprising extent: "from the ankle to the trochanter, and over the glutei muscles." In the first few cases, which came under the cure of Mr. Hutchison, this gentleman's plan of treatment, in addition to the usual medical means, consisted of local bleeding by means of cupping glasses, followed by fomentations. Subsequently, however, he adopted the method of making several free incisions with a scalpel on the inflamed surface, in a longitudinal direction, through the integuments, and down to the muscles, as early in the disease as possible, and before any secretions had taken place. These incisions were about an inch and a half in length, two or three inches apart, and varied in number from six to eighteen, according to the extent of surface, which the disease is found to occupy. Mr. Hutchison states, that these incisions will yield between fifteen and

twenty ounces of blood, and give relief to the tense skin, at the same time that they form channels for the escape of fluid, and the prevention of bags of matter. After the operation, fomentations, or saturnine lotions, were employed.

By the preceding kind of treatment, Mr. Hutchison found the fatal termination of the disease rendered less frequent, and gangrenous mischief wholly prevented. He adds that he never lost a case in the Deal Hospital for the last five years, during which the practice was followed. (See *Med. Chir. Trans.* vol. v. p. 278, &c.)

Instead of several moderate cuts, Mr. Lawrence thinks the most powerful means of arresting the complaint is making one or more long incisions through the inflamed skin and the subjacent adipous and cellular textures, which are the seat of the disease. These incisions, he asserts, are followed very quickly and almost instantaneously by relief and cessation of the pain and tension; and this alleviation of the local suffering, he assures us, is accompanied by a corresponding interruption of the inflammation, whether it be in the stage of effusion, or in the more advanced period of suppuration and sloughing. Mr. Lawrence further maintains, that this treatment is employed to the greatest advantage at the beginning, since it prevents the further extension of inflammation, and the occurrence of suppuration and sloughing. At a more advanced stage, the incisions limit the extent of suppuration and gangrene; and, at a still later time, they afford the readiest outlet for matter and sloughs, and facilitate the commencement and progress of granulation and cicatrization. (*Med. Chir. Trans.* vol. xiv. p. 67, &c.) In favour of the practice of several, or of one or more free incisions, I have to mention Dr. McDowell, of Dublin, Dr. Reese, and Professor Delatfield, of New York, who have uniformly obtained the most satisfactory result; from it. (See *Amer. Ed. of this Dictionary*, art. ERYSIPELAS;) *Boyer and Beauchêne* at Paris, and a vast number of surgeons in this country.)

To incisions of the kind first suggested and practised by Mr. A. C. Hutchison, and also to the much longer but less numerous ones adopted by Mr. Lawrence, Sir W. Dobson prefers many small punctures, which he repeats mostly twice a day to the number and extent required; and often, in bad cases, three or four times in the twenty-four hours. The quantity of blood and serous fluid discharged from these punctures, although sometimes considerable, he says, need never create any alarm. With this practice he joins the exhibition of camphor mixture, liquor ammon. acet., and tincture of rhubarb. He also employs a lotion, composed of liquor ammoniac acet., camphorated spirit, and water. (See *Med. Chir. Trans.* vol. xiv. p. 206.)

The great points, on which differences of opinion exist, respecting the treatment by incisions and punctures, are the period when they are indicated, and with respect to incisions, their number and extent. That the practice of incisions with moderation and judgment has been the means of saving many limbs and lives, I consider as fully established as the opposite fact, that immoderate incisions have occasionally accelerated the patient's death. I have heard of instances in which a cut was made from the shoulder down to the hand, or from the trochanter major to the foot,

In order, however, to let the reader have a fair view of this part of the subject, I annex some observations of Dr. M'Dowel. "In the treatment of phlegmonoid erysipelas (says he), there is now, I hope, but little difference of opinion, as every practical surgeon must be aware of the importance of early and free incision, in arresting speedily the progress of inflammation, giving great and striking relief in a few minutes, preventing sloughing of the fibrous and other tissues, and purulent infiltration of the cellular membrane. By a timely incision, severe constitutional disturbance will be prevented, or, if it has set in, will be delayed in a few hours. Puncturing, as a substitute for incision in phlegmonoid erysipelas, is comparatively of little use. The depth of the incision must be proportioned to the depth to which the inflammation has extended, and the number of incisions proportioned to the extent which the disease has been permitted to attain. In the leg, I have frequently been obliged to make three, four, or five incisions to prevent disorganisation of the soft parts. If the inflammation extends beneath the fascia, this membrane must be divided. Little benefit will be derived from a superficial cut. The edges of the divided membrane retract considerably. Previous to division, the vessels being gorged with blood, the colour of the skin is of a deep red. In a few minutes, after the free division of the inflamed part, we find it nearly restored to its natural appearance. In the great majority of cases, if treated promptly, it will be unnecessary to carry our incision deeper than the cellular membrane." (M'Dowel in *Dubl. Journ. of Med. Science*, vol. vi. p. 178.)

A difference of opinion seems to prevail then about the degree of usefulness of punctures in the early stage, in which Dr. M'Dowel would prefer incisions. Yet I have seen three pints of serous fluid discharged from punctures in several instances, and the progress of the disease completely arrested by them. Incisions, no doubt, would also have answered. In the North London Hospital, I frequently practise early and free, yet not enormous incisions. Whatever merit belongs to the practice, and I now acknowledge that it is the means of saving numerous lives and limbs, the honour of this improvement in surgery belongs to Mr. A. Copland Hutchison. Whoever looks over the reports of the consequences of incisions of immoderate length, as detailed in the *Lancet* and other works, cannot fail to be struck with the following facts:—Several patients, treated in this way, instead of being saved, went out of the world in a very sudden manner, sometimes from the shock of an enormous wound on the constitution in its disturbed state; sometimes from profuse hemorrhage. In one or two instances, the cutaneous nerves, as well as large veins and arteries, were not spared, and a partial paralysis ensued.

I know of more than one case, in which the patient died of hemorrhage in a few minutes after an immoderate incision had been made. Dr. M'Dowel, a decided advocate of free incisions, candidly relates the following fact:—"The following case (says he), I witnessed ten years since; and at a more remote period than this, incisions in phlegmonoid erysipelas were constantly practised. A strong and healthy young

man had severe phlegmonoid erysipelas of the leg, after an injury of the patellar bursa. The limb, from the foot to half way up the thigh, was enormously swollen, extremely tense, and painful. There was high inflammatory fever. A free incision was made in the leg through the fascia, which retracted widely after its division; the parts were much gorged with blood, and disorganisation of the cellular membrane and aponeurosis had commenced at one part. There was profuse bleeding from the entire almost of the cut surface. The extent of bleeding was not attended to by the person in charge of the case, and in twenty minutes life was nearly extinct. Every plan of stimulation and support was adopted, except transfusion; but death occurred in an hour and a half after the operation." (M'Dowel in *Dubl. Journ. of Med. Science*, vol. vi. p. 179.) This case teaches us, at all events, that the bleeding must not be neglected. I am of opinion, therefore, that incisions of preposterous length are not the most prudent practice; by preposterous, I mean such as require a foot ruler or a yard for their measurement; for nobody is more convinced than I am, that free incisions of less extent are often of the highest service.

Now let me inquire, under what circumstances are punctures and incisions called for? To determine this point, we must remember the principles on which their usefulness depends. First, they are serviceable as affording an outlet to the serosity which fills and distends the cellular tissue, and acts mechanically in bringing on disorganisation of that texture. Secondly, they are useful in occasioning a discharge of blood, whereby the inflammation is checked. Thirdly, in the more advanced stage, incisions are beneficial in affording an outlet for the matter and sloughs. As the cavities of the cellular tissue all communicate, I find that Sir William Dobson's plan of making numerous small and repeated punctures generally answers very well for the discharge of the serosity from that texture, in the early stages of phlegmonous erysipelas. But, if the distension of the cellular tissue increase, notwithstanding this practice, combined with local and general antiphlogistic treatment, then I deem the method of making one or two free incisions in the part advisable to prevent gangrene of that texture. In the stage of suppuration and sloughing of the cellular tissue, no difference of opinion prevails about the necessity of free and depending incisions for the discharge of the matter, and removal of the sloughs. (See *Boyer, Traité des Maladies, Chir.* t. ii. p. 22.; *Dupuytren, Clin. Chir.* t. ii. p. 322.)

Phlegmatous erysipelas is generally considered to be an unfit case for bleeding and free evacuations, and to require tonic treatment. In short, the right practice, in every example of erysipelas, is to let the remedies be regulated in a great measure by the state of the constitution, the pulse, the strong or reduced condition of the system, the sort of fever accompanying the disorder, the age, temperament of the patient, and the particular stage of the complaint. At first, though antiphlogistic treatment may be the only safe plan, circumstances afterwards change so considerably, that this must be abandoned, and a method, quite the reverse of it, rigorously adopted.

Desault's Parisian Chirurgical Journal, vol. ii. *Ceayres* Chir. De Desault par Bichat, t. ii. p. 581, &c. *Cullen's* First Lines of the Practice of Physic, vol. i. *Pearl's* Pract. Obs. on Erysipelas, &c. 1802. *Pearson's* Principles of Surgery, 1808. Some parts of Hunter's Treatise on the Blood, Inflammation, &c. *Jassus*, Pathologie Chir. t. i. p. 4, &c. ed. 1809. *Traité des Maladies Chir.* par M. le Baron Boyer, t. ii. p. 6. et seq. *Willan* on Cutaneous Diseases. *A. C. Hutchinson*, in Med. Chir. Trans. vol. v. p. 278, &c. and Practical Obs. in Surgery, ed. 2. *T. Bateman*, A Practical Synopsis of Cutaneous Diseases, p. 128, &c. ed. 3. *Dict. des Sciences Méd.* vol. xlii. p. 253, &c. *Rayer*, *Traité des Mal. de la Peau*, t. i. *Butler's* Remarks on Irritative Fever. Devonport, 1825. *Dr. Duncan*, in Edin. Med. Chir. Trans. vol. i. *Arnott*, in Med. Phys. Journ. vol. lvii. *Jamies*, On Inflammation. *Wells*, in Trans. of a Society for the Improvement of Med. and Surgical Knowledge, vol. i. *W. H. Burrell*, in Edin. Med. Journ. vol. xxiv. *Lawrence*, in Med. Chir. Trans. vol. xiv. *Tuercotte*, in Cyclopædia of Practical Med. art. Erysipelas. *Stevenson*, in Edinb. Med. Chir. Trans. vol. i. *Gibson*, Op. cit. vol. ii. *Higginbottom* On Uses of Nitrate of Silver, ed. 2. *Dr. M'Dowel*, in Duhal Journ. of Medical Science, vol. vi. p. 161. 8vo. 1834.

ERYTHEMA. (From *ἔρυσθημα*, red.) A redness of any part. A mere rash or efflorescence, not accompanied by any swelling, vesication, or fever; circumstances which, according to Dr. Bateman, distinguish it from erysipelas. (*Synopsis of Cutaneous Diseases*, p. 119. ed. 3.) Its six varieties are described in the latter work. For the erythema mercuriale, see *Mercury*. The term is often wrongly applied to eruptions, attended with redness, and distinct papular and vesicular elevation, as we see in the instance of mercurial erythema, which Dr. Bateman says should be named *eczema*.

ESCHAR. (From *ἑσχαρῶς*, to form a scab, or crust.) This term is applied to a dry crust, formed by a portion of the solids deprived of life by the action of concentrated heat. When any living part has been burnt by the actual or potential cautery, all that has been submitted to the action of this application, loses its sensibility and vital principle, becomes hard, rough on the surface, and of a black or grey colour, forming what is properly named an *eschar*, a slough, produced by caustics, or actual fire.

ESCHAROTICS. (From *ἑσχαρῶς*, to form a crust over.) Applications, which form an eschar, or deaden the surface on which they are put. By escharotics, however, surgeons commonly understand the milder kinds of caustics, such as the *hydrargyri nitrico-oxidum*, *sulphate of copper*, &c.

EXARESES. (From *ἐξαίρεσις*, to remove.) One of the divisions of surgery adopted by the old surgeons; the term implies the removal of parts.

EXCORIATION. (From *excorio*, to take off the skin.) A separation of the cuticle; a soreness, merely affecting the surface of the skin.

EXFOLIATION. (From *exfolio*, to cast the leaf.) The process by which a dead piece of bone is separated from the living is termed *exfoliation*. One part of a bone is never separated from another by the rotting of the dead part, for what comes away is as firm as it ever was. Before any part of a bone can be thrown off by exfoliation, it must be dead. But, even then, till the process of exfoliation begins, the bone adheres as strongly as ever, and would remain for years, before it could be separated by putrefaction alone. The human bones are composed of two substances, viz. a true animal matter, and an earthy one, the phosphate of lime, which are only mixed with each other. A dead bone acts on the system, in the same manner as any other extraneous body. It stimulates the adjacent living parts, in consequence of which, such a process is begun, as must terminate in its being

thrown off. The effects of this stimulus are, first, that the living adjacent bone becomes more vascular; a circumstance, which always takes place, when a part has more to do, than is just sufficient for the support of life. Secondly, that the earth of the living part, when it is in contact with the dead bone, is absorbed; and there the bone becomes softer, and adheres by its animal matter only. As Mr. Wilson has stated, "before any mark of separation is seen on the surface, the living bone surrounding the dead, for the extent of a mere line, has become as soft as if it had been steeped in acid." (*On the Skeleton and Diseases of the Bones*, p. 281. 8vo. Lond. 1820.) Thirdly, that the living animal part is at last absorbed along the surface of contact: this part of the process commences, however, long before the last is finished; and both of them begin at the surface; though, in their course, they do not every where take place in an equal degree at the same time. Fourthly, in proportion to the waste, made by the last part of the process, granulations arise from the living surface, and fill up the intermediate space, so that there is no vacuum. These different stages together constitute ulceration. When any part of a bone is once loose, it is pushed to the surface in the same manner as most other inanimate bodies would be, and this stage is partly mechanical, and partly a continuation of ulceration. A proof of the third stage, above mentioned, may be derived from cases, in which people die, while exfoliation is going on. A small groove, or worm-eaten canal, can then be discovered, which becomes gradually deeper, and follows the irregularities of the living and dead surfaces. After the application of the trepan, a circular piece of bone is frequently thrown off, which is always less than the space from which it came. This, as Mr. Hunter observed, would never be the case, were there not a loss of substance. However, in what manner this loss of substance is produced, has frequently been a question, many pathologists, and amongst them, I believe, is Mr. Gulliver, adopting the belief, that dead bone is not absorbed.

"Although (says Mr. Wilson) in general the absorption takes place in the living bone, it still appears, that, under peculiar circumstances, the absorbing vessels have the power of acting on and removing the substance of dead bone. This happens after the dead part has been separated from the living, and when, from its shape, and the form of the living surrounding bone, it is prevented from obtaining a passage to the surface of the body; as in exfoliations of the cranium, when the inner table of the exfoliated part is broader and wider than the outer table." (*On the Skeleton*, &c. p. 282.) In very hard bones, the colour of the dead exfoliating portion is generally white; but, in softer bones, it is yellow, dark, and sometimes black. (*Wilson, op. cit.*)

It was anciently believed, that whenever a bone was denuded, the exposed surface must necessarily exfoliate; and, this being taken for granted, the old surgeons used to put immediately in practice whatever they thought best calculated to bring on an exfoliation as quickly as possible. For this purpose, the actual cautery was usually applied to the part of the bone, which was uncovered; and as, under such treatment, a portion of the bone was of course killed, and then exfoliated, the prejudiced practitioner believed, that he had only

accelerated a process, which must of necessity have followed in a more slow and tedious manner.

According to Mr. Hunter, neither caustics nor the actual cautery hasten exfoliation; they only produce death in a part of the bone, which is the first step towards exfoliation; and if they ever hasten exfoliation, when the bone is already dead, it must be by producing inflammation in the adjacent living bone; a change that makes it exert a power of which it was previously incapable.

Exfoliation is not a necessary consequence of a bone being laid bare, and deprived of its periosteum. If the bone be in other respects uninjured, healthy, and enjoy a vigorous circulation of blood through its texture, granulations will be generated on the surface of such bone, and they will cover and firmly adhere to it, without the smallest exfoliation being thrown off; especially in young subjects. But, if caustic, stimulating, or drying applications be made use of, or the bone be left for a considerable time exposed, the circulation in the superficial portion of it will necessarily be disturbed and destroyed, and that part of the surface, through which the circulation ceases to be carried on, will be separated, and cast off, by the process of exfoliation.

If any application to an exfoliating portion of bone be at all efficacious, it must be one which will stop the mortification in the affected bone, and promote the absorption of those particles of phosphate of lime, which form the connection between that which is living and that which is actually dead. And as the bone dies from the same causes as the soft parts mortify, we should at least follow in practice the same principles which we adopt in the latter instance; and though, from the inferior vascularity, and vital power of bones, we cannot expect surgery to have as much control over their affections, as over those of the soft parts, yet, every good will thus be obtained, which it is possible to acquire. Attention to such principles will at least teach us to refrain from making the death of part of a bone more extensive than it would be, if the cautery, caustics, and strong astringents, were not employed.

The best mode of attempting to prevent an exfoliation from occurring at all in a bone, that has been exposed by a wound, is, to cover the part again, as soon as possible, with the flesh, which has been detached from it. This, as I shall hereafter notice, (see HEAD, INJURIES OF,) may generally be practised with advantage, when the scalp has been detached from the cranium, provided the flap still retain even the most limited connection with the rest of the integuments.

When the exposed bone cannot be covered, it should be dressed with the mildest and simplest applications, with plain lint, or lint spread with the unguentum cetaceum.

The dead pieces of bone, when very tedious in exfoliating, when wedged in the substance of the surrounding living bone, and when so situated as to admit of being safely sawn, or cut away, may sometimes be advantageously removed in this manner. (See CARIES and NECROSIS.) In such operations, Hey's saws may be employed with great convenience; and where these are not applicable, that invented by Machell, and described in Sir A. Cooper's *Surgical Essays*, or another devised by Græfe, and explained by

Schwab, (*De Serra Orbiculari*, 4to Berol. 1819,) deserve to be recollected.

In speaking of necrosis, I shall have occasion to notice the efficacy of blisters, kept open with the savin cerate, in quickening the process by which dead portions of bone are loose particularly pointed out by the late Mr. Crowther, in his work on the white swelling.

Thomson published three Memoirs on Exfoliation. The two first are inserted at pages 372. and 403. *Mém. de l'Acad. des Sciences*, 1758; the third at p. 223 of the same work, for 1760. *P. Poissonnier*, *An recenti vulnere nutatis ossibus extoliatist conclusio negans*, 4to. Parisii, 1760. *Journ. de Méd. par Le Roux*, t. xxxi. p. 801.; t. xxxii. p. 181.; t. xxxiii. p. 168.; t. xxxvi. p. 537.; t. xxxviii. p. 153.; t. xxxix. p. 132. *Theden*, *Neue Bemerkungen*, &c. kap. 3. 8vo. Berlin, 1782. *Trans. for the Improvement of Med. and Chir. Knowledge*, vol. ii. p. 277, &c. *Wiedmann*, "De Necrosi Ossium," *Dict. des Sciences Méd. art. Exfoliation*, *J. Thomson's Lectures on Inflammation*, p. 394. 398. *P. Boulay*, *Sur l'Exfoliation des Os*, 4to. Paris, 1814. *J. Wilson*, on the Structure and Physiology of the Skeleton, and on the Diseases of the Bones, &c. p. 230. &c. 8vo. Lond. 1820. *R. Liston's Essay on Caries*, &c. in *Edin. Med. Surg Journ.* 78.

EXOMPHALOS. (From $\epsilon\chi$, out of, and $\sigma\mu\phi\alpha\lambda\delta\varsigma$, the navel.) A hernia at or near the navel.

EXOPHTHALMIA. (From $\epsilon\chi$, out, and $\sigma\mu\phi\alpha\lambda\delta\varsigma$, the eye.) In *exophthalmia*, *ophthalmoptosis*, *ptosis bulbi oculi*, the eyeball is of its natural size, and free from disease: it merely changes its situation, and partly or completely protrudes from the orbit. It is only confusing the subject to consider, as specimens of this disease, the cases in which the globe of the eye is affected with enlargement, and, on that account, projects from the orbit in a preternatural degree, as happens in hydrophthalmia, staphyloma, and cancerous disease. When the globe is pushed entirely out of the orbit, it generally lies upon the temple, or cheek, and vision is totally destroyed. There are instances, however, in which a considerable degree of sight was recovered, notwithstanding the exophthalmia was complete, and had lasted several years. (*Hoppe in Phil. Trans. for 1744. Richter's Bibl. band 4. p. 343.*)

There are three descriptions of causes, which may occasion exophthalmia:

1. The first and least common is a violent concussion of the head. A man fell from a height of about fifteen or sixteen feet, and pitched upon his head. The right eye was forced out of its socket, and hung over the cheek. The patient was deprived of his senses immediately after the accident, and affected with coma. There was a contusion over the right parietal bone; but no fracture. The eye spontaneously resumed its natural position, a short time after the accident, and, in the course of a month, with the assistance of low diet, and repeated bleeding, the cure was completed. (*Mém. de l'Acad. de Chirurgie*, t. 1. p. 198. 4to.) It is alleged, that the eye has been forced out of the orbit in a violent fit of sneezing. But such cases must be very uncommon, and imply a considerable relaxation of those parts, which serve to retain the eye in its socket, or some other predisposing causes, to which attention should be paid in the treatment. (*Richter, Anfangsgr. der Wundarz. b. iii. p. 407. ed. 1795.*)

2. A far more frequent cause of exophthalmia is a thrust in the eye with an instrument, which is narrow enough to pass between the orbit and

the eyeball, so as to push the latter out of its place. A stick, a tobacco-pipe, (*White's Cases in Surgery*, p. 131.) a foil, &c. may cause the accident. Repeated experience proves, that, in such cases, though the optic nerve, and muscles of the eye may be forcibly stretched, the interior parts of the organ seriously injured, and the dislocated eye generally deprived of the faculty of seeing, yet, when the organ is replaced as speedily as possible, it not only sometimes recovers its natural motion, but also its original power of vision. (See *Scultet. Appendix*, obs. 69. *Covillard*, obs. 27. *Borellus*, centur. 3. obs. 54. *Rhodus*, centur. 1. obs. 84. *White's Cases*, p. 131.) Previously to reducing the eye, we should examine the instrument which was pushed into the orbit; as, when it is brittle, a fragment of it may remain behind in the socket, and require to be extracted by means of the finger or a probe. When the weapon is pointed or hard, it sometimes pierces the bones of the orbit, and enters the brain, nose, or antrum. In the first case, which is often difficult to ascertain immediately, though after a time, it is generally rendered plain enough by the symptoms induced, the consequences are mostly fatal. In the two other cases, although the danger is not pressing, the surgeon should be very attentive, in the event of suppuration, to procure and maintain a ready outlet for the matter.

There is generally little difficulty in replacing the eye. Frequently it returns of itself into its natural situation, as soon as any trivial obstacles to its reduction are removed; and in other instances, it easily admits of being put into its proper place with the hand. The indication, says Richter, is always accomplished with more facility, the sooner it is attempted. When the protrusion has existed several days, and the eye and other parts in the orbit are already inflamed, Richter recommends us to endeavour to diminish the inflammation by general antiphlogistic means, and external emollient applications, before we try to replace the eye, and the reduction of this organ is afterwards to be effected in a gradual manner. When the optic nerve, and one or more of the muscles of the eye are torn, no hope can be entertained, that the eyesight and motion of the organ will ever be regained. But this degree of injury, as Richter observes, cannot always be immediately detected, because the optic nerve and muscles are concealed by the conjunctiva; and, if the nature of the case were known, still it would be advisable to replace the eyeball.

When the instrument, with which the eye has been pushed out of its socket, is blunt and thick, like a finger, a stick, a foil, &c. the eyeball itself always sustains a violent contusion, which brings on vehement inflammation, and lessens or destroys all hope that, after the reduction, the eyesight will be restored. Sometimes, an extravasation of blood in the orbit occurs, the iris is lacerated, the cornea burst, and a part of the humours of the eye discharged. Although, under such circumstances, it is scarcely to be expected that the eyesight can be recovered, yet, it is proper to reduce the eye, because, should the organ be destroyed by suppuration, or the loss of its humours the deformity may be obviated by an artificial eye, which is not the case, when the eye has been cut away. It is also to be considered, that the mis-

chief often seems to be worse than it really is, and the eyesight is sometimes regained, contrary to all expectation.

After the reduction of the eye, the first care of the surgeon should be to prevent and diminish inflammation. In some cases, the inflammation is slight; while, in others, especially when the eyeball has been severely struck, it is extremely violent. All the usual antiphlogistic means, both general and topical, are to be employed, and, of the latter, Richter says, astringents are the best, as the inflammation arises from the contusion and stretching which the parts have suffered. The possible consequences of inflammation, such as suppuration, opacity of the cornea, &c. are to be treated according to the rules laid down in other parts of this dictionary. (See CORNEA, OPACITY OF; HYPOPIUM; OPHTHALMY.) In general, the sight is restored in proportion as the inflammation is diminished. Should this not happen, after the ophthalmia has been entirely removed, the surgeon must try what effect such remedies, as stimulate the nerves, will have upon the optic nerve. An account of the most eligible medicines for this purpose will be found in the article AMAUROSIS.

3. The third cause of exophthalmia is a preternatural tumour in the orbit, or neighbouring parts. The swelling, as it enlarges, gradually pushes the eyeball out of its socket. The tumours, which may be formed in the orbit, are of several kinds. The principal, however, are encysted swellings, which contain either fat, an aqueous fluid, a pappy substance, or a thick matter. Sometimes, the cellular tissue in the orbit is affected with induration and swelling, so as to force the eye partly or completely out of this cavity.

Adipous swellings occupy the interspace of the recti muscles, emerge between the globe and the orbital circumference, and have an oblong figure. When the conjunctiva is freely divided, the fatty mass is easily drawn forwards with a hook, and dissected out. (*Travers*, in *Synopsis of Dis. of the Eye*, p. 225.)

An abscess in the orbit may cause a protrusion of the eyeball. (*Pellier*.) Exostoses may have the same effect. Sir Astley Cooper has related one case, which proved fatal, in consequence of the exostosis making its way to the brain through the orbital process of the os frontis. (*Surgical Essays*, part i. p. 157.) Mr. Guthrie has seen two instances: in one, the disease attained the size of a large marble, and then became stationary; in the other, it was much larger, and a portion of it had been ineffectually removed by means of a hot iron, which increased the inconvenience, without giving any relief. Hence, if an operation were deemed advisable, Mr. Guthrie would prefer the cautious use of a small chisel or saw. (*Operative Surgery of the Eye*, p. 154.) This author is at the same time aware of the case, in which M. Brossaut brought about the exfoliation of a considerable part of an exostosis of the os planum and internal angular process with caustic, so that the eye returned into its place, and the cure was completed. (*Mém. de l'Acad. de Chir.* t. v. p. 171. 4to.) In the records of surgery may be found examples, in which the displacement of the eye was produced by a tumour, that grew out of the frontal sinus. (See *Langen-*

beck's *Neue Bibl.* b. ii. p. 247.) In some cases, in consequence of suppuration in the antrum, the lower part of the orbit is raised, and the eye forced out of its place. Fungous diseases of the antrum may occasion the same mischief. (See *Parisian Chir. Journal*, vol. i. p. 104, &c.)

Schmidt records two cases of exophthalmia, produced by an hydatid of the lachrymal gland. One had a fatal termination; but, in the other, a puncture gave vent to an ounce of clear fluid, and cured the protrusion of the eye; but, the eyesight was lost. (*Ueber die Krankheiten des Thränenorgans*, p. 54.) Farther particulars of the latter case may be seen in Mr. Guthrie's work, p. 157.)

Not long ago, Langenbeck extracted from the sinus frontalis of a girl, a large hydatid, which had forced the outer table considerably forwards, and depressed the orbital process of the os frontis so far, that the eyeball was propelled as low as the extremity of the nose. After the front of the sinus had been perforated, and the hydatid removed, there was a cavity left two inches and a half in depth. (*Neue Bibl.* b. ii. p. 247. Hanover, 1819.) My friend Mr. Lawrence mentioned to me a remarkable case, which presented itself at the London Eye Infirmary: it was an exophthalmia, which arose from a collection of hydatids in the orbit, and was cured by making an incision, and afterwards promoting their discharge. In all these examples, the eyeball is displaced from the orbit gradually, and vision is at length impeded. Instances, however, are on record, where the sight was never lost, though the eye was protruded for years. (See *Richter's Chirurg. Bibliothek*, band iv. stück ii. p. 243. *White's Cases in Surgery*, p. 135.) In one instance, the sight was not at all lessened, and the iris retained its natural mobility. (*Langenbeck, Neue Bibl.* b. ii. p. 245.)

Experience proves, also, that after the reduction, the motion of the eye, and power of seeing may be regained, in cases, where the eye has been gradually pushed out of the orbit, and been displaced a considerable time, even as long as several years, during all which period vision was lost. (*Acrell, Brocklesby, in Med. Obs. and Inquiries*, vol. iv. p. 371.) Langenbeck relates a case of exophthalmia from a steatoma in the orbit, where, though vision was entirely prevented during the displacement, the pupil was of its regular shape, and the iris capable of motion: after the extirpation of the tumour, the eyesight became so good, that the patient could discern the smallest objects. (*Neue Bibl.* b. ii. p. 240.) In order to reduce the eye into its natural position, it is necessary to remove the cause by which its protrusion is occasioned. Suppuration and fungous tumours in the antrum must be treated according to directions laid down in the article ANTRUM. The induration and swelling of the cellular substance in the orbit may be sometimes dispersed by means of mercury. (*Louis, Sur Plusieurs Maladies du Globe de l'Œil, in Mém. de l'Acad. Royale de Chirurgie*, t. xiii. éd. 12mo.) When such treatment fails, we are recommended to extirpate the eye. (*Richter, Anfanggr. der Wundart., b. iii. p. 413.*) Exostoses, situated in the anterior part of the orbit, may sometimes be removed. The continental surgeons generally advise us to expose the tumour by an incision, and to apply caustic or the actual to it, in order to kill the protuberant part

of the bone, and make it exfoliate. In this country, most practitioners would prefer the employment of cutting instruments for removing such exostoses. When, however, the tumour lies deeply in the orbit, if it cannot be got at, and it should resist the effect of mercurial medicines and mezerion, we are directed to extirpate the eye. (*Richter, Op. et loco cit.*) Abscesses in the orbit ought to be opened, and after this has been done, the eye generally returns into its proper position. (*Pellier.*) When encysted tumours in the orbit admit of being extirpated in the customary manner, the plan should be adopted; but, when this cannot be done, Richter's advice may be followed, which is to open them, press out the contained matter, and afterwards extract the cyst. Considerable difficulty, however, frequently attends every effort to remove the whole cyst, and unless this be done, a permanent cicatrization cannot be expected. (See *Travers's Synopsis*, p. 225. See TUMOURS, ENCYSTED.)

On account of the vicinity of the brain, and the communication between the parts within the orbit, and the dura mater, the extirpation of tumours from that cavity is not exempt from risk of fatal consequences, as two cases, published by Langenbeck, fully prove. (*Neue Bibl.* b. ii. p. 241—244.) I remember a young lady who was referred to Mr. Lawrence and myself, by Mr. Maul of Southampton, for advice respecting a tumour, occupying the inner and upper portion of the orbit, and attended with a degree of exophthalmia, constant exacerbation at the period of the menses, and occasionally double vision. (See DIPLOPIA.) We refrained from advising any immediate attempt at extirpation, the swelling being so firm and immovable, that the disease was suspected to be partly of a bony nature. However, on seeing this case, about a fortnight afterwards, I was surprised to find the tumour not more than half its former size, and all the firm and (what was conceived to be) bony induration below the superciliary ridge of the os frontis gone, as well as the exophthalmia, and derangement of vision. Some sharp bony irregularities, however, could now be most plainly felt, projecting in front of the diminished swelling.

A memorable case of exophthalmia is related by Mr. Travers: the globe of the eye appears to have been gradually forced upwards and outwards, and to have had its motions considerably impeded, in consequence of the orbit being partly occupied by two swellings, which were of the nature of aneurism, by anastomosis. (See ANEURISM.) The swellings could not have been removed, without at the same time extirpating the eye. Mr. Travers was therefore induced to try, whether applying a ligature to the carotid artery would have the effect of checking and curing the disease; an expectation which was warranted by analogous instances, in which the growth of swellings, and their dispersion, are brought about by lessening the quantity of blood determined to them. The experiment completely succeeded; the swellings in the vicinity of the eye subsided; the patient was freed from several grievous complaints, to which she had been previously subject; and, amongst other benefits, a cure of the exophthalmia was one result, which most interests us in the present place. The case is also highly important on other accounts, and, more particularly as confirming the fact, that the carotid artery may be tied,

without any dangerous effects on the brain, and as proving, that, in cases of aneurism, the surgeon should not be afraid of proceeding to such an operation. (See *Méd. Chir. Trans.* vol. ii. art. 1.) The judgment and decision, with which Mr. Travers acted in this case, appear to me highly meritorious.

The carotid artery was also tied by Mr. Dalrymple, of Norwich, in a case very similar to the preceding, and with equal success. (See *Méd. Chir. Trans.* vol. vi. p. 111, &c.)

Mr. Guthrie has seen an exophthalmia on each side, the result of an aneurism of each ophthalmic artery, and other disease in the orbits. (*Operative Surgery of the Eye*, p. 158.)

When the causes of exophthalmia have been removed, the eye must be put into its natural situation. If the organ has been long displaced, the surgeon often finds the fulfilment of this indication attended with difficulty. Indeed, he is frequently obliged to employ methodical bandages for the purpose of promoting the gradual return of the eye into the orbit. Yet, even in such cases, the eyesight is often regained; but, if this should not happen spontaneously, stimulants and tonics are to be tried.

Fab. Hildan. centur. vi. obs. 1. Vander Wiel, centur. ii. obs. 9. Paw. Obs. Anat. 23. Tulpus, lib. i. cap. 28. Hope, in Phil. Trans. for 1744. Louis, Sur plusieurs Maladies du Globe de l'Œil, &c. in Mém. de l'Acad. de Chirurgie, t. xiii. in 12mo. Brocklesby, in Medical Obs. and Inquiries, vol. iv. p. 371. White's Cases in Surgery, p. 181—135, &c. Warner's Cases in Surgery, p. 108. edit. 3. Lassus, Pathologie Chir. t. ii. p. 144. edit. 2. Richerand, Nosogr. Chir. t. ii. p. 117. edit. 2. Méd. Chir. Trans. vol. ii. art. 1.; vol. iv. p. 316.; and vol. vi. p. 111, &c. Richter's Anfangsgr. der Wundaran. b. iii. p. 406, &c. Gött. 1795. Langenbeck Neue Blbl. b. ii. p. 225, &c. Lond. 1820. Dr. Montan, in Hædler's Manual, vol. i. p. 195. Petitjean, in Journ. de Méd. par Corvisart, t. xiv. G. J. Guthrie, Operative Surgery of the Eye, p. 145, &c. 8vo. Lond. 1823.

EXOSTOSIS. (from $\epsilon\zeta$, out, and $\sigma\sigma\tau\iota\sigma$, a bone.) An exostosis is a tumour formed by an exuberant growth of bony matter on the surface of a bone, or it is formed by the more or less considerable enlargement of a part, or the whole, of a bone. (Boyer, *Mat. Chir.* t. iii. p. 541.)

In general, however, it is only when the enlargement is partial, that it is termed an exostosis. As Mr. Mayo has pointed out, some hypertrophies of bone are connected with a salutary principle; while others constitute curable, or incurable diseases. The arm of a blacksmith acquires, through daily exertion, additional muscular force, weight, and size; the bones in it enlarge; their crust becomes harder, and of a more compact grain; and the lines upon the surface, which give attachment to tendons, become rough and prominent ridges. This is health. When Mr. Cheshire's apparatus for supporting the spine is worn, the pressure on the lower jaw generally causes this bone to enlarge, and to throw out a bony swelling, where the chin strap is applied. This tumour is an exostosis, yet it evidently results from the salutary principle, which strengthens a part in proportion to the exertion imposed upon it. (See *Mayo's Outlines of Human Pathology*, p. 11.)

While the growth of the whole body is proceeding rapidly, abnormal swellings of parts of bones are common, especially of the clavicle, sternum, or ribs. These are exostoses, which require no treatment, as they generally subside

of themselves in the course of a year or two. Exostoses are still more common at the period, when the body has recently attained its full growth. But the disease is not limited to the early, nor to the middle periods of life. (*Ib.*)

One division of exostoses is into *true* and *false*; the former being of a truly osseous consistence, the others being more or less hollow, spongy expansions of the bones, sometimes containing a quantity of cartilaginous, fibrous, medullary, or fungous matter within the shell of the disease. Periostoses, or mere thickenings of the periosteum, are also sometimes classed amongst *false* exostoses. (*Dict. des Sciences Méd.* t. xiv. p. 218.) According to Sir Astley Cooper, exostoses have two different seats: by *periosteal* exostosis he means, an osseous deposition seated between the external surface of the bone, and the internal surface of the periosteum, and firmly adherent to both; by *medullary* exostosis, he signifies a similar formation, originating in the medullary membrane, and cancellated structure of a bone. The same experienced surgeon makes two other general divisions of exostoses into the *cartilaginous* and *fungous*, the first being "preceded by the formation of cartilage, which forms the nidus for the ossific deposit," while the second is a tumour softer than cartilage, yet firmer than fungus, in other parts of the body, containing spiculae of bone, being of a malignant nature, and depending "upon a peculiar state of constitution and action of vessels." It is a disease similar to "fungus hæmatodes, but somewhat modified by the structure of the part in which it originates." (*Surgical Essays*, part i. p. 155.)

If a true exostosis be immersed in diluted muriatic acid, so as to separate the earthy part of it, the tumour will yet retain its form, and present the same kind of fibro-cartilaginous matrix, which exists in healthy bone. (*Ib.*)

Exostoses differ in size. Those of the cranium are generally small and circumscribed, yet exceptions occur; for Sir Everard Home removed a very large tumour, which had a bony base, and was situated on the head. (Sir A. Cooper, *Surgical Essays*, part i. p. 156.) The largest true exostoses are formed upon the long bones. In the history of surgery may be found numerous cases of enormous exostoses; but nearly all of them of the species termed *false*, and many of them were situated on the jaw, the clavicle, or the extremities of the long bones. Observations of this kind are abundant in l'Histoire de l'Acad. des Sciences; les Mém. de l'Acad. de Chir.; the Sepulchretum Anatomicum; the writings of Morgagni, &c. (*Dict. des Sciences Méd.* t. xiv. p. 219.)

The bones, most frequently affected with exostosis, are those of the cranium, the lower jaw, sternum, humerus, radius, ulna, bones of the carpus, and particularly the femur and tibia. There is, however, no bone of the body, which may not become the seat of this disease. It is not uncommon to find all the bones of the cranium affected with exostosis, and the ossa parietalia sometimes an inch thick.

The exostosis, which forms between the outer table of the skull and the pericranium, is of extremely hard consistence, and generally attended with little pain, while the *fungous* exostosis, springing from the diploe of the skull, is less firm, more vascular, and of a malignant nature, making its way through the inner table, and occasioning

disease of the dura mater, and fatal effects on the brain. (See *Sir A. Cooper's Surgical Essays*, part i. p. 156.)

Sometimes the tumour is confined to a small part of the affected bone, composing a mass superadded to its surface, and of various shapes. Sometimes it rises insensibly, having no very distinct limits, and resembling a more or less regular portion of a sphere. In some instances, its figure is styloid, and it projects in a greater or less degree. On other occasions, its base is rendered distinct by a pedicle, or contraction, which varies in breadth and length in different cases. In particular instances, the exostosis, though limited to the surface of a bone, occupies the whole extent of it. Thus, the whole external surface of one of the bones of the skull has been found occupied by an exostosis, while the inner table was in the natural state. The whole circumference of the femur sometimes acquires an enormous size, at the same time that its medullary surface continues entirely unchanged. These are the *periosteal* exostoses of Sir Astley Cooper. In other examples, on the contrary, the two surfaces and the whole thickness of the bone are deformed by an augmentation of bulk; and when this happens in a cylindrical bone, the medullary cavity is more or less reduced, or even totally obliterated. In a few extremely uncommon cases, the substance of a bone acquires great solidity, and a hardness compared to that of ivory, without any material increase of bulk. An exostosis rarely occupies the whole extent and thickness of a bone; but when this happens in a cylindrical bone, the articular surfaces generally remain in their natural state.

Common situations of exostoses are the upper part of the humerus and tibia, and the lower part of the femur, especially near the insertion of the tendon of the adductor magnus. (*Sir A. Cooper*) In the long bones, exostoses are generally narrow, and of greater height, than thickness; sometimes largest at their base, sometimes the reverse. In the flat bones, they are usually broad, but they form flat discs, connected to such bones by means of short narrow pedicles. In the round bones, they are rounded and nodular. To these laws, as Mr. Mayo observes, there are many exceptions. (*Outlines of Human Pathology*, p. 12.)

The structure and consistence of exostoses present great differences. Sometimes, especially when the tumour is not very large, and situated on the surface of a cylindrical bone, one may trace with the eye the diverging of the osseous fibres, in the interspaces of which we might say, that there is deposited a new bony substance, the organization of which is less distinct. Sometimes the tumour is entirely cellular, and formed of a few broad laminae, intercepting extensive spaces, which are filled with matter different from the medulla, and of various quality. This case is denominated the *laminated exostosis*. Sometimes the enlarged portion of bone makes a sort of hollow sphere, with thick hard walls, and the cavity is filled with a firm indolent fibrous substance. One form of exostosis Sir Astley Cooper has named the *cartilaginous exostosis of the medullary membrane*. "In this case, the shell of the bone becomes extremely expanded, or rather the original shell is absorbed, and a new one deposited; and within this ossified cavity thus produced, a very large mass of cartilage is formed, elastic, firm, and fibrous." It is

not malignant, but often ends in a very extensive disease. (*Surgical Essays*, part i. p. 173.)

In other instances, the tumour is perfectly solid, exceeding in consistence that of the hardest bones, and equalling that of ivory. The ivory exostosis is thought by Mr. Mayo to be occasionally malignant; and he mentions, that Mr. Stanley, has a preparation of one, which is combined with medullary sarcoma. (*Human Pathology*, p. 14.) I suspect, that this must have been an accidental concurrence with the more solid exostosis. Here the surface is sometimes smooth, and like that of the bone in its natural state; sometimes irregular, full of little projections, and in some degree stactalical. It is uncommon to find a large portion of an exostosis converted into a pulraceous substance; but it is not at all unfrequent to see this substance composing part of the tumour. Lastly, it often happens, that the same exostosis presents an assemblage of the ivory substance, and of the cellular laminated substance, the cavities of which are partly filled with a pulraceous matter, and partly with a sort of gelatinous substance.

An extraordinary instance of what is sometimes called *spiculated exostosis*, is related. Spiculae, or ramifications of bone, are represented as projecting from the various bones, and causing anchylosis of every joint, with the exception of the wrists and knees. One branch is seen to extend from the coccyx to the femur. Another case is also reported by Fréke, where the exostoses are compared to the branching of coral, the bony formations projecting from the cervical and other vertebræ, and joining others from the ribs, so as to make a kind of bodice on the back. (See *Phil. Trans.* vol. 41; and *Wickham on Diseases of Joints*, p. 8.)

When an exostosis is not very large, it hardly affects the surrounding soft parts; but when it has made considerable progress, the muscles become stretched and emaciated, the cellular tissue is thickened, and, its layers being adherent together, a kind of confusion is produced amongst all the adjacent parts. Exostoses not of considerable size may, however, seriously interrupt the functions of certain organs. The action of the flexor muscles of the leg has been known to be obstructed by an exostosis in the vicinity of the knee. A similar tumour, arising near the symphysis pubis, need not be very large to impede considerably the functions of the urethra, as experience has proved. An exostosis in the orbit has been known to displace the eye and destroy vision. Lastly, exostoses, when situated near certain important organs, and of large size, may affect with different degrees of gravity the functions of these parts, as the brain, the lungs, &c. (See *Boyer, Mal. Chir.* t. iii. p. 541—544.)

Sir Astley Cooper has related a case, in which the eyes were pushed out of their sockets by two exostoses, which grew from the antra, and one of which destroyed the patient by making its way to the brain through the orbital process of the os frontis. (*Surgical Essays*, part i. p. 157.) In one instance, reported by the same author, an exostosis from the sixth or seventh cervical vertebra abolished the pulse at the wrist, by pressing upon the subclavian artery. (P. 159.) In another, a *cartilaginous* exostosis of the medullary membrane of the lower jaw extended so far back, that it pressed the epiglottis down upon the rima glottidis, and caused such difficulty of respiration, and so much irritation, that the patient was destroyed. (P. 175.)

Some particulars of an exostosis, are recorded, which projected from the posterior surface of the symphysis pubis into the bladder. The case, while the patient lived, might have been mistaken for an adherent calculus. (See *J. Cloquet, Pathol. Chir.* p. 130. 4to. Paris, 1831.) Dupuytren had a case, in which an exostosis of the femur obliterated the femoral artery. (See *Clin. Chir.*) A patient had an exostosis of the first rib, which threw forward the subclavian artery, so as to give the appearance of a subclavian aneurism. (See *Mayo's Outlines of Human Pathology*, p. 12.) I find a case referred to, in which an exostosis of the anterior surface of the sacrum pushed the rectum so far forwards, as to render the introduction of a small bougie into that bowel very difficult. (*B. Bell on Diseases of Bones*, p. 115, 12mo. Edinb. 1828.) Frequently exostoses interrupt the free movement of a joint; thus, Mr. H. Lyford removed one, which was of the size and shape of the little finger, and situated just on the inside of the capsular ligament of the shoulder joint, on the front and inner part of the humerus. The direction of the point was upward and inward toward the clavicle and sternum, and the motion of the humerus inwards was interfered with. (See *W. J. Wickham on Diseases of the Joints*, p. 7.)

Venercal exostoses, or nodes, are observed to arise chiefly on compact bones, and such of these as are superficially covered with soft parts, as, for instance, the bones of the cranium, and the front surface of the tibia.

The causes of exostoses are obscure. They may be induced, however, by a blow, or pressure. Most writers impute the disease to internal causes, such as scrofula and lues venerea. That the latter affection is the cause of nodes, which are certainly a species of exostosis, no one will deny: but, that scrofula is concerned in producing exostoses is more doubtful. Sometimes I have suspected, that some of those bony swellings, which are so common in children during the rapid growth of the body, are connected with a scrofulous constitution. At all events, I have noticed them with great frequency in children of this description, though it might only be an accidental coincidence.

Hydatids are occasionally found within exostoses, in which circumstance the former are supposed to be the cause of the enlargement of the bone. A remarkable specimen of such a disease in the tibia is mentioned by Sir Astley Cooper. (*Surgical Essays*, parti. p. 163.) He refers also to a humerus, in the museum of St. Thomas's Hospital, where the shell of the bone is considerably expanded, the periosteum over it thickened, and in the seat of the cancellated structure, are several hydatids, supposed to have been the cause of the enlargement of the exterior surface of the bone, as well as of the increase of its cavity. (*Vol. cit.* p. 161.)

A most interesting case of a bony tumour on the forehead, containing hydatids, was published by Mr. R. Keate. (*Med. Chir. Trans.* vol. x. p. 278.)

The disposition to the formation of ossific tumours may prevail throughout the system, and display itself in other textures, besides the bones. Thus, Mr. Mayo refers to a specimen of ossification of the lungs, taken from a patient, who died of pulmonary disease after amputation of the leg for ivory exostosis. (See *Outlines of Human Pathology*, p. 14.) The alliance, between the ossification of ligament, muscle, tendon, and exostoses,

is well illustrated in Jeff's skeleton in the Hunterian Museum. Some of the ossifications form exostoses, while others pass from one part of the skeleton to another. The first prevail, especially in places, where muscles are inserted. The second have generally followed the course of the larger muscles, and may be seen on the right side, joining the clavicle and acromion to the humerus, in the situation of the supra spinatus, and passing from the lower angle of the scapula to the humerus in the course of the teres major and latissimus dorsi. On the back, more extensive ossifications appear, which affix the scapulae to the sacrum and ilium, and to the spines of the lumbar and dorsal vertebrae. From the pelvis, ossifications extend in the direction of the glutæus maximus, biceps, and triceps. Ossifications of the tendinous and ligamentous parts are still more common, producing anchylosis of the vertebrae, left elbow, tibia and fibula, and of the bones of the tarsus to one another. (See *Museum Catalogue*.)

The readiness, with which bony tumours form in some persons, renders it probable, that constitutional causes have great influence. Thus, such a blow as, in the generality of persons, would hardly excite notice, will, in others, bring on swellings of the bone which is struck. Sir Astley Cooper adverts to a young friend of his, in whom an exostosis, which was undoubtedly caused by a blow, is growing on the metacarpal bone of the little finger. (*Loc. cit.*) Mr. Abernethy used to mention in his Lectures, a boy, from Cornwall, who was so excessively afflicted with an apparent predisposition to exostoses, or an exuberant deposition of bony matter, that a very trifling blow would occasion a bony swelling on any bone of his body. His ligamentum nucha was ossified, and prevented the motion of his neck; the margins of his axillæ were also ossified, so that he was, as it were, completely pinioned. Besides all this, the subject in question had numerous other exostoses on various parts of his body. Mr. Abernethy gave, in this case, muriatic and acetic acids, with the view of dissolving the lime, which it was conceived might be too abundant in the system; but, even if this theory had been correct, and the acids capable of the chemical action intended, after passing into the circulation, how could they be expected to dissolve only the redundant depositions of phosphate of lime, and at the same time leave the skeleton itself undissolved?

When an exostosis depends upon lues venerea, it is almost always preceded by an acute pain, which in the beginning extends to nearly the whole of the affected bone, but afterwards becomes fixed to the point where the exostosis forms, and it is most severe in the night-time. When an exostosis is caused by scrofula, says Boyer, the pain is duller, or rather it is quite inconsiderable. It is the same with the exostosis which succeeds a blow, or contusion, without any manifest general cause. In the latter example, the pain, immediately excited by the accident, subsides in a few days, and the swelling occurs so slowly, that no notice is taken of it till it has attained some magnitude. (*Mal. Chir.* t. iii. p. 545.)

An exostosis constantly feels hard; but its size is various, and it may be indolent, or painful. By these signs, and its firm adhesion to the bones, it may be always distinguished from other tumours. Some exostoses cannot be ascertained before death.

Such was the case in which the parietal bone was found, after death, to be three times thicker than natural. Such also was the example, related in the memoirs of the Academy at Dijon, in which a person died from an exostosis on the internal side of the os pubis, the tumour having prevented the discharge of the urine, and the introduction of a catheter, by its pressure on the neck of the bladder.

Exostoses may be either *acute*, or *chronic*, in their progress. In the first case, which, according to Boyer, happens most commonly in the *cellular* exostosis, described by authors under the name of *laminated*, the appearance and formation of the tumour are quick; the swelling rapidly acquires a considerable size; and, it is always preceded by, and accompanied with, continual violent pain, which the external and internal use of opium has little effect upon, and the intensity of which is not increased by pressure. The pain is sometimes so severe that it occasions a good deal of symptomatic fever. Boyer, who seems not to be aware of the origin of what he terms the *cellular*, and what Sir Astley Cooper has named *fungous exostosis*, from the medullary membrane, finds difficulty in accounting for the rapid growth and great sensibility of the tumour, considering the natural density of the bones, and the little energy of their vital properties.

In the hardest kinds of exostosis, the tumour is preceded by no pain, or, if any, it is very slight; the tumour grows slowly; and although it sometimes attains a considerable size, its increase is attended with no particular sensibility, and no disturbance of the animal economy. (*Boyer, Op. cit. t. iii. p. 546.*)

Our ignorance of the pathology of exostoses, particularly their causes, accounts for the imperfection of our treatment of them. With the exception of the venereal exostosis or node, there is no species of this affection, for which it can be said that we have any medicine of efficacy.

Boyer regards some exostoses as a perfectly inorganic mass of lime, and, consequently, he entertains no idea that the absorbent vessels can possibly take away the particles of the tumour, just as the seceding arteries have luid them down.

He acknowledges, indeed, that he has seen a venereal exostosis of the humerus, as well as a few other bony swellings, subside; but he represents the event as extremely rare; and he advances it as a principle, that the resolution of exostoses hardly ever happens, and that the greater part of the examples, recorded in proof of the occurrence, were nothing more than periostoses. (*P. 547.*)

However, a young woman was in the Middlesex Hospital with an exostosis of the humerus. It was sawn off, but grew again. A rubefacient plaster was applied, an abscess followed, and the new bone was absorbed. (*See Mayo's Human Pathology, p. 13.*) When abscesses form, exostoses are very subject to be attacked with caries, or necrosis.

When an exostosis is hard, chronic, and free from pain and alteration of the structure of the bone, it is more common for it to cease to enlarge and remain stationary during life, without producing inconvenience, provided it be so situated as not to impede the functions of any vital organ.

But, in the *cellular* exostosis of Boyer, which I take to be the same disease as the *fungous* exostosis of the medullary membrane of Sir Astley Cooper, the acute and rapid progress of the disease

indicates a deeper and more serious alteration of the texture of the bone. A part of the tumour usually consists of a pultaceous, or gelatinous matter, and the rest, still endued with its natural organization, though altered by the disease, soon presents one or several cavities, in which there is suppuration. At the same time, the external soft parts, being excessively and rapidly distended, inflame, ulcerate, and leave exposed a more or less extensive portion of the tumour, the disease of which has in many cases been very wrongly supposed to be caries. It is not, observes Boyer, that the part of the swelling denuded by ulceration is not sometimes affected with caries; but, then it exists as a complication of the original disease, and as a particularity, by no means the result of the ulceration of the soft parts, and of the exposure of the diseased bone to the contact of the air. When the soft parts are thus ulcerated, the opening contracts to a certain point, and becomes fistulous. The suppuration is always of bad quality, and in a quantity proportioned to the size of the cavity of the abscess and the strength of the patient. The fever, which commences at an early period of the disorder, assumes a slow type, and its continuance, together with the copiousness of the ichorous discharge, the irritation, &c. may bring on the patient's dissolution.

The following are the symptoms of what Sir Astley Cooper denominates the *fungous exostosis of the medullary membrane*. The disease begins with a general enlargement of the affected part of the limb, extending a considerable way around the seat of the exostosis itself. This form of the complaint mostly occurs in young persons, though Sir Astley Cooper has seen it in an individual fifty years old. "Its increase proceeds very gradually; and even when it has acquired considerable magnitude, although it produces some diminution of motion in the limb, it does not occasion pain, nor prevent the patient from using it. When any pain does arise, it is of an obtuse kind, only being acute in the event of a nerve being stretched by the tumour. Thus an exostosis of the thigh-bone sometimes causes great agony, by pressing on the sciatic nerve. Paleness, debility, and irregularity of the bowels, are observed to attend the early stage of the disease; and afterwards the complexion becomes sallow. In the mean time, the diseased part of the limb attains an enormous size; but the skin retains its natural colour. At many points, the swelling feels hard; at others, it is so elastic as to cause the presence of fluid to be suspected; but, if an opening be made, only blood is discharged. The surface of the tumour next becomes tuberculated, and the prominences tender, and their surface is often slightly inflamed. The rest is now broken, the appetite impaired, and the bowels extremely irregular. At length, the tubercles ulcerate; the skin secretes pus; but, when the swelling itself is exposed, it discharges a bloody-coloured serum. A fungus then forms, which sometimes bleeds profusely, and, after it has risen very high, sloughing occurs, and considerable portions of the swelling are thrown off. But, although the swelling may be lessened by this process, Sir A. Cooper has never known the disease cured by it; and, in the end, the patient is destroyed by the effects of the repeated bleeding, immense discharge, and constitutional irritation." In this disease, as in common fungus hematodes,

tumours of a similar nature are often formed in other parts of the body, and, after the amputation of the affected bone, frequently make their appearance in organs of the greatest importance to life. The swelling is described as originating from the medullary membrane, and as removing the muscles to the distance of three inches, or more, from the bone, so that they represent a thin layer spread over the tumour. The blood-vessels and large nerves are also similarly displaced. The tuberculated appearance of the skin, which is itself sound, is caused by projecting small masses on the surface of the tumour. Under the muscles is the periosteum, pushed to a considerable distance from the bone. A part of the swelling itself is yellow, like fat; another portion resembles brain; and a third is composed of coagulated blood with interstices filled with serum. In some parts, the white substance is found nearly as firm as cartilage; but, in general, it presents a more spongy appearance; and is interspersed with spiculae of bone. The shell of the bone itself is in part absorbed; in some places it is only thinner than usual; while in others it is immensely expanded, so as to form a case like wire-work over the tumour. The fungous granulations, proceeding from the medullary membrane itself, are exceedingly vascular, and often shoot from the cavity of the bone beyond the level of the integuments. (*Sir A. Cooper, Surgical Essays, part i. p. 165—168.*)

One termination of exostosis, not sufficiently noticed by writers, but which has been observed, especially in the hard and staccatical exostosis, is that by necrosis. Tumours of this description, after acquiring a large size, have been attacked by necrosis, separated from the bone which served them as a base, and been surrounded with a reproduction in every respect similar to that with which nature surrounds sequestra formed under any other circumstances. This termination is undoubtedly the most favourable of all, because nature proceeds in it slowly, without any violent disturbance; but, unfortunately, it is the least common. Art can imitate it; but her means are very inferior to those of nature. (*Boyer, Mal. Chir. t. iii. p. 547—550.*) A few years ago, a most interesting case of an enormous exostosis of the upper maxillary bone, which followed the preceding course, was under my notice. It was believed at first to be a malignant tumour of the antrum; but the bony formation after exciting abscesses, was attacked with necrosis, and was ultimately thrown off by exfoliation. On this case, I had a consultation with my friend, Mr. Lawrence.

The hardest exostosis, which has grown slowly, and without causing severe pain, is the least dangerous of all. After the disease has attained a certain size, it may become stationary, and continue in this state, without inconvenience, during life. This is most frequently observed in the ivory exostosis; and I join Boyer and others, in not considering this case as at all disposed to malignancy. Without having precisely this extreme hardness, however, some exostoses, which are tolerably solid, and in which the natural organization of bone is still distinguishable, are capable of undergoing a slight reduction, after the removal of their cause by nature or art. Boyer states, that this sometimes happens in a few scrofulous exostoses, and particularly in such as are venereal, and not of large size.

The cellular exostosis of Boyer, the fungous exostosis of Sir A. Cooper, and the cases which are named *osteosarcomata*, are the most serious of all, especially when the texture of the bone is considerably altered, and the disease is in a state of ulceration. The rapid formation of the disease, the violent shock which it imparts to the constitution, and the hectic disturbance which it excites, generally bring the patient into imminent danger, and commonly leave no other resource but that of amputating the limb.

The treatment of exostoses is to be considered in a medical and surgical point of view. When any general cause of the disease is known, or suspected, such cause is to be removed by those means, which experience has proved to be most efficacious. Thus Boyer recommends mercurial and antiscrofulous remedies, &c. according to the nature of the case. At the present day, iodine, and the hydriodate of potash are frequently prescribed.

Whatever may be the species of exostosis, or the nature of its cause, relief, says Boyer, may be derived from the outward use of opium, whenever the disease is attended with severe pain. He speaks favourably of the application of a linseed-meal poultice, mixed with a decoction of the leaves of nightshade and henbane, to which a strong solution of opium has been added. But he thinks that an antiphlogistic plan, with bleeding, is hardly ever admissible, because it weakens the patient too much in so tedious a disease, and can only be a palliative, incapable of curing, or preventing, the ravages of the disorder.

When there is no pain, or it has been appeased, during or after any general method of treatment, which may have been indicated, the surgeon may try resolvent applications, particularly soap and mercurial plasters, the tincture or ointment of iodine, the liniment of ammonia, bathing in water, containing a small quantity of soda, or potassa, hydro-sulphuretted washes, &c. It must be confessed, however, that the progress of exostoses can scarcely ever be checked by any general methodical treatment. The muriatic and acetic acids have been administered, but without effect; nor am I acquainted with any remedies which possess efficacy, except iodine and mercury, which last we know will rarely answer, except in cases of nodes. In the commencement of any deep-seated disease in a bone, Sir A. Cooper thinks, that the best medicine, for internal exhibition, is the oxymuriate of quicksilver in small doses, together with the compound decoction of sarsaparilla. (*Surgical Essays, part i. p. 169.*) Boyer is firmly of opinion that, with the exception of recent small exostoses, the nature of which is even doubtful, the resolution of such tumours is almost impossible. A slight diminution of the swelling, and its becoming perfectly indolent, are the most favourable changes which can be hoped for, whether they occur spontaneously, or are the fruit of surgical assistance. (*Mal. Chir. t. iii. p. 554—557.*)

Blisters have often been applied to the skin over exostoses, and kept open for a long while with savine ointment; but, although they tend to diminish venereal nodes, after they have been lessened as much as they can be by mercury, and they promote the absorption of dead bone in cases of necrosis, their efficacy in the treatment of exostoses has not been considerable. However, a trial

of them in some examples is rational; and Sir Astley Cooper approves both of leeches and blisters, a discharge from the latter being kept up with equal parts of the mercurial and savin ointments. (*Surgical Essays*, part i. p. 169.)

When exostoses merely occasion a deformity, and no pain, nor inconvenience, from the pressure which they produce on the neighbouring parts, it is certainly most advisable not to undertake any operation for their removal; for, as Boyer has truly observed, in by far the greater number of instances, the local affection is much less to be dreaded, than the means used for removing it.

Caustics and the cautery have occasionally been applied to exostoses; but they mostly do mischief. Boyer mentions a woman, in whom some caustic was applied to an exostosis at the inside of the tibia; but which, instead of removing the tumour, caused a necrosis, of which she was not well two years afterwards. In a few instances, however, after the removal of fungous, or cartilaginous exostoses, of the interior of a bone with cutting instruments, the application of the cautery has prevented a reproduction of the diseased mass, as we find exemplified in a case recorded by Sir Astley Cooper, where such a disease of the jaw was thus extirpated. (*Surgical Essays*, part i. p. 158.) The bold and successful manner, also, in which the hydatid exostosis of the head was attacked with the saw, caustics, and the actual cautery, by Mr. R. Keate, is particularly entitled to the attention of the surgical practitioner. (*Med. Chir. Trans.* vol. x. p. 288, &c.) I have already noticed the occasional cure of true exostoses, not malignant ones, by an accidental attack of necrosis. Mr. Travers, aware of this important fact, has suggested the practice of removing the periosteum in some cases, for the purpose of producing the death and exfoliation of the swelling, or a part of it, when circumstances render some attempt to get rid of it urgently necessary. So far as my information extends, no attempts to stop the progress, and effect the cure of a fungous exostosis, by tying the main artery of the limb, has ever yet succeeded. Two cases, proving the inefficiency of this practice, are detailed by Sir A. Cooper. (*Vol. cit.* p. 170.)

As the *fungous exostosis of the medullary membrane* is evidently connected with a state of the constitution analogous to what prevails in fungus hæmatodes (see *this word*), the permanent success of amputation should never be too boldly promised; but, as no medicines have any material power over the disease, and the operation is the only chance of relief, it ought to be advised.

Cartilaginous exostoses of the medullary membrane may sometimes be extirpated by removing their outer bony covering, and then cutting away the cartilaginous matter closely from the bony surface to which it is attached. Sometimes, as I have noticed, these measures are followed by the use of the actual cautery.

Periosteal exostoses are also either *cartilaginous*, or *fungous*, which latter are attended with less general swelling of the limb, and are more prominent than fungous exostoses of the medullary membrane. Ulceration, bleeding, sloughing, and great discharge ensue, and, unless some operation be performed, the patient loses his life. (*Sir A. Cooper, Surgical Essays*, part i. p. 180.)

The *cartilaginous exostosis*, between the pe-

riosteum and bone, arises from inflammation of the periosteum, and subjacent part of the bone; and a deposition of firm cartilage, adherent to both these surfaces, takes place. In this substance bony matter is secreted, which is first thrown out from the original bone. As the cartilage increases in bulk, the quantity of phosphate of lime augments, and fresh cartilage is constantly deposited upon the outer surface of the tumour. On dissection;—1st, the periosteum is found thicker than natural; 2dly, immediately below the periosteum, cartilage; and 3dly, ossific matter, deposited within the latter from the shell of the bone, nearly to the inner surface of the periosteum. When the growth of such a swelling ceases, and the disease is of long standing, the exterior surface consists of a shell of osseous matter, similar to that of the original bone, and communicating with its cancelli, in consequence of the primitive shell having been absorbed. (*Sir A. Cooper, Surgical Essays*, part i. p. 186.) The *periosteal cartilaginous exostoses* constitute the indolent, hard forms of the disease. In their early stage, they may sometimes be checked by small doses of mercury, the decoction of sarsaparilla, and the emplastrum ammoniaci cum hydrargyro. (*Vol. cit.* p. 196.) When large, or troublesome, they may be sawn away, as Sir A. Cooper states, without danger, if the disease be well discriminated from the fungous swelling.

When exostoses are productive of much pain, and injure the health, and their situation admits of their being safely removed, with the aid of suitable saws, or even with that of a gouge and mallet the operation may be undertaken. Many tumours of this kind, however, have bases so very extensive, and deep, that, when situated on the limbs, amputation becomes preferable to any attempt made to saw or cut away the exostoses, and preserve the members on which they are situated.

When the part, by which they are connected to the bone is slender, their removal is generally a business of facility. I have heard of cases, in which they were accidentally broken off, and lay loose, before the operation was begun.

In removing an exostosis, its base must be as freely exposed by the knife as circumstances will allow, and to this part a small fine saw may be applied. In cutting away some exostoses, the flexible saw, described by Dr. Jeffray, of Glasgow, has been occasionally employed. Mr. Hey's saws, and the semicircular trephine, are now so well known to the profession, that I scarcely need recommend them to be remembered in the present cases. Mr. Machell, a surgeon in London, invented a saw, well calculated for cutting a bone at a great depth, without injuring the muscles. It is a small, fine, perpendicular wheel-like saw, turned by means of a handle connected with machinery. It is highly commended by Sir A. Cooper, who has given a drawing of it in his *Surgical Essays*, part 1. An orbicular saw, invented and used by Professor Graefe, of Berlin, likewise merits particular notice on account of its ingenuity. (See C. G. E. Schwall, *De Serra Orbiculari*, 4to. Berol. 1819.) I would likewise recommend to the notice of surgeons the ingenious rotation saw, contrived by Professor Thal of Copenhagen, and of which a description and engraving may be found in the *Edin. Med. and Surgical Journal*, No. 74. A strong pair of bone-

nippers, and especially cutting forceps, the edges of which are in the line with the handles, will also be useful.

E. Victorin, De Ossibus tuberosis. Upsal, 1717. *Haller*, Disp. Chir. t. iv. p. 561. *P. H. Maehring*, De Exostosi Steatomatode Claviculæ, ejusdem felici Sectione. Godani, 1732. *J. Caspari*, De Exostosi Cranii variorum. Argent, 1730. *J. K. Fayolle*, De Exostosi, Monsp. 1774. *Abercromby*, in Trans. for the Improvement of Med. and Chir. Knowledge, vol. ii. p. 309. *Bonn*, Descriptio Theauri Ossium Hoviani. *Dumont*, Journ. de Méd. t. xiii. Hist. de l'Acad. des Sciences, 1737. p. 28. *Housslet*, in Mém. de l'Acad. de Chir. t. iii. *Matani*, De Ossibus Tumoribus, p. 20. *Petit*, Traité des Mal. des Os, t. ii. *Morgagni*, De Sedibus, &c. ep. 50. art. 56. *Kulmus*, De Exostosi Claviculæ. *Haller*, Collect. Dis. Chir. t. iv. *R. Keate*, in Med. Chir. Trans. vol. x. *Sir A. Cooper*, Surgical Essays, part i. 8vo. Lond. 1818. *J. F. Lobstein*, Compte de son Musée Anatomique, p. 21, &c. 8vo. Strasb. 1820. *B. Bell*, On Dis. of Bones, chap. iv. 12mo. Edinb. 1828. *W. J. Wickham*, On Dis. of the Joints, p. 6. 8vo. Winchester, 1835. *Herbert Mayo*, Outlines of Human Pathology, p. 11. 8vo. Lond. 1835. Catalogue of the Museum of the Royal College of Surgeons, London, 4to.

EXTRAVASATION. (from *extra*, out of, and *vas*, a vessel.) A term, applied by surgeons to the passage of fluids out of their proper vessels, or receptacles. Thus, when blood is effused on the surface, or in the ventricles of the brain, it is said, that there is an *extravasation*. When blood is poured from the vessels into the cavity of the peritoneum, in wounds of the abdomen, or when the contents of any of the intestines are effused in the same way, surgeons call this accident an *extravasation*. The urine is also said to be *extravasated*, when, in consequence of a wound, or of sloughing, or ulceration, it makes its way into the cellular substance, or among the abdominal viscera. When the bile spreads among the convolutions of the bowels, in wounds of the gall-bladder, this is a species of extravasation. In wounds of the thorax, or abdomen, an extravasation of blood also frequently happens in the cavity of the pleura or peritoneum. Large quantities of blood are often extravasated in consequence of vessels being ruptured by violent blows: in the scrotum, on the shoulder, and under the scalp, this effect is observed with particular frequency. In the articles, HEAD, INJURIES OF, and WOUNDS, I have treated of extravasations of blood in the cranium, chest and abdomen.

EYE, CALCULUS IN THE INTERIOR OF. Scarpa dissected an eye, which was almost entirely transformed into a stony substance. It was taken from the body of an old woman, and was not above half as large as the sound one. The cornea appeared dusky, and, behind it, the iris, of a singular shape, concave, and without any pupil in its centre. The rest of the eyeball, from the limits of the cornea backward, was unusually hard to the touch. The particulars of the dissection of this case will be read with interest, in Scarpa's Treatise on the Diseases of the Eye.

Haller met with a similar case. (See *Obs. Pathol. Oper. Min. obs.* 15.) Fabricius Hildanus, Lancisi, Morgagni, Morand, Zinn, and Pellier, make distinct mention of calculi in the interior of the eye. Ossifications of the capsule of the lens, of that of the vitreous humor, and of, what was supposed to be, the hyaloid membrane, are noticed by Mr. Wardrop. (*Morbid Anatomy of the Human Eye*, vol. ii. p. 128. 8vo. Lond. 1818.)

EYE, CANCER AND EXTIRPATION

OF. One of the well-known characters of carcinoma in general is to attack persons advanced in age, rather than children and young subjects. Hence, an observation, made by Desault, that cancer of the eye is most frequent in childhood, could not but appear a position inconsistent with the usual nature of the disease in general. Yet, how was this statement to be contradicted, while it was confirmed by the testimony of Bichat himself, who says, that more than one-third of the patients, on whom Desault operated in the Hôtel-Dieu for cancer of the eye, were under twelve years of age? Here truth and accuracy, as in many other questions relative to disease, would never have been attained without the aid of morbid anatomy, whereby distempers, which bear a superficial resemblance to each other, while they are in reality of a totally different nature, are prevented from being confounded together. Now, when Scarpa even goes further than Bichat, and asserts, that in twenty-four individuals, affected with what is called carcinoma of the eye, twenty of those, at least, are children under twelve years of age, this declaration, considered with the acknowledged propensity of cancer, on all other occasions, to attack old, rather than young subjects, might have remained a mysterious anomaly in the history of disease, had not the valuable investigations of Mr. Wardrop proved beyond all doubt, that the afflicting disease, which rendered it necessary for so many young subjects to undergo a severe operation, was not true cancer, but what is now denominated, by modern surgeons, *fungus hæmatodes*, or *medullary cancer*. (*Obs. on Fungus Hæmatodes*, 8vo. Edin. 1809.) As Scarpa observes, this author has afforded a solution of the question, by showing, from careful observation, founded on pathological anatomy, that the morbid change of structure in the eyeball of a child, commonly called carcinoma, is not in reality produced by cancer, but by another species of malignant fungus, to which the epithet hæmatodes is applied; a disease, indeed, equally, and, with regard to the eye, more formidable and fatal, than cancer, but distinguished from it by peculiar characters, which, not being confined to age, sex, or part of the body, attack the eyeball both of the infant and adult. (Scarpa, transl. by Briggs, p. 502. ed. 2.)

According to Scarpa, and, indeed, the sentiments of several other surgeons of the present day, cancer is always preceded by scirrhus, or a morbid induration of the part affected. As the disorganization increases in this hard scirrhous substance, an ichorous fluid is formed in cells within it, and afterwards extends towards the external surface of the tumour, causing ulceration of the investing parts. The compact and apparently fibrous mass is then converted into a malignant fungous ulcer, of a livid, or cineritious colour, with edges everted, and irregularly excavated, and with a discharge of acrid, offensive sanies. The scirrhus, composing the base of the malignant fungus, instead of increasing in size, now rather diminishes, but retains all its original hardness, and, after arising a certain way above the ulcerated surface, is destroyed at various points by the same ulcerative process, from which it originated. And, if any part of the livid fungous sore seem disposed to heal, it is a deceitful ap-

EYE.

pearance, as, in a little time, the smooth points are again attacked by ulceration. To relate in this place all the differences between cancer and fungus hæmatodes of the eye would be superfluous, as the subject is elsewhere considered (See CANCER and FUNGUS HÆMATODES); but I may briefly advert to a few remarkable points of diversity. 1st, The primary origin of fungus hæmatodes is generally in the retina, especially that point at which the optic nerve enters the cavity of the eye. 2dly, True cancer of the eyeball, when it begins on any part of the organ itself, instead of commencing as fungus hæmatodes at the deepest part of the eye, originates on its surface in the conjunctiva; and, so far as present evidence extends, if we except the lachrymal gland, this membrane is the only texture, connected with the eye, ever primarily affected with carcinoma. (*Scarpa on Diseases of the Eye*, p. 526. edit. 2; and *Travers, Synopsis of the Diseases of the Eye*, p. 99.) 3dly, Cancer of the eye appears to Scarpa, less destructive than fungus hæmatodes, because it begins on the exterior parts of the eye, so that whatever relates to the origin and formation of the disease is open to observation; and, because a cancerous fungus on its first appearance, is not according to his views, actually malignant, but becomes so in process of time, or from improper treatment, previously to which period good surgery may be employed with effect. In this light, Scarpa regards many excrescences on the conjunctiva and anterior hemisphere of the eye, which appear in consequence of a staphyloma of the cornea, long exposed to the air and ulceration; those which arise from relaxation and chronic inflammation of the conjunctiva; from ulceration of the cornea, neglected or improperly treated; from violent ophthalmia, not of a contagious nature, treated in the acute stage with astringent and irritating applications; from suppuration of the eye, rupture of the cornea, and wasting of the eyeball; or from blows, or burns on the part. Nothing, says Scarpa, is more probable, than that all these ulcerated fungi were, on their first appearance, not of malignant character, or certainly not cancerous, and that many of them were not actually so at the time of a successful operation being done.

Now, in the opinion of the same valuable author, there is no criterion as yet known of the precise time when a sarcoma of the eye changes from the state of a common ulcerated fungus to that of carcinoma; for, the exquisite sensibility, darting pains, rapidity of growth, colour, and ichorous discharge, are not an adequate proof of cancer. The symptom, however, on which he is inclined to place the greatest dependence, as a mark of the change in question, is the almost cartilaginous hardness of the malignant ulcerated fungus, which induration, he asserts, is not met with in the benign fungus, and never fails to precede the formation of cancer. (See *Scarpa on the Eye*, transl. by Briggs, edit. 2. p. 511—513.)

4thly. The last difference of fungus hæmatodes from cancer of the eye, here to be noticed, is the pulpy softness of the whole of the diseased mass, at the first of these diseases; a character completely opposite to the firm almost cartilaginous consistence of the carcinomatous fungus.

What is termed fungus hæmatodes may be

composed of a combination of medullary, erectile and melanotic matter; but in other instances, either of the latter may exist as a separate disease, different from fungus hæmatodes. (See *Aneurism by Anastomosis, Nævi*, and *Melæcholia*.)

Before describing the operation of removing an eye, affected with malignant disease, the following corollaries, drawn by Scarpa, should be recollected. 1. The complete extirpation of the eye, for the cure of fungus hæmatodes, although performed on the first appearance of the disease under the form of a yellowish spot, deeply seated in the eye, is useless, and rather accelerates the death of the patient. But, although this statement, made by Scarpa, is mostly true, modern experience justifies the hope, that exceptions to the foregoing melancholy inference are possible. Thus, Mr. Wishart removed from a boy, nine years old, an eye that had been affected with fungus hæmatodes about four months, and no relapse had taken place eighteen months after the operation. (See *Edin. Med. and Surg. Journ.* No. 74. p. 51.)

2. The exterior fungous excrescence of the eye, commonly called carcinoma, beginning on the conjunctiva and anterior hemisphere, *while it is soft, flexible, and pulpy*, although accompanied with symptoms similar to those of carcinoma, is not actually this disease, nor does it become malignant and strictly cancerous, until it is *rigid, hard, coriaceous, warty, and, in every respect, scirrhous*.

3. The inveterate fungous excrescence, hard to the touch in all its parts, covered with ulcerated warts, which has involved the whole of the eyeball, optic nerve, and surrounding parts, and rendered the bones of the orbit carious, and contaminated the lymphatic glands behind the angle of the jaw, and in the neck, is incurable.

4. On the contrary, the partial or total extirpation of the eye will succeed, when attempted before the external fungous excrescence has changed from the state of softness to that of a scirrhous, warty, and carcinomatous hardness. (Vol. cit. p. 526.)

The operation of removing the eye is commonly believed to have been first performed in the sixteenth century by Bartisch; but, as M. Velpeau observes, it had probably been executed at a much earlier period, for J. Lange, who published in 1555, states, that he succeeded in reducing into the orbit an eye, which some other surgeons wished to extirpate. (*Nouv. Elem. de Méd. Opér.* t. i. p. 781.) Bartisch employed an instrument, shaped like a spoon, with cutting edges, and by means of which the eye was separated from the surrounding parts, and taken out of the orbit. Fabricius Hildanus preferred a sort of probe-pointed bistoury. Bidloo made use of scissors, and a pointed bistoury.

Until the time of M. Louis, no precise directions had been given about the mode of performing the operation: his method consists in dividing the attachments of the eye to the eyelids; then those of the small oblique muscle; next, those of the great oblique muscle; then those of the levator palpebræ superioris, varying, according to their insertions, the manner of holding the knife. The eyeball is afterwards detached, and the four straight muscles, and optic nerve, divided with a pair of scissors.

The following is the ordinary method : —

1st. Stage. If the state of the disease requires the eyelids to be removed, two semilunar incisions are first to be made at the base of the orbit, and the eyelids are to be detached from it, and dissected away with the rest of the tumour. But, when the eyelids are to be preserved, the first step consists in making an incision about an inch in length, through their external commissure. The eyelids are then to be everted, and the front of the tumour is then to be taken hold of with a tenaculum, single or double, or a ligature may be passed across it.

2d. Stage. The point of the knife is then introduced at the inner angle, and passed close to the ethmoid bone nearly down to the foramen opticum. It is then to be conveyed across the floor of the orbit, so as to divide the attachment of the lesser oblique muscle, the connection of the conjunctiva to the eyelid, and some adipous and cellular tissue. It is next to be brought again to the inner angle, and, with the edge turned upward, the greater oblique muscle is to be cut, and the blade carried across the upper part of the orbit, in which movement some operators endeavour to cut out also the lachrymal gland, as the knife is about to unite the two incisions near the external angular process.

3rd. Stage. The eye is now only retained in the orbit by a kind of pedicle, composed of the four straight muscles and the optic nerve. Supposing the operator prefers dividing it with scissors, they may be introduced on the nasal side of the orbit, with their concavity towards the swelling, and while the swelling is drawn forwards and outwards, the pedicle may be divided at one stroke. If any fibres should remain uncut, their division must now be completed. If a long, narrow knife is preferred, it may also be introduced on the nasal side of the orbit, as recommended by Velpeau. (*Nouv. Elém. &c.*, t. i. p. 787.) This gentleman, however, does not object to introducing the knife or scissors on the temporal side as preferred by Desault, Travers, Lawrence and Maligne. The lachrymal gland is best removed by seizing it with a hook, and then dissecting it out of its fossa. Dupuytren used to begin with detaching the eye from the upper part of the orbit; he then divided the pedicle, and drew the swelling towards the cheek. The operation was finished by detaching the tumour inferiorly, from within outwards. Thus, there were only two stages. (See *J. F. Maligne, Manuel de Méd. Opér.* ed. ii. p. 402. 12mo. Paris, 1837.)

Mr. Travers, with a straight double-edged knife, freely divides the conjunctiva and oblique muscles, so as to separate the eyeball and lachrymal gland from the base of the orbit. Drawing the eye then gently forwards with the ligature, he introduces a double-edged knife, "curved breadthwise," at the temporal commissure of the lids, for the purpose of dividing the muscles, vessels, and nerves, by which the globe remains attached. The hemorrhage he represses with a small bit of fine sponge put into the orbit, and a light compress, applied over the eyelids, and supported with a bandage. The sponge, he says, should not be suffered to remain longer than the following day, when a soft poultice in a muslin bag may be substituted for the compress. He approves of

giving an opiate at bed-time, and joins Ware in condemning the practice of cramming the orbit with lint or charpie, and leaving it to be discharged by suppuration. (*Synopsis of the Diseases of the Eye*, p. 308.)

As soon as the eyeball has been removed, the surgeon should examine with his finger, whether any indurated or diseased parts have been left behind, and, if they have, he should next cut them away with scissors, or the knife.

The employment of sponge is objected to by Velpeau, as likely to cause some mischief by its expansion within a solid cavity. (*See Nouv. Elém. t. i. p. 788.*) If a dossil of lint be held for a little while on the bleeding vessels, the hemorrhage will generally stop, and the plan of forcibly distending the orbit with lint, or sponge, will be unnecessary. The bleeding is from the ophthalmic artery and its branches. The bleeding having been stopped, the edges of the incision at the outer commissure are to be brought together with a suture; the eyelids approximated to one another; and some soft pieces of lint, or fine linen, wetted with cold water, laid over them.

For a few days after the operation, antiphlogistic treatment is proper. The patient should be kept in bed, until all risk from inflammation is past, and suppuration has been freely established. In one case, operated upon by Mr. Guthrie, the symptoms of inflammation were so violent, that it was necessary to take away 250 ounces of blood in the course of the three first days. (*Operative Surgery of the Eye*, p. 183.) Sometimes, fungous granulations continually form in the orbit, notwithstanding they are repeatedly destroyed; and sometimes, the disease extends even to the brain, and produces fatal consequences. When malignant fungous excrescences grow from the cornea alone, it is clearly unnecessary to extirpate the whole eyeball.

For information relating to the subjects of this article, consult particularly *Mémoire sur plusieurs Maladies du Globe de l'Œil*; où l'on examine particulièrement les cas qui exigent l'extirpation de cet organe, et la méthode d'y procéder; par *M. Louis*, in *Mém. de l'Acad. de Chir.* t. xlii. p. 262. édit. in 12mo. C. F. Katschmeid, *Programma de oculo-ulcere canceroso laborante feliciter extirpato*, &c. Jenæ, 1748. *J. G. G. Voil, Oculi Humani Anatomia et Pathologia ejusdemque in statu morboso Extirpato*, 8vo. Norimb. 1810. *Bertrandi, Traité des Opérations de Chirurgie*, p. 519. éd. 1784. Paris. *Sabatier, De la Médecine Opératoire*, t. iii. p. 54. éd. 1. *Richter, Anfangsgr. der Wundarzn.* b. iii. p. 415. Gött. 1795. *Mémoire sur l'Extirpation de l'Œil Carcinomateux*, in *Œuvres Chir. de Desault* par Bichat, t. ii. p. 102. *Richerand, Nosographie Chir.* t. ii. p. 103, &c. édit. 2. *Wurc*, in *Trans. of the Medical Society of London*, vol. i. part. i. p. 140, &c. *Lassus, Pathologie Chir.* t. i. p. 450. édit. 1809. *Wardrop, On Fungus Hematodes*, p. 93, &c. *Scarpa*, On the principal Diseases of the Eye, chap. 21. édit. 2. transl. by Briggs, 8vo. Lond. 1818. *B. Travers, A Synopsis of the Diseases of the Eye*, sec. iv. 8vo. Lond. 1820. *J. H. Wistar*, in *Edin. Med. and Surg. Journ.* No. 74. *G. J. Guthrie, Operative Surgery of the Eye*, p. 178, &c. 8vo. Lond. 1823. *Wm. Lawrence, R. Middlemore, and Wm. Mackenzie*, in their respective Treatises on Dis. of the Eye. *M. Velpeau, Nouv. Elém. de Méd. Opér.* t. i. 8vo. Paris, 1832. *J. F. Maligne, Manuel de Méd. Opér.* p. 401. éd. 2. 12mo. Paris, 1837.

EYE, DISEASES OF. See AMAUROSIS; CATARACT; CORNEA; ENANTHIS; EXOPHTHALMIA; FUNGUS HEMATODES; HEMERALOPIA; IRIS; HYDROPHTHALMIA; HYPOPIUM; LEUCOMA; NYCTALOPIA; OPHTHALMY; PTERYGIUM; PUPIL; CLOSURE OF; STAPHYLOMA, &c. &c.

EYELIDS, DISEASES OF. See ECTROPION; LAGOPHTHALMUS; HORDEOLUM; PROSIS;

TRICHIASIS; and TUMOURS, ENCYSTED. In the examination of the interior of the upper eyelid, the most convenient plan is that of everting the part over a probe, placed just across the upper edge of the cartilage of the tarsus, which is then to be suddenly inclined outwards and upwards, when the whole inner surface of the lid will be exposed, the part continuing in this everted state until replaced by the surgeon.

FEVERS. Two species of fever, viz. the *inflammatory*, and the *hectic*, are particularly interesting to surgeons, because frequently attendant on surgical disorders.

In treating of inflammation, I have mentioned, that a febrile disturbance of the constitution is attendant on every considerable inflammation. In the present article, some account will be offered of the particulars of this disorder.

The fever about to be described is known and distinguished by several names; some calling it *inflammatory*; some *symptomatic*; and others *sympathetic*. It is supposed by certain writers to be sometimes *idiopathic*; that is, to originate at the same time with the local inflammation, and from the same causes. (*J. Burns.*) In other instances, and, indeed, we may say, in all ordinary surgical cases, it is *symptomatic*; or, in other words, it is produced, not directly by the causes, which originally produced the inflammation, but in consequence of the sympathy of the whole constitution with the disturbed state of a part.

Mr. Travers's opinions seem partly to coincide with those of Mr. Burns, though differently expressed. He considers constitutional irritation to be of two kinds, direct and reflected; by which he implies, "that the first is wholly and immediately derived from the part, commences and is identified with the local mischief, and the constitution has no share in its production. The second, on the contrary, originates in a peculiar morbid state of the constitution, to which the injury or inflammation has given birth, or it may be previously existing. The first is truly symptomatic, never originating spontaneously, and, being immediately induced by the local irritation, is capable of being essentially mitigated, or arrested by its removal. The second is occasionally purely idiopathic, and, being oftener the cause than the effect of the local action, is seldom influenced by the local treatment. In the first, the local changes are dependent on local causes; in the second, they depend on constitutional causes." (See *Travers on Constitutional Irritation*, p. 47.) As the expression reflected irritation, if understood in its literal sense, involves the reader in an hypothesis, which is perhaps not correct, I do not see any advantage in the employment of it. Used figuratively, however, it may be as allowable as many other expressions in medical language.

Idiopathic inflammatory fever is said to be always preceded by chilliness. The symptomatic or sympathetic inflammatory fever sometimes takes place so quickly, in consequence of the violence of the exciting cause, or of the local inflammation, that no preceding coldness is observable. If, however, the local inflammation be more slowly induced, and, consequently, operate more gradually on the system, then the coldness is evidently perceived. The symptomatic fever, induced by scalding, or burning a part, is quickly produced, and we have very little time to attend to the earliest

period of its formation. On the other hand, the symptomatic fever, induced by wounds, is excited more slowly, and the period of its formation is longer. This fever is not produced, when the inflammation only affects parts in a slight degree; but it makes its appearance if the local inflammation be considerable, or if it affect very sensible parts. (*Burns.*)

The degree, in which the symptomatic fever is excited, does not altogether depend upon the absolute quantity or violence of the inflammation; but, in a great measure, upon the degree of the local inflammatory action, compared with the natural power and action of the part affected. Parts, in which the action is naturally low, are extremely painful when inflamed, and the system sympathizes greatly with them. Hence, the constitution is very much affected, when tendons, bones, or ligaments, are the parts inflamed. Severe inflammation of a large joint, every one knows, is apt to excite the most alarming, and even fatal derangement of the system. When very sensible parts are inflamed, as, for instance, the eye, the symptomatic fever is generally more considerable, than it would be, were it to arise from an equal quantity and degree of inflammation in a less sensible organ.

In common parts, as muscles, cellular membrane, skin, &c. the symptoms will be acute; the pulse strong and full, and the more so, if the inflammation be near the heart; but, perhaps, not so quick, as when the part is far from it: the stomach will sympathize less, and the blood will be pushed farther into the small vessels.

If the inflammation be in tendinous, ligamentous, or bony parts, the symptoms will be less acute, the stomach will sympathize more, the pulse will not be so full, but, perhaps, quicker; there will be more irritability, and the blood, not being propelled so well into small vessels, will forsake the skin.

It seems to be a material circumstance, whether the inflammation be in the upper or lower extremity; that is, far from, or near the heart; for the symptoms are more violent, the constitution more affected, and the power of resolution less, when the part inflamed is far from the source of the circulation, than when near it, even when the parts are similar, both in texture and use.

If the heart, or lungs, are inflamed, either immediately, or secondarily by sympathy, the disease has more violent effects upon the constitution than the same quantity of inflammation would, if the part affected were not a vital one, or one with which the vital parts did not sympathize. If the part be such as the vital ones readily sympathize with, then the sympathetic action of the latter will affect the constitution, as in an inflammation of the testicle. In such cases, the pulse is much quicker and smaller, and the blood is more sily, than if the inflammation were in a common part, such as muscle, cellular tissue, and skin.

When the stomach is inflamed, the patient feels an oppression and dejection through all the stages of the inflammation; the pulse is generally low and quick, and the pain obtuse, strong, and oppressive; such as the patient can hardly bear. If the intestines are much affected, the same symptoms take place, especially if the inflammation be in the upper part of the canal; but, if only the colon be affected, the patient is more roused, and the pulse is fuller, than when the stomach alone is

inflamed. When the uterus is inflamed, the pulse is extremely quick and low. When the inflammation is either in the intestines, testicle, or uterus, the stomach generally sympathizes. In inflammation of the brain, the pulse varies more than in the same affection of any other part; and, perhaps, we must, in this instance, form a judgment of the complaint, more from other symptoms than the pulse.

When inflammation is situated in a part not very essential to life, and occasions the general affection of the system, called inflammatory fever, the pulse is fuller and stronger than common, and the blood is pushed further into the extreme arteries than when the inflammation is in a vital part. The patient, after many occasional rigors, is at first rather roused. The pulse is as above described, when the constitution is strong and not irritable; but, if this be extremely irritable and weak, as in many women, who lead sedentary lives, the pulse may be quick, hard, and small, at the commencement of the inflammation, just as if the vital parts were concerned. The blood may also be sily; but it will be loose and flat on the surface. (*Hunter*.)

The kind of constitution makes a great difference; and, as Mr. Travers has justly observed, "it is scarcely necessary to illustrate the influence of an irritable temperament upon the consequences of casual injury or disease. Practically, we all know it well. We say, *such a person would be a bad subject for a compound fracture*; and whoever has had opportunities of watching several subjects of compound fracture under treatment at one and the same time, well knows the import of this phrase, and that the greatest degree of mischief is often accompanied by the least constitutional disturbance, and, for this reason, is soonest and most perfectly restored. The first few hours will enable an experienced observer to determine, whether the subject of a serious injury or operation will do well or otherwise. How vastly different in different individuals is the inconvenience attending such minor derangements as a boil, an enlarged gland, a whitlow, or a simple ophthalmia. In some, the constitution seems ignorant of the affair, and the individual pursues his ordinary occupations. In others, the whole system sympathizes; the spirits are ruffled; the nights are restless; the appetite fails; the pulse acquires an undue bound; and the white tongue, the creeping chilliness, and slight erratic pains of symptomatic fever are present." (*Travers on Constitutional Irritation*, p. 15.)

We may set down the ordinary symptoms of inflammatory fever, occurring in consequence of local inflammation in common parts, and in a healthy habit, as follows:—The pulse is frequent, full, and strong; all the secretions are diminished; the patient is vigilant and restless; the perspiration is obstructed, and the skin is hot and dry; the urine is high-coloured, and in small quantity; the mouth is parched, and the tongue furred; an oppressive thirst is experienced; with disturbance of the nervous system; loss of appetite and sleep; and, in some cases, delirium.

TREATMENT OF INFLAMMATORY FEVER.

Upon this part of the subject very little is to be said; for as, in almost every instance, the febrile disturbance of the system is produced, and entirely kept up by the local inflammation, it must

be evident that the means, employed for diminishing the exciting cause, are also the best for abating the constitutional effects. Hence, it very seldom happens, that any particular measures are adopted expressly for the fever itself; as this affection is sure to subside in proportion as the local inflammation is lessened, or resolved. But, when the febrile disturbance is considerable, and the inflammation itself is also considerable, the agitated state of the system may have in its turn a share in keeping up, and even increasing, the local affection, and should be quieted as much as possible. However, in these very instances, in all probability, we should be led to a more rigorous adoption of the antiphlogistic plan of treatment, by an abstract consideration of the state of the local inflammation itself, without any reference to that of the constitution. Indeed, the increased action of the heart and arteries, and the suppression of the secretions, require the employment of antiphlogistic means, and antimonials, the very same things, which are indicated for the resolution of the local inflammation itself. Bleeding, purging, cold drinks, low diet; the exhibition of the antimonial tartarizatum, or James's powder; and bathing the feet and body in warm water, are measures, which have the greatest efficacy in tranquilizing the constitutional disturbance implied by the term inflammatory fever. But, I think it right to repeat, that it is hardly ever necessary to have recourse to such an evacuation as general bleeding, merely on account of the fever; as this is only an effect, which invariably subsides in proportion as the local cause is diminished.

As Dr. Thomson has remarked, "the inflammatory fever, succeeding to external injuries, or to surgical operations, undergoes a kind of natural crisis, by the appearance of suppuration. In these instances, therefore, unless when the patient is strong and in full health, when the disease is seated in an organ of much importance to life, or is in danger of spreading, as is the case in all inflammations of the membranes lining the three great cavities of the body, the lancet ought to be used with caution. For we may, by too free a detraction of blood, produce a sudden sinking of the powers of life, and convert the existing constitutional symptoms into fever of a different type or character. But, in all cases of inflammation, in which any doubt arises, with regard to the farther general detraction of blood, it may, I believe, be laid down as a general rule, that it is safer to employ local, than general blood-letting." (*Lectures on Inflammation*, p. 170.)

HECTIC FEVER.

The sympathetic or symptomatic fever already described, is an immediate affection of the constitution, in consequence of some local disorder; hectic fever is a remote effect. When hectic fever is a consequence of local disease, it has commonly been preceded by inflammation and suppuration; but there is an inability to produce granulation and cicatrization; and the cure, of course, cannot be accomplished. The constitution may now be said to be oppressed with a local disease, or irritation, from which it cannot deliver itself.

A distinction should be made between hectic fever, arising entirely from a local complaint in a good constitution, which is only disturbed by too great an irritation, and hectic fever, arising prin-

cipally from the badness of the constitution, which does not dispose the parts to heal. In the first species, it is only necessary to remove the part, (if removable) and then all will do well; but, in the second, nothing is gained by a removal of the part, unless the wound, made in the operation, is much less, and more easily put into a local method of cure; by reason of which, the constitution sinks less, under this state and the operation together, than under the former disease. Here the nicest discrimination is requisite. (*Hunter.*)

Owing to a variety of circumstances, hectic fever comes on at very different periods after the inflammation, and commencement of suppuration. Some constitutions, having less powers of resistance than others, must more easily fall into this state.

Hectic fever takes its rise from a variety of causes, which have been divided into two species, with regard to diseased parts; viz. parts called vital, and others not of this nature. Many of the causes of hectic fever, arising from diseases of the vital parts, would not produce this constitutional affection, if they were in any other part of the body; such, for instance, is the formation of tumours, either in, or so situated as to press upon, a vital part, or one, whose functions are immediately connected with life. Scirrhi in the stomach, and mesenteric glands; diseased lungs, liver, &c. very soon produce hectic fever.

When hectic fever arises from a disease of a part, that is not vital, it commences sooner, or later, according as it is in the power of the part to heal, or continue the disease. If the part be far from the source of the circulation, the fever will come on sooner, with the same quantity of disease. When the disease is in parts which are not vital, and excites hectic fever, it is generally in situations, where so much mischief happens as to affect the constitution, and where the powers of healing are little. This is the case with diseases of many of the joints. We must also include parts which have a tendency to such specific diseases, as are not readily cured in any situation.

Although hectic fever commonly arises from some incurable local disease of a vital part, or from an extensive disease of a common part, yet it is possible for it to be an original disease in the constitution, without any local cause whatever, that can be specified.

Hectic is a slow mode of dissolution: the general symptoms are those of a low, or slow fever, attended with weakness. But, there is rather weak action, than real weakness; for, upon the removal of the hectic cause, the action of strength is immediately produced, and every natural function is re-established, however much it may have been previously impaired.

The particular symptoms are debility; a small, quick, and sharp pulse; the blood forsakes the skin; loss of appetite; frequently a rejection of all aliment from the stomach; wasting; a great readiness to be thrown into sweats; spontaneous perspirations, when the patient is in bed; pale-coloured, and very copious urine; and often a constitutional purging.

Hectic fever has been imputed to the absorption of pus into the circulation; but, no doubt, much exaggeration has prevailed in the doctrine which ascribes to this cause many of the bad symptoms frequently attacking persons who have sores. When suppuration takes place in particular parts,

especially vital ones, hectic fever almost constantly arises. It also attends many inflammations, before suppuration has actually happened, as in cases of white swelling of the large joints. The same quantity and species of inflammation and suppuration in any of the fleshy parts, especially such as are near the source of the circulation, have in general no such effect. Hence, in the first instances, the fever is only an effect on the system, produced by a local complaint, that has a peculiar property.

The constitution sympathizes more readily with diseases of vital organs, than with those of any other parts; their diseases are also in general more difficult of cure, than the same affections of parts, which are not vital. All diseases of bones, ligaments, and tendons, affect the constitution more readily, than those of muscles, skin, cellular membrane, &c.

When the disease is in vital parts, and is such as not to kill, by its first constitutional effects, the system then becomes teased with a complaint, which is disturbing the necessary actions of health. In the large joints, a disease continues to harass the constitution, by attacking parts which have no power, or rather no disposition, to produce salutary inflammation and suppuration. Thus, the system is also irritated by the existence of an incurable disease. Such is the theory of the cause of hectic fever.

If the absorption of matter always produced the symptoms above described, how could any patient, who has a large sore, possibly escape hectic? for, there is no reason to suppose, that one sore can absorb more readily, than another. If absorbed matter occasioned such violent effects as have been commonly ascribed to it, why does not venereal matter do the same? We often know that absorption is going on, by the progress of buboes. A large one, just on the point of bursting, has been known to be absorbed, in consequence of a few days' sea-sickness. The person continued at sea for four and twenty-days afterwards; yet, no hectic symptoms followed, but only the specific constitutional effects, which were of a very different description.

When the cavities of veins are inflamed, matter is sometimes formed within these vessels, and cannot fail to get into the circulation; yet, though violent and dangerous disturbance of the constitution follows, hectic symptoms do not arise. Also, very large collections of matter produced without visible inflammation, as many abscesses of the scrofulous kind, are wholly absorbed in a short time, but no bad symptoms are the consequence.

We may conclude, therefore, that the absorption of pus has no share in occasioning hectic fever. Many arguments might be adduced to expose the absurdity of the doctrine; but here it will be sufficient to refer the reader to what Mr. Hunter has said further on the subject, in his work on inflammation.

It is much more probable, that hectic fever arises from the effect, which the irritation of a vital organ, or other parts, such as joints, has on the constitution; when either incurable in themselves, or are so for a time to the constitution.

TREATMENT OF HECTIC FEVER.

There is no method of curing the consequences above related. All relief must depend on the

cure of the cause (*viz.* the local complaint), or on its removal.

Tonic medicines have been recommended, on account of the evident existence of great debility. Antiseptics have also been given, in consequence of the idea that, when pus is absorbed, it makes the blood disposed to putrefy. For these reasons, bark and wine have been exhibited. In most cases, bark will only assist in supporting the constitution. Until the cause is removed, however, there seems no prospect of curing a disorder of the constitution. It is true, tonic medicines may make the system less susceptible of the disease, and also contribute to diminish the cause itself, by disposing the local complaints to heal. When, however, hectic fever arises from a specific disease, such as the venereal, though bark may enable the constitution to bear the local affection better, than it otherwise could do, yet, as Mr. Hunter remarked, it can have little effect upon the syphilitic mischief.

No medicine, not even bark itself, has any direct power of communicating strength to the human constitution. All that can be done, in the treatment of hectic fever, when it is thought inexpedient, or impracticable, to remove the morbid part, is to combat particular symptoms, and to promote digestion. It is by bringing about the latter object, that bark in these cases is useful. The infusion of cinchona, and the sulphate of quinine, being more likely to agree with the stomach, than the decoction, or powder, should generally be preferred. Nourishing food, easy of digestion, should be frequently taken, in small quantities at a time. Nothing is more prejudicial to a weak constitution, than overloading the stomach. Wine may also be given; but not too freely, and not at all, if it should create heartburn, as it sometimes does in hectic patients. Madeira, or sherry, is less apt, than port, to have this disagreeable effect. In these cases, it is likewise often found useful to administer gentle cordial aromatic draughts. But, of all medicines, opium is perhaps the most valuable to those, who are afflicted with hectic fever: it alleviates pain, procures sleep, and checks the diarrhoea, which so frequently contributes to hasten the patient's dissolution.

When the local complaint, connected with this fever, is totally incurable, it must, if possible, be removed by a manual operation. Thus, when a diseased joint keeps up hectic fever, and seems to present no hope of cure, amputation must be performed. But, when the local disease is attended with a chance of cure, provided the state of the constitution were improved, the surgeon is to endeavour to support the patient's strength. Great discretion, however, must be exercised, in deciding how long it is safe to oppose the influence of an obstinate local disease over the system, by the power of medicine; for, although some patients, in an abject state of weakness, have been restored to health by a removal of the morbid part, many have been suffered to sink so low, that no future treatment could save them from the grave. Clemency in the practice of surgery does not consist so much in delaying strong and vigorous measures, as in boldly deciding to put them in execution, as soon as they are indicated.

When hectic fever arises from local diseases in parts, which the constitution can bear the removal of, such parts should be taken away, if they cannot be cured, consistently with the advice already

given. When the disease arises from some incurable disease in an extremity, and amputation is performed, all the above-mentioned symptoms generally cease, almost immediately after the removal of the limb. Thus, as Mr. Hunter has correctly observed, a hectic pulse, at one hundred and twenty, has been known to sink to ninety in a few hours after the removal of the hectic cause. Persons have been known to sleep soundly the first night afterwards, who had not slept tolerably for several preceding weeks. Cold sweats have stopped immediately, as well as those called colliquative. A purging has immediately ceased, and the urine begun to drop its sediment.

FICATIO, or FICUS. (a fig.) A tubercle about the anus, or pudenda, resembling a fig.

FINGERS, ABSCESSES OF, see **WHITLOW**;
AMPUTATION OF, see **AMPUTATION**; **DISLOCATIONS OF,** see **DISLOCATION**; **FRACTURES OF,** see **FRACTURE**.

FINGERS SUPERNUMERARY.

Since allowing the redundant number of fingers to remain would keep up deformity, and create future inconvenience, the surgeon is called upon to amputate them. The redundant fingers may be with, or without, a nail; seldom more numerous than one upon each hand; generally situated just on the outside of the little fingers; and, so far as my observation extends, incapable of motion in consequence of not being furnished, like the rest of the fingers, with muscles. For the most part, the phalanges are also imperfectly formed, or deficient. The best plan is to cut off supernumerary fingers with a scalpel, at the place, where they are united to the other part of the hand. The operation should be performed while the patient is an infant, that is to say, before the superfluous parts have acquired much size, and while the object can be accomplished with the least pain. The incisions ought to be made, so as to form a wound with edges, which will admit of being brought together with strips of adhesive plaster.

FINGERS, PERMANENT CONTRACTION OF.

Baron Dupuytren has made some interesting observations on this affection, to which each of the fingers, but especially the ring-finger, is liable. Most of the individuals, who have this infirmity, have been accustomed to make efforts with the palm of the hand, and to handle bodies of great hardness. When a tendency to the complaint begins, some difficulty is experienced in extending the fingers; and the ring-one soon becomes contracted; the carpal phalanx being first implicated, and the others afterwards inclining in the same direction. In this stage, the flexion of the two adjacent fingers becomes more marked, but no knottiness is yet perceptible in front of, and around the cord on the palmar side of the ring-finger. Its second and third phalanges are straight and moveable; the first is bent more or less to a right angle, and is moveable on the metacarpal bone; but, it cannot be put into the straight position by the most violent efforts. Dupuytren refers to a case, in which a trial was made to cure the patient by means of the application of different weights, which were increased up to 150lb, without the flexion being removed.

When the ring-finger has become very much bent, the skin is thrown into folds, the concavity of which is towards the fingers, and the con-

verity towards the radio-carpal articulation. On first inspection, one might suppose the skin to be diseased; but this is not the case. A tense cord is felt on the palmar side of the finger; it extends towards the first phalanx, and may be traced to the upper part of the palm. When the finger is bent, it disappears almost entirely. If attempts be made to extend the fingers, the tendon of the palmaris brevis is felt to move, and the motion is propagated to the upper part of the palmar fascia. The patient is unable to grasp largish bodies; and, if he try to take hold of them more forcibly, or an endeavour is made to extend the fingers, he experiences acute pain. The causes of this disease were formerly referred either to thickening and contraction of the skin, spasm of the muscles, disease of the flexor tendons, or that of their fibrous sheaths, or some change in the articular surfaces and lateral ligaments. All was uncertainty, when Dupuytren had an opportunity of dissecting a hand in which this infirmity existed. A drawing having been first made of it, the integuments were removed from the palm and palmar aspect of the finger, after which the folds and wrinkles had entirely disappeared. From this it was clear, that the disorder did not depend upon the state of the skin. As soon as the palmar fascia had been exposed, it was found to be tense, contracted, and shortened, and that from its inferior part cords or bands proceeded to the sides of the affected finger. On attempts being made to straighten the finger, M. Dupuytren observed, that the fascia became tense. He then divided the prolongations of it extending to the sides of the finger. The contraction ceased immediately, and the fingers assumed a very slightly bent position. In fact, the disease was ascertained to be owing to the extreme tension of the palmar fascia, brought on by a contusion of the palm, or the long continued pressure of hard substances upon it. The plan of cure, adopted by M. Dupuytren, consisted in making a transverse incision, about ten lines in length, over the metacarpophalangeal joint of the ring-finger. The skin was first divided, and then the palmar fascia. As soon as this had been done, the finger became straight, and could be extended almost as readily as in the natural state. After the operation, the hand was fixed with a bandage, upon a piece of pasteboard, for a few weeks, and the fingers kept extended. In one case, M. Dupuytren made semicircular incisions; one at the base of the ring-finger, in order to divide the two digital and lateral prolongations of the palmar fascia, sent to this finger; the other, an inch and a quarter from the first, in the palm of the hand, for the purpose of dividing the digital prolongation at its root, and thus detaching it from the palmar fascia. (See *Dupuytren Clin. Chir. t. i. art. 1.*)

In a lecture, delivered subsequently to the preceding observations, M. Dupuytren adverts to flexions of the fingers, arising from other causes; as a previous wound of the palm known by the scar; alteration in the formation of the phalanges, by disease, and unattended with the kind of cord, observed when the palmar fascia is implicated; and a division of the extensor tendons with a cutting instrument, which parts, not being united again, leave the flexors without any antagonists. A continued wound, producing sloughing of the skin of the palm, may have the same result, if its edges be suffered to be drawn together, instead of

cicatization being completed by the formation of a new cutaneous texture. (See *Clin. Chir. t. i. p. 521.*) Burns of the palm are frequently followed by this deformity, when the preceding indication is neglected. Amongst other causes of permanent flexion, M. Dupuytren notices, deformity of the articular surfaces of the phalanges, produced by the long continued position of the fingers in certain employments, as in lacemakers, tailors, &c.; by wounds of the flexor tendons, or their displacement, in consequence of having been extensively laid open for the cure of whitlow. The wound of a joint may be another cause of contraction of the finger; and a gunshot-injury of the flexor muscles may lead to the same consequence. M. Dupuytren's observations on this subject seem to me equally original and valuable. The toes are also liable to a contraction, dependent upon a state of the plantar fascia, corresponding to that of the palmar.

FISSURE. (from *findo*, to cleave asunder.) A fine crack in a bone is so called.

FISTULA, an opening, the consequence of a wound, abscess, or ulceration; it has no disposition to heal, and is connected with a channel, or canal, running more or less deeply and extensively in the soft parts. From the resemblance of this channel to the cavity of a pipe, or reed, the term is derived. A fistula commonly leads to the situation of some disease keeping up suppuration; and from which place the matter cannot readily escape. Thus, the presence of a dead piece of bone, or of a foreign body often keeps up suppuration, and the fistula continues for the discharge of the matter. When an abscess forms near the anus, the matter lodges, and the part is disturbed by the action of the sphincter, a *fistula in ano* is produced. Sometimes a fistula is produced by the continual discharge of some healthy secretion through a wound, or ulcer, as exemplified in salivary, lachrymal, and urinary fistulæ. The lining of old fistulæ may assume the appearance of certain mucous membranes, though follicles and villi, like those of the intestinal canal, have never been observed in it. As Andral remarks, when most perfectly organized, it can only be compared to the most simple mucous membranes, such as those of the ureters, or lesser branches of the hepatic ducts. The lining of fistulæ, like mucous membranes in general, when not irritated, is pale and of a grayish colour; but, if affected with acute, or chronic inflammation, it exhibits the same shades of injection and redness, seen in a mucous texture. It is also liable to certain affections, which pertain almost exclusively to mucous membranes, as fungous growths, callosities, &c. The cellular tissue, connected with the lining of fistulæ, may become thickened, indurated, and scirrhous, just like the submucous cellular tissue in general. Finally, just as adhesions never take place between the different points of a surface, lined by a mucous membrane, unless a solution of continuity has taken place in it, so the sides of a fistulæ cannot adhere together, and its cavity be obliterated, unless incisions be made to bring the textures and the membrane-like investment of it, into contact. (See *Andral, Précis d'Anat. Pathol. t. i. p. 261.*)

FISTULA IN ANO. See **ANUS**.

FISTULA LACHRYMALIS. In correct language, this term can be applied only to one case, viz. that in which there is an ulcerated open-

ing in the lachrymal sac, unattended with any tendency to heal, and from which opening the tears, and a mucous, or puriform fluid, are from time to time discharged. Such has been the confusion, however, respecting the nature of the diseases of the lachrymal passages, and so great has been the force of ancient custom, that down to the present time, the generality of British, as well as foreign surgeons, imply by the expression, *fistula lachrymalis*, several forms of disease, totally different from each other, and to only one of which the name is at all applicable. In order not to assist in perpetuating this absurd and erroneous plan, from which nothing but mistakes and ignorance can result, I shall follow the example, pointed out by Beer, Schmidt, and our countryman, Dr. M'Kenzie, and consider the various forms of disease, to which the lachrymal passages are subject, not under the head of *fistula lachrymalis*, but under that of LACHRYMAL ORGANS, DISEASES OF THE.

FISTULÆ IN PERINÆO. Incisions in the urethra generally heal with great facility; a fact, amply proved by the common result of the lateral operation: but, when apertures are formed in the urethra, either from diseased states of the constitution and the part together, or of the latter alone, and when they are accompanied with any considerable destruction of the sides of the urethra, and of the corpus spongiosum, they are difficult of cure. (*Sir B. Brodie, in Med. Gaz. Dec. 26. 1835. No. 13.*)

When the methods, recommended for the removal of Strictures (See URETHRA, STRICTURES OF,) have not been attempted, or not succeeded, nature endeavours to relieve herself by making a new passage for the urine, which, although it often prevents immediate death, yet, if not remedied, is productive of much inconvenience and misery to the patient through life. The mode in which nature endeavours to procure relief, is by ulceration on the inside of that part of the urethra which is enlarged, and situated between the stricture and the bladder. Thus the urine becomes applied to a new surface; irritating the part, and occasioning the formation of an abscess, to which the urine has access; and when the matter is discharged, be it by nature or by art, the urine passes through the aperture, and generally continues to do so, whilst the stricture remains. (*Sir A. Cooper, Surgical Essays, part ii. p. 212.*)

In some cases, a fistula in perinæo occurs as a consequence of severe gonorrhœa. The urine comes away in a very small stream, because the urethra is inflamed, swollen, and contracted. At last, a pain is felt in the perinæum, a tumour is felt there; and this state is frequently attended with complete retention of urine, or with great difficulty of making water. At length the tumour bursts, or is opened with a lancet; pus is discharged; then the difficulty of making water subsides, and, a day or two afterwards, the patient finds that, whenever he voids his urine, a portion of it comes through the opening in the perinæum. (*Sir B. Brodie, in London Med. Gaz. vol. for 1835—36. p. 486.*)

The ulceration, which is always on the side of the urethra next the external surface, commonly begins near, or close to the stricture, although the stricture may be at a considerable distance from the bladder. The stricture is sometimes included in the ulceration, by which means it is removed; but, unluckily, this does not constantly happen.

The urethra having ulcerated, the urine readily gets into the loose cellular texture of the scrotum and penis, and it may diffuse itself all over those parts; and as it is very irritating to them, they inflame and swell. The presence of the urine prevents the adhesive inflammation from taking place; it becomes the cause of suppuration wherever it is diffused, and the irritation is often so great, that it produces mortification, first in all the cellular tissue, and afterwards in several parts of the skin; all of which, if the patient live, slough away, making a free communication, between the urethra and external surface, and producing what are termed *fistulæ in perinæo*, though it is plain enough to every surgeon, who knows the correct meaning of the word *fistula*, that a recent opening, produced in the perinæum by ulceration or sloughing, ought not to be called a fistula, immediately it is formed, and, at least, not until it has acquired some of the characters, specified in my explanation of the term *fistula*.

A fistula in perinæo, then, is the result of an abscess in the perinæum, communicating with the urethra at one extremity, and opening externally at the other. "The whole or part of the urine flows through the fistula, whenever the patient makes water; the constant irritation of the urine causes the sides of the fistula to become hard and callous; and, at last, a sort of button-like projection, with the orifice of the fistula in the centre, is discovered in the perinæum. The fistula differs in length, and size; and the opening into the urethra differs in size also. There is sometimes a single fistula, sometimes there are several; and, accordingly as the fistula is larger, or smaller, accordingly as there are more or less sinuses, communicating with the urethra, so does a larger, or smaller quantity of urine escape through this unnatural passage, whenever the patient makes water. Sometimes the urine, thus voided amounts to only a few drops; sometimes it comes away in a small stream; and sometimes it comes away in so large a quantity, that that which is voided by the perinæum is greater than what is voided in the natural way." (*Sir B. Brodie, in Lond. Med. Gaz. vol. for 1835—36, p. 486.*) I have seen a few examples, in which all the urine was discharged through the fistula. One of those cases, was that of a medical gentleman, whom I lately attended with Sir Benjamin Brodie. In the King's Bench, there was a man about four years ago, who had been passing the whole of his urine through a fistula in the perinæum for fourteen years; and the anterior portion of the urethra seemed to be obliterated.

Although a fistula in perinæo is productive of much distress, inasmuch as the flow of urine in this direction wets the patient's dress, irritates the integuments, and sometimes the urine causes a good deal of pain, as it is running out, the fistula, as Sir Benjamin Brodie has well observed, is not an evil unmixed with good. If a man has a stricture, it saves him from the ill consequences of a retention of urine. A spasm affects the stricture, and he cannot make water through the natural passage; but the fistula being formed, the urine escapes from it, and thus the return of retention of urine, and the ill consequences of over-distention of the bladder are prevented.

When the disease is the consequence of gonorrhœa, there is generally only a single abscess; but, when it is connected with a stricture, there

may be many abscesses formed in succession. Thus, a patient, with a stricture of long standing, may have fistula produced in various directions, and terminating in the perineum, the middle of the scrotum, or even in the groin, the nates, or the rectum. When the matter and urine have been freely discharged through one opening, a fresh abscess is not often formed; but, in the opposite case, several abscesses are liable to follow. (1b.)

In many cases, the matter is putrid and offensive, in consequence of the pernicious effects of the urine, and the admixture of it and dead cellular tissue with the pus which is produced. Sir Benjamin Brodie is of opinion that the matter may even act as a poison on the system; and, on this principle, he partly explains the repeated shiverings during the formation of the abscess; the dry brown tongue; hot skin; frequent pulse; and other typhoid symptoms.

According to Mr. Hunter, when ulceration takes place further back than the portion of the urethra between the glans penis and membranous part of the canal, the abscess is generally more circumscribed.

A fistula in perineo, and a general effusion of urine, producing gangrene, are both connected with ulceration of the urethra; but, as Sir Benjamin Brodie remarks, the ulceration occurs under different circumstances. "If the patient be miking water in a small stream, and a little ulcer forms behind the stricture, the greater part of the urine flows out by the natural passage, and it is not probable, that more than a few drops will dribble into the cellular membrane, through the ulcerated orifice. But, if the patient has complete retention of urine; if the stricture be so contracted, that not a drop of water can pass through it; and, if then the urethra ulcerates behind the stricture; the next time the patient tries to make water, he strains with the bladder and abdominal muscles; the urine cannot pass by the natural passage, and it is driven by the muscles, as by a syringe, into the cellular membrane of the perineum first, and into that of the scrotum, penis, and nates afterwards, and a great deal of urine is extravasated. In the one case, it dribbles into the cellular membrane; in the other, it is driven into it; and hence sloughing under certain circumstances, and an abscess under others." (Sir B. Brodie, in *London Med. Gaz.* vol. for 1835—36. p. 487.)

The urine sometimes insinuates itself into the corpus spongiosum urethrae, and is immediately diffused through the whole, even to the glans penis, so as to produce a mortification of all those parts. A fatal instance of this kind is reported by Sir C. Bell. (*Surgical Obs.* vol. i. p. 98.)

Although the ulceration of the urethra be in the perineum, the urine generally passes easily forwards into the scrotum, which contains the loosest cellular tissue in the body; and there is always hardness, extending along the perineum to the scrotum, in the track of the pus. (Hunter.)

The direction, which the extravasated urine takes, is determined by the connexion of the superficial with the deep perineal fascia below the transverse muscle. This connexion prevents the urine from extending towards the thigh or the buttock; and, if it become very widely extravasated, it does not pass downwards, or backwards, but forwards into the scrotum and penis, and then into the groin, and cellular tissue of the parietes

of the abdomen, and this nearly up to the ribs. I was lately called to a man, a patient of the Bloomsbury Dispensary, in which this course of the effused urine was exemplified.

Sir Astley Cooper is of opinion, that, as soon as the abscesses, which are the forerunners of the fistula, can be plainly felt to contain a fluid, it is best to open them. The extensive destruction of parts by ulceration will thus be prevented; the place not unfrequently then heals up expeditiously without any fistulous orifice being left, and a tendency to those dangerous extravasations of urine is also prevented, which, if the abscesses are not opened early, often prove destructive to life. (*Surgical Essays*, part ii. p. 212.)

Ulceration can only be prevented by destroying the stricture; but when the urine is diffused in the cellular tissue, the removal of the stricture will generally be too late to prevent all the mischief, although it will be necessary for the complete cure. Therefore, an attempt should be made to pass a bougie, or rather a catheter, for perhaps the stricture may have been destroyed by the ulceration, so as to allow the instrument to be introduced. When this is the case, bougies or catheters must be almost constantly used, in order to procure as free a passage as possible. In these cases Sir A. Cooper expresses a preference to metallic bougies, the size of which is to be gradually increased, until their diameter exceeds the natural diameter of the passage. In some instances, however, he considers it advisable to introduce a pewter catheter, of large size, and to allow it to remain in the bladder, so as at once to act upon the stricture, and hinder the urine from passing through the preternatural opening. In this manner, a permanent cure may often be effected. Although this experienced surgeon agrees with most surgeons of the present day, respecting the general inexpediency of employing caustic for the removal of a stricture, under the preceding circumstances, yet he admits, that instances do present themselves, in which, from long neglect the urethra, and the parts surrounding the stricture, are so altered in structure, that no instrument can be passed through the obstruction, without danger, and where the slower action of caustic is safer, than the use of a metallic bougie. (*Surgical Essays*, part ii. p. 213.) The experience of modern surgeons tends to prove, however, that particular cases form exceptions to the plan of employing bougies, or catheters, though a fistulous opening may have occurred; as when the apertures in the urethra are the consequences of ulceration and abscess, unaccompanied by stricture, and take place in a bad constitution, perhaps only preceded by a slight discharge from the urethra. Here bougies would increase the tendency to ulceration, and aggravate the local and constitutional irritation. (Sir A. Cooper, p. 216.) I believe, that this is the right view of the latter point, because, when an abscess and fistulous opening form from gonorrhoea, they arise not so much from diminution of the canal of the urethra, but from the tendency in certain constitutions, to have abscesses of this description produced by even slight degrees of irritation in the urethra. Hence, if a catheter be useful in such a case, it is not by dilating the urethra, but conducting the urine through it, without allowing it to enter the abscess. A bougie would serve no useful purpose.

In fistula in perineo from stricture, the cure mainly depends upon the diagnosis of the primary disease,—the obstruction in the urethra. In nineteen cases out of twenty, by the time that the stricture is fully dilated, the fistula has healed. It is more easy, (as Sir Benjamin Brodie observes) for the urine to pass along the natural passage, if it be of its proper diameter, than it is for it to pass through the oblique passage of the fistula. The fistula has generally a kind of valvular opening into the urethra, which the urine does not readily enter; and when the stricture, in front of the fistula has been dilated, and the urine has a free passage in that direction, it ceases to flow in the other.

When inflammation from extravasation of urine is attended with suppuration* and mortification, the parts must be freely divided, in order to discharge both the urine and pus. When there is sloughing, the incisions should be made in the mortified parts.

Frequently the new passages for the urine do not heal, on account of the stricture not being removed; and even when this has been cured, they often will not heal, but become truly fistulous, and produce fresh inflammation and suppurations, which often burst* by distinct openings. Such new abscesses and openings often form, in consequence of the former ones having become too small, before the obstruction in the urethra is removed.

Such diseases sometimes bring on intermittent disorders, which do not yield to bark; but cease as soon as the fistula and disease of the urethra have been cured.

These occur where, from the communication of the fistula with the urethra being unusually large, and from there being several fistulae, or from some other cause, the cure of the fistula, or fistulae, does not immediately follow the removal of the stricture. Under these circumstances Sir Benjamin Brodie recommends an examination of the perineum to be made, in order to ascertain whether there is any cavity in it, in which the urine or pus lodges. If the orifice of the fistula is such, that matter, formed at the bottom of it does not readily escape, either the orifice should be dilated, or a fresh opening made elsewhere, according to the rules commonly recognised for the treatment of abscesses in general. But, if there is no impediment of this kind to the cure, and the stricture has been duly dilated, Sir Benjamin Brodie approves of the introduction of an elastic gum catheter into the bladder, and of its being continued there for the evacuation of the urine, under which treatment a cure of the fistula will often take place.

In some instances, the latter plan should not be continued beyond a certain stage of the case: at first, the catheter kept in the urethra, frequently promotes the healing of the fistula; but, in the end, it may have the contrary effect, by acting on the bottom of the wound, as an extraneous body. The state of the case is particularly admitted by Sir Benjamin Brodie:—"In many cases, the permanent retention of a catheter in the bladder does not answer the purpose in respect to the cure of the fistula. It would do so, if it altogether prevented the urine from flowing through it; but the fact is, that it does not in reality produce this effect;

after three or four days, a little urine always finds its way by the side of the gum catheter, and gets into the fistula, although the greater part is drawn off through the catheter. Another circumstance also takes place. The gum catheter acts like a seton, inducing inflammation and suppuration of the mucous membrane of the bladder; and some of the pus which is secreted, passes through the fistula, and keeps it open, as much as it would be kept open by the urine itself." (Sir B. Brodie, *Op. et vol. cit.* p. 488.)

If there be reason to suspect this to be the case, the best plan is to draw off the urine three times a day, and withdraw the catheter directly after each evacuation. The aim should be to let all the urine which is secreted be thus removed by the catheter, and no opportunity afforded for it to enter the fistula. But, as Sir Benjamin Brodie has explained, and as was exemplified in the case of a gentleman, whom I lately attended, the urine sometimes cannot be comfortably retained the time required; and if the catheter be more frequently introduced it becomes a source of irritation, keeps up suppuration, and does as much harm, as if it were continually retained. In the case referred to, the permanent retention of catheters in the urethra, and the frequent introduction of them were plans both tried unsuccessfully. One or two large deep cavities, filled with matter, and communicating with the fistulae, were laid open, and followed by considerable improvement. But the use of catheters, in any way, always led to fresh abscesses, and could never be followed up long and regularly enough, without bringing on great local and constitutional disturbance. The constitution was indeed a truly irritable one. Abscesses at length formed successively in the testes, chord, and in the cellular tissue behind Poupart's ligament. An attack of diarrhoea came on, the appetite failed, and the gentleman died.

The opening of a fistula in the perineum may sometimes be healed by touching it with the nitrate of silver, but the deeper part of it often continues unhealed, and abscesses form again. Hence, Sir Benjamin Brodie tried the plan of stimulating the bottom of the fistula, while he took measures to prevent the orifice from healing prematurely. A small quantity of nitrate of silver was melted in a platina spoon, and the end of a probe, having been coated with it, was passed quite to the termination of the fistula, the orifice of which was then slightly touched with caustic potash. The method sometimes answered, and sometimes failed.

If all these plans prove ineffectual, Sir Benjamin Brodie is in favour of trying what the daily introduction of a good-sized metallic instrument will accomplish.

When a perineal fistula exists, communicating with the urethra, but having no external opening, a free incision is to be made into the abscess, and the rest of the treatment conducted on the principles applicable to common fistula in perineo. Sometimes a small indurated lump, not bigger than a horse bean, may be felt in the perineum. It may keep up for a long period a kind of gleet, in consequence of urine entering its cavity, and the matter oozing into the urethra. The cure consists in puncturing it, dilating the urethra with catheters, and, if necessary, touching the deeper part of the wound with caustic potash. (Sir B. Brodie, *Op. cit.*)

Some practitioners occasionally resort to the actual cautery for healing fistulæ in perinæo, which resist milder plans.

The following method of laying open such fistulæ was more commonly followed a few years ago, than at the present day.

As little as possible of the sound part of the urethra must be opened. Hence, the surgeon is guided to the inner orifice of the fistulæ by means of a staff, introduced (if possible) into the bladder, and a probe passed into one of the fistulous passages. The probe should be first bent, that it may more readily follow the turns of the fistula. When it can be made to meet the staff, so much the better; for then the operator can just cut only what is necessary. When the fistula is so straight, as to admit of a director being introduced, this instrument is the best. When neither the probe, nor the director, can be made to pass into the staff, the sinuses are to be opened as far as the first instrument goes, and then the continuation of the passage sought and laid open. The difficulties of this dissection, however, in the thickened, diseased state of the parts in the scrotum and perinæum, are such as can only be duly appreciated by a man who has either made the attempt himself, or seen it made by others. I have seen one of the first anatomists in London fail in two instances to trace the continuation of the urethra, and baffled in the endeavour to pass an instrument. The difficulty and confusion, arising from the hardened, enlarged state of the parts, which are cut, have been well depicted by Sir C. Bell. (*Surgical Obs.* vol. i. p. 129.)

When fistulæ in perinæo have been laid open, the wounds are to be at first dressed down to the bottom, which will prevent a premature reunion of the parts near the surface, and make the granulations shoot from the bottom, so as to consolidate the whole by one bond of union. (*Hunter on the Venereal Disease*, ed. 2.; See also *Urinary Abscesses and Fistulæ*.) Sir A. Cooper's practice, in cases where a considerable portion of the urethra has been destroyed, will be hereafter noticed. (See URETHRA.)

FISTULA, SALIVARY. See PAROTID DUCT.

FLUCTUATION. The perceptible motion communicated to any collection of purulent matter, or other kind of fluid, by applying the fingers to the surface of the tumour, and pressing with them alternately, in such a manner, that the fingers of one hand are to be employed in pressing, or rather in briskly tapping upon the part, while those of the other hand remain lightly placed on another side of the swelling. When the ends of one set of fingers are thus delicately applied, and the surgeon taps, or makes repeated pressure with the fingers of the other hand, the impulse given to the fluid is immediately perceptible to him, and the sensation, thus received, is one of the principal symptoms, by which practitioners are enabled to discover the presence of fluid in a great variety of cases. Great skill in ascertaining by the touch the presence of fluid in parts, or being endowed with the tactus erigens, as it is termed, distinguishes the man of experience remarkably, perhaps, as any quack practitioner can be specified.

When the collection of fluid is very deeply situated, the fluctuation is frequently obscure, and sometimes not at all distinguishable. In this cir-

cumstance, the presence of the fluid is to be ascertained by the consideration of other symptoms. For example, in cases of hydrops pectoris and empyema, surgeons do not expect to feel the undulation of the fluid in the thorax with their fingers; they consider the patient's difficulty of breathing, the uneasiness attending his lying upon one particular side, the œdema of the parietes of the chest, the dropsical affection of other parts, the more raised and arched position of the ribs on the affected side, the preceding rigors, fever, and several other circumstances, capable of being learned with the aid of the stethoscope, from which a judgment is formed, both with regard to the presence and the peculiar nature of the fluid.

FOMENTATION. The application of flannel or cloths wet with warm water, or some medicinal decoction. Fomentations are chiefly of use in relieving pain and inflammation, and in promoting suppuration, when this is desirable. Some particular decoctions, however, are used for fomentations, with the view of affecting, by means of their medicinal qualities, scrofulous and other sores of a specific nature. I shall merely subjoin a few of the most useful fomentations in common use.

FOMENTUM AMMONIÆ MURIATIS. R. Fomenti communis lbj. Ammon. Mur. ℥j. Spirit. camph. ℥ij. Just before using the hot decoction, add to it the ammonia muriata, and spirit.

FOMENTUM CHAMÆMELI. R. Lini contusi ℥j. Chamameli ℥ij. Aq. distillat. lbvj. Paulisper coque, et cola. A fomentation in very common use.

FOMENTUM CONII. R. Fol. conii recent. lbj. vel. fol. Conii exsiccat. ℥ij. Aq. comm. lbij. Coque usque reman. lbj. et cola. Sometimes applied to scrofulous, cancerous, and phagedenic ulcers.

FOMENTUM GALLÆ. R. Gallæ contusæ, ℥ss. Aq. ferventis lbij. Macera per horam et cola. Used in prolapsus ani, and sometimes employed, as a cold application, in hemorrhoids.

FOMENTUM PAPAVERIS ALBI. R. Papav. Alb. exsiccati, ℥iv. Aq. pur. lbvj. Bruise the poppies, put them in the water, and boil the liquor, till only two quarts remain, which are to be strained. Employed for the relief of pain, whether from inflammation, neuralgic affections, ulcers, &c.

FORCEPS, an instrument much employed in surgery for a variety of purposes, and having accordingly various constructions. The general design, however, of surgical forceps is to take hold of substances which cannot be conveniently grasped with the fingers; and, of course, the instrument is always formed on the principle of a pair of pincers, having two blades, either with, or without handles, according to circumstances. The smallest forceps is that which is employed in the operation of extracting the cataract, and which is useful for removing any particles of opaque matter from the pupil, after the chief part of the crystalline lens has been taken away.

Another forceps, of larger size, is that used for taking up the mouths of the arteries, when these vessels require a ligature, in cases of hemorrhage. This instrument is also frequently employed for taking dressings off sores, removing pieces of dead bone, foreign bodies from wounds, and particularly, for raising the fibres, which are about to be cut, in all operations, where careful dissection is re-

quired. This forceps resembles that which is contained in every case of dissecting instruments, and is often called the *artery or dissecting forceps*, from its more important uses.

Neither of the foregoing forceps is made with handles; each opens by its own elasticity; and the ends of the blades only come into contact when pressed together by the surgeon.

The following kinds of forceps are constructed with handles, by means of which they are both opened and shut:—

1. The common forceps, contained in every pocket-case of surgical instruments, and used for removing dressings from sores, extracting dead pieces of bone, foreign bodies, &c.

2. Larger forceps, employed for extracting polypi.

3. Forceps of different sizes and constructions, used in the operation of lithotomy, for taking the stone out of the bladder, or for breaking the calculus, when it is too large to be extracted in an entire state.

4. Cutting forceps, as the common bone-nippers, with transverse edges, and the sharp forceps, made with the edges in the same line with the handles, used by Mr. Liston, and others, for the division of bones.

FRACTURE. A solution of continuity of one or more bones, produced in general by external force; but occasionally, by the powerful action of muscles, as is often exemplified in the broken patella.

Fractures constitute so interesting a branch of surgery, and the accidents themselves are so frequent and important, that the more scientific and successful views now entertained of the whole subject, than those prevalent forty or fifty years ago, must be highly gratifying to every admirer of the incessant progress of surgery towards perfection. Nor is this branch of surgery simply mechanical, or restricted to the consideration of bandages, splints, and other apparatus; but comprises questions and investigations not surpassed, in respect to their scientific character, by any others in the whole range of surgery.

Mr. Pott, it is true, made many excellent observations on the treatment of fractures in general, and his remarks on compound fractures in particular are in some respects the best which are extant; but what surgeon will now presume to defend the weak arguments upon which he has founded the doctrine of paying unqualified attention to the relaxation of the muscles, as if this were an object which should constantly supersede every other consideration, and invariably regulate the posture of the limb? I have no hesitation in declaring my own belief, that the doctrine and practice recommended by Pott, in regard to fractured thighs, have done considerable harm, and the more so, as coming from a man, who was deservedly looked upon as one of the best and most experienced judges of surgical practice. Many a surgeon in this country implicitly believed every thing which was asserted by so able a master; and the very observations, which some years ago were here considered to be the glory of their author, and the pride of English surgery, are now exposed by the surgeons of neighbouring countries, as specimens of wrong precepts and bad practice. M. Roux, in fact, had but too much room for animadversion upon this subject. (*See Voyage fait à*

Londres en 1814, ou Parallèle de la Chirurgie Angloise avec la Chirurgie Française, p. 173, &c.) Still Pott's observations on the use of the 18-tailed bandage, the necessity of quietude, the principles on which splints ought to be constructed, and his inestimable remarks on compound fractures, are excellent, and will long survive some of his other tenets.

So long as the process, by which broken bones unite, was less correctly understood, and while the symptoms, characteristic of each particular fracture had been less minutely traced than at the present time, this department of practice must have been conducted under great disadvantages. The several complications of fracture are also now more accurately comprehended, and more judiciously considered. Bandages are applied, not for useless display, but to promote and fulfil some more desirable purpose; some indication, which the circumstances of the accident truly require to be accomplished. The same may be said of all the mechanical contrivances employed in the treatment of fractures. For such improvements, and others, which will be noticed in the course of this article, the public are indebted to numerous labourers, amongst whom I may cite as eminently distinguished, Desault, Pott, Boyer, Dupuytren, and Sir Astley Cooper. The observations of Sir Astley Cooper, on fractures of the joints, are indeed highly creditable to this part of English surgery.

To the experiments and investigations of Duhamel, Breschet, Sanson, Cruveilhier, and Dupuytren, we are principally indebted for all the most valuable information yet extant relative to the formation of callus; a subject, however, which has not been neglected by British surgeons, as will be hereafter noticed. The perfection to which the mechanical aids have been brought, is owing likewise to the ingenuity of many individuals, especially Desault, Boyer, Assellini, Sir Astley Cooper, Dupuytren, Amesbury, Earle, McIntyre, and Greenhow. The inventions of the two latter gentlemen, with reference to the treatment of broken legs, deserve every commendation.

Let it not be any longer supposed, that the treatment of fractures is only a mechanical business. In fact, whoever pretends to be capable of conducting it efficiently, without a due acquaintance with anatomy and pathology, and the principles on which inflammation, abscesses, gangrene, wounds, ulcers, and erysipelas, hæmorrhage, and various febrile disturbances of the constitution should be treated, must absolutely be a simpleton, or an impostor; for all these complications frequently accompany or follow fractures. Under such circumstances, what man of common sense would trust his limb and life to a mere bone-setter? But, the sequel of this article will enable the reader to judge of the truth of of these observations

1. DIFFERENCES OF FRACTURES.

The differences of fractures depend upon what bone is broken; what portion of it is fractured; the direction of the fracture; the respective position of the fragments; and, lastly, upon circumstances accompanying the injury, and making it simple, compound, or variously complicated.

1. *In respect to the bone affected.* Sometimes it is one of the broad bones, as the scapula; the

sternum, or the os ilium. Sometimes it is a short bone, like the os calcis; but, far more commonly, it is one of the long bones. The situation and functions of the broad bones render their fractures unfrequent. The bones of the skull are the only exception to this remark; for, they are often broken; but, here the assistance of the surgeon is required less for the solution of continuity itself, than for the affection of the brain, and the extravasation of blood, with which the case is apt to be combined. Fractures of the short bones are still more unusual, because these bones, being nearly equal in their three dimensions, are capable of greater resistance, and are not much within the reach of external violence. Besides, most of them are but little exposed to the operation of outward force, by their situation, or functions. Hence, except when limbs are crushed, fractures of short bones are generally caused by muscular action, which frequently breaks the patella, and sometimes the olecranon, and os calcis. The long bones, which serve as pillars, or arches of support, or levers, are, from the very nature of their functions, particularly liable to fractures.

2. *In respect to the part of the bone broken.* The long bones may be fractured at different points. Very often their middle portion is broken, and, in this circumstance, they usually break like a stick, which has been bent beyond its extensibility by a force applied at each end of it. Sometimes the fracture occurs more or less near the extremities of the bone, which is always an unfavourable event. Lastly, the bone is sometimes broken in several places, and the injury may be produced by two different causes, which operate successively, or simultaneously, upon the broken parts of the bone; or it may be occasioned by one single cause, which acts at the same moment upon several points of it. These distinctions of fractures, deduced from their particular situation (says Boyer), are not mere scholastic refinements; they have a truly important influence over the prognosis and treatment.

3. *In respect to the direction in which the bone is broken.* Thus, fractures are distinguished into *transverse* and *oblique*. The obliquity renders the surface of the injury larger, and materially increases the difficulty of maintaining the ends of the bone in contact, after the fracture has been set. Oblique fractures are subject to considerable variety, which depends upon the degree of their obliquity, and whether they are partly oblique and partly transverse. When a bone is broken in different places at once, and divided into several fragments, or splinters, the fracture is termed *comminuted*.

Duverney admitted another class of fractures, viz. *longitudinal*. (See *Maladies des Os*, t. 1. p. 167.) Such cases were regarded by J. L. Petit as only imaginary, because he conceived, that any blow, capable of breaking a bone longitudinally, would more readily cause a transverse fracture. For the same reason, Louis absolutely rejected the possibility of longitudinal fractures.

The following case, however, is related by Leveillé. An Austrian soldier, who was put under his arms in the year 1800, in consequence of being struck by a ball in the lower third of the leg at the Battle of Marengo, and who had walked a distance of several miles, after re-

ceiving the injury. In the end, amputation became necessary, and Leveillé preserved the tibia, upon which the impression of the ball was distinguishable. From this point proceeded several longitudinal and oblique lines, which extended from the lower third, towards the upper head of the tibia, and passed through the whole thickness of the parietes of the medullary canal. They were acknowledged to be really longitudinal fractures, by Dubois, Chaurier, Duméril, Deschamps, and Roux. (*Nouvelle Doctrine Chir.* t. ii. p. 158.)

In several cases of fractured thigh-bones from gunshot violence, which were under the care of Dr. Cole and myself in Holland, the bone was split longitudinally to the extent of seven or eight inches. The fact, however, that bullets and other balls do produce longitudinal fractures, is now universally admitted; and were there any doubt upon the subject, a specimen sent to England by the late Dr. Cole would soon remove it. Boyer, who formerly denied the possibility of longitudinal fractures, was latterly of a different opinion:—"On trouve néanmoins, à la suite des plaies d'armes à feu, les os fendus suivant leur longueur, jusques dans leurs articulations,"—but he is correct, when he adds, that such instances afford no proof of the possibility of a simple longitudinal fracture. (See *Maladies Chir.* t. iii. p. 10.) M. J. Cloquet has recorded a case, in which the fall of a building buried a man in the ruins, and occasioned several longitudinal fractures. (See *Pathol. Chir.* 4to. Paris.)

4. *In regard to the respective position of the fragments.* These differences are highly important, because the treatment essentially consists in obviating, or preventing, the displacement of the fragments. It is not to be supposed, however, that such displacement is a constant effect of all fractures, for it seldom takes place where there are two bones, and only one of them is broken. Neither does it invariably happen in every fracture of the neck of a bone, as is exemplified in certain fractures of the neck of the thigh-bone, the fragments of which sometimes change their relative situation only when the limb is too freely moved about. Fractures of the leg are also observed, in which there is neither a displacement of the fragments, nor an alteration in the shape of the limb, especially when the tibia alone is fractured near its upper part, where it is very thick. When the ulna alone is broken at its upper part, there is hardly ever any displacement. The corresponding surfaces of the fragments having a large extent cannot be separated, or can only be so with difficulty. Fractures of the fibula are also frequently unattended with displacement. But, when both bones of the leg or fore-arm are fractured together, there is generally more or less displacement; and such is also the case when a fracture occurs in the thigh, or upper arm, where there is only one bone. Here, the little extent of the surfaces of the fracture, and the great number of muscles, facilitate displacement.

The displacement may happen in respect to the diameter, length, direction, or circumference, of the bone.

In respect to the diameter. In transverse fractures, this kind of displacement is frequently exemplified. The two fragments may either be in contact at a part of their surfaces, or they may not be in contact at all. In the latter circum-

stance, the limb is shortened by the ends of the fracture slipping over each other.

In respect to length. The mode of displacement, in which the ends of the broken bone pass more or less over each other, is chiefly noticed in oblique fractures, but sometimes in transverse ones, when the displacement, in the direction of the diameter of the bone, has been such that the surfaces of the fracture are no longer in contact. Whenever the limb is shortened, it is by displacement of the lower fragment.

To the species of displacement here spoken of, may be referred that which takes place in fractures of the patella, olecranon, and os calcis; but with this difference, that the fragments, instead of passing over each other, recede from each other in the direction of the length of the bone, and continue separated by a more or less considerable interspace.

In respect to the axis of the bone. In this kind of displacement, the two fragments where they meet, form an angle, and the bone appears bent. This displacement is often termed the *angular deformity*. It may occur in the leg, when the limb does not lie upon a surface exactly horizontal, and the heel is lower than the rest of the limb. The angular projection is then anterior. On the contrary, it would be posterior, if the heel were too much raised. In fracture of the shaft of the thigh, it will happen if the lower part of the limb be too much depressed, or elevated, or placed too much outwards or inwards.

In respect to the circumference of the bone. This displacement occurs when the lower fragment performs a rotatory movement, while the upper one continues motionless. Thus, in fractures of the neck of the femur, if the foot is badly supported by the apparatus, its weight, together with that of the limb, and the action of the muscles, inclines it outward, and turns the lower fragment in the same direction. This is called the *rotatory displacement*.

Besides these displacements, there are others of a more complicated nature, which happen in several directions at once. For example, such is the displacement, observed in a fracture of the thigh-bone, when the lower fragment is drawn upward and inward, while the foot is turned outward.

With respect to the causes of displacement, I may remark, that as the bones are only passive instruments of locomotion, they possess not, in their own organisation, any power capable of causing the change of situation which takes place; but yield to the impulse of external bodies, the weight of the limb or part, and the action of muscles.

The displacement may be produced by an external force, either at the moment when the fracture happens, and by the very action of the same cause, as breaks the bone: or it may be caused by the weight of the body when the fracture precedes the fall; or, lastly, it may be brought on by some other external force, acting on the fragments, sooner or later, after the occurrence of the injury.

The outward violence operates sometimes directly on the situation of the fracture; sometimes on parts more or less distant from it. In both cases, the action of the force is not confined to the production of the fracture, but is partly spent in causing a displacement of the fragments.

Fractures are generally occasioned by falls.

Sometimes, however, the fall does not happen till after the leg, or thigh, is actually broken. The weight of the body then produces the displacement, by pushing the upper fragment against the soft parts, which are more or less lacerated. This is what happened to Ambrose Paré who, being kicked by a horse, endeavoured to get out of the way, but instantly fell down, and the two bones of his left leg, which had been fractured, being impelled by the weight of the body, not only passed through the skin, but even through his stocking and boot. Boyer saw a nearly similar case, in a young man, who was struck on the middle of the thigh by the pole of a carriage, which fractured the femur. The patient fell down, and in the fall the upper fragment was not only driven through the muscles and integuments, but also through his breeches.

The weight of the limb itself may produce displacement according to the direction, or circumference of the bone, as already detailed. The disturbance of the limb, also, in lifting the patient, and carrying him to his bed, may sometimes alter the relative situation of the fragments, and cause displacement.

But of all the causes of the displacement of fractures, the action of the muscles is the common and most powerful. Amongst the muscles, surrounding a fractured bone, some are attached to it throughout its whole length, and are equally connected with both the fragments. Some arise from the bone above, and are inserted either into that, which is articulated with the lower fragment, or into the lower fragment itself. Lastly, others come from a point more or less distant, and terminate in the upper fragment. The muscles around the thigh-bone furnish examples of these three arrangements. The adductor is attached to the bone through the greater part of its length. The long portion of the biceps, the semi-membranosus, and semi-tendinosus, come from the pelvis, and are inserted into the leg, a part, with which the lower fragment is articulated, and all the motions of which it follows. The tendon of the adductor magnus is inserted into this fragment itself. Lastly, the iliacus, psoas, pectineus, &c. come from the loins and pelvis, and are attached to the femur, not far from its upper end.

The muscles attached to both fragments, perhaps contribute but little to the displacement. They may, however, draw them to the side on which they are situated, and thus change the direction of the limb.

The displacement is principally owing to such muscles as are affixed to the lower fragment, or part with which this fragment is articulated. Suppose the humerus to be broken between its upper end and the insertion of the great pectoral. This muscle, aided by the latissimus dorsi and teres major, will draw the lower fragment inward, and displace it by drawing it to the inner side of the upper fragment, which remains motionless. In fractures of the neck of the thigh-bone, the upper fragment, included within the capsular ligament, affords attachment to no muscle; but all those which are affixed to the lower fragment tend to draw it upward and backward. In all cases, the lower fragment follows every movement made by the part of the limb with which it is articulated, and, consequently, the muscles, attached to the bones of this last part of the limb, become a

powerful cause of displacement. Thus, in a fracture of the thigh-bone, the biceps, semi-tendinosus, and semi-membranosus, draw the leg, and with it the lower fragment, upward, inward, and backward, so as to make the lower end of the fracture ascend at the inside of, and rather behind, the upper one, the extremity of which then projects forward and outward. In a fracture of the leg, the gastrocnemius, soleus, and peronei muscles, acting upon the foot, draw the lower fragments of the tibia and fibula to the outer and posterior-side of the upper fragments. For here, as well as every where else, the strongest muscles, in producing the displacement, draw towards their own side the end of the fracture, on which they operate. And as the posterior muscles of the leg are far more numerous and powerful than the anterior, while those on its outside are not antagonised by any others, the displacement must happen in the direction backward and outward. Whenever, therefore, a bone is fractured at a given point, the knowledge of the muscles will enable a surgeon to determine *a priori* in what direction the displacement is disposed to happen.

Lastly, the muscles, attached only to the upper fragment, may contribute to the displacement. In a fracture of the thigh, situated immediately below the little trochanter, the psoas and iliac muscles carry forward the extremity of the upper fragment, which elevates the integuments, and forms a more or less considerable projection near the fold of the groin. But the displacement of the upper fragment is generally less considerable and important than that of the lower.

The manner in which the displacement of fractures is effected by the action of muscles explains one circumstance which frequently attends these cases, especially fractures of the thigh, clavicle, and leg. This is a rising, a projection, of the upper fragment, or that which is nearest the trunk. One might believe, at first sight, that such projection is formed by the upper fragment quitting its natural situation, and rising over the lower one. But, on the least reflection, it becomes manifest, that the upper end of the fracture projects only because the lower one is displaced, and drawn towards that side on which the strongest muscles are situated. Thus, in practice, in order to make the *rising end of the bone* (as it was termed) disappear, it is only necessary to reduce the lower fragment. If, instead of doing this, pressure be made on the projecting part, the design fails; and if the plan be still more forcibly pursued and continued, inflammation, ulceration, and sloughing, and the conversion of the case into a compound fracture, are likely to be the consequences.

5. In respect to circumstances, with which fractures are accompanied. The most important division of fractures is into simple and compound. By simple fracture, surgeons mean a suddenly formed breach in the continuity of one, or more bones, without any external wound, communicating internally with the fractured. By a compound fracture, they signify the same sort of injury of a bone, or bones, attended with a laceration of the integuments, which laceration may be produced by the protrusion of one, or both ends of the fracture, through the skin, or by a ball, or other body, which enters, or otherwise wounds, the soft parts, at the same moment that it breaks the bone.

Fractures are said to be complicated when at-

tended with diseases, or accidents, which render the indications in the treatment more numerous, and require the employment of different remedies, or the practice of sundry operations, for the accomplishment of the cure.

Thus, fractures may be complicated with severe degrees of contusion, wounds of the soft parts, injury of blood-vessels, a dislocation, or diseases, and particular states of the constitution, as the scurvy, rickets, syphilis, cancer, pregnancy, &c.

The complication of fracture with dislocation is frequent in the ankle and vertebral column. In the first case, the dislocation usually precedes the fracture; but, in the second, the fracture of the body or bodies of the vertebrae, precedes the dislocation, which otherwise is exceedingly rare.

Under the head of differences in fractures may be fitly introduced that injury to the bones of children, which is denominated a *bending* of them from falls, blows, and external violence, since this injury requires the same treatment as fractures, although crepitus and displacement of the fragments do not attend it. In 1821, Dr. J. R. Barton, of Philadelphia, published a valuable paper on the subject, including also remarks on another injury to the bones of children, which he calls a *partial or incomplete fracture* of a single bone, or both bones. These cases had been previously noticed by Underwood and Boyer, and perhaps by them alone. Dr. Barton has illustrated his paper by very accurate drawings of the deformity, resulting from both of these accidents. (See *Amer. Med. Recorder for 1821* and *Reese's Amer. ed. of this Dictionary*.) In the course of three years, Mr. Hart, of Dublin met with five cases of partial fracture of long bones: one of the humerus; two of the radius; and two of the femur. "The diagnostic symptoms of this affection (he observes) are pain and a bent state of the bone injured, without absolute shortening of the limb. On the contrary, it is lengthened on the side, to which the ends of the fractured part project." (See *Dublin Journ. of Med. Science*, vol. i. art. i. 8vo. 1832.)

2. THE CAUSES OF FRACTURES.

Are divided into *predisposing* and *remote*.

In the first class are comprehended the situations and functions of the bones, the age of the patients, and their diseases. Superficial bones are more easily fractured, than those which are covered by a considerable quantity of soft parts. The functions of some bones render them more liable to be fractured than others; thus the radius, which supports the hand, is more liable to be fractured than the ulna. The clavicle, which serves to keep the shoulder in its proper position, and support on its arched extremity all the motions of the upper limb, is particularly subject to be broken. The gradual increase of the quantity of the phosphate of lime, in the structure of the bones, makes them brittle, in proportion as we advance in years; and, in old age, the proportion of the inorganised to the organised part is so great, that the bones are fractured by the slightest causes. In childhood, the animal and organised part bears a greater proportion to the earth, and the bones being, consequently, more elastic and flexible, are not so easily broken as in old age.

Lues venerea, cancer, rickets, scurvy, and scrofula, predispose to fractures. B. Hall mentions two venereal patients, of whom the hardest and

largest bones were completely broken by the ordinary action of the muscles of the limb. Sir Benjamin Brodie had a patient, whose clavicle broke exactly in the situation of a venereal node. (See *Med. Gaz.*) In the museum of University College, London, are two thigh-bones, taken from a patient, who was using mercury for the cure of syphilis: one has several nodes upon it; the other broke as he was turning himself in bed. Fabricius Hildanus quotes from Sarazin, a physician of Lyons, the case of a gouty patient, sixty years of age, who, in putting on his glove, broke his arm above the elbow. Desault used often to speak of a nun of Salpêtrière, whose arm was broken, as a person was handing her out of a carriage. Louis, who was vexed that no union took place, was not a little surprised to find her thigh-bone experience the same fate one day as she was changing her posture in bed. It was then learned, that she had a cancer in her right breast. Leveillé observed similar cases in the Hôtel-Dieu; Sir Astley Cooper has met with others; and at this present time (March 1837), there is in the North London Hospital a woman with cancer of the breast, whose humerus was broken about a fortnight ago by the ordinary action of the muscles. A few months ago she was in the same institution for a similar occurrence; and she had previously sustained the same kind of injury of other bones. A few years ago, I attended a gentleman's coachman, who had a cancerous disease of the bladders and whose thigh-bone broke at its upper third, as he was turning himself in bed. Around the fractured part a scirrhous mass had been deposited between the periosteum and the bone; and one of the ribs was found in a similar condition, and also broken. The preparations are placed in the museum of University College. (See *Med. Chir. Trans.* vol. xvii.)

According to Leveillé, the history of two girls is related by Buchner, one of whom died rickety at the age of sixteen, having broken the femur a short time before her death; and the other, after taking the breast very well for two years, and thriving for a time, became affected with rickets, and met with the same accident as she was merely running along the street. (*Nouvelle Doctrine Chir.* t. ii. p. 163.)

Many extraordinary instances of fractures from the morbid softness and fragility of the bones are upon record. Suffice it here to refer to the Philosophical Transactions; *Mém. de l'Acad. Royale des Sciences*; *Act. Hafniens.*; *Ephem. Nat. Cur.* dec. 1. ann. 3. obs. 112; Gooch's *Chirurgical Works*, vol. ii.; Saviard, *Obs. Chir.* p. 274; Gibbon's *Institutes of Surgery*, vol. i. p. 370, &c. (See *Fragilitas and Mollities Ossium.*)

On the subject of fractures, produced by the scurvy, Marcellus Donatus; Saviard; Heyne de *Morbis Ossium*; Poupert's *Works* inserted in the *Mém. de l'Acad. des Sciences*, 1699; and the *Treatise* published at Verona, in 1761, by Jean de Bona, may be consulted. To these works I would add Lord Anson's *Voyage*, in which the effect of the scurvy in producing the absorption of the callus of old fractures, a disjunction of the fragments, and a renewal of ulcers which had been many years healed, is curiously exemplified.

Paré, Platner, Callisen, and several other writers, set down cold as a predisposing cause of fractures. This doctrine has originated from these injuries being more frequent in the winter time, but is erroneous, since, in cold countries, the greater

number of falls which happen in winter from the slippery and very hard state of the roads, is a circumstance that fully explains why fractures are then more common than in summer.

The remote cause of fractures is external force variously applied, in falls, blows, &c. In particular instances, the bones are broken by the violent action of the muscles attached to them; this is almost always the case with the fractured patella. Occasionally the olecranon and os calcis have likewise been broken by the violent contraction of the muscles inserted into them. With respect to the heel, Petit records two instances, one of which was communicated to him by Poncelet, and the other seen by himself in Madame La Présidente de Boissière, who met with the accident in walking a gentle pace in the court of the Hôtel de Soubise. When the injury happens in leaping, or falls from a high situation, Leveillé thinks it more probable, that a portion of the os calcis is torn off by the powerful action of the muscles of the calf, than that it is broken by any blow immediately on the part. He states, that Desault used frequently to cite two examples of this kind, one of which is recorded in his *Œuvres Chirurgicales*.

Whether the long bones can be fractured by the mere action of the muscles, has been a disputed point. In the Philosophical Transactions, a fracture of the humerus is ascribed to this cause; and Bottemuit knew of the same accident being produced as a person was striking a shuttlecock with a battledore. According to Debonumarchef, as a man was descending a ladder at a quick rate, his heel got entangled in an opening, and he made a violent exertion to avoid falling. The consequence was a fracture of the lower third of the leg. Curet informs us, that a cabin-boy, aged seventeen, made a considerable effort to keep himself from being thrown down by the rolling of the ship. The femur was fractured by the powerful action of the muscles of the thigh. The lad had no fall, and, with some difficulty, supported himself on the other limb, till he received assistance.

We are told, says Leveillé, by Poupée Desportes, that a negro, about twelve or thirteen years old, was seized with such violent spasmodic contractions of the muscles of the lower extremities, that the feet were turned backward, and the neck of each thigh-bone was fractured, the ends of the broken bones also protruding through the outside of the thigh. A cure was an exfoliation. We read also, in the *Cuiosa Acad. Naturæ Curiosorum*, that during a fit of epilepsy, a child, ten years old, had its left humerus and tibia broken, and that, upon opening the body, other solutions of continuity were observed. Chambers assisted in dressing a child, eleven or twelve years old, that had broken the humerus in throwing a stone a considerable distance. (*Nouvelle Doctrine Chir.* t. ii. p. 164. 166.)

It is the belief of Richerand, however, that a long bone, when healthy, can never be broken by the mere contraction of the muscles. (*Nosogr. Chir.* t. iii. p. 12. édit. 4.)

For my own part, making all due allowance for the inaccuracy of some of the reports, I think the possibility of the long bones being broken by the violent action of the muscles is sufficiently proved. I have never seen but one example; but it was an unequivocal one; I attended, for the late Mr. Ramsden, an exceedingly strong man, at Penton-

villie, who broke his os brachii in making a powerful blow, although he missed his aim, and struck nothing at all. The whole limb was afterwards affected with vast swelling and inflammation. This man, I remember, was also visited by Mr. Welbank senior. According to Nicod, the greater number of fractures of long bones, by mere muscular action, are preceded by pains in the broken limbs; and, in one of the cases, published by this author, not only was this circumstance remarked, but an abscess and exfoliation of a portion of the fractured humerus ensued. In another instance, reported by this gentleman, the clavicle, in a state of preternatural fragility from disease, was fractured in an effort to carry the arm far behind the back. After the reunion of the fracture, an abscess took place, and a piece of the bone exfoliated. (*Annuaire Méd. Chir. des Hôpitaux de Paris*, p. 494—498, &c. 4to. Paris, 1819.)

3. SYMPTOMS OF FRACTURES.

Some of the symptoms of fractures are equivocal: the pain, and inability to move the limb, commonly enumerated, may arise from a mere bruise, a dislocation, or other cause. The crepitus; the separation and inequalities of the ends of the fracture, when the bone is superficial; the change in the form of the limb; and the shortening of it; are circumstances, communicating the most certain information: and the crepitus, in particular, is the principal symptom to be depended upon, though occasionally attendant on dislocations, and arising, as Sir Astley Cooper has explained, from a change in the quality of the synovia. (*On Dislocations*, &c. p. 6.) The signs of fractures, however, are so exceedingly various, according to the bones, which are the subject of injury, that it cannot be said, that there is any one, which is invariably present and characteristically confined to them. The writers of systems of surgery usually notice loss of motion in the injured limb, deformity, swelling, tension, pain, &c. as forming the general diagnosis of fractures. However, it is easily comprehensible by any one, acquainted with anatomy, that numerous fractures cannot prevent the motion of the part, nor occasion outward deformity; and every surgeon must know, that though, at first, there may be pain in the situation of a fracture, no inflammation, swelling, and tension can take place till after a certain period. There may be, however, a swelling produced in the first instance by extravasation of blood, or by displacement of the ends of the bone.

When, therefore, a limb is broken, and the event is not manifest from the distortion of the part, it is proper to trace, with the fingers, the outlines of the suspected bone: if it be the tibia, let the surgeon examine with his fingers, whether any inequality can be discovered along the anterior surface, and along the sharp front edge of that bone. If it be the clavicle, let him trace the superficial course of the bone, in the same attentive manner. Wherever any unusual pain occurs, or any unnatural irregularity appears, let him try if a grating or crepitus cannot be felt, on endeavouring to make one end of the suspected fracture rub against the other. When the humerus, or the os femoris, is the subject of inquiry, a crepitus is felt almost as soon as the limb is touched; and, in the case of the broken thigh, there is a considerable shortening of the extremity, except in a few cases of fractures, com-

pletely transverse. But when there are two bones as in the leg and the fore-arm; and only one is broken, the other continues to prevent the limb from being shortened, and thrown out of its natural shade, so that a crepitus can only be felt by a very careful examination with the fingers. The difficulty of the diagnosis is increased, when the surgeon is consulted late, and great swelling has come on. "Where is the surgeon," says Boyer, "that has not sometimes hesitated to deliver an opinion in certain cases of this description?" (*Malad. Chir.* t. iii. p. 27.)

When the injured limb is shortened, the surgeon, before pronouncing that such change proceeds from the passage of the fragments over each other, must be sure, that the bones are not dislocated, and that the limb is not naturally shorter, than the other, or in consequence of a previous fracture, that has been badly set.

In comparing the length of the lower extremities, one should place the pelvis in a horizontal position, and put the two anterior superior spines of the ossa ilium in the same line: for, if these processes are not on a level, the limb, towards which the pelvis inclines, will seem longer than the opposite member.

The practitioner who is well acquainted with the anatomy of the limbs, and particularly with the mutual relations of the eminences of the bones to each other, will readily perceive the alterations produced by a fracture. Whenever, in consequence of a fall, or blow, a limb becomes concave at a part where it ought to be convex, or straight, *et vice versa*, the change of shape and direction must proceed from a fracture with displacement. The inner edge of the great toe, when the leg rests on a horizontal surface, should correspond with the inner edge of the knee-pan. If this natural relation be altered; if the inner edge of the great toe correspond with the outer edge of the knee-pan, there can be no doubt of the existence of a fracture of both bones of the leg. (*Boyer*, vol. cit. t. iii. p. 25.)

I am aware that considerable harm, and great unnecessary pain, have been occasioned by too much solicitude to feel the grating of fractured bones, and, whenever the case is sufficiently evident to the eyes, the practitioner who gives way to this habit, at the expense of torture to the unfortunate patient, ought in my opinion to be severely censured. A fracture is an injury necessarily attended with a great deal of pain, and followed by more or less swelling and inflammation; and to increase these evils, by roughly or unnecessarily handling the part, is ignorant and cruel, and (if I may use the expression) unsurgical.

In some kinds of fractures, the broken bone is so surrounded with thick fleshy parts, that it is difficult to feel a crepitus, or ascertain the existence of the injury. Some fractures of the neck of the thigh-bone are cases illustrative of this observation. In very doubtful cases, the stethoscope has been proposed as a means of elucidating the diagnosis, and Lisfranc is said to have used it with success. (*See Edinb. Med. and Surg. Journ.* No. 78. p. 237.)

4. PROGNOSIS OF FRACTURES.

The prognosis of fractures varies, according to the kind of bone injured, what part of it is broken, the direction of the breach of continuity, and what other mischief complicates the case. Fractures of bones, which have many strong muscles inserted

into them, are more difficult of cure than those of other bones, which have not so many powers attached to them capable of displacing the fragments.

A fracture of the middle part of a long bone is less dangerous than a similar injury near one of its joints, which may be followed by synovial inflammation and ankylosis. Thus, in a fracture of the thigh-bone, near the condyles, the inflammation and swelling extend to the knee-joint, which is affected with a degree of stiffness that continues for a long while, and sometimes cannot be entirely cured during life. The experiments of M. Cruveilhier prove, that various forms of irritation will make the periosteum ligaments and cartilages ossify; and it has been ascertained, that in some cases of fracture near the joints, the ligaments have sometimes been converted into bone. (See *Andral, Anat. Pathol.* t. i. p. 300.)

Inflammation of a joint, brought on by fracture, is attended with more severe symptoms, in proportion as the contusion has been more violent. In a fracture near an articulation, it is to be observed, also, that common splints have little command over the short fragment, so that it is often difficult with them to prevent displacement; and, with respect to transverse fractures of the neck of the thigh-bone *within the capsular ligament*, although the possibility of the reunion of such cases *by means of bony matter*, is no longer a disputed point; the cure is more commonly effected only by means of a fibrous ligamentous substance.

When a bone is fractured in several places, the case is more serious, and the difficulty of cure greater. But, the accident is still worse, when a limb is fractured in two different places at once; as, for instance, in the thigh and leg. Here, without the assistance of a double oblique plane, or McIntyre's excellent apparatus, it would be almost impossible to reduce the fracture of the thigh and maintain the reduction well, so as to preserve the natural length of the limb.

Oblique fractures are more troublesome, and difficult of cure than transverse ones, because an oblique surface does not resist the retraction of the lower portion of the broken bone, and consequently the ends of the fracture are kept duly applied to each other with difficulty.

Fractures, complicated with violent contusion of the soft parts, or with a wound, rendering them *compound*, are much more dangerous than others free from such accidents. The bad symptoms, which render compound fractures so dangerous, are of many kinds: hemorrhage; violent and extensive inflammation of the limb, either phlegmonous or erysipelatous; delirium and fever; large abscesses; gangrene; &c. Fractures of the leg are generally more serious than similar injuries of the upper extremity. The wound of a large artery may add considerably to the danger of a fracture.

In a debilitated old man, or an unhealthy subject, or a constitution predisposed to inflammation, particularly erysipelas, or to violent derangement of the nervous system, a fracture is less likely to end well than in a healthy child, or a strong young person, or one of good constitution. In extreme old age, the cure of a fracture is always more difficult, and sometimes impossible. (*Boyer*, t. iii. p. 32.) The scurvy certainly retards the formation of callus, and, as I have already noticed, even produces its absorption again; but it is not true that pregnancy always prevents the union of fractures. Some

years ago, I attended, for Mr. Ramsden, a woman in a court leading out of St. Paul's Churchyard, who broke both bones of her leg when she was several months gone with child. Her pregnancy, however, did not appear to be at all unfavourable to the cure, as it followed in the usual time. "It is not generally settled," says a modern writer, "whether pregnancy should be accounted a complication. I, as well as some other practitioners, have seen a pregnant woman get well of a simple fracture in the ordinary time." (*Leveillé, Nouvelle Doctrine Chir.* t. ii. p. 159.) And in another place he says, "*Contre l'opinion de Fabrice Hildan, l'expérience m'a prouvé que, chez les femmes grosses, le cal était aussi prompt à se former, que chez toute autre personne.*" (*Op. cit.* t. ii. p. 172.) The experience of Boyer also tends to prove, that pregnancy does not generally prevent the union of fractures. (See *Mal. Chir.* t. iii. p. 32.)

The cases, in which fractures remain disunited, will be considered in a future section.

5. TREATMENT OF FRACTURES IN GENERAL.

The treatment embraces three principal indications. The first is to reduce the pieces of bone into their natural situation. The second is to secure and keep them in this state. And the third is to prevent any unpleasant symptoms likely to arise, and relieve them if they come on.

The first indication is only applicable to cases attended with displacement; for, when the fragments are not out of their relative position, the surgeon must strictly refrain from all avoidable disturbance of the limb. His interference should then be limited to putting up the fracture, resisting the accession of unfavourable symptoms, and removing them, if possible, after they have taken place.

6. OF THE REDUCTION OF FRACTURES.

The means employed for the reduction of fractures in general are chiefly three, viz. *extension*, *counter-extension*, and *coaptation*, or *setting*. But, as Boyer remarks, these means should vary according to the species of displacement; and surgical writers have generalised too much in representing them all three as necessary for the reduction of every kind of fracture. In fact, there are several cases, in which extension and counter-extension are positively useless: of this nature are fractures of the patella and olecranon, where the displacement consists of a separation of the fragments. Here the reduction may be accomplished, by putting the limb in a position in which the muscles attached to the upper part of the bone are relaxed, and then pushing the upper fragment into contact with the lower.

Extension signifies the act of pulling the broken part in a direction from the trunk, with the view of bringing the ends of the fracture into their natural situation. By counter-extension, surgeons imply the act of making extension in the opposite direction, in order to hinder the limb, or even the whole body, from being drawn along by the extending power, which would then be unavailing.

It was formerly recommended to apply the extending force to the lower fragment, and the counter-extension to the upper one. Such practice, indeed, was advised by Mr. Pott, and is still generally preferred in this country; but upon

the Continent it has been abandoned. The objections made to it by Boyer are: first, that it is frequently difficult, and sometimes impossible, to take hold of the two fragments; as, for example, when the neck of the thigh-bone is broken. Secondly, that by applying the extension and counter-extension to the broken bone itself, most of the muscles which surround it are compressed, and such compression produces in these organs a spasmodic contraction, which often renders the extension and counter-extension useless, and sometimes even hurtful. (*Mal. Chir.* t. iii. p. 34.) The French surgeons, therefore, apply the extending force to that part of the limb which is articulated with the lower fragment, and the counter-extension to that which is articulated with the upper. For instance, in a fracture of the leg, the extending means act upon the foot, and the counter-extending upon the thigh; and in a fracture of the thigh, the extension is applied to the leg, while the counter-extending power fixes the pelvis.

One circumstance must here occur to the mind of the surgical reader. In this country, it is properly inculcated, that one of the first principles to be attended to in the reduction of fractures, is to put the limb in such a position as will relax the most powerful muscles connected with the broken bone; because these muscles principally impede the reduction, and disturb the ends of the fracture. But, in the French mode of making the extension and counter-extension, how can this grand principle be conveniently fulfilled? If the extending and counter-extending means are not to be applied to the broken bone itself, but to others which are articulated with it, the limb must of necessity be kept in a straight posture at the time of reducing the fracture; for were the limb placed in a half-bent state, the extension and counter-extension, as practised by the continental surgeons, would not be in the same line, and therefore less efficiently and readily accomplished. If it be advantageous to bend the limb at the time of reducing a fracture, the French mode of practising extension and counter-extension may not be the best. I am not, however, one of those surgeons, who are entirely blinded with the idea of the possibility of relaxing the whole of the muscles connected with the broken bone, by merely bending the limb. On the contrary, I am convinced with Desault, that, in general, what is gained by the relaxation of some muscles, is lost by the tension of others. But where it is possible to relax, by a certain posture, the set of muscles most capable of preventing the reduction and disturbing the coaptation of a fracture, that posture I would select. Thus, in a fracture of the leg, the strong muscles of the calf undeniably possess this power, and the bent position which relaxes them, appears to me, therefore, generally the most judicious and advantageous, not only during the reduction, but during the whole treatment of the case. Many years ago, I had under my care, in the military hospital at Cambray, a fracture of the tibia and fibula, which was at first treated in the straight posture. The gentlemen who assisted me reduced the fragments, and made them lie tolerably well. But every time the bandage was opened, the bones were always found displaced again. Finding that this inconvenience went on for two or three weeks, we resolved to lay the

limb on its outside, in the bent position. Not the least trouble was afterwards experienced in keeping the fragments reduced. In the North London Hospital, I had a strong athletic brick-layer with an exceedingly oblique, almost a longitudinal, fracture of the leg, and, notwithstanding the aid of M'Intyre's apparatus, and the trial of the bent position, the projection of the upper fragment could not be prevented. The straight posture was then resorted to; but this caused the displacement to be still greater. The bent posture as advised by Pott, with the limb laid on its outside, was then tried, but in vain; and we were obliged ultimately to return to the bent position on M'Intyre's apparatus, as the most effective. The case terminated without deformity. Unless, therefore, the situation of the fracture very high up the leg, or of a wound, abscess, or some other particular reason, indicate an advantage or convenience from the straight posture, I always reduce a fractured leg in the bent position.

I was also formerly of opinion, that the bent position of the limb on its side, as advised by Pott, was the best for fractured thighs; but this sentiment has subsequently appeared to me erroneous, and it gives me pleasure to have this opportunity of declaring my entire conversion to the principles and practice adopted in these cases by Desault and others, who urge the necessity of endeavouring to render the apparatus more efficient. The considerations which led me to this change will be related in speaking of fractured thighs. If, then, the straight posture be advantageous for broken thighs, I think it will be universally allowed, that the parts of the limb recommended by the French surgeons for the application of the extension and counter-extension, are the most proper.

The evils and difficulties formerly encountered in setting fractured limbs undoubtedly proceeded in a great measure from the violent extension and counter-extension practised by our ancestors. As they were ignorant of the utility of relaxing the muscles, which displaced the ends of the broken bone, they had no means, but the employment of actual force, to effect the reduction. Since, however, the excellent instructions delivered by Pott have received due attention, practitioners have generally been careful, in the reduction of fractures, to incapacitate the muscles as much as possible by relaxing them, and thus all necessity for violent extension and counter-extension has been removed.

It is difficult to lay down rules respecting the precise degree of force which should be used in making extension; for it must vary in different cases, according to the species of displacement, and the number and power of the muscles concerned in producing it. In transverse fractures, displaced only according to the diameter of the bone, a very moderate extension suffices, as it is merely practised with a view of lessening the friction and pressure of the surfaces of the fracture against one another. But whatever be the direction of the fracture, when the fragments pass over each other, the extension and counter-extension should be such as to remove the shortening of the limb, and overcome the force of those muscles, which, after all attention has been paid to their relaxation, still oppose the reduction.

Extension, however, ought never to be practised in a violent and sudden way; but, in as gradual a manner as possible, the utmost care being taken not to shake, nor even move, the limb any more than can be avoided. When the practitioner extends a broken member all at once violently, he excites the muscles to strong spasmodic action, and there is some danger of lacerating them, because their fibres are not allowed the requisite time to yield to the force which elongates them. The extension is to begin in the direction of the lower fragment, and be continued in that which is natural to the body of the bone.

In every case of fracture with displacement, as soon as the necessary extension has been made, the surgeon is to endeavour to place the ends of the broken bone in their natural situation: this is termed *coaptation*, or *setting*. This operation is to be undertaken in different ways, according to the species of displacement, and the practitioner can almost always execute it by acting upon the lower fragment, without applying his fingers directly to the fracture itself, in order to regulate the contact of the extremities of the bone. When, however, it is judged necessary for this purpose to touch the broken part itself, it should be done with the utmost gentleness, so as to avoid pressing the soft parts against the points and splinters of bone.

Although the reduction of fractures may in general be accomplished with tolerable facility, it sometimes happens that the first attempts fail. This is occasionally ascribable to the employment of too much force, and too little management, in making the extension; whereby the muscles are irritated, and act so powerfully, that the design of the surgeon is completely frustrated. Here, the grand means of success is putting the limb into such a position as will relax the most powerful muscles which oppose the reduction. Sometimes, however, the irritable and convulsive state of the muscles is not the effect of any wrong mode of proceeding on the part of the surgeon; but arises from the alarm, pain, and injury caused by the accident itself, the comminuted state of the bone, the irritation of spiculae, or the very oblique direction of the fissure. Here relaxing the muscles is also the most likely method of removing the difficulty. In short, now that the utility of paying attention to this principle is universally known in the profession, a fracture is rarely met with which cannot be immediately reduced; particularly if opium be given, and a copious bleeding be premised when the patient is a strong muscular subject. This evacuation, indeed, will also prove for other reasons highly beneficial, where the limb is much contused and swollen, and the tendency to inflammation is great. But supposing the bone can not be made to lie well at first, it will easily be made to do so in the course of a few days, when the tendency to spasm has diminished, and the pain and first irritation have subsided. Only let the surgeon watch and regulate the position of the limb about this period, and the cure will be completed without any deformity.

7. OF THE MEANS FOR KEEPING FRACTURES REDUCED.

After the bones have been put into their natural situation, time alone would complete their cure, were there not in the muscles a continual propensity to displace the ends of the fracture

again. In cases of fracture, the muscles are often affected with involuntary spasmodic action, by which the broken part would certainly be displaced, were no measures taken to maintain the extremities of the broken bone in contact. Besides, the patient, in easing himself, coughing, sneezing, &c. must unavoidably subject the limb to a degree of motion, by which the coaptation would be altogether destroyed. Hence, the necessity of employing means for fixing the broken limb so effectually, that it may continue perfectly motionless during the whole time requisite for the union of the fracture. The means, employed for the fulfilment of this indication, are: an advantageous position; quietude; bandages; splints; and various kinds of apparatus.

In the treatment of all fractures, the position of the part, and indeed of the whole body, is a thing of material importance. Whenever the case is a fracture of the lower extremities, the patient should lie strictly in bed, until the callus is completely formed and strong. It is likewise an advantage not to have the bed too wide, because the surgeon and assistants can then more conveniently get at any part of the limb. As feather-beds are too yielding, a horse-hair mattress is preferable. Boyer, indeed, is so impressed with the utility of letting the patient lie upon a surface, which will not sink, that he recommends two mattresses to be used, and a board to be laid under the upper one, from the hip to beyond the patient's foot. (*Mal. Chir.* p. 39. vol. iii.)

Generally the most favourable position for a fractured limb is that, in which all the muscles, passing over the fracture, and extending either to the lower fragment, or to that part of the limb, which is articulated with it, are equally relaxed. The injured limb should also have firm support at every point, and its position ought to be regulated, so that not only this object be carefully fulfilled, but at the same time the chance of displacement from the action of the muscles, or the weight of the body, or part itself, may be diminished as much as possible.

The natural, or rather the most easy, position of the limb, is that which is usually chosen by a person who reposes himself, or who is sleeping; for then all motion is suspended, and every part assumes that posture which is most congenial to it. In this condition, the limbs are not extended, nor yet entirely bent; but only in a moderate state of flexion. Hence, Boyer remarks, that a half-bent position of the limbs is that which is most natural, and that in which all the muscles enjoy an equal degree of relaxation, and, consequently, that it is, generally speaking, the best for fractures. This posture, which was recommended by Hippocrates and Galen, has been highly extolled by Pott, who appears to have exaggerated its advantages. Considered in a general way, it is without contradiction preferable to every other position of the limb; but its employment should be liable to exceptions, as will be noticed in treating of particular fractures. (*See Traité des Mal. Chir.* t. viii. p. 40.)

In whatever position a broken limb is placed, it should bear, throughout its whole length, equally and perpendicularly upon the surface on which it lies, and not be only partially supported. When, for example, only the extremities of a fractured limb rest upon the bed, the weight of the limb

itself will make it bend in the situation of the fracture. The limb will also be rendered crooked, if the broken part be supported, while the extremities of the limb (especially the inferior), sink lower by their own weight. The displacement of the fracture is not the only inconvenience arising from the limb being laid upon a surface, where it is not every where equally well supported. The parts which bear on this surface, experience a painful degree of pressure, which, if long continued, may produce inflammation, and even sloughing of the integuments. Thus, in fractures of the leg, gangrene of the heel has sometimes arisen entirely from this cause. Such inconveniences may often be prevented by laying a fractured limb on a surface of corresponding form; that is to say, on a surface, which is depressed where the limb has projections, and rises where it presents depressions. The surface should not be so hard as to annoy the patient; yet it ought to be sufficiently firm not to yield to the weight of the limb and apparatus. The best pillows and pads for the support of broken limbs are stuffed with chaff of oats, a substance which is preferable to feathers, tow, or wool, because it more readily admits of being pushed from the place where the limb is prominent to another situation where the member presents a depression or hollow.

In whatever position fractured limbs are placed, they ought to be kept perfectly quiet during the whole time requisite for the union. If the broken bone be moved while the callus is forming, the surfaces of the fracture rub against each other, and the process is disturbed and retarded; and, indeed, sometimes by repeatedly moving the limb, the consolidation of fractures is entirely prevented.

In order to maintain the limb in the right position, and in a state of quietude, and to preserve the fragments in proper contact with respect to each other, the surgeon is to caution the patient to avoid moving more than can be helped, and every cause likely to subject the limb to any kind of shock or concussion is to be removed. But, in particular, it will be necessary to apply a retentive apparatus, usually consisting of bandages, splints, tapes, straps and buckles, soft pads, &c.

At St. Bartholemew's Hospital, it has been customary ever since the time of Pott, to apply to the integuments over a simple fracture a plaster of brown soap cerate; and many surgeons still follow the same plan. "If this plaster be employed, it should be put on in such manner as that it may be renewed and shifted as often as may be necessary without moving the limb in any manner: it being certain, that when once a broken thigh or leg has been properly put to rights, and has been deposited properly on the pillow, it ought not ever to be lifted up, or moved from it again without necessity, until the fracture is perfectly united." (Pott.) In the North London Hospital, neither the soap nor any other plaster is commonly used for simple fractures. I know, however, of no objection to it, and often employ it in private practice, on the principle that it affords some trivial support and protection to the injured part, and is mostly agreeable to the patient.

With respect to bandages, the common roller answers for fractures of the humerus, radius, ulna, and fibula. Indeed, when M'Intyre's apparatus

is made use of, or Dessault's method of treating a broken thigh is followed, it is the most eligible bandage for all simple fractures of the lower extremity, and even for some compound ones. But if a broken thigh or leg is to be treated according to Pott's directions, then the eighteen, or many tailed bandage is necessary. The advantages of it are that, by means of it, all necessity is avoided of lifting up, and disturbing the limb, every time it is dressed, or every time the bandage loosens. Indeed, with it the leg or thigh need never once be removed during the cure, from the pillow or splint, on which it has been deposited.

The same advantage, however, is obtained with common rollers, when M'Intyre's apparatus is used, which, as well as the limb itself, is to be encircled by them. (See *Description of a Splint invented for the Treatment of Fractured Limbs by James M'Intyre*, 8vo. Newcastle, 1825.) In the North London Hospital we dispense with the sock, and fix the limb with three rollers: one surrounds the upper part of the leg and the knee; another binds the foot to the foot-piece and encircles the ankle; and the third is applied to the central part of the leg, including the situation of the fracture. This last roller admits of being taken off, and the fracture, simple or compound, examined, without meddling with the other rollers, which steady the upper and lower parts of the leg, and therefore it does not undergo the slightest disturbance. On the whole, I cannot fancy that any apparatus for broken legs, will ever fulfil its purposes better than that of Mr. M'Intyre, which has also the recommendation of great simplicity. A very cheap form of this apparatus has lately been contrived by Mr. Liston, the peculiarities of which are the omission of most of the thigh part, and the placing of an aperture at the point where the heel lies, so that the painful pressure on this part is considerably lessened. However, those surgeons who prefer to treat fractured thighs in the flexed position, with the patient on his back, will find M'Intyre's apparatus, as arranged by himself, exceedingly convenient.

Another surgeon of Newcastle, Mr. T. M. Greenhow, is also the inventor of an exceedingly ingenious apparatus for fractures of the lower extremity. It enables the surgeon to bring the whole circumference of a broken leg into view, after the fracture has been set, without the least movement or disturbance of any part of the limb. This, as every man of experience knows, is a great advantage in the treatment of compound fractures, where the application of dressings to the wound sufficiently often, the prompt discharge of abscesses, the preservation of the parts in a cleanly state, and the opportunity of inspecting the position of the ends of the fracture in the early stages of the formation of the callus, are objects contributing very essentially to the favourable progress and termination of these accidents. With this apparatus permanent extension either of the leg or thigh, if judged advisable, may be adopted, there being a contrivance for this object. One chief principle of Mr. Greenhow's apparatus is, that the limb remains supported in an iron framework, after every thing else has been removed. (See *T. M. Greenhow's Description of an Apparatus intended to facilitate the Treatment of Fractures*, &c. 8vo. Lond. 1833.)

In France, the preference is given to Scultetus's

bandage in almost every instance, where we employ the eighteen-tailed one, from which it principally differs in being composed of separate transverse pieces admitting of removal, so that when a part of the bandage is soiled, it can be taken away, and a clean piece, (first stitched to that which is about to be removed,) drawn under the limb, without disturbing the whole of the dressings. Dupuytren was partial to this bandage, not only in cases of compound fracture, but others where a frequent change of parts of the bandage was rendered necessary by the discharge.

As a general remark, we may say, that some apparatus of the foregoing kinds, a double oblique plane, or else splints, are unquestionably the most efficient of all the applications made to a broken limb, with the view of keeping the ends of the fracture steady, and in a proper state of contact.

"Splints," says, Pott, "are generally made of pasteboard, wood, or some resisting kind of stuff, and are ordered to be applied lengthways on the broken limb; in some cases three, in others four; for the more steady and quiet detention of the fracture.

"That splints, properly made and judiciously applied, are very serviceable, is beyond all doubt; but their utility depends much on their size, and the manner in which they are applied.

"The true and proper use of splints is to preserve steadiness in the whole limb, without compressing the fracture at all. By the former they become very assistant to the curative intention; by the latter they are very capable of causing pain and other inconveniences; at the same time that they cannot, in the nature of things, contribute to the steadiness of the limb.

"In order to be of any real use at all, splints should, in the case of a broken leg, reach above the knee, and below the ankle; should be only two in number, and should be so guarded with tow, rag, or cotton, that they should press only on the joints, and not at all on the fracture.

"By this they become really serviceable; but a short splint, which extends only a little above and a little below the fracture, and does not take in the two joints, is an absurdity, and what is worse, it is a mischievous absurdity.

"By pressing on both joints, they keep not only them, but the foot steady; by pressing on the fracture only, they cannot retain it in its place, if the foot be in the smallest degree displaced; but they may, and frequently do, occasion mischief, by rudely pressing the parts covering the fracture against the edges and inequalities of it.

"In the case of a fractured os femoris, if the limb be laid in an extended posture, one splint should certainly reach from the hip to the outer ankle, and another (somewhat shorter) should extend from the groin to the inner ankle. In the case of a broken tibia and fibula, there never can be occasion for more than two splints, one of which should extend from above the knee to below the ankle on one side, and the other splint should do the same on the other side." (See *Pott's Chir. Works*, vol. i. p. 298, &c. edit. 1806.)

Splints, double oblique planes, and other kinds of support for broken limbs, must always be lined with pads of tow, oat-chaff, or other soft materials, for otherwise their pressure would cause severe pain, inflammation, ulceration, and even sloughing.

Assalini strongly disapproves of the employment of all tight bandages, and of covering the whole of a broken limb with splints. He was called to a gentleman of rank at Paris, who had broken the knee-pan transversely. He laid the limb upon a concave splint, the shape of which was adapted to the under surface of a part of the leg and thigh. No bandage was used, merely two leather straps, which crossed upon the knee, and included the fractured bone. A perfect bony union was thus easily effected. Assalini afterwards extended the use of a concave splint, applied under the limb, to fractures of the leg and thigh. In the first of these cases, however, only the thigh is received in the hollow splint, and from this two lateral splints go along the leg. The apparatus has also a kind of sole for the support of the foot. As this simple contrivance is fastened with a very few straps, and no plasters, or bandages are used, the surgeon has constantly a view of the whole front of the limb, and of the fractured part of it. In compound fractures, he covers the wound with linen compresses, wet with cold water. (*Manuale di Chirurgia, Parte prima*, 1812.) See SPLINT.

So convinced is Baron Larrey of the advantage of keeping broken limbs perfectly motionless, after they have been properly set, that he sometimes employs an apparatus which moulds itself to the shape of the limb, then hardens, and remains applied during the whole of the treatment, unless circumstances call for its earlier removal. The apparatus is made by wetting the pads, compresses, and bandages in a lotion, containing the acetate of lead and white of egg, which, when it has dried, leaves the apparatus sufficiently hard and stiff to afford full support and steadiness to the limb, with the advantage of being most perfectly accommodated to the exterior of it. This plan is followed, not merely in simple, but compound fractures, and when there is a necessity for removing the patient any distance, is found by Larrey highly expedient.

In oblique fractures of the thigh, and sometimes even in those of the leg, the difficulty of accomplishing by the ordinary means a cure free from deformity, and especially without a shortening of the limb, led to the idea of employing permanent extension. This expression implies the operation of a bandage, or machine, which continually draws the fragments of the broken bone in contrary directions, at the same time that it restrains them from gliding over each other, and maintains them in contact during the whole time necessary for their union. In England, this practice has long been relinquished. It appears to have been chased away by the dazzling theory of relaxing every muscle in such manner as to render it incapable of displacing an oblique fracture. Desault saw, however, great inconsistency in the doctrine of the possibility of relaxing the muscles, so as to incapacitate the whole set of them connected with a broken thigh; and he never ceased to inculcate that a mechanical apparatus was the main thing by which the shortening of the limb was to be prevented. When we consider the treatment of fractured thighs, we shall find that the principle of permanent but moderate extension has had in France advocates of great talent and eminence, though it is a method to which many surgeons in this country entertain strong objections.

By means of permanent extension (observes Boyer), we not only succeed in uniting the frac-

ture, while the limb preserves its natural length; but, we afford the part a steadiness which is singularly favourable to the formation of the callus. In order to derive from permanent extension the utmost benefit, and render the method as little painful as possible, and supportable during the whole time of treatment, he recommended the machines and bandages to be constructed and applied conformably to the following rules.

We should avoid compressing the muscles which pass over the situation of the fracture, and the elongation of which organs is necessary to restore to the limb the length which it has lost by the gliding of the fragments over each other.

The extending and counter-extending force ought to be divided upon as large surfaces as possible.

The powers, making permanent extension, should act according to the direction of the axis of the broken bone.

The extension should be practised in as slow, gradual, and insensible a manner as possible.

Lastly; the parts, upon which the extending and counter-extending force acts, should be defended; and the compression, made by the tapes, or other pieces of the bandage and apparatus, ought to be equalised. (*Mal. Chir.* t. iii. p. 56. 59.)

If we consider the principles on which the mechanical means operate usefully in the treatment of different fractures, we shall find that they are various. For the most part, they have this effect by holding the ends of the fracture steadily in contact, maintaining the proper length of the limb, and hindering motion not only of the broken bone itself but of the joints connected with it, without which object being fulfilled, the fracture must always be liable to hurtful disturbance. In fractures of the shafts of the femur and humerus, and of the tibia, fibula and bones of the fore-arm, the apparatus acts beneficially in all or some of these ways; but, on certain occasions, it accomplishes its purpose, not by any direct action on the broken part of the limb itself, but by holding the limb in a particular position, and maintaining its due length. Thus, when the neck, or upper part of the thigh-bone is broken, the apparatus can have but an imperfect effect, by its direct operation on the fracture, this portion of the bone being, as it were, not within its immediate grasp. But, by holding the limb in the right position, keeping it steady, and preventing its retraction, and the eversion or inversion of the foot, it accomplishes all which it is in the power of surgeons to do, especially if care be taken to let the pelvis and broken portion of the bone be so connected together by the apparatus, as to render them, as it were, one piece, only moveable together, in every movement of the patient, or change in the surface on which he is lying.

Frequently position does every thing, without the slightest attempt to make any direct pressure on the fracture, or to act upon it immediately by any other means. This is exemplified in fractures of the clavicle, cases, in which, as well as several others, we see no splints at all employed, the requisite position of the arm and shoulder being maintained with a sling roller and pad in the axilla. Even in some cases where a splint is employed, it only operates by fixing the limb in the desirable position, as illustrated in fractures of the olecranon. In these last cases we do also use mechanical means to keep the upper fragment from ascending too far; but, in other instances, position

and quietude are the only principles in operation, as in the treatment of fractures of the coracoid and acromion processes of the scapula. Here the relaxation of the muscles by position, and quietude of the shoulder, are the only essential things to be attended to, and, whatever mechanical means are employed, are not designed to act directly on the broken parts of the bone.

Occasionally, the application of splints, bandages, and other mechanical means should be deferred. This is proper in fractures near joints, as of the olecranon, patella, &c. where the inflammation and swelling prohibit any compression of the part. Under such circumstances, the first indication is to subdue the inflammation by means of cold applications, bleeding, &c., care being taken, however, to lay the limb in a judicious position.

B. MEANS FOR PREVENTING AND REMOVING THE UNFAVOURABLE SYMPTOMS LIABLE TO ARISE FROM FRACTURES.

After having reduced the fracture, applied the apparatus for maintaining the reduction, and put the part in an advantageous position, the practitioner is to attend to another indication, viz. the prevention and removal of any unfavourable symptoms.

With the exception of a few simple fractures of the upper extremity, it is proper to allow for the first few days only very low diet. When the patient is young, and strong, and the swelling and inflammation considerable, venesection should be practised. In other circumstances, it may be dispensed with, because it is well known, that for the quick formation of callus, by which the fracture is to be united, strength and a vigorous circulation are highly favourable. The patient may be permitted to drink as often, and as much as he likes, of any cooling acid beverage. A very low diet is only to be continued the first few days, unless great inflammation arise; for experience proves, that the method, when too much prolonged, has bad effects, and tends, on the same principle as bleeding, to retard the union of the fracture.

Costiveness is to be obviated by the use of mild aperient medicines. It must be confessed, however, that in fractures of the lower extremity, the disturbance of the limb caused by the patient's being obliged to move himself, after taking a purgative, is seriously objectionable; but, perhaps, in all, and certainly in some, habits, the neglect to open the bowels soon after the accident, would have still more pernicious consequences. In order to lessen the disturbance, a bed-pan should be introduced under the patient. Here, also, I feel it my duty to recommend to the notice of the profession a very complete fracture-bed invented by my friend, Mr. Earle. One great convenience of this bed, the cost of which is moderate, is to enable the patient to void his feces, without the slightest change of position, or disturbance; an object effected by the simple contrivance of a little kind of trap, opening under the bed, out of which a small portion of the mattress admits of being withdrawn, and a tin receptacle is placed for the reception of what is voided from the bowels and bladder. Some other advantages of this apparatus will be hereafter briefly mentioned.

With respect to external applications, we should carefully avoid using all such plasters and ointments as irritate the skin, or create a disagreeable

itching; for they sometimes bring on erysipelas. The *emplastrum saponis* in common use is the best for all simple fractures, and it is the best, rather because it does no harm, than because it does any essential good. In some cases, and especially in summer, it is a good plan for the first few days to wet the bandages with cold water; for in this way, the tendency to inflammation and swelling may be considerably lessened. The surgeon, however, should recollect, that the bandage shrinks when wet, and may become so tight as to do harm, if not attended to. Solutions of the acetate of lead make the bandages stiff and hard; and as they are perhaps not more efficacious than cold water alone, the latter is sometimes preferred.

When a fracture is well set, the position of the part right, and the bandage and splints neither too tight, nor too slack, the less the broken bone is moved, and the less the apparatus and dressings are disturbed, the better. Sometimes, however, the practitioner is obliged to take off the splints, and undo the bandage, in order to ascertain that the ends of the fracture lie in even contact. Were he to leave the splints on the part too long, without ever being sure of this important point, he might find, when too late for alteration, that the fracture was in a state of displacement, and the limb seriously deformed. Hence, one reason for employing the eighteen-tailed bandage, or an apparatus, like that of M^r Intyre's, which admits of being opened, without disturbing the limb, or even without lifting it from the surface upon which it has been deposited.

In fractures of the lower extremities, particularly of the legs, it sometimes happens, the first two or three nights after the reduction, that the limb is affected with spasms, which displace the ends of the bone. Here, if the patient be young and strong, let blood be taken from the arm, the bowels be emptied, and opium, or morphia prescribed; strict attention being also paid to restore the ends of the fracture to a right position again. If they cannot be kept in exactly a good posture at first, they will admit of being so, after a few days, when the tendency to spasm has diminished.

When the callus has acquired some firmness, the patient should still keep the part or limb quiet, until the union is perfectly consolidated. And, in fractures of the lower extremity, even after the union has proceeded so far, that the splints admit of being left off, the patient ought not to venture to get out of bed, or bear upon the limb, till several more days have elapsed.

All fractures, however simple and well treated they may be, are constantly followed by weakness and stiffness of the limb. These unpleasant consequences are the greater, the more violently the limb has been contused, the nearer the fracture is to a joint, and the longer the part has remained motionless, and without exercise. The stiffness always affects the inferior joint of the broken bone, much more than the superior. For the relief of these effects of fractures, it is customary to employ friction, liniments, emollient applications, cold washes and bathing; but, sometimes, notwithstanding such remedies, the member does not quickly recover its strength, but continues stiff and weak for a year, or even a longer time. The most effectual plans for the prevention of this state should therefore be resorted to early. These consist in making the joints nearest the fracture execute

slight motions, as soon as the union is sufficiently advanced, not to be in danger of interruption from this practice. A great deal of caution, however, is necessary in moving the part, and it is safer for the surgeon to superintend the business himself, than leave it to the patient, or others. One of the best proceedings also for the hinderance of much weakness and stiffness in the limb after a fracture, is to discontinue the splints and tight bandages, immediately the state of the callus will allow. The manner in which their pressure retards the circulation, and prevents the action of the muscles, is one of the principal causes of the stiffness of the limb, and, consequently, the sooner they can be safely left off, the sooner will the patient regain the free use of the limb.

In France, the chief division of fractures is into *simple* and *complicated*, which last includes, amongst many varieties, the cases which we name *compound*. We shall here briefly notice a few of the complications, and the particular treatment which they require.

Fractures (says Boyer) are always attended with a certain degree of contusion, which is constantly more severe in cases where the violence has acted directly on the situation of the fracture. But such contusion can only be regarded as a complication of the accident, when it exists in so violent a degree as to demand a different treatment from that which is employed in simple fractures.

In this circumstance, the splints and bandage should be applied rather slackly, and the latter ought to be wet with cold water, or some resolvent lotion. The patient is to be bled more or less freely, according to his age, the state of his constitution, and violence of the contusion. The next day, the splints and bandage should be opened; a thing highly necessary to be observed; for where it has been neglected, the limb has been known to mortify, in consequence of the swelling having rendered the bandage too tight. (*Boyer, Mal. Chir. t. iii. p. 63, 64.*)

In simple fractures, it does not often happen, that a large artery is wounded; but when the injury does occur, and a diffused aneurism takes place, the surgeon is to expose the vessel by an incision, and apply a ligature above and below the opening. We are to be careful, however, before resorting to the operation, that the tumour is not a venous extravasation, which may almost always be dissipated by resolvent applications.

Fractures are sometimes complicated with a dislocation. Here, if possible, the luxation should invariably be reduced before the fracture is set. The possibility of reducing the dislocation (says Boyer) depends upon the species of articulation, the situation of the fracture, and other circumstances of the case. When it is a ginglymoid joint, when the ligaments are lacerated, and the swelling is not considerable, the luxation may be reduced easily enough; but when it is an orbicular joint, surrounded by numerous muscles, and when the fracture is near the articulation, and situated below the dislocation, the reduction of the latter is impossible. The attempt, indeed, would be injurious, because the necessary extension could not act upon the upper fragment; and were it to operate upon the lower, it could only have the effect of painfully stretching the muscles, and perhaps lacerating them. The fracture, therefore, should be at first attended to, and after its firm union, an ea-

detestable may be made to rectify the dislocation. Boyer conceives, that there will be more probability of success, when care is taken to move the limb gently, as soon as the state of the callus will permit it. He also recommends the employment of anobstinate relaxing applications. He confesses, however, that the attempt rarely succeeds after the perfect union of the fracture. There are, it is true, examples, in which old dislocations may be reduced; but these are cases which are not complicated with a fracture; an accident which always renders the muscles and ligaments so stiff, that they cannot yield to the extension requisite for the reduction. "I do not know (says Boyer) that a luxation, complicated with fracture, has ever been reduced, when the nature of the joint, and the circumstances of the case, prevented the treatment from beginning with the reduction of dislocation." (*Mal. Chir.* t. iii. p. 79.)

COMPOUND FRACTURES.

Here the first question is, whether an attempt should be made to save the limb? If the first opportunity of amputating be lost, there may never be another. Inflammation comes on, and the constitutional disturbance may prove fatal, and no second opportunity may present itself. In some cases, traumatic gangrene will invade the limb, and hardly leave time for the surgeon to amputate. Indeed, after it has once begun, so rapid is its progress, that unless the operation be immediately performed, the patient's doom is sealed. Hence, in this kind of mortification, it is now a maxim not to wait for the red line of demarcation, but to remove the limb without the least delay, even though the mortification may be in a spreading state. With the exception of this case, if the first opportunity of amputating has been lost, the surgeon must wait until the constitutional disturbance has partly subsided, before the knife can be used. This period may occur on the establishment of suppuration. But whether he ought now to amputate or not, will depend upon the extent and nature of the local injury; whether the soft parts are severely contused and lacerated—the bones crushed and comminuted—the degree of suppuration—the state of the pulse, &c. Under doubtful circumstances, the surgeon may yet be disposed to persevere in his endeavour to save the limb, and sometimes ultimately succeed in bringing the patient through all dangers; in extricating him from the weakening effects of repeated abscesses, profuse suppuration, &c. But in other instances, the long continuance of the suppuration—the presence and formation of dead bone—the diseased state of all the cellular tissue—the implication, perhaps, of a neighbouring joint in the mischief, and the urgency of the hectic disturbance of the system, will compel the surgeon to amputate.

Supposing an attempt is to be made to save the limb, then the first indication is to reduce the fracture. For this purpose, lay the limb on the splint or apparatus, with pad, &c., and attend to the relaxation of muscles. When the protruding end of the bone cannot be returned, it is to be sawn off, or the wound enlarged.

When the fracture is comminuted, such fragments as are perfectly detached, quite exposed, and near the surface, are to be extracted.

The second indication is to bring the sides of the wound together, with an adhesive plaster; or after

its edges have been approximated, the wound may be covered with lint, moistened with the blood, as advised by Sir Astley Cooper; and if the wound unite, the compound fracture is at once converted into a simple one. With the view of keeping off inflammation, the bandages may be wetted with cold water.

In all leading points, the treatment of compound fractures is like that of simple, with the exception of measures called for by the wound itself; the higher degree of inflammation; the abscesses; the detached pieces of bone; the splinters, or sequestra; and the more severe constitutional disturbance. The same attention to keeping the ends of the bone in their proper position, and completely at rest, is even more urgently necessary.

As the presence of a suppurative wound, and the frequent formation of matter, render it indispensable to undo the bandage more frequently than in simple fractures, it should always be a maxim to employ such splints, bandage, or apparatus, as will admit of this being done, as often as necessary, without any disturbance of the fracture. The frequent occasion to apply leeches, is another circumstance rendering it important to choose an apparatus which will admit of this being done without disturbing the limb.

An apparatus, which will allow the surgeon to get at almost any part of the circumference of the limb, is particularly advantageous. Hence the superiority of M'Intyre's and Greenhow's apparatus, and the use of fracture-boxes.

While inflammation prevails in a high degree in the early stage of the case, the splints should not be tightly applied, and cold evaporating lotions and leeches may now be of great service. Venesection may also be beneficial when the patient is strong and full of blood; and saline purgatives and opium should be given.

One rule is to make early openings for the discharge of abscesses, and to let them be free and depending. Another maxim is to take away sequestra as soon as exfoliation is sufficiently advanced.

In tedious severe cases, patients sometimes fall victims to sloughing over the sacrum or trochanters. In the suppurative stage, attended with hectic symptoms, there is an obvious necessity for supporting the constitution, by means of tonics, sulphate of quinine especially, and light nutritious food, and wine. In this stage, opium, pure air, and cleanliness, will be of vast importance.

OF HÆMORRHAGE IN COMPOUND FRACTURES.

Profuse arterial bleeding is chiefly seen in compound fractures of the leg; but it may happen in those of the thigh, or humerus. If a wound of the anterior or posterior tibial artery be conjoined with a violent contusion and extensive laceration of soft parts, comminution of bone, or long fissures of it extending into, or near the joint, amputation will generally be most prudent. In the opposite circumstances, the wound of the artery is not an adequate ground for removing the limb. In the treatment of such an accident, pressure and cold applications are inefficient, and it is indispensable to employ the ligature. Then the question is, whether the wounded part of the artery should be exposed and tied, or the femoral artery itself taken up. Dupuytren and Delpech, instead of adding to the mechanical injury of texture, already existing

in the fractured part of the limb, advocated and practised the latter measure, with decided success. In this way, the bleeding was commanded without any additional disturbance of the broken part of the limb. If we look over the particulars of cases, where operations were practised to secure the anterior or posterior tibial artery, in compound fractures, we shall find, that the result has commonly been mortification of the limb, and the patient's death. However, if the anterior tibial artery were wounded in the lower third of the leg, where its place is superficial, I think, that the plan of securing it here, would then be preferable to that of taking up the femoral artery.

OF THE FORMATION OF CALLUS, AND THE CONSOLIDATION OF FRACTURES.

In the treatment of fractures, the whole business of the surgeon consists in putting the displaced extremities of the bone into their natural situation again; in keeping them in this position by means of a suitable apparatus; in endeavouring to avert unfavourable symptoms, and in adopting measures for their removal, when they have actually occurred. The consolidation of a broken bone is (strictly speaking) the work of nature, and is effected by a process, to which a good constitution, with as little disturbance of it as possible, is above all things propitious.

The process, alluded to, is that by which the new bone, or the *callus*, as it is termed, which forms the uniting medium, is produced.

OF THE TIME REQUISITE FOR THE FORMATION OF THE CALLUS, AND OF CIRCUMSTANCES, WHICH FAVOUR, RETARD, OR PREVENT IT.

Surgical writers have been absurdly anxious to specify a determinate space of time, which should be allowed for the formation of the callus, as if this process always went on in different cases with the same uninterrupted regularity. Forty days were often fixed upon as necessary for the purpose. This doctrine is not only false, but dangerous, inasmuch as patients have been thereby induced to suppose themselves cured, before they were so in reality, and have consequently moved about too boldly, and thus run the risk of occasioning deformity, or a new fracture. It is impossible to determine precisely, and in a general way, the period requisite for the cure, because it differs according to a variety of circumstances. When it is stated, that the callus is usually formed between the twentieth and seventieth day, sooner or later, according to the age and constitution of the patient, the thickness of the bone, the weight which it has to support, the state of the patient's health, &c. we are to understand, that the whole of the process of osseous union is not yet effected, and only that the bone has generally attained a sufficient degree of firmness to admit of the apparatus being discontinued.

1. *Age.* Fractures are consolidated, *ceteris paribus*, with more ease and quickness in young subjects, than in adults, or old persons. In general also, the callus forms more speedily in proportion as the individual approaches to infancy. In two children, whose arms had been broken in difficult labours, De la Motte found the humerus united in twelve days, by a very simple apparatus. In fact, at this period of life, every part has a tendency to grow and develop itself, and the vitality

of the bones is more active, their vascularity greater, their gelatinous substance more abundant. On the contrary, in advanced age, the parts have lost all disposition to development, the vascularity of the bones is in a great measure obliterated, and (to use the expression of Boyer) their vitality is nearly annihilated under the mass of phosphate of lime, which accumulates in them.

2. *Constitution.* A fracture is united much sooner, in a strong healthy person, than a weak unhealthy subject. Sometimes, the consolidation is prevented by some inexplicable unknown cause, nothing wrong being remarkable either in the constitution, or the part. Ruysch and Van Swieten met with several cases of this kind, in which the patients were apparently quite healthy, and judiciously treated; and there are few surgeons of much experience, who are not acquainted with similar examples.

3. *Thickness of the Bone, and Weight which it has to support.* The bones are thicker and larger, in proportion as they have a greater weight to bear, and as the muscles inserted into them are more powerful. It is observed, *ceteris paribus*, that the larger the bones are, the longer is the time requisite for their union. Thus a broken thigh-bone is longer in growing together again, than a fractured tibia; the tibia longer than the humerus, the bones of the fore-arm, clavicle, ribs, &c.

As it is not till the definitive callus of which I shall hereafter speak, has been formed, that the bone acquires full strength, and a considerable time is necessary for the completion of that callus, the fact teaches us the prudence of never letting the bone be subjected to much violence, or any great efforts made with the limb, while its firmness depends only upon the provisional callus, the formation of which will be presently explained. Hence one reason, why fractures of the arm are sooner cured than those of the tibia, and why six or eight weeks at least are necessary in the treatment of a broken thigh-bone, which of itself has to support in progression all the weight of the trunk.

4. *State of Health.* Fractures unite with more quickness and facility, when the patient enjoys good health. The scurvy has a manifest and powerful effect in retarding the consolidation of fractures, and even in causing the absorption of the callus several years after its formation, so that a bone becomes flexible again at the point, where it was formerly broken. In Lord Anson's Voyage, this phenomenon is particularly recorded. (See p. 142. edit. 15. in 8vo.) Langenbeck is acquainted with several cases, in which the provisional callus at the end of eight weeks became again soft, and the bone flexible, in consequence of the patients being attacked with fevers, or erysipelas. (*Neus Bibl.* b. i. p. 90.) Cancer, lues venerea, and rickets, are also stated by surgical writers to obstruct, and sometimes hinder altogether, the formation of callus.

With respect to the union of broken bones being prevented by disease, Sir Benjamin Brodie believes, that this may be the case, where there is an abscess in the bone, a necrosis, or some other conditions. "I know, however," he observes, "that the rule is not *absolute*; for, in a great many instances, where the bone is diseased, it will unite perfectly. I had a patient, who had disease

of the bones, whether it arose from syphilis, mercury, or a cachectic state of the constitution, I cannot say; however, some of the bones had nodes upon them, and were very much enlarged. The principal enlargement was in one of the clavicles. There was a portion of this bone enlarged, and much diseased besides. This man, in using his arm, broke the collar-bone, the fracture going through the diseased part. I bound up his arm, and concluded, that there would be no union; but to my surprise, it united quite as soon as ordinary fractures. Women, labouring under cancer of the breast, are very liable to a similar disease of different bones in the body. Sometimes this disease, which is indicated by pains, like those of rheumatism, will affect nearly the whole of the bones, which then become brittle, and very liable to break. I first observed this fact, many years ago, in the case of an old woman, who was dying of cancer, and who, in turning one day in bed, broke the thigh-bone. I concluded that the broken bone would not unite; but, union took place as well as under ordinary circumstances. I attended a lady, two years ago, who had cancer of the breast, and pains in the limbs, indicating cancerous disease of the bones. There was a scirrhus affection of the collar-bone; and one day, in moving her arm, the collar-bone was broken; but, it united, just as if it had been a healthy bone." (Sir B. Brodie, in *Lond. Med. Gaz.* for 1833, 34. p. 56.) The truth of the latter statement has been proved in the case of a woman, with a cancerous breast who has been a patient in the North London Hospital more than once under Mr. Liston, for spontaneous fractures, which have always united again tolerably well. I was once called to a gentleman's coachman in Montague Mews, for a retention of urine, dependent on a cancerous disease of the bladder. A few days afterwards, his thigh-bone broke, as he was turning in bed; and, in the course of another week he died. The post mortem examination detected a scirrhus tumour under the periosteum, surrounding the fractured part of the bone; and one of the ribs, which had given way, was similarly encompassed. The history of the case is recorded in the *Med. Chir. Trans.* vol. xvii. and the specimens are preserved in University College Museum.

Fabricius Hildanus has cited two cases, which tend to prove, that the union of fractures is retarded by pregnancy. (*Cent.* 5. obs. 87. *Cent.* 6. obs. 68.) Alanson has also related a case in which the union, which had been delayed during pregnancy, took place after delivery; (*Med. Obs. and Inq.* vol. iv. No. 37.) and Werner has published an account of a fracture of the radius in a pregnant woman, where the cure was apparently retarded for a long time by this circumstance, and though the union took place previously to delivery, the callus was not very firm till after that event. (*Richter, Bibl.* b. xi. p. 591.) From facts, however, mentioned in a preceding page, there can now be no doubt, that pregnancy frequently does not prevent the formation of callus in the ordinary time, though the observation of Mr. Wardrop is true, that many instances have been observed of bones fractured during pregnancy, never showing any disposition to unite till after delivery. (*Med. Chir. Trans.* vol. v. p. 369.)

Besides the remarks, made here and in a fore-

going page on the causes preventing the union of fractures, a few additional observations on the same subject will be introduced in the sequel of this article, when I speak of the modes of attempting the cure of old disunited fractures.

OF SOME CIRCUMSTANCES NECESSARY FOR THE CONSOLIDATION OF FRACTURES.

Three local circumstances were insisted upon by Boyer, as necessary to obtain a firm callus, without deformity. 1. The two fragments must be possessed of sufficient vascularity. 2. The surfaces of the fracture must correspond. 3. They must be kept in a completely motionless state.

The two fragments must be sufficiently vascular. If one of them should be too scantily supplied with blood, the fracture would be incapable of union. This is what may happen in certain fractures of the neck of the femur, where the head of this bone is entirely detached, and the ligamentous substance, which is reflected over its neck, and serves as its periosteum, is totally lacerated, as well as the vessels, which ramify upon it. Hence, the upper fragment, lodged in the cotyloid cavity, may no longer receive from the vessels, sent to it through the ligamentous teres, a sufficiency of blood for the formation of callus, with any degree of certainty. This is especially likely to be the case, when the patient is far advanced in years, and the vessels considerably lessened in diameter. An adequate circulation must exist in both portions of bone; for, without it, the attempt at union will fail.

The surfaces of the fracture must correspond. This circumstance is not absolutely necessary for the consolidation of the fracture; but, without it, the formation of the callus will be slow and irregular. For instance, in a transverse fracture of the thigh-bone, the fragments, after being displaced according to the thickness of the bone, may undergo a second displacement according to its length, by passing beyond each other. The surfaces of the fracture are then not at all in contact, and the portions of bone only touch each other by their sides. Here, at the end of the 1st month, the union will frequently have made but little progress; nor can the cure be accomplished without deformity and shortening of the limb.

The fragments must be retained in a motionless state. This condition is so essential to the formation of callus, that, if the ends of a fracture were daily moved, they could not unite. The two extremities of the bone would then heal separately, just like the sides of a wound which have not been put in contact. The ends of a fracture, however, which cicatrize separately do not (according to Boyer) always become smooth, nor is there ordinarily any capsular ligament. (*Mul. Chir.* t. iii. p. 86.)

OF THE FORMATION OF CALLUS.

Perhaps no subject has excited more discussion, than the formation of callus. The ancients ascribed it to the extravasation of a gelatinous fluid, which was called the osseous juice, and which, becoming hard, served to unite the ends of the broken bone, just as glue serves to unite two pieces of wood. Hence, in order to favour the production of callus, they were in the habit of recommending their patients to eat abundantly of every sort of viscid farinaceous aliment, the glu-

tinous parts of animals, and especially osteocolla, of which Fabricius Hildanus relates miracles.

But, if these accounts were true, callus must be inorganic; or else one would be compelled to admit, that the inspissation of an inorganic fluid was capable of producing an organised substance; which is an absurdity. Besides, observation demonstrates, that callus is an organised matter, like the substance of bone itself.

According to Duhamel, callus is formed by the periosteum, which he regards as the organ of ossification. When a bone is fractured (says this naturalist), the periosteum of the two fragments first grows together, and then swells, and forms a circular rising round the fracture. The thickened membrane is converted into a gelatinous substance, which soon becomes a cartilaginous matter. In this vessels are developed, and different points of ossification commence, which multiply and unite. Thus, when every part of the periosteum near the fracture is hardened and ossified, *this membrane is changed, as it were, into a sort of clasp, which extends over the two fragments, and holds them together.*

It was objected to Duhamel's theory, that, if a bone be slit longitudinally in the situation of a former fracture, the fragments are observed to have their substances blended completely together, and not simply to be in contact in the manner of two pieces of wood placed end to end, and kept in contact by means of a clasp. Duhamel, with the view of obviating this difficulty, supposed that the periosteum elongated itself from the circumference towards the centre of the bone, and that such continuation of this membrane underwent the same changes, as that portion which was contiguous to the fracture, and thus served to unite the ends of the fragments between which it was interposed. He admits, also, in some cases, that the *internal periosteum, or medullary membrane, may furnish productions extending between the ends of the fracture*, like the continuation of the external periosteum with which they become connected. Lastly, he supposed, that, in young subjects, whose bones had not acquired their full degree of hardness, the cartilaginous part was capable of extension, and that, in cases of fracture, it contributed to the more perfect union of the fragments.

The system of Duhamel was opposed by Haller and Dethleef, who, after a long series of experiments, came to the conclusion, that callus is formed by a gelatinous juice, which, exudes from the extremity of the fractured bone, particularly from the medullary texture, and is effused all about the fracture; that such juice is organised, forms a cartilage, and at length ossifies.

But, whatever difference there may seem to be betwixt this doctrine, and that of Duhamel, it appeared to Boyer to be merely in the mode of explaining the facts. All these observers noticed the same phenomena; and all the experiments of Dethleef accorded perfectly well with those of Duhamel. Both found, during the first days, immediately after the fracture, blood and lymph extravasated between the fragments, and a small tumour in the situation of the fracture. Both also remarked, that this tumour became softer, and that it afterwards formed a gelatinous, then a cartilaginous, and lastly, a bony substance, which

composed the uniting medium. But Duhamel contends, that the cartilage is produced by the periosteum, while Haller and Dethleef argue, that it is the production of the extravasated lymph.

Boyer thinks, that Duhamel imputes too much to the periosteum; but, that Haller and Dethleef were also wrong, if they supposed that an unorganised lymph could produce an organised substance by inspissation. (See *Le second Mémoire sur les Os, par M. Bordenave, recueilli et publié par M. Fougereux*, p. 124.) It appears to Boyer much more natural to believe, that the gelatinous lymph already contains the rudiments of organisation, which become visible as they are developed; just as it is usually believed, that the rudiments of all our organs are contained in the transparent mucilage, of which the embryo seems to consist.

The experiments of Duhamel and Dethleef were carefully repeated by Bordenave, who ascertained several new and interesting facts. The result was the same in regard to the phenomena observed; but the explanation of them was different.

Instead of attributing the formation of callus to the periosteum, like Duhamel; or to the extravasation of lymph, or fibrine, like Dethleef; Bordenave conceived, that broken bones unite again by a process analogous to that which nature employs for the union of the divided soft parts. His inference is principally founded on two facts generally admitted. 1st, That there is in the bones a vascular texture, designed to maintain the circulation in them. 2dly, That such texture dilates when fractures are uniting, as appears from the swelling in the situation of the fracture, without which swelling there could be no union. Bordenave further remarks, with Haller and Dethleef; 1st, That callus, at the commencement of its formation, appears to consist of a glutinous fluid effused from the ruptured vessels. 2dly, That this substance afterwards assumes the form of cartilage, to which certain vessels are distributed, which deposit the bony matter, and thus begin the generation of callus. 3dly, That the particles of bone, being all joined together, the callus changes into a porous substance, which in time becomes solid and compact, like the substance of bones.

John Hunter explained the formation of callus by the organisation of the extravasated blood, and its subsequent ossification. He noticed also the inflammation of the extremities of the bone, the softening and rounding of them, and the partial absorption of their osseous particles.

According to Mr. Howship, the first effect of fracture is the extravasation of blood between the fragments into the medullary cavity, and also into the periosteum, which is thus thickened. The blood coagulates, loses its colouring matter, becomes organised, assumes the appearance of cartilage, and is at length converted into bone. This latter change is first effected external to the fragments, and in the medullary canal, so that an osseous case is formed before the complete reunion of the fracture. (See *Med. Chir. Trans.* vols. vi., vii., and viii., and *G. Gulliver, in Edinb. Med. and Surg. Jour.* for July 1835. p. 44.) Mr. Howship's observations are interesting, as coinciding very much with those previously made by Duhamel, Villermé, Breschet, and Dupuytren.

John Bell looked upon callus as a regeneration

of bone, organised by the same action as that by which the original bone is formed. "It would appear, that this author had remarked the effusion of blood, and condensation of the soft parts at an early period, so as to form a sort of capsule around the fracture; for, Mr. Liston possesses a large drawing by Mr. Bell, in which these circumstances are clearly marked in a fractured femur." (*G. Gulliver, Op. cit.*) This drawing which as Mr. Gulliver states, is in the peculiar graphic style of Mr. Bell, I had an opportunity some time ago of showing to the surgical class of University College, London.

Troja had seen the extremities of a fractured bone covered in a few days with gelatinous matter, which was gradually converted into cartilage, and then into bone. He had also noticed the swelling of the periosteum to a certain period, and the subsequent diminution of its thickness, as well as the obliteration of the medullary cavity, near the fracture, by osseous matter.

The observations, made by Baron Larrey, lead him to reject, as erroneous, the doctrine, which refers the production of callus to the periosteum, and he adopts the opinion, that the union and reparation of bones are the work of their own vessels. He adverts to examples in which, after the use of the trephine in young subjects, the perforation becomes more or less closed by new bone, thrown out from the circumference towards the centre. Here, says he, the ossification assuredly can neither be referred to the pericranium, nor the dura mater. The first of these membranes has been extensively destroyed, and, if the second were concerned, a vertical substance, shutting up the opening, would be apparent. In further support of his opinions, Baron Larrey cites the well-known celerity with which fractures of the lower jaw unite, on account of the great vascularity of that bone; and he believes, with Sir Astley Cooper, that, if the ends of a fracture do not touch, in consequence of loss of substance, the intervening space remains unfilled up by new bone; a position, which seems rather repugnant to what he has said, concerning the mode of reparation after the use of the trephine.

With respect to the alleged impossibility of union, when fractures are attended with loss of substance, Mr. Gulliver observes, that the union of bone, under such circumstances, is common in the lower animals, and has been repeatedly observed in the human subject, of which a remarkable instance is recorded by M. Contrevoz. (*Mem. de l'Acad. de Chir.*) "Professor Syme showed me a case in the Royal Infirmary of Edinburgh, in which he had removed from the tibia of an adult male about an inch of the entire diameter of the bone, which had been completely reproduced; and I saw in the practice of Dr. Bushe of New York, a similar example in the femur of a young man, which was not followed by a shortening of the limb equal to the length of that portion of the shaft of the bone removed by Dr. Bushe." (*Gulliver, in Edinb. Med. Journ.* No. 124. p. 46.) If any doubt could exist on this point, it would cease on our remembering the occasional cures of disunited fractures, effected by sawing off the ends of the bone.

Larrey has often seen the superficial layers of the tibia exfoliate, after a necrosis produced by a cause, which had destroyed the whole of the periosteum on the front surface of that bone, as is sometimes the case in hospital gangrene. He has seen

these layers replaced by red vascular granulations, disposed in parallel lines, which granulations soon ossified, that is to say, phosphate of lime was substituted for the vermilion colour of the vessels, and gave the new-formed substance the appearance and consistence of bone. Lastly, this substance was covered with a new cellular membrane, derived from the adjacent textures; but, in the place of the cicatrix, a depression always remained, proportioned to the loss of substance. If the formation of callus depended on the periosteum, Larrey argues, that the broken patella could never unite by bone, as it is often found to do, when the fragments are kept closely in contact. Here he contends, that the union is brought about by the action and inosculation of the vessels belonging to the substance of the fragments themselves. Lastly, he adverts to preparations, in which the vessels of callus were successfully injected by the celebrated Soemmering. (*See Journ. Complém. du Dict. des Sciences Méd.* t. viii, p. 107, & c. 8vo. Paris, 1820.)

Mr. Liston, formerly, concided very much with Larrey. "To the surrounding soft parts (says he) has been attributed a great share of the work in the union of broken bones; and when bones have been fractured in circumstances not admitting of this assistance, the process of separation, it is said, cannot be accomplished. In dissecting a fractured limb, which has been removed during the process of union by callus, it will be found, that the new bone is uniformly attached to the sound part of the old, the vessels of the part employed in this process being much increased in size; the newly deposited bone, which in its turn carries on the process, being perforated by numerous and large foramina, for the entrance of corresponding ramifications of arteries. The new formations will be perceived shooting from the opposed ends till these are united; and the masses, in which they are deposited, will be direct, and but slightly prominent, or, on the other hand, irregular and unshapely, according as the separated ends are favourably or unfavourably placed. I can conceive it possible (says Mr. Liston), and, in fact, have frequently found new bone connected with the soft parts; but, this was the produce of a splinter which had still retained its vitality, and whose vessels had formed a contribution to the general action. Great powers, not only in the production, but also in the removal of bone, have been long allowed to the periosteum. No one, I will venture to say, has as yet detected this membrane in either of these acts. New bone has not been found adhering to the periosteum, either in fractures or necrosis; far less has a complete substitute, composed of the ossified periosteum, been ever discovered enclosing a sequestrum. In every instance, the new formation is deposited in nodules, adhering firmly to the old bone, and, as remarked above, freely perforated by nutritious arteries. The vessels of the bone, no doubt, are ramified on the external and internal periosteum; but it is only after their entrance into the perforations, that they become disposed to pour out ossific matter." (*Edin. Med. and Surg. Journ.* No. 78. p. 47.)

On this part of the subject, Mr. Gulliver informs us, that he has had frequent opportunities of seeing the new bone in the dense cartilaginous substance, surrounding the fracture, at an early period; and, "in some of these examples, the new formation might easily be turned off from the old bone without injury to the texture of the latter.

Mr. Symé possesses a fracture of the lower third of the femur, presenting numerous bony points in the dense substance around the injury, which have no connection with the old bone; and Mr. Liston very candidly showed me a fractured tibia, in which he had turned off a portion of new bone with the periosteum. Mr. Howship describes and figures a cartilaginous state of the periosteum, in which there was ossific deposit in the fracture of one of the lower animals, and he refers to Mr. Heavside's Museum for similar examples in the human subject, which appear to be conclusive. In fractures of the bones of rabbits, I have frequently seen the thickened and indurated periosteum the seat of ossific deposit, while the contiguous cellular texture became gradually condensed around the fracture. It appears indeed, that the fibrous and cellular tissues are of great importance in the reparation of fractures, and that the preliminary steps in the process are mainly dependent on these structures." (G. Gulliver in *Edinb. Med. and Surg. Journ.* No. 124. p. 53.) This is the doctrine of Andral, Dupuytren, and Cruveilhier, the latter of whom gives the case of a reparation of fractured spine, where the vessels of the contiguous fibrous textures had evidently contributed greatly to the work of ossification. (See *Anat. Pathol. Larr.* iv. pl. 4.)

For the most complete account of the process, by which broken bones unite, we are indebted principally to M. M. Villermé, Breschet, Sanson, Cruveilhier, and Dupuytren, all of whom, however, owe a great deal to their predecessors in the same field of inquiry, more especially to Duhamel. In 1808 Baron Dupuytren instituted certain experiments to determine the truth of the statements, made on this subject by Bordenave and Bichat, but was surprised to find nothing to justify their accounts, and he was led to adopt other views, partly founded, however, on those of Duhamel. The process is far more complicated, than represented by Bordenave and Hunter. Many years ago, Sir Benjamin Brodie also made experiments upon animals, with the view of elucidating this subject, and the preparations are still preserved. At that time he thought of publishing a paper on the union of fractures; but, before his investigations were completed, he found the whole matter so satisfactorily made out by Baron Dupuytren, that he was induced to relinquish the design. (See *London Med. Gaz.* for 1833-34. p. 54.) The results of Mr. Bransby Cooper's experiments seem also to agree very much with those arrived at by Dupuytren, due allowance being made for the greater celerity of the process in the bones of rabbits, than in those of the adult human subject. (See *Guy's Hospital Reports*, part 4.) The researches of M. M. Villermé, Dupuytren, and Breschet prove, that all the old descriptions of the process were too limited and exclusive. When a bone is broken, the soft parts near it are torn and contused, and the vessels of these, as well as of the periosteum and medullary membrane, assist in the reparation. It has long been familiarly known, that callus is not formed suddenly; that it requires more or less time for its production; and that the broken part of the bone only obtains solidity by degrees. Now, before the work of repair is complete, several changes happen, one after another, or in succession. Hence, the process is now usually divided by pathologists into four stages.

In the *first*, comprising a period of about ten days from the time when the accident took place, if the injured parts are examined, blood is found to be extravasated around the ends of the fracture, between them, and even in the medullary canal. The ecchymosis may extend to parts far from the fracture. Considerable inflammation and swelling ensue at the irritated points. The muscular fibres are confounded with the inflamed cellular tissue, and very soon cannot be distinguished from other parts. The periosteum becomes red, swollen, and softened, and a reddish serous fluid is effused between it and the portions of the bone, which it covers. The fibrous appearance of the ends of the bone disappears. The medullary membrane itself swells, inflames, and gradually obliterates the tube in the centre of the bone. The medulla acquires a greater consistence, and the portion of it in one fragment is conjoined with that of the other. If we look at what is passing between the ends of the fracture, we find, that the conglobated blood between them is absorbed in a few days, and replaced by a gelatinous fluid; and, between the fourth and the sixth day, the surfaces of the fracture are sometimes, but not always, covered by a reddish, fleecy substance. (See Dupuytren, *Clinique. Chir.* t. iv. p. 132.)

In the *second stage*, extending from the tenth to the twenty-fifth day, the swelling of the soft parts becomes firmer, and every day more intimately adherent to the substance between the ends of the fracture; and the muscles resume their usual appearance. This *tumour of the callus*, as it is termed by Baron Dupuytren, now diminishes in extent, and becomes more distinct from the surrounding parts. Its texture is homogeneous, very like fibro-cartilage, and divided with difficulty. Its fibres are parallel to the axis of the bone. The swollen medullary membrane, transformed into a fibro-cartilaginous texture, progressively lessens the central cavity of the bone, and at length fills it up. The internal production, or peg (*cheville*) resulting from these organic changes, becomes blended, on the level of the fracture, with the substance interposed between the fragments. (See Dupuytren, *Op. et t. cit.* p. 133.)

As the formation of the callus advances, other particularities are noticed, and these occur in what may be considered as the *third stage*, which begins about the twenty-fifth day, and is prolonged to the fortieth, or even the sixtieth. In weak constitutions, the process is not finished till the end of the third month. The firm, homogeneous, fibrous mass, constituting what Dupuytren names, the *tumour of the callus*, acquires by degrees a cartilaginous, and rather an osseous consistence. About the end of this period, the fragments are placed in the centre of a solid ferule, which adheres to every point of their circumference. This kind of ferule, or clasp, the very same thing which was accurately described by Duhamel, is covered by thickened periosteum, which is united to that which invests the sound portions of the bone, and no external traces remain of the solution of continuity. The surrounding cellular tissue is yet stiff and indurated. The soft substance between the fragments has become denser and more adherent to the extremities of the bone; but it is still far from uniting them with any degree of perfection. The central peg, continuing to extend itself towards the ends of the fracture, rapidly assumes a greater consistence,

and soon forms a very solid osseous cylinder. It is commonly at this period, that surgeons discontinue the apparatus; but the callus, now existing, is not to remain, and consequently Baron Dupuytren terms it the *provisional callus*.

Fourth stage. Between the third and the fifth, or sixth month, the tumour of the callus becomes gradually more compact; and the central ossification, or peg (*cheville*) undergoes the same transformation. The substance, interposed between the fragments, acquires all the organic characters, and the consistence of the firm substance of bone, from which it is only distinguishable by its particular colour. It is this intervening substance, transformed into an osseous tissue, which makes what Baron Dupuytren has named the *definitive callus*.

Finally, the central ossification (*la cheville*) assumes a lighter texture, cells are produced within it, and, after having been converted into a reticular texture, it disappears, leaving the central canal of the bone perfectly free again. After the restoration of the medullary canal, a medullary membrane, which invests the cells, becomes continuous with the membranethat lines it and secretes the medulla. Lastly, the external portion of the provisional callus, (for the central ossification may be looked upon as another part of it) disappears.

As Dupuytren further explains, the differences of fractures must occasion slight varieties in the formation of the callus. Thus, when the two ends of the fracture pass over one another, the internal cylindrical ossification, or peg, is not formed; and the case is the same, when the bone does not present a medullary canal.

This history of the process, by which fractures unite, must at once let us understand, that the period of forty days, sometimes specified as the time requisite for the consolidation, is far from being sufficient, and that it should be much longer in oblique fractures, and those where the ends of the bone ride over one another.

The same history would lead us to expect what certain facts prove, that, down to a certain period, when a fracture has united with much deformity of the limb, the surgeon may safely make the callus yield, so as to bring the limb into a better shape. Dupuytren has recorded cases, in which he accomplished this purpose in the leg, after the twentieth and even the fifty-ninth day, and in which, a deviation of the hand towards the radial side of the fore-arm was rectified as late as the twenty-fifth day. The advantage, now spoken of, may be obtained without breaking the callus, which is a substance endued with a certain degree of suppleness and elasticity. The fragments having been brought into a better position by the observance of the principles, recommended to be attended to in the reduction of fractures generally, the improved situation of the fragments is to be secured by mechanical means. Thus, as Dupuytren remarks, supposing there is a projection made by the end of one, or those of both fragments, the limb is to be placed between two inflexible planes, which compress it in two diametrically opposite directions. As the projecting points receive the greatest pressure, they tend to return to the level of the rest of the bone. If, by means of pads, the projection is increased, while a vacancy is left at the opposite point, then the effects produced will be still more marked, and even carried so far as to cause de-

formity in the other direction. The same improvement may be brought about, even without acting directly on the seat of the fracture, by employing the lower fragment as a lever, and applying an apparatus, calculated to incline it in the direction, that will bring it into a better position, with respect to the upper fragment. (*Dupuytren, Clin. Chir. t. iv. p. 147.*) The apparatus should be put on more tightly, than in a recent stage of fracture; but the manner, in which the limb bears the pressure must be vigilantly attended to. So long as the deformity is not entirely corrected, the apparatus should be opened every third, or fourth day, and fresh, but gentle, attempts at reduction made. Every little improvement made by each manual interference, is then to be secured by means of the bandage and apparatus. In this way, the natural shape of the limb will be gradually restored. The plan is not, however, to be continued too long, as it would altogether prevent union of the bone. Another maxim, laid down by Dupuytren, is, that, when the deformity has been considerable, the treatment after its removal, should be continued as long as if the case were a recent fracture. (*Clin. Chir. t. iv. p. 146—151.*)

The *provisional callus* then differs from the *definitive*, not only in point of situation, and time of its formation, and continuance, but in its inferior consistence and solidity. When completed, it only possesses the strength necessary to resist the moderate action of the muscles, and to support a certain weight. Nay, after the removal of the splints, it will sometimes yield to these forces, especially in oblique fractures. In the North London Hospital, I have now (April 1837) a patient, whose thigh was obliquely fractured in its upper third on the 1st of last October. After the limb had been kept in splints three months, and seemingly united well and without deformity, the apparatus was discontinued; but the mere action of the muscles, as the man lay in bed, produced a retraction of the limb three days afterwards. The fracture was then set again, and in another three months, union was again completed, and the apparatus removed. In four or five days, the callus yielded again, and now the fracture has been set for the third time.

The support of the provisional callus is frequently overcome by a blow, or rough use of the limb. Sometimes, it is weakened, or destroyed by the influence of constitutional diseases, fever, &c.

The *definitive callus*, though less bulky, is harder, stronger, and more compact, than the *provisional*. Hence, after the definitive callus has been completed, bones rarely, or never break in the exact situation of the former fracture. Excepting in very aggravated forms of scurvy, I believe, that the definitive callus is hardly ever disorganised and destroyed by the effects of constitutional diseases.

When the two ends of a fracture are in contact only at a point, it is here alone that the definitive callus can be produced; but, as a compensation, the external, or provisional callus is then never entirely absorbed.

In fracture of the neck of the thigh-bone, entirely within the capsular ligament, the provisional callus cannot reach the fracture, and, if bony union follow, it is effected by a process within the bone itself. "The instances, (says Mr. Mayo) in which union is effected through a process, originating in the bone itself, are fractures of the cranium, and of the neck of the thigh-bone, within

the capsular ligament. In the first of these cases, no provisional callus is formed; in the second, the provisional callus has no means of reaching the fracture. It is difficult to explain why a provisional callus does not form about fractures of the cranial bones. The physical cause of this negative phenomenon is not known. The final cause, however, is evident. If a hard swelling, such as a provisional callus, were stretched, as a ridge along the inner aspect of a cranial fracture, it would encroach upon the cranial cavity; and hemiplegia, epilepsy, or some other form of cerebral disorder would attend the cure of every fracture of the skull. No callus therefore is formed. But the fracture, after a time, shows a disposition to unite through forces inherent in the bone itself, &c. In a fissure of the skull, examined some months after the injury, the only change apparent is the rounding of the edges externally. After a year or two, the fissure is united at its internal or cerebral aspect. After the lapse of many years, the narrowest part of the fissure is entirely filled up. In persons, who have lived ten, twenty, or fifty years, after loss of portions of the cranium, the slow restoration of the bone appears to have been progressive for the whole period. In fifty years, a trephine hole is nearly closed by the shelving growth of bone from the margin towards the centre." (See *Mayo's Outlines of Human Pathology*, p. 8.) The causes of the difficulty of bringing about osseous union in such fractures of the neck of the femur, as are entirely within the capsular ligament, will be hereafter considered.

When the ends of a fracture only touch laterally, as I have stated, there is strictly no provisional callus. The vessels of the adjoining cellular tissue, muscles, and other textures, here greatly assist in the work of reparation. The side of one fragment becomes soldered to that of the other, and here the callus is permanent, or never removed. In such a case, there is no internal cylindrical ossification; no *cheville*, as the French term it; because it would evidently be of no service.

In compound fractures, followed by supuration, the bones remain disunited for many weeks. Here also no provisional callus is formed. The ends of the bones soften and granulate, and, in proportion as the secretion of pus subsides, the granulations begin to deposit the osseous matter, which is to constitute the uniting medium. This part of the subject was explained many years ago by John Hunter, and the late Mr. Wilson. (*On the Skeleton, Diseases of Bones, &c.* p. 233. 8vo., also *Dict. des Sciences Méd.* t. xxxviii, p. 486.)

Fractures of the patella, olecranon, condyles of femur, coronoid process of ulna, acromion, and coronoid process of the jaw, are generally united by a ligamentous substance.

Broken cartilage does not unite by cartilage, but by means of osseous matter, deposited around the solution of continuity, in the manner of a provisional callus, which, however, is here permanent.

As the provisional callus in adults never begins to ossify before the tenth day, we know, that, if great inflammation, or other causes, forbid the application of mechanical means during this period, no permanent deformity will be the result of deferring the employment of splints, bandages, &c. On this principle, and, with the view of letting the limb get into a more favourable state to bear the pressure of mechanical means, Sir Stephen Love Ham-

mick does not usually apply any apparatus during this stage. In infancy, however, where the callus is completed with surprising quickness, the surgeon must be careful to set the fracture without delay.

OF THE CONDUCT TO BE ADOPTED AT THE ORDINARY PERIOD OF THE CONSOLIDATION OF FRACTURES; AND OF UNUNITED FRACTURES, AND FALSE JOINTS.

When the requisite time for a broken bone to become firmly united has elapsed, it is proper to examine carefully and cautiously the place of the fracture, in order to learn whether the callus has acquired a suitable degree of strength. If the bone should be found to bend in the least at the injured part, the callus is not sufficiently strong, and the limb should be immediately put up in the apparatus again, with the view of preventing a new fracture, or, at all events, deformity.

For the same reason, the patient should not be allowed to make free use of his limb, as soon as the fracture has united. In fractures of the lower extremity, he ought to use crutches, and only let the weight of the trunk by degrees bear upon the injured limb. From neglect of this precaution, the callus has been known to be absorbed, the limb to be shortened, and the patient become a cripple. An accidental slip may also produce the fracture again; for the provisional callus, so far from being firmer than the rest of the bone, is at first considerably weaker.

That the state of the constitution has vast influence over the process by which broken bones are reunited, is unquestionable. Schmucker found the formation of callus, even in the most simple fractures, sometimes delayed eight months, and, in one example, more than a year; but, all the patients were unhealthy. (*Vermischte Chir. Schriften*, b. i. p. 26.)

There are certain indescribable constitutions, in which bones, particularly the os brachii, will not unite again after being broken. These temperaments are also exceedingly various; at least, I infer so from two subjects, to whom I paid particular attention. One was a strong, robust man, whose chief peculiarity seemed to be his indifference to pain: the ends of his broken humerus were cut down too, turned out, and sawn off by Mr. Long, in St. Bartholomew's Hospital, and the limb was afterwards put in splints, and taken the greatest care of; but no union followed. The other case was a broken tibia and fibula, which remained disunited for about four months; but afterwards grew together. The latter subject was a complete instance of hypochondriasis. I afterwards saw a woman, under Sir James Earle, in the above hospital, whose os brachii did not unite, though it had been broken several months. Every attempt to move the bone occasioned excruciating torture. The woman died of some illness in the hospital, and, on dissecting the arm, the cause of the fracture not having united was found to arise from the upper, sharp, pointed extremity of the lower portion of the broken bone having been forcibly drawn up by the muscles, and penetrated the substance of the biceps, in which it still remained. I am indebted to Mr. Earle for the description of the appearance in the dissection, and I do not know, that this kind of impediment to the union of a fracture has been noticed by any earlier writer than Mr. Charles White, who appears to have

conceived the possibility of the occurrence, (*Cass in Surgery*, p. 70. edit. 1770.)

Sir Benjamin Brodie attributes the want of union mostly to the state of the constitution. "A gentleman (says he), was growing fat, and not liking to do so, he placed himself on a very spare diet, though accustomed to good living previously. After six months of starvation, he broke his arm, and the bone would not unite. I saw him many months afterwards, and there was scarcely any union even by soft substance. Another patient, about whom I was consulted, a lady, was growing fat, and thought she would also prevent it by pursuing a similar system of diet. Some months afterwards she broke her arm, and union did not take place." A man broke his thigh, and remained ten days without any action of the bowels: no union of the fracture ensued. The same distinguished surgeon adverts to other facts, which tend to prove, that tight bandaging, and other circumstances, unfavourable to a free circulation in the limb, may prevent union. (*See Lond. Med. Gaz.* for 1833-34, p. 57.)

It is observed by Larrey, that the gunshot wounds of the extremities, complicated with fracture, especially with that of the humerus, received by the soldiers of the French army in Syria, were almost all followed by the formation of accidental joints. The two fragments of the broken bone continued moveable, their asperities and projecting angles having been destroyed by friction, and their ends being rounded and covered with a cartilaginous substance, so as to facilitate the motions which the patients executed in various directions, in an imperfect manner, and without pain. Larrey acquaints us, that many invalids were sent back to France with such infirmity.

"I ascribe," he says, "the causes of these accidental articulations:

1. To the continual motion, to which the wounded soldiers were exposed, after their departure from Syria, till their arrival in Egypt, in consequence of their having been obliged either to walk this journey on foot, or to be carried it on beasts.

"2. To the bad quality of the food, and the brackish water, which the men were under the necessity of drinking in this painful journey.

"3. To the state of the atmosphere of Syria, almost entirely destitute of vital air, and impregnated with pernicious gases, issuing from the numerous marshes, near which we were a long while stationed.

All these causes may have prevented the formation of callus, either by diminishing the quantity of the phosphate of lime, or moving the bones out of that state of coaptation, in which they should constantly lie, in order to unite.

Bandages, embrocations, rest, and regimen, proved quite ineffectual." (*Larrey, Mém. de Chir. Mil.* t. ii. p. 131, 132. *Langenbeck, N. Bibl.* b. i. p. 81.)

The presence of an ulcer, a sinus, loose splinters of bone, a necrosis, or other suppurating disease, near a fracture, is a circumstance that often seriously retards or completely prevents the formation of callus. How frequently have I noticed, in compound fractures, that, while the wound suppurates largely, and while there are spiculae and dead portions of bone unextracted, no solid union takes place; but that, as soon as the wound,

ulcer, or sinus admits of being healed, and the suppuration ceases, ossification goes on in the most favourable manner. Schmucker relates a case, illustrating the truth of these observations, where the tibia and fibula were broken so obliquely, that the ends of the fracture could not be made to lie well, a necrosis of a portion of the tibia followed, and no callus was formed at the end of eight months, when a sinus on each side of the leg still continued. This eminent surgeon now laid the sinuses open, and extracted the dead pieces of bone, by which means the impediment to the formation of callus was removed, and the fracture, which had till then remained loose and moveable, became firmly united in two months. (*Vermischte Chir. Schriften*, b. i. p. 25, 26.)

A little boy was brought into the North London Hospital, with fracture of the humerus, and extensive laceration of the skin, but the wound had no communication with the fracture. A good deal of suppuration ensued from the wound, and afterwards large abscesses formed, followed by the detachment of a dead portion of bone. The fracture did not unite.

Fulse joints, which occur in cases of fracture without union, have been generally supposed to resemble common joints. According to Boyer, this opinion is incorrect. The ends of the fracture, which are sometimes rounded, and sometimes pointed, are connected together by a cellular and ligamentous substance. But, their surfaces are not covered by a smooth cartilaginous matter, nor is there constantly a capsular ligament. "I am convinced of this fact, by the dissection of several ununited fractures, the fragments of which are preserved in my museum." (*Boyer*, t. iii. p. 94.) And, in another place, the same Professor, speaking of these false joints, remarks: "I repeat that I have never found, in their structure, any thing which could be compared with an articulation; neither capsular ligament, nor smooth cartilaginous surfaces. On the contrary, I have invariably found, in the false joints of the thigh-bone and humerus, which I have had opportunities of dissecting, a fibrous ligamentous substance, extending from one fragment to the other, and it is very probable, that, with some modifications, it is the same with all the other cases, which I have not seen.

"But, in the fore-arm, the ends of the fracture may assume a structure, which bears a greater resemblance to an articulation. This is what happened in an example, which was communicated to Bayle by Sylvestre, in the *République des Lettres*, *Juillet*, 1685, p. 718, &c. A similar case is recorded by Fabricius Hildanus, *Obs.* 91. *Centur.* 3." (*Boyer, Mal. Chir.* t. iii. p. 101—103.)

On this subject, Langenbeck observes, that the edges of the fragments heal, and resemble those of a hare lip. "When the parts are incessantly moved, the end of one fragment becomes excavated, in the form of an articular cavity. I have in my possession (says he) a lower jaw, and an olecranon, the fractures of which are not united. For the connecting medium, nature has provided a white substance, resembling ligament. In a mule patient, I have also seen an articular connection established in the body of the thigh-bone subsequently to a fracture." (*Neue Bibl.* b. i. p. 93.) When a capsule has been formed, it is alleged not to be of a ligamentous nature. (*Bichat, Anatomie Générale*, t. iii. p. 191.)

In the Hunterian Collection may be seen a false joint in the bones of the fore-arm, where the resemblance to a natural articulation was greater, than what Boyer has seen in other situations.

According to Professor Sharpey, the connection is mostly by means of a tough, fibrous, ligamentous-looking mass; and the nearest approximation to a new articulation, which occurs, consists in the existence of cavities, more or less extensive, between the fibres of this connecting substance. (See *Syme's Principles*, ed. ii. p. 161.) The bond of union is stated to differ from ordinary ligament in presenting no fibrous appearance. Sir Benjamin Brodie, who has made this remark, coincides with Boyer, with regard to the ordinary mode of connection; admitting, however, the occasional formation of a new, or false joint, where "the rounded ends of the bones are covered by a thin ligamentous substance, and the inner surface of the capsule is lined by a smooth membrane, like the synovial membrane, and capable of secreting synovia." (See *Lond. Med. Gaz.* for 1833-34, p. 57.)

A valuable dissertation on false joints was published by Reisseisen, entitled "*De Articulationibus analogis, quæ Fracturis Ossium superveniunt.*"

A false joint in the arm, or fore-arm, does not absolutely prevent the motion of the limb, which may yet be of considerable use; but, when the disease is in the thigh or leg, the member cannot support the weight of the body, and the patient is unable to walk without crutches.

The diversity of causes, which may be concerned in preventing the union of fractures, plainly shows, that the treatment should be different in different cases.

When the want of union is ascribable to the ends of the fracture not being in a state of coaptation, and to their having been moved about too frequently, the obvious indications are, to set the fracture better, and to take adequate measures for keeping its extremities in contact and perfectly motionless.

If the union has been prevented by a portion of muscle, or other soft part, getting between the ends of the bone, the only means of affording a chance of union would be cutting through the integuments, removing the displaced soft parts, and placing the ends of the bone in contact. (*Wardrop, in Med. Chir. Trans.* vol. v. p. 363.)

When the advanced age of the patient seems to be the cause of the union not taking place, the application of the proper apparatus is to be continued a considerable time, since experience proves, that, in old subjects, the cure of fractures often requires many months. In such examples, also, tonic and cordial medicines, with a nutritive diet, are highly proper.

Any thing in the state of the constitution, likely to account for the want of union, should be removed or rectified. "One patient may require to be put upon a better diet; another may require purgative medicine; another may stand in need of tonics. Mr. Wilson used to relate the case of a woman who was a dram-drinker, and who broke her leg. At first, she was not allowed to take her customary drams, and the bones showed no disposition to unite. At last, she was allowed to take a certain quantity of spirit, and union took place immediately." (*Brodie, Op. et vol. cit.* p. 56.)

When several months have elapsed since the

accident, and there is reason to apprehend that a preternatural joint or a ligamentous union has taken place, a variety of local plans have been proposed.

Here, I may remark, that no severe operation will be justifiable, unless the inconvenience, arising from the want of bony union, be considerable. If a broken rib were not to unite, by osseous matter, it would be of little consequence. I opened an old man, who was in this state, yet he had never complained of it, nor indeed had he ever been aware of it. Sir Benjamin Brodie has a specimen of a joint, formed in a rib after fracture; and the patient was believed to have suffered little or no inconvenience from it. (See *Lond. Med. Gaz.* for 1833-34, p. 58.)

The most ancient method of treatment is that of forcibly rubbing the ends of the fracture against each other, so as to make them inflame, and take on a disposition to form callus. This plan was recommended by the late Mr. John Hunter, and has had the approbation of many other distinguished modern practitioners. In a disunited fracture of the leg or thigh, Mr. Hunter used to let the patient get up, and attempt to walk with the splints on the limb, so that the requisite irritation might be produced. The idea of exciting a degree of inflammation in the situation of the fracture, certainly appears rational, and the practice has been attended with a degree of success. Mr. White records an example, in which he cured a broken thigh on this principle, a strong leather case having been made for the limb. (*Cases in Surgery*, p. 75.) A broken tibia, treated on similar principles, is mentioned by Mr. Amesbury. (*On Fractures*, p. 211. ed. ii.) The method is spoken of in Celsus: *si vetustas occupavit, membrum extendendum est ut aliquid lædatur: ossa inter se manu dimovenda, ut concurrendo exasperentur, et ut si quid pingue est, eradatur, totumque ut quasi recens fiat, &c.*

I have seen cases, in which the union was thus brought about. "In numerous instances (says Sir Benjamin Brodie,) I have known patients in the hospital kept in bed for ten weeks, and even longer, without union taking place. A splint has then been bound on each side of the limb; we have put the patient on crutches, made him walk about, put the limb to the ground, and exercise it with the splint on, and the fracture has become united. Then in other cases I have applied blisters to fractures which were slow in uniting": but, if this method is to be useful, it must be tried in eight or ten weeks after the accident. (*Brodie, in Med. Gaz.* for 1833-34, p. 58.)

The foregoing treatment, however, is only likely to answer, before a new joint, or a ligamentous connection, has been completely formed, and when the limb has hitherto been kept motionless.

When the case is old, and there are grounds for believing that a new articulation, or ligamentous connection, has taken place, we are advised to cut down to the ends of the bone, rasp or saw them off, and then treat the limb just as if the case were a recent compound fracture.

Sir Everard Home used to mention the case of a man with ununited fracture of the humerus, who was under Mr. Hunter's care. There was an artificial joint, and Mr. Hunter made an incision into it, and then having introduced a spatula, he irritated the whole surface of the artificial joint. This

brought on considerable inflammation, which ended in ankylosis, and the patient was cured. (*Sir B. Brodie, in Med. Gaz. for 1833-34, p. 58.*)

This bold practice was first suggested by Mr. C. White. "Robert Elliott, of Eyham, in Derbyshire, a very healthful boy, nine years old, had the misfortune, about Midsummer, in the year 1769, by a fall, to fracture the humerus, near the middle of the bone. He was immediately taken to a bone-setter in that neighbourhood, who applied a bandage and splints to his arm, and treated him as properly," says Mr. White, "as I suppose he was capable of, for two or three months. His endeavours, however, were by no means productive of the desired effect, the bones not being at all united. A surgeon of eminence, in Bakewell, was afterwards called in; but as he soon found he could be of no service to him, and as the case was very curious, he advised the lad's friends to send him to the Infirmary at Manchester. He was accordingly brought thither the Christmas following, and admitted an in-patient. Upon examination, we found it to be a simple oblique fracture, and that the ends of the bone rode over each other: his arm was become not only entirely useless, but even a burden to him, and not likely to be otherwise, as there was little probability that it could ever unite, it being now six months since the accident happened.

"Amputation was therefore proposed as the only method of relief: but I could not give my consent to it, for as the boy was young, and had a good constitution, it was hardly possible that it could be owing to any fault in the solids or fluids, but that either nature was disappointed in her work by frequent friction, while the callus was forming, or rather, that the oblique ends of the bone, being sharp, had divided a part of a muscle, and some portion of it had probably insinuated itself betwixt the two ends of the bone, preventing their union. Whichever of these might be the case, I was of opinion," continues Mr. White, "that he might be relieved by the following operation, viz. by making a longitudinal incision down to the bone, by bringing out one of the ends of it, which might be done with great ease, as the arm was flexible, and cutting it off, either by the saw or cutting pincers; then by bringing out the other, and cutting off that likewise, and afterwards by replacing them end to end, and treating the whole as a compound fracture.

"The objections, made by the other gentlemen concerned, to this proposal, were, first, the danger of wounding the humeral artery by the knife; secondly, the laceration of the artery by bringing out the ends of the bones; and, thirdly, that we had no authority for such an operation. As to the first, that was easily obviated, by making the incision on the side of the arm opposite to the humeral artery. The place of election appeared to me to be at the external and lower edge of the deltoid muscle, as the fracture was very near to the insertion of that muscle into the humerus; the danger of wounding the vessel not only being by that means avoided, but, after the operation, while the patient was confined to his bed, the matter would be prevented from lodging, and the wound be easily closed, to renew the dressings. The second objection will not appear to be very great, when we consider that, in compound fractures, the bone is frequently thrust with great violence through the integuments, and seldom attended with laceration

of any considerable artery; and as this would be done with great caution, that danger would appear very trifling. The third and last objection is no more than a general one to all improvements.

"This method which I have been proposing," says Mr. White, "was at last resolved upon, and I assisted in the operation, which was performed by a gentleman of great abilities in his profession, on January 3., in the present year (1760). The patient did not lose above a spoonful of blood in the operation, though the tourniquet was not made use of. When the operation and dressings were finished, the limb was placed in a fracture-box, contrived on purpose, the lad confined to his bed, and the rest of the treatment was nothing different from that of a compound fracture.

"The wound was nearly healed in a fortnight's time, when an erysipelas came on, and spread itself all over the arm, attended with some degree of swelling: this, by fomentations, and the antiphlogistic method, soon went off, and the cure proceeded happily, without any other interruption. In about six weeks after the operation, the callus began to form, and is now quite firm. The arm is as long as the other, but somewhat smaller, in consequence of such long-continued bandages: he daily acquires strength in it, and will soon be fit to be discharged." (*Cases in Surgery, p. 69, &c.*)

In another instance of a broken tibia, which continued disunited an extraordinary length of time, Mr. White practised an operation, somewhat similar to the foregoing one, with complete success. He made a longitudinal incision, about four inches in length, through the integuments, which covered the fracture. By the application of a trephine, he cut off the upper end of the bone, and as the lower end could not be easily sawn off, he contented himself with scraping it. In the course of the subsequent treatment, he had occasion to take off, with the cutting pincers, a small angle of tibia, and to touch the lower part of the bone with the butter of antimony, as well as to introduce the same caustic between the extremities of the fracture, in order to destroy a substance, which intervened. A trifling exfoliation followed. In twelve weeks the bone was firmly united. (*Op. cit. p. 81., 82.*)

Besides Mr. White's cases, there are now some other instances upon record, where the operation, which he first proposed, has succeeded. In the year 1813, Langenbeck operated upon a humerus in the foregoing manner, and the result was perfectly successful. The ununited fracture was situated at the insertion of the deltoid. (*Neue Bildl. b. i. p. 95.*) Mr. Rowlands, of Chester, by a similar operation, believed that he had cured a fractured thigh, which had lost all disposition to unite. (*See Med. Chir. Trans. vol. ii. p. 47.*) I understand, however, from Sir Benjamin Brodie, that the subject of this operation lately died, and that on examination of the broken part of the limb, there was no bony union. Viguier, surgeon to the Hôtel-Dieu, at Toulouse, practised Mr. White's operation with success. (*See Larrey, Mém. de Chir. Militaire, t. ii. p. 132.*)

On the other hand, the operation has frequently failed. In the instance, in which I saw it executed on the humerus by Mr. Long, in St. Bartholomew's Hospital, it did not answer, though the ends of the bone were most fairly sawn off, and the case treated with particular care and skill.

Boyer states, that he once performed the same operation in a similar case; but, that it had not the desired effect. (*Traité des Mal. Chir.* t.iii. p.110.) Dr. Physick, of New York, when he was a student in 1785, saw this proceeding unsuccessfully adopted in a case where the humerus remained disunited. (See *Medical Repository*, vol.i. New York, 1804.) Besides these examples, I have heard of others, in which Mr. Cline, Mr. Green (*Med. Chir. Review*, Feb. 1828; and *Lond. Med. Gazette*, p.357.), and other practitioners tried the experiment with no better success. What is still more discouraging, the operation has sometimes proved fatal. (*Richerand, Nosogr. Chir.* t.iii. p.39. ed. 2. *Larrey, Mém. de Chirurgie Militaire*, t.ii. p.132.)

Baron Dupuytren deemed the removal of one end of the fracture sufficient, and gives two cases, in which the plan succeeded; one of a thigh-bone, the other of a lower jaw. In the latter instance, however, he scraped away the ligamentous texture from the anterior fragment. (See *Journ. Univ. des Sciences Méd.* t.ix. 1820; and *Clin. Chir.* t.iv. p.667; 8vo. Paris, 1834.)

The difficulties, the danger, and the frequent ill success of White's operation, had rendered another mode of treatment extremely desirable, when Dr. Physick, of New York, suggested the plan of introducing a seton through the preternatural joint, with the view of exciting inflammation, and bringing about the union of the bone. It was, in fact, a practice founded on Hunter's principles. Dr. Physick had an opportunity of performing the new operation on the 18th of December, 1802, in an example of disunited humerus, twenty months after the occurrence of the accident. "Before passing the needle (says Dr. Physick), I desired the assistants to make some extension of the arm, in order that the seton might be introduced, as much as possible, between the ends of the bone. Some lint and a pledget were applied to the orifices made by the seton-needle, and secured by a roller. The patient suffered very little pain from the operation. After a few days, the inflammation (which was not greater than what is commonly excited by a similar operation through the flesh of any other part) was succeeded by a moderate suppuration. The arm was now again extended, and splints applied. The dressings were renewed daily for twelve weeks, during which time no amendment was perceived; but, soon afterwards, the bending of the arm at the fracture was observed not to be so easy as it had been, and the patient complained of much more pain than usual, whenever an attempt was made to bend it at that place. From this time, the formation of the new bony union went on rapidly, and on the 4th of May, 1803, was so perfectly completed, that the patient could move his arm in all directions, as well as before the accident happened. The seton was now removed, and the small sores occasioned by it healed up entirely in a few days. On the 28th of May, 1803, he was discharged from the hospital perfectly well, and he has since repeatedly told me, his arm is as strong as ever it was." (*Physick, in Medical Repository*, vol.i. New York.) In the London Medical Repository for Aug. 1823, a case is also noticed, in which Dr. Physick cured an ununited fracture of the lower jaw by means of a seton.

On this subject an interesting memoir was read by Laroche to the Ecole de Médecine at Paris

(Germinal, an 13). It was entitled "*Dissertation sur la non-reunion de quelques fractures, et en particulier de celles du bras, et sur un moyen nouveau de guérir les fausses articulations qui en résultent.*" The author of this production affirms, that when he was at Augsburg, he saw Baron Percy, then with the army of the Rhine, pass a seton through the imperfectly healed cicatrix of a compound fracture of the thigh, which fracture seemed to have lost all disposition to unite. The method answered so well, that in two months the patient was able to walk without crutches.

Sir Benjamin Brodie has also successfully employed the seton in a case of ununited broken thigh. The patient was a boy about 13. (See *Med. Chir. Trans.* vol.v. p.387, &c.) In this country, the same operation has been practised for the cure of a disunited humerus by Mr. Stansfield, of Leeds. (See *Op. cit.* vol.vii. p.103., &c.) It appears, also, that Sir Charles Bell applied the method to a fracture of the leg, at the time when M. Roux was in England. The patient was a child six years old, and the broken bones had continued without union three years. The case had been originally mistaken by some unskilful surgeon for a mere contusion. The result is not stated. (*Parallèle de la Chir. Angloise*, &c. p.195.) In the North London Hospital, Mr. Liston lately employed a seton for an ununited fracture of the radius and ulna. The result was successful in reference to the latter bone. After cutting down to the fracture, he destroys the ligamentous connections as much as possible, and then passes the seton, which he takes out again sooner than is usually done. The result of an operation of this kind on the humerus, performed by him on a child in the North London Hospital, about five months ago, I am not at present acquainted with.

We are not to expect, that Dr. Physick's operation will succeed in every instance. Like most other surgical means, it is liable to occasional failures, amongst which, I believe, we must include the attempt, made on a disunited thigh by Mr. Wardrop (see *Med. Chir. Trans.* vol.v. p.365.) though a partial amendment is mentioned. In a case, recorded by Mr. Amesbury, the seton did not answer. Mr. A. C. Hutchinson was also obliged to take out the seton, in a case of ununited humerus, and only partial benefit was effected. (See *Practical Obs.* p.389. ed. 2.) Three instances of failure were seen by Mr. Amesbury, (*On Fractures*, p.224.) and an additional one has been recorded by Mr. Earle. (See *Med. Chir. Trans.* vol.xii. p.195.)

In the same case, and also in another, which I saw under this gentleman's care, the plan of cutting down to the ends of the fracture, and rubbing them with caustic potassa, was tried, but without success.

The result of the practice with the seton is, that it has sometimes succeeded in the upper extremities; but that, where it has been performed on the lower ones, so far as Sir Benjamin Brodie has been able to ascertain, it has only answered in a single instance, which was that of a patient under him in St. George's hospital. "Dr. Dorsey (who was Dr. Physick's nephew) in the last letter, which I had from him before his death, informed me as the result of the operations with the seton in the United States, that it had generally succeeded in the upper limbs, but that it had always failed in

the lower." He added, that, "in the former case, it was often necessary to keep the seton in for several months." (*Op. and Vol. cit.*) M. Portal, however, surgeon to the Palermo Hospital, cured by the seton an ununited fracture of the upper third of the femur in a child two years old. (*See Archives Gén. Méd.*, 1835.) An instance of an ununited fracture of the tibia was also successfully treated with a seton by Dr. Browne. (*See Dublin Hospital Reports*, vol. iv. p. 320.) A very similar case was published by Mr. Boggie. (*See Med. Chir. Trans.* vol. vii.) Dr. Mott has treated eleven cases of ununited fractures in this manner. Of these, three were of the femur; three of the tibia, and five of the humerus. In all, the plan is stated to have succeeded perfectly, except in three of the humerus, which were afterwards cured by sawing off the ends of the bones. (*Amer. Journ.*) These results are different from those, which might have been expected from the investigations of Sir Benjamin Brodie, and the statements of others, concerning the success of sawing off the ends of the bone.

Instead of several of the foregoing severe and often unsuccessful plans, Mr. Amesbury has tried, the influence of local pressure and rest. He maintains the ends of the fracture closely pressed together, the pressure, when the fracture is transverse, operating longitudinally, and when oblique, transversely. On this subject, Sir Benjamin Brodie observes, "I do not know, that this firm pressure produces the union of the bone by a process, at all like that which takes place in the first instance after fracture. I think it more likely that it causes the surfaces to grow together without the provisional callus being formed on the outside. However that may be, I know, that, in several cases, it has succeeded. I have attended two cases with Mr. Amesbury in which this plan was adopted, and in which it succeeded perfectly. I had a patient in St. George's Hospital, in whom I tried this method of treatment; and in that case also it succeeded, so that at the end of some weeks, the fractured bone, which had been ununited for many months, became completely consolidated. The pressure must here be considerable, so as to give the patient a good deal of pain, yet not sufficient to do him injury." Sir Benjamin Brodie, however, has known of several cases, in which this method has failed; but notwithstanding this fact, he pronounces it to be on the whole a more successful plan, than any other. A short sling, pads, and a particular apparatus are used accordingly. (*On Fractures*, p. 236.) Mr. Buchanan, of Hull, has related two cases, in which the union of fractures followed a perseverance in the application of tincture of iodine. (*On Diseases of Joints*, p. 75.)

FRACTURES OF THE NASAL BONES.

These bones, from their situation, are much exposed to external violence. The fragments may be displaced, or not. In order to replace them, the surgeon must pass a female catheter, a ring-handled forceps, or any such instrument, into the nostrils, and, using it as a lever, push the fragments outwards; while, with the index-finger of the left hand, he prevents them from being pushed out too far. When the fragments are disposed to fall inwards again, some authors advise supporting them with an elastic gum cannula, or lint, introduced into the nostril; but I am inclined to believe

with Sir C. Bell, that no tubes can be employed so as to support the broken bones; and when these have been replaced, they will not readily change their position, as they are acted upon by no muscles. (*See Operative Surgery*, t. ii. p. 222.) Besides, as Delpech remarks, since the tubes cannot reach the fragments, they cannot support them, and they must be attended with all the inconvenience of foreign bodies placed in contact with parts already inflamed, or about to become so. (*Précis des Mal. Chir.* t. i. p. 222.)

As fractures of the ossa nasi are the result of falls, and direct blows on the face, the soft parts are always either contused, or wounded. These fractures are sometimes attended with dangerous symptoms; depending either upon the concussion of the brain, produced by the same blow which causes the fracture; or, on the cribriform lamella and the crista galli of the os ethmoides being driven inwards, so as to compress the brain. This last danger, however, some modern surgeons consider as void of foundation; and whenever the symptoms indicate an affection of the brain, the nature of the case is referred to the intimate connection between the bones of the nose and the os frontis. (*Delpech, Précis des Mal. Chir.* t. i. p. 221. 8vo. Paris, 1816.)

Sometimes the fissure extends through the nasal process of the upper maxillary bone, and across the fossa for the lachrymal sac, attended with discharge of blood from the puncta lachrymalia and nostril, and obstruction to the passage of the tears. Mr. Hooper, of the London Road, had a case, in which not only the fissure extended in this way, but the brain received injury from the blow, and the patient died. The accident was produced by a horse-brush being thrown with violence, and striking the face.

When there are symptoms of pressure on the brain (*see HEAD, INJURIES* &c.) and the ossa nasi are much depressed, the surgeon must immediately raise them, and endeavour to draw gently forwards the perpendicular process of the os ethmoides, which is connected with the cribriform lamella and crista galli. Perhaps, a pair of closed common forceps, introduced into each nostril, might best enable the surgeon to do what is necessary. Bleeding and the antiphlogistic treatment are always proper; for, the vicinity of the eye renders it liable to become inflamed; and when there are symptoms of injury of the brain, extravasation, &c. the necessity of such practice is still more strongly indicated.

FRACTURES OF THE LOWER JAW.

This bone is sometimes fractured near the chin; but, seldom so as to produce a division of the symphysis, the solution of continuity generally happening between this part and the insertion of the masseter. In University College Museum, however, there is a specimen of a fracture situated precisely at the symphysis. In other instances, the fracture occurs near the angles of the jaw, that is to say, between the insertion of the masseter and the root of the coronoid process. The bone may also be broken on each side at the same time; in which event, the middle portion is extremely difficult to keep right, because many of the muscles, which draw the lower jaw downwards, are attached to that part. The condyles and coronoid process are also sometimes broken.

Fractures of the lower jaw may be either perpendicular to its basis, oblique, or longitudinal: of the latter, examples have been known, in which a portion of the alveolar process with the teeth in it, was detached from the rest of the bone.

The soft parts are generally contused and wounded. An instance is reported by Dr. Richelot of the accident being complicated with an injury of the external maxillary artery. (*Archives Gén. Jan. 1833.*) J. L. Petit mentions one case, in which the bone was broken, and the coronoid process quite denuded, by the kick of a horse.

When the fracture is near the symphysis, the side on which the processus innominatus is situated is drawn downward and backward by the submaxillary muscles, while the other fragment is supported by the muscles which close the jaw. When the fracture is more backward, the displacement occurs in the same way, but not so easily. When the bone is fractured in two places, the middle portion is always pulled downwards and backwards by the muscles attached to the chin, while the two lateral pieces are kept up by the levator muscles. When the ramus of the jaw is broken, the masseter, being attached to both pieces, prevents any considerable degree of displacement. When the neck of the condyle is fractured, the pterygoideus externus will pull the condyle forwards.

When a blow has been received on the lower jaw, or the bone injured by a fall, or the pressure of some heavy body; when an acute pain is experienced in the part, and an inequality can be felt at the basis of the bone; when some of the teeth, corresponding to that inequality, are lower than the others; and when a crepitus is perceptible on moving the jaw; there can be no doubt of a fracture. When the gums are lacerated, or the bone denuded by a wound, the case is (if possible) still more manifest.

Fractures of the rami and condyles produce great pain near the ear, particularly when the jaw is moved; and a crepitus may be felt.

Fractures of the lower jaw, whether simple or double, are easily set, by pushing the displaced part upward, and a little forward, and then pressing on the basis of the bone, so as to bring it exactly on a level with the portion which has preserved its natural position. Indeed, the correctness of the reduction may always be rightly judged of, by attending to the line which the base of the jaw ought to form, and observing that the arch of the teeth is regular. The maintenance of the reduction, however, is difficult; and can only be well executed by supporting the lower jaw, and keeping it applied to the upper one. As the latter indication cannot be properly fulfilled in persons, whose teeth are very irregular, it is sometimes necessary to interpose an even piece of cork between the teeth on each side of the mouth, and against this cork the lower jaw is to be kept up with the bandage presently noticed, while the aperture, left between the incisors in the situation where no cork is placed, allows food and medicines to be introduced with a small spoon.

When the bone is fractured in two places, one on each side of the symphysis, and great difficulty is experienced in keeping the central fragment from being drawn downwards and backwards towards the os hyoides by the depression of the lower jaw, the instruments, proposed by Graefe, Lonsdale, and

others, will fix the bone and prevent the displacement. The apparatus consists of a groove, for the reception of the arch of the teeth, and of a square plate of steel, which is placed under the chin, and admits of being screwed up to the part. On this plate a piece of cork, or a compress is put.

As soon as the fracture is set, the surgeon should adapt some thick pasteboard, previously wetted and softened with vinegar, to the outside of the jaw, both along its side and under its basis. Over this moistened pasteboard, a bandage with four tails is to be applied, the centre being placed on the patient's chin, while the two posterior tails are to be pinned to the front part of a nightcap, and the two anterior ones fastened to the same cap near the occiput. When the pasteboard becomes dry, it forms the most convenient apparatus imaginable for surrounding and supporting the fracture. A piece of soap-plaster may now be applied to the skin underneath, which will prevent any ill effects of the hardness and pressure of the pasteboard.

Until the bone is firmly united, the patient should be allowed only such food as does not require mastication, and it may be given by means of a small spoon, introduced between the teeth. Broths, soups, jellies, tea, and other slops, appear most eligible.

In order to keep the middle portion of the bone from being drawn downwards and backwards towards the larynx, it is frequently necessary to apply tolerably thick compresses just under and behind the chin; which are to be well supported by the bandage already described.

I need hardly state the necessity of enjoining the patient to avoid talking, or moving the jaw more than can be avoided.

When the condyle is fractured, as it is incessantly drawn forward by the action of the pterygoideus externus, and, on account of its deep situation, cannot be pressed back, the neck must, if possible, be pushed towards it. For this purpose, the bandage must be made to operate particularly on the angle of the jaw, where a thick compress should be placed.

Compound fractures of the lower jaw are to be treated on the same principles as similar injuries of other bones. If possible, the external wound should be healed by the first intention; and, when this attempt fails, care must be taken to keep the wound clean by changing the dressings about once in three days; but not oftener, lest the fracture suffer too much disturbance. Compound fractures of the jaw, and even simple ones, which are followed by abscesses, are liable to be succeeded by necrosis and exfoliations.

It now and then happens, that fractures of the lower jaw continue ununited: Dr. Physick's successful treatment of one such case with a seton, and Dupuytren's by sawing off the end of one fragment, I have already noticed.

Fractures of the coronoid process are stated not to admit of bony union.

FRACTURES OF THE VERTEBRÆ.

On account of the shortness and thickness of these bones, they cannot be broken, without considerable violence. The spinous processes, which project backwards, are most exposed to such injury; for they are the weaker parts of the vertebræ, and most superficially situated. On this account, it is possible for them to be broken, without any

mischief being done to the spinal chord. The violence, which is great enough to break the bodies of the vertebræ, must produce more or less concussion, or other mischief of the spinal chord; from which more perilous consequences are to be apprehended, than from the injury of the bones, abstractedly considered. The displaced pieces of bone may press on the spinal chord, or even wound it, so as to occasion a paralytic affection of all the parts, which derive their nerves from the continuation of it below the fracture.

There may be fractures of the vertebræ, without displacement; or fractures complicated with dislocation, or extravasation of blood on the membranes of the spinal chord, of which last occurrence several specimens are preserved in University College Museum. Sir Benjamin Brodie has noticed, that, in consequence of external violence, a narrow clot of blood may be extravasated, within the substance of the spinal chord, and that from its peculiar situation, it may be productive of the most dangerous symptoms. With respect to laceration of the chord and its membranes, he observes, that it may be torn completely through, or lacerated in one part and not in another; and, he refers to a case, described by M. Ollivier, in which the attachments of the nerves on one side were destroyed, and, not on the other.

As for the concussion, the minute organisation of the spinal chord may be injured by it, even when there is neither fracture, nor dislocation, and the investing membranes exhibit no effects of the injury. "In such cases, if there be an opportunity of examining the spinal chord at a very early period after the accident, the central part of it is found to be softer, than natural, its fibrous appearance being lost in that of a semifluid substance. If the patient survives for a longer period, the alteration of structure is perceptible in the whole diameter of the chord, and occupies from one to two inches, or even more of its length; and at a still later period, it has often proceeded so far as to terminate in its complete dissolution." (*Sir B. Brodie in Med. Chir. Trans.* vol. xx. p. 121, 122.)

Sir Astley Cooper divides fractures of the bodies of the vertebræ with displacement into two classes: first, those which occur above the third cervical vertebra; and, secondly, others which happen below that bone. The first cases, he says, are almost always immediately fatal, if the displacement be to the usual extent. In the second description of cases, death takes place at various periods after the injury. The reason of this difference is ascribed to the circumstance of the phrenic nerve originating from the third and fourth cervical pairs, whence, in the first class of cases, death is immediately produced by paralysis of the diaphragm, and the stoppage of respiration. (*On Dislocations*, p. 552.)

Sir Benjamin Brodie correctly refers the symptoms, which arise, as an immediate consequence of injuries of the spine; 1st, To concussion of the spinal chord; 2dly, To laceration, or division of its substance; 3dly, To pressure, made on it, either by displacement of bone, or by extravasated blood. Afterwards inflammation of the membranes of the chord may take place, and other organs may be secondarily affected, giving rise to another order of symptoms, which did not exist in the beginning. He adds, that, when the symptoms are viewed generally, they vary: 1st, according to the part of the spinal chord, on which the injury has been in-

flicted; 2dly, according to the kind and degree of injury, which the chord has sustained; 3dly, according, as, from accidental circumstances, the life of the patient is prolonged for a longer, or shorter period, or ultimately preserved. (*See Brodie in Med. Chir. Trans.* vol. xx. p. 127.) These facts deserve to be particularly remembered, for, without the recollection of them, the practitioner would be extremely perplexed in his endeavours to explain the great differences in the symptoms, and results of different cases.

As the mere concussion of the spine may occasion symptoms, which resemble those, usually occurring, when the vertebræ are fractured, the diagnosis is generally obscure. An inequality in the line of the spinous processes, and a crepitus, may sometimes be distinctly felt. The lower extremities, and the rectum, and bladder, are generally paralytic; the patient being afflicted with retention of urine and involuntary discharge of the feces.

According to Sir Benjamin Brodie's observations, the patient is generally unconscious of the bladder being distended; but occasionally he suffers as from an ordinary retention of urine, though in a less degree. "The incapability of voiding the urine is usually an early symptom, and, in fatal cases, it continues to the last. When a complete, or partial recovery takes place, the power of emptying the bladder is restored sooner, than that of using the muscles of the lower limbs. In cases in which the catheter is not employed, the urine flows involuntarily, as in most other cases of over-distended bladder where the urethra is free." "At other times, there is a constant dribbling of urine, although the bladder is in a contracted state, so that, on the introduction of the catheter, no urine flows." (*Sir B. Brodie, in Med. Chir. Trans.* vol. xx. p. 141.)

With respect to *paralysis of the voluntary muscles*, Sir Benjamin Brodie remarks, that, if the spinal chord be divided through its whole substance, or extensively lacerated, or subjected to any considerable pressure, the paralysis is immediate and complete. But, if the injury be partial, certain muscles may be paralysed, while others retain their power of voluntary motion. He notices also the well-known fact, that paralysis of the lower limbs is more common, than that of the upper. "In some cases, in which the injury has affected the spinal chord in the lower part of the neck, the lower limbs are rendered paralytic, while there is either no paralysis, or a less degree of it, in the upper limbs. The reason of this is sufficiently obvious to any one who considers what are the origins of the nerves, which form the axillary plexus, some of them being probably above the part which is injured. But the circumstance is still remarkable in this respect, that it is contrary to what happens, when the functions of the spinal chord are interrupted in consequence of caries of the cervical vertebræ. In these last cases, the paralysis is often complete in the upper limbs for many weeks, or even for months, before it extends to the lower. I have met with only a single case, in which, after an injury of the cervical portion of the spine, there was almost complete paralysis of the muscles of the upper extremities, and none whatever of those of the lower." (*Sir B. Brodie in Med. Chir. Trans.* vol. xx. p. 129.) I think, we must agree with the same experienced surgeon that, when paralysis of the upper and lower limbs

follows a fracture of the lumbar vertebræ, an instance of which is recorded by Mr. Stafford, or when it follows a concussion of the loins, as once seen by Sir Benjamin Brodie himself, we must suppose, that another part of the spinal chord, as high as the origin of the nerves, which form the axillary plexus, has suffered from the effects of concussion.

On the subject of *affections of the nerves of sensation*, Sir Benjamin Brodie after noticing the well-certain fact, that if the spinal chord be lacerated, or subjected to any considerable degree of pressure, the sensibility of the parts below the seat of injury is totally destroyed, refers to another, which is, that, if the injury be in the situation of the sixth or seventh cervical vertebra, the destruction of sensibility is frequently partial in the upper extremities, while it is complete in the trunk and lower extremities. "In many instances, the destruction of sensibility is incomplete at first, but becomes complete afterwards, as the process of softening makes progress in the injured portion of the spinal chord." (Sir B. Brodie in *Med. Chir. Trans.* vol. xx. p. 135.)

With respect to the *affection of respiration*, if the fracture be as high as the third cervical vertebra, and the chord be there injured, the nervous influence cannot be transmitted either to the diaphragm, or the other muscles of respiration; and a fatal asphyxia immediately takes place. But, if respiration be performed artificially, by inflating the lungs, the action of the heart and life may be maintained for several hours. When the spinal chord is seriously injured in the lower part of the neck, below the origin of the phrenic nerves; or in the upper part of the back, the action of the diaphragm is not interfered with, while the intercostal muscles, as well as the muscles of expiration, are paralytic. "The patient, therefore, breathes by the diaphragm only. The ribs are motionless, and the air is expelled from the lungs, not by the contraction of the abdominal muscles, but simply by the elasticity of the abdominal parietes, and the pressure of the abdominal viscera, operating on the lower surface of the diaphragm, where that muscle is relaxed." Under these circumstances, the patient is incapable of expectorating mucus, if it be collected in the trachea; if he coughs, it is by a forcible inspiration, followed by a sudden relaxation of the diaphragm; and respiration is carried on with more difficulty in the sitting, than the recumbent posture. But, it is further observed by Sir Benjamin Brodie, that injuries of the spinal chord in the lower part of the neck, are not necessarily followed by the foregoing consequences. The pressure on the spinal chord may be so small, or the disorganisation of it from concussion may be so trifling, that the muscles of respiration are not at any period affected by it; or they may not be so in the first instance, and yet become affected afterwards. In one case, which fell under Sir Benjamin Brodie's observation, a fracture of the seventh cervical vertebra, which was followed by a softening and dissolution of the spinal chord, the difficulty of respiration did not take place until the twelfth day; but death occurred in less than three days afterwards. (See *Med. Chir. Trans.* vol. xx. p. 138.)

Injuries of the spinal marrow, including those resulting from, or accompanying fracture, are well known to produce certain changes in the urine and

urinary organs. Besides an inability of voiding the urine, there is sometimes, as Sir Benjamin Brodie has pointed out, a marked diminution in the quantity of this fluid secreted. In some cases, the urine, first secreted, although of an acid quality and free from mucus, has a peculiarly offensive smell; while, in others, it is exceedingly acid, with an opaque yellow appearance, and a yellow amorphous sediment. But, the most common changes are an ammoniacal smell, great turbidness, and a deposit of a large quantity of adhesive mucus, and the urine, when tested with reddened litmus, or turmeric paper, is found to be very alkaline. After some time, phosphate of lime, secreted by the inner coat of the bladder, is blended with the mucus, which is tinged with blood. These appearances may come on as early as the third or fourth day, or not begin for a week, or eight, or nine days. Sir Benjamin Brodie has not found, that injury of one part of the spine is more liable to produce them, than that of another. In fatal cases, they sometimes continue to the last. At other times, they go on for two or three weeks, and then subside. Occasionally the urine varies from day to day, being now alkaline and depositing adhesive matter; then clear and acid; and afterwards alkaline again. (Sir B. Brodie.)

Fractures and other injuries of the spine frequently bring on inflammation of the mucous membrane of the bladder and ureters; and occasionally spots of extravasated blood are found in the kidneys. In University College Museum is a bladder, taken from a patient, who died of an injury of the spine, which is in a softened and ulcerated state. In Mr. Barlow's case, the infundibula and pelvis of the kidneys were dilated with urine, which was mixed with pus. The bladder, whose coats were thickened, also contained a considerable quantity of pus. (See *Med. Chir. Trans.* vol. xvii. p. 120.)

Wherever the injury of the spinal chord is situated, the bowels are torpid, and the abdomen tympanitic. In many cases, where the cervical portion of the chord is injured, and the patient dies in two, or three days, there is a disposition to vomit. In more protracted cases, the discharges from the bowels are of a black colour, semifluid, and of a peculiarly offensive smell. It would appear also, both from the experiments of M. Chossat, and facts, recorded by Sir Benjamin Brodie, that injuries of the superior portion of the spinal chord are sometimes followed by a remarkable evolution of animal heat. (See *Med. Chir. Trans.* vol. xx. p. 146.)

With respect to effects on the sensorium immediately after the accident, Sir B. Brodie has not observed any material ones, except where the injury was of the cervical portion of the spinal chord, and then, he observes, that the results are very different in different cases. (*Ib.* 149.)

If the lumbar vertebræ are displaced, the lower extremities are rendered so completely insensible, that they may be pinched, burnt, or blistered, without the patient suffering any pain. The penis, in such cases, is generally erect. In general, also, according to Sir Astley Cooper's observations, patients, with fractured lumbar vertebræ, die within a month, or six weeks; but, he knew of one patient that lived two years, and then died of gangrene of the nates. In fractures with displacement of the dorsal vertebræ, the symptoms are very similar; but, the paralysis extends higher, and the abdomen becomes excessively inflated. Death commonly

FRACTURES.

follows in two or three weeks; but, Sir Astley Cooper remembers one case, in which a gentleman survived the accident nine months. According to Sir B. Brodie's experience, where a considerable injury has been inflicted on the spinal chord in the lower part of the neck, or in the neighbouring part of the back, of such a nature, as to paralyze all the muscles of respiration, excepting the diaphragm, the patient rarely lives to the end of the fourth, or fifth day; and mostly dies still earlier. (See *Med. Chir. Trans.* vol. xx. p. 156.) Fractures of the cervical vertebrae, below the origin of the phrenic nerve, occasion paralysis of the arms, though it is seldom complete. Sometimes, when the fracture is oblique, one arm is more affected than the other. As the intercostal muscles are paralytic, great difficulty of respiration prevails. The abdomen is also considerably inflated. Death generally follows in from three to seven days.

Sir Benjamin Brodie has never known priapism occur from injury of the spinal chord, except in combination with paralysis. It "may take place (he observes) whether the patient suffers from the effects of simple concussion of the spinal chord, or from those of pressure. It seems to be connected with injuries of the upper, rather than with those of the lower portion of the chord: at least, I am not aware, that I have met with it, where the seat of injury has been below the sixth dorsal vertebra. It is for the most part an early symptom, showing itself in the course of the second, or third day, and it seldom continues after the first fortnight. It occurs even where the sensibility of the parts is totally destroyed, and may be induced by the mechanical irritation caused by the introduction of the catheter, where the patient is entirely unconscious of the operation. This circumstance was pointed out to me, many years ago, by Professor Macartney, of Trinity College, Dublin, and I have had many opportunities of verifying the correctness of the observation." (Sir B. Brodie, in *Med. Chir. Trans.* vol. xx. p. 140.) In the North London Hospital, one case occurred under Mr. Liston, in which priapism accompanied a fracture of the lumbar vertebrae, and Sir Benjamin Brodie informs me, that he has lately heard of another similar case. We had also in the North London Hospital, an instance, where priapism was one of the symptoms, following a violent blow on the occiput.

Sir Astley Cooper notices the following, as the appearances found in *post mortem* examinations. The spinous process of the displaced vertebra is depressed; the articular processes are fractured; the body of the vertebra is broken through, the separation rarely happening in the intervertebral substance. The body of the vertebra usually projects forward half an inch, or an inch. Between the vertebra and the sheath of the spinal marrow, blood is extravasated, and frequently on the spinal chord itself. When the displacement is slight, the spinal marrow is compressed and bruised. When greater, it is torn through by the bony arch of the spinous process, and a bulb is formed at each end, but the dura mater continues whole. (See *Sir A. Cooper on Dislocations, &c.* p. 554, &c.)

Fractures of the spinous processes, without other serious mischief, are not dangerous. It has usually been thought, that, even when a fracture of the spine is attended with displacement, any attempt to bring the fragments into a better position would be too dangerous to be made. Some practitioners

have, however, ventured upon it. Mr. Barlow, of Writtle, did so, and, though no harm resulted from the experiment, it cannot be said that any permanent good was derived from it, for, when the patient died some months afterwards, the fracture had united still in a displaced condition. It was "performed by persons pulling at the superior and inferior extremities, which had the desired effect; for, the angular projection was greatly lessened, and the patient did not seem to experience any pain during the extension." The following particulars show, however, that the displacement was far from being obviated. The case was a transverse fracture of the first lumbar vertebra, extending obliquely downwards and forwards, through the upper portion of its body. "The upper part of the vertebral column, together with the upper fragment of the fractured vertebra, had been thrown forwards, the superior fragment resting on the fore and upper part of the inferior fragment, to which it was connected by callus. The corresponding articular process of the last dorsal and first lumbar vertebrae had been dislocated; those of the former having been thrown upwards and forwards. On the right side, the inferior articular process of the last dorsal vertebra was separated from the corresponding process of the first lumbar to the extent of a third of an inch, while their surfaces were rounded and nearly obliterated. On the left side, the processes were about the same distance from each other, but connected by an intermediate portion of new bone. The formation between the roots of the spinous processes was more than twice its natural dimensions. The ligamentum subflavum must have been ruptured. The vertebral canal, immediately behind the line of fracture, was diminished one half in calibre." (*W. R. Barlow, in Med. Chir. Trans.* vol. xvii. p. 115.)

The following is the view, adopted by one high authority. "Dislocations and fractures, with displacement of the cervical vertebrae, are not always immediately fatal; and I cannot say, that no circumstances can exist, which would justify the attempt to effect reduction in such cases; but it is evident, that, if the attempt be made at all, it must be with the greatest caution, and Boyer describes a case, in which a child died under it. There can be no doubt, however, that, when the injury is in the lower part of the spine, the attempt to effect reduction may be not only made with impunity, but that it may be successful. In proof of this assertion, I may refer to a case, which occurred in the practice of Mr. Hardwicke, of Epsom; the patient being afterwards admitted into St. George's Hospital, labouring under paralysis of the lower limbs." Sir Benjamin Brodie likewise refers to another case under his care in the same hospital; a fracture, with great displacement of the third and fourth lumbar vertebrae. By fixing the thorax, and cautiously extending the pelvis, he endeavoured to restore the vertebrae to their proper place. "The attempt was in some degree successful, no ill effects of any kind resulted from it." (See *Med. Chir. Trans.* vol. xx. p. 158.)

In the instances seen by Mr. Crosse, in which a fracture of the spinal column was attended with displacement, producing pressure on the medulla, and paraplegia, the compressing portion of the bone was almost universally the body of a vertebrae, so generally broken, and not the arch. (See *Trans. of Prov. Med. Assoc.* vol. v.)

If, after a certain time, circumstances justify the suspicion of inflammation of the spinal chord, and the state of the pulse will admit of the practice, venesection should be employed; but, inasmuch as cupping the part near the injury could not be performed without turning the patient, and disturbing the fracture, I deem it always unadvisable. The same remark applies to leeches. I believe, with Sir Benjamin Brodie, however, that it is a great mistake to suppose that bleeding is always proper. "In the majority of cases, the state of the pulse is such as actually to contra-indicate the abstraction of blood; and the blood, when drawn, does not in general present those appearances, which are supposed to mark the existence of inflammation." (*Sir B. Brodie, in Med. Chir. Trans. vol. xx. p. 162.*) Neither does blood-letting seem to this gentleman to arrest the process of softening and dissolution of the spinal chord, but, on the contrary, to accelerate it.

Keeping the vertebral column perfectly motionless is an indication plainly presenting itself, and the best mode of fulfilling it is to let the patient lie steadily on his back.

When the patient is affected with a flatulent distention of the abdomen, vomiting, hiccough, &c. the belly may be rubbed with camphorated liniment; and purgative or turpentine clysters, and antispasmodics given.

In all cases, in which the lower part of the body is paralytic, the catheter is necessary. "It does not, however, prevent the urine becoming alkaline, nor the secretion of adhesive mucus from the lining membrane of the bladder. When these changes have taken place, the bladder should be emptied several times daily; and it may be advisable in some instances to inject tepid water into it, so as to prevent any portion of the mucus being retained in its cavity." (*Sir B. Brodie.*)

The torpid state of the bowels demands active purgatives, as calomel, jalap, castor and croton oil. Sir B. Brodie finds that the action of purgatives, in these cases, is promoted by combining them with ammonia. When the motions are black and offensive, attention to this part of the treatment is of high importance. (*Op. et vol. cit. p. 163.*)

When the bladder, rectum, and lower extremities are paralytic, Boyer advised rubbing the back, loins, sacrum, and limbs with liniments containing the tincture of cantharides. With respect to the external and internal use of stimulants, however, it can never be judicious, when there is reason to apprehend much inflammation of the injured parts; and as for the idea of thus restoring the nervous influence, there can be little chance of success, the cause of its interruption being here of a mechanical nature. (*Delpsch, Mat. Chir. t. i. p. 222.*) In an early stage of the case, who would venture to move the patient about for any purpose of this kind?

Some authors recommend trepanning, or cutting out a portion of the fractured bone, when the compression of the spinal marrow, or its injury by a splinter, is suspected; but, according to my judgment, the indication can never be sufficiently clear to authorise the operation, which, on account of the great depth of the intervening soft parts, must be tedious, and even difficult to effect, without risk of increasing the injury, which the spinal marrow may already have received. An unsuccessful operation of this kind was once performed by Mr. H. Cline, and another by Mr. Tyrrell.

Some cases, published by Sir C. Bell, tend to prove, that the danger to be apprehended from injuries of the vertebrae, is the same as that which accompanies injuries of the brain. Hence, he is an advocate for general and local bleeding, and keeping the patient perfectly quiet. But, with respect to operations for the removal of fragments of bone, it is his decided belief, that an incision through the skin and muscles covering the spine, and the withdrawing of a portion of the circle of bone, which surrounds the marrow, would be inevitably fatal, the membranes of that part being particularly susceptible of inflammation and suppuration. And, even if a sharp spicula of fractured bone had run into the spinal marrow, and caused palsy of the lower parts of the body, Sir C. Bell thinks, that exposing the medulla to extract the fragment would so aggravate the mischief, that inflammation, suppuration, and death, would be the inevitable consequences. (*Surgical Obs. vol. i. p. 157.*)

The question, respecting such an operation, seems to Sir Benjamin Brodie to lie in a very small compass. "If the whole, or nearly the whole, of a vertebra be driven forwards, the depression of the posterior part of it will, of course, occasion a diminution of the size of the spinal canal; but the removal of any portion of the vertebra, which is accessible to an operation, will be of little avail, as the irregularity in the anterior part of the canal, made by the displacement of the body of the vertebra, must be the same after, as it was before, the operation." This view coincides with that which I have long entertained. (*See First Lines of Surgery, ed. vi. p. 586.*) "If (observes Sir Benjamin Brodie) there be simply a fracture on each side of the spinous process, with a depression of the loose or intermediate portion of bone, there must be a corresponding diminution of the size of the vertebral canal; but, as that canal is much larger than the spinal chord, which it contains, it does not follow, that the spinal chord is really compressed, or that any material diminution of the symptoms would follow the elevation or the depression. But, let it be supposed that the spinal chord is really suffering from pressure, a much less degree of violence, than that which is necessary to occasion a fracture of the spine, may produce concussion, softening, and ultimately dissolution of the spinal chord, with a train of symptoms much worse than those which arise from simple pressure. Now, no operation can be of the smallest advantage in this respect; but, on the contrary, if it be necessary to apply the saw in the performance of it, the jar and disturbance of the parts, which it must occasion, is even likely to aggravate the mischief. If these views be correct, it is evident that the cases, in which there are any reasonable grounds for the performance of the operation, must be of very rare occurrence." (*Sir B. Brodie, in Med. Chir. Trans. vol. xx. p. 160.*) In fact, no operation of this kind has yet been the means of preserving life, or even of relieving the worst symptoms.

Sir Charles Bell describes inflammation of the spinal marrow as "attended with an almost universal nervous irritation, which is presently followed by excitement of the brain: in the mean time, matter is poured into the sheath of the spinal marrow, and either by its pressure causing palsy, or by its irritation disturbing the functions of the part, so as to be attended with the same con-

sequences. The excitement of the brain being followed by effusion, death ensues." (p. 159.) Cases are also referred to, where palsy of the lower extremities comes on several months after an injury of the spine, owing to thickening of the membrane of the medulla, or disease of the latter part itself. Here Sir C. Bell recommends perseverance in local bleeding, and deep issues. (p. 160.)

When recovery takes place, the restoration of sensibility usually precedes that of the power of voluntary motion. The power of emptying the bladder is also sooner restored, than that of using the muscles of the lower limbs. (Sir B. Brodie, *Op. et vol. cit.* p. 136.—141.)

A fracture of the processus dentatus almost always proves instantly fatal, as happened in the example mentioned by Sir A. Cooper. (*On Dislocations, &c.* p. 548.) In the article DISLOCATION, I have adverted to the remarkable instance of a fracture and displacement of the atlas, where the patient lived forty-seven weeks after the accident, and to the last week of his life was able to walk to the water-closet, which was on the same floor with his bed. After death, "the condyles of the occiput still rested upon the articulating surfaces of the atlas, but the atlas was found to be not a separate and independent vertebra, but an appendix to the axis. So much of its anterior portion, as includes the surfaces by which it is articulated with the occiput and with the axis, had been violently separated from the posterior portion of its ring, and had been carried in an oblique direction downwards and forwards, until it arrived upon the same plane, but anterior to the axis, to the body and transverse processes of which it became attached by perfect bony union, while the posterior fragment had suffered no displacement. Under these circumstances, the bone presented two spinal foramina, and four transverse, but no odontoid process. This organ having been fractured and separated, no organ passed through the anterior spinal foramen." (*B. Phillips, in Med. Cur. Trans.* vol. xx. p. 82.) In the practice of Mr. Clue a case occurred, in which a boy, with a fracture of the atlas, lived a year after the accident.

The particulars of the following case, under my care in University College Hospital, were registered by Mr. Morton, then house-surgeon. — Thomas Robinson was admitted November 2. 1835, for injuries received by the fall of a very heavy piece of timber on the lower part of the neck, a short time before he was brought to the hospital. He was perfectly sensible; the pupils were quite active under the influence of light, and no symptom prevailed, indicating affection of the brain. His arms and superior extremities were completely paralysed. If raised up, and the support then removed, they immediately dropped. The man had lost all sensation in the inferior extremities and in the trunk, as high as the middle of the chest. Also in the arms, excepting from the point of the shoulder down to the elbow. He had *pruritus*, with *emissio seminis*. Respiration was performed imperfectly, and in a short hurried manner. Though pain was experienced in the back of the neck, when the head was moved, no crepitus was distinguishable. The skin was rather cold; at first merely external warmth was applied, and some tea given. On the day after that of the patient's admission, the skin was warm, respiration quicker, and pulse more frequent, but perfectly compressible. He

was placed on his side at his own request. In respiration, no action of the intercostal and abdominal muscles could be perceived. As no urine had passed, a pint was drawn off with a catheter; and gr. viij. of calomel, followed by aperient mixture, were given to promote evacuations from the bowels. The mixture was rejected by vomiting. In the afternoon, the pulse had risen to 120 beats in a minute, and the difficulty of breathing had increased. The face was flushed, and skin hot. Twenty-four ounces of blood were taken away; but without benefit, as the pulse afterwards rose to 156, and became irregular both as to rhythm and strength. Death took place twenty-four hours after the accident. In the *post mortem* examination, the right articular process was found detached from the body of the third vertebra. The left portion of the arch of the fourth was broken, but not displaced. The arch of the fifth was much comminuted, and the spinal chord exposed, and pressed upon. The body of this vertebra was also broken through, and the sharp edge of the fracture had caused copious extravasation behind the pharynx, in front of the vertebral column.

William Parker, æt. 13, was admitted under me, October 15. 1836, in consequence of his cravat having been caught by some machinery, and his neck drawn against a projecting lever. In this position, he had been suspended about a minute and a half, and directly he had been released, he was brought to the hospital. His breathing was then slow, and somewhat laboured, the face slightly livid, the pupils acted, the hands were warm, and the pulse rather slow and feeble. The boy was laid on a table, and covered with blankets, and the windows opened to admit of a supply of fresh air. The breathing, however, did not improve, and inspiration gradually became slower, and the intervals of respiration longer. In eight or ten minutes the lips became livid, the pulse sunk, and the surface of the limbs and trunk began to grow cold. Hot water was applied to the feet, the chest, and epigastrium, and artificial respiration was resorted to by closing the nostrils, and blowing air into the mouth through a piece of maulin. This soon brought a rosy colour into the cheeks, the pulse became stronger, the temperature of the body rose, and some slight effort at respiration was supposed to be made. A little ammonia and water was put into the mouth, but could not be swallowed. At the same time, the vapour of strong liq. ammon. was applied to the nostrils. Whenever the artificial respiration was discontinued, the breathing went on but slowly and feebly, the pulse sunk, and the lips became livid. In this manner he went on for some hours, the vital powers partially recovering, while artificial respiration was carried on, and sinking directly it was interrupted. Although there was great suspicion entertained that the spine had suffered injury, I wished to render the introduction of air into the lungs as complete as possible, and therefore performed tracheotomy, so that a small pair of bellows might be used for this purpose. But neither this plan, nor galvanism, tried by Dr. Ritchie, was of any material service; and death took place at the end of six hours and a half. In the *post mortem* examination, blood was found effused between the muscles in front of the cervical vertebrae. The anterior common ligament was ruptured opposite the second and third vertebrae. A considerable

quantity of blood was found in the intermuscular cellular tissue behind the cervical vertebrae, opposite the second, third, and fourth of them. A fracture of the arch of the third was detected, the part of it above the spinous process being broken off, and the portion of it on each side of that process also fractured. Although the fragment might have been depressed, it did not seem to be so at the period of examination. In the spinal canal, blood was effused; but there was no apparent laceration of the dura mater, or injury of the chord: the bowels were greatly distended with air. This case, which I have also referred to in the article *ASPHYXIA*, illustrates the consequences of an injury of the spinal chord, implicating the origins of the phrenic nerves.

A. Cooper, Op. cit. p. 549. See *J. T. Soemmering*, Bemerkungen über Verrenkung und Bruch des Rückgraths, svo. Berlin, 1793. *F. A. E. Cuvette*, Dis. Med. Chir. sistens Casum Subluxationis Vertebrae Dorsali cum Fractura complicata, postfactam Repositionem et varia dira Symptomata duodecim m. Septimanae funestae. Argent. 1761. Case of Fractured Spine, *Lancet*, vol. ii. p. 97. *C. Wenzl*, Von den Krankheiten am Rückgrathe, Bamberg, 1824, fol. *Sir Charles Bell*, On Injuries of the Spine and Thigh-bone. Lond. 4to. 1824. *B. Phillips*, in *Med. Chir. Trans.* vol. xx. *Sir R. C. Brodie*, *ibid.*

FRACTURES OF THE STERNUM.

The sternum is less frequently broken than its exposed position might lead us to expect; and the reason of this fact is imputed to the bone resting, as it were, upon the yielding cartilages of the ribs, and also, in some measure, to its spongy texture. When the accident does occur, it is from the direct application of external violence to the injured part; and hence the fracture is always accompanied with contusion, or even a wound of the integuments, and more or less injury of the thoracic viscera. As *Boyer* remarks, the sternum, in consequence of the elasticity of the cartilages of the ribs, may be readily propelled backward by pressure in this direction, and the result is an actual change in the form, and a real diminution of the chest. Now, since this cavity is always accurately filled by its contents, these alterations cannot happen in a considerable and sudden manner, without a risk of the thoracic viscera being contused and even ruptured. Thus, when the sternum has been fractured by violent blows on the chest, the heart and lungs have been found severely contused, and sometimes lacerated; and there will always be greater danger of such mischief, when the fracture is attended with depression of one or more of the fragments. In the museum of University College is a heart, the right ventricle of which was lacerated by the fragment of a broken sternum. *M. Sanson* saw a similar occurrence. (See *Diet. de Méd. et de Chir. Pratiques*, art. *Fracture*.) In some cases, a large quantity of blood is effused in the cellular tissue of the anterior mediastinum; and, in others, the accident is followed by inflammation, and suppuration in the same situation, and necrosis of the broken part of the bone. Since the lungs are also liable to be ruptured by the same force, which causes the fracture, or wounded by the depressed pieces of bone, emphysema may be another complication, as was exemplified in a case related by *Flajani*. (*Collezione d'Osservaz. &c. di Chir.* t. ii. p. 214. 8vo. Roma, 1802.)

If dependance can be placed upon the particulars of a case, recorded *M. David*, the sternum may be broken by the violent action of the muscles connected with it (*Mém. sur les Contrecoups*), and

sometimes, from the same cause, in the efforts of parturition.

A fracture of the sternum is rendered obvious by the inequalities perceptible, when the surface of the bone is examined with the fingers; by a depression, or elevation of the broken pieces; a crepitus and an unusual moveableness of the injured part in respiration. The breathing is difficult, and mostly accompanied with cough, spitting of blood, palpitations, and inability to lie on the back. According to the observations of *Petit* and *Baldinger*, several of these latter symptoms may continue, with less intensity, a long while after the fracture has been cured. (*Leveillé, Nouvelle Doctrine Chir.* t. ii. p. 243.) When displacement occurs, the lower fragment generally is pushed forwards, or even more or less overlaps the upper.

Fractures of the sternum, when mere solutions of continuity, only require common treatment; viz. a bandage round the chest, quietude, bleeding, and a low regimen, with the view of preventing what may be considered as the most dangerous consequence, inflammation within the chest.

In cases, attended with great depression of the fractured bone, the necessary incisions should be made, in order to raise with an elevator the portions of the bone driven inwards, or to extract with forceps any loose splinters, which seem to be similarly circumstanced. However, it is not often necessary to trephine the sternum, either to raise a depressed portion of the bone, or to discharge extravasated fluid. In the first circumstance, I believe with *Sir C. Bell*, that the formal application of the trephine can never be right, though the surgeon may be called upon to extract loose splinters. (See *Operative Surgery*, vol. ii. p. 218.) Such an operation, however, may occasionally be proper when abscesses form under the sternum, or the bone is affected with necrosis, and the natural separation of the diseased parts is likely to occupy a considerable time.

Fractures of the sternum are more frequently produced by gunshot violence, than any other cause, and in these cases the splinters may require extraction. At the battle of Marengo, the French general *Champeux* received such a wound, with which he lived nearly a month: the injury was attended with so many splinters, that when they were removed, the pulsations of the heart were visible to a considerable extent. (*Leveillé*, vol. *cit.* p. 214.)

The ensiform cartilage, when ossified in old subjects, is liable to fracture. Little more can be done in such a case, than to relax the abdominal muscles by raising the thorax and pelvis, and then apply a bandage to the part, for the purpose of keeping it steady. When the blow has been violent, the patient should be freely bled.

FRACTURES OF THE RIBS

Generally happen near the greatest convexity of these bones, several of which are often broken together. The first rib being protected by the clavicle, and the lower ribs being very moveable, are less liable to fracture, than the others. When the spicula of a fractured rib is beaten inward, it may lacerate the pleura, wound the lungs, and cause the dangerous train of symptoms attendant on emphysema. (See *EMPHYSEMA*.) The pointed extremity of the rib, projecting inwards, may cause an extravasation of blood; or, by its irritation,

produce inflammation in the chest. A fracture, not at all displaced, or situated under thick masses of muscle, may be difficult to detect, particularly in fat subjects; and, no doubt, is frequently never discovered. The surgeon should place his hand on the part, where the patient seems to experience a pricking pain in the motions of respiration, or where the violence has been applied. The patient should then be requested to cough, in which action the ribs must necessarily undergo a sudden motion, by which a crepitus will often be rendered perceptible. All the best practitioners, however, are in the habit of adopting the same treatment, when there is reason to suspect a rib to be fractured, as if this were actually known to be the case by the occurrence of a crepitus, or the projection of one end of the fracture; which, indeed, in the instances which are displaced, makes the nature of the accident sufficiently plain.

A broken rib cannot be displaced either in the direction of the diameter of the bone, or in that of its length. The ribs, being fixed posteriorly to the spine, and anteriorly to the sternum, cannot become shortened. Nor can one of the broken pieces become higher, or lower, than the other, because the same muscles are attached to both fragments, and keep them at an equal distance from the neighbouring ribs. The only possible displacement is either outward or inward. In the treatment of simple fractures of the ribs, free from urgent symptoms, the principal indication is to keep the broken bones as motionless as possible. For this purpose, after a piece of soap plaster has been applied to the side, and over it proper compresses (supposing the displacement to be outwards), a broad linen roller is to be firmly put round the chest, so as to impede the motion of the ribs, and compel the patient to perform respiration chiefly by the descent and elevation of the diaphragm. A scapulary will prevent the bandage from slipping downwards. When the fractured part is depressed inwards, the compresses should be placed on the anterior and posterior part of the bone. As a roller is apt to become slack, many surgeons, with good reason, prefer a piece of strong linen, large enough to surround the chest, and laced with packthread, so as to compress the ribs in the due degree.

When there is reason, from the symptoms, to think the lungs injured, or disposed to inflame, copious and repeated bleedings should be practised. Indeed, as pleuritis, or pneumonia, is always liable to succeed the accident, and is a most dangerous occurrence, every person free from debility, either having a broken rib, or supposed to have such, should always be bled in the first instance. The *mixture cetacei*, with opium, is an excellent medicine for appeasing the cough, which disturbs the fracture, and gives the patient infinite pain.

FRACTURES OF THE SACRUM.

The sacrum, although superficial, is less frequently broken than the other bones of the pelvis; a fact attributable to its thickness, its spongy texture, and the advantageous way in which it supports the weight and efforts of the whole trunk. For the sacrum to be broken, the violence must be exceedingly great, like that resulting from the fall of a very heavy body, or the passage of a carriage wheel over the convex side of the bone, or a fall from a great height on that part. On the other hand, fractures of the sacrum, when they do happen, are gene-

rally accidents of a most dangerous kind, because, in addition to other injuries, with which they, in common with all fractures of the pelvis, are liable to be complicated, great damage is done to the sacral nerves. Hence, retention of urine, inability to retain this fluid, involuntary discharge of the feces, paralysis of the lower extremities, &c. Another principal danger also depends upon the injury, which the pelvic viscera may have suffered from the same violence, which broke the bone.

When the fracture is situated at the upper part of the sacrum, which seldom happens on account of the thickness of the bone in that situation, there is no displacement, unless the bone is smashed, and the fragments are driven inwards by the same force which produced the fracture; a case, which always implies severe injury of the external and internal soft parts. But when the fracture occupies the lower portion of the bone, where it is less thick, the inferior fragment may be displaced inwards, towards the rectum. In general, fractures of the higher part of the bone are not easily detected. (See *Boyer, Mal. Chir.* t. iii. p. 152.)

When the violence has been such as to make it probable that it has extended its effects to the pelvic viscera, every means in the power of art must be adopted for the prevention of inflammation. In particular, copious bleeding should be practised, and, if necessary, repeated. Leeches should be applied to the vicinity of the sacrum, and the parts kept cool with the *lotio plumbi acetatis*. Any difficulty, either in the expulsion or retention of the urine and feces, will likewise claim immediate and constant attention. (See *URINE, Retention of, Incontinence of, &c.*) With regard to the particular means for promoting the union of the fractured sacrum, quietude is the most important; and after the risk of inflammation is over, all that can be done is to apply a roller round the pelvis, or a T bandage to the part, with or without a piece of soap plaster.

FRACTURES OF THE OS COCCYGIS.

Though much slighter than the sacrum, it is less frequently broken, because less exposed to external force, and capable of a degree of motion, by which it eludes the effects of violence. But, in elderly persons, in whom the different pieces are connected by ankylosis, a fall on the buttock, or a kick, may fracture this bone. The accident is known by the movableness of the fragments, and the acute pain produced when the thighs are moved, the fragments being then disturbed by the action of the external sphincter, *gluteus maximus*, and *coccygeus*.

The treatment of fractures of the coccyx consists in enjoining quietude. The patient should avoid walking about, as this would put the *gluteus maximus* muscle into action, and disturb the broken bone. The patient should refrain from lying upon his back, or placing himself in a sitting posture. All formal attempts at reduction are not only useless in respect to the fracture, but hurtful to the soft parts, which are not in a state to bear handling without ill effects.

FRACTURES OF THE OSSA INNOMINATA

Are generally produced by the passage of the wheels of heavy carriages over the pelvis, falls from great heights, the kicks of horses, &c., and are always attended with considerable contusion of the soft parts, and sometimes with great injury

of the pelvic viscera. The anterior superior spinous process of the ilium is sometimes broken off by the kick of a horse. I have seen several examples of fracture of the pelvis by gunshot, some of which were accompanied by injury of the bladder or rectum.

The two ossa innominata may be broken together; but commonly only one of them is thus injured. Most frequently, the fracture takes place in the upper expanded portion of the bone, known under the name of the ilium, though sometimes it happens either in the ischium, or the os pubis. The solution of continuity may be limited to one part of the bone, or extend to several parts of it; and there may be a greater or lesser number of fragments, and these attended, or not, with displacement. In many instances, in which the pelvis has been violently jammed between two bodies, or run over by a heavy carriage, the bones of the pelvis, besides being fractured, are dislocated, some interesting examples of which accident are recorded by Sir A. Cooper. (*Surgical Essays*, part i. p. 49, &c.)

When I was an articled student at St. Bartholomew's Hospital, several cases presented themselves, in which the ilium, ischium, and os pubis, were found fractured on opening bodies after death; and, when the great violence necessary to produce the accident is considered, we cannot wonder that the injured state of the pelvic viscera should frequently prove fatal. In University College Hospital, some other instances of fracture of the pelvis have fallen under my notice. Fractures of the ossa innominata are unavoidably attended with more or less contusion of the soft parts; and when the violence has been very great, the pelvic viscera may be seriously bruised, crushed, or lacerated, and the large nerves contained in the pelvis, or the spinal marrow itself, injured: hence, extravasation of blood or urine in the cellular tissue of the pelvis; ecchymosis deeply situated; injury of the kidneys; complete loss of motion; paralysis of the lower extremities; discharge of blood, or a black bilious matter, by vomiting or stool, either immediately or at more or less distant periods from that of the accident; retention of urine; fever; painful tension of the abdomen from inflammation of the peritoneum and bowels; the formation of abscesses, which are sometimes of great extent; sloughing; and death. (*Boyer, Mal. Chir.* t. iii. p. 154.)

As the same author has observed, the violence occasioning a fracture of the ossa innominata, may produce a displacement of the fragments, and carry them more or less away from their natural situation. When the os pubis, or ischium, is broken, the splinters may be propelled into the urethra, or even through the bladder, and give rise to extravasation of urine; or by merely compressing these organs, they may cause more or less interruption of their functions. But, unless the fragments be displaced by the same force which caused the fracture, they can hardly be drawn out of their place by any other circumstance, since they are retained by the muscles attached to both fragments, and by surrounding ligamentous expansions.

Owing to the deep situation of fractures of the pelvis, and to there being generally no displacement nor mobility of the fragments, the diagnosis is sometimes attended with difficulty. A suspicion of the

accident may be entertained, when the pelvis has suffered considerable violence, the patient experiences great agony, and all motion of the trunk and lower extremities is difficult and painful. If the fracture should be in the ilium, especially its upper and front portion, or in the os pubis, the mobility of the fragments, or even a crepitus, may be distinguished in a thin subject, if, when he is lying horizontally, with his thighs and legs bent, and his head and chest elevated, the projecting part of the os innominatum be taken hold of, and an attempt be made to move the fragments in opposite directions.

When the fracture is of a part of the os innominatum, very deeply placed, and is limited to a single point of the os pubis, or ischium, so that no detached moveable fragment has been produced, the exact nature of the case can rarely be made out with certainty, before the patient's death, and the dissection of the parts.

Fractures of the ossa innominata are accompanied with serious danger. When the fragments are displaced, and do not admit of being rectified again, the disorder arising from this cause may have fatal consequences. And, as Boyer observes, even when such displacement does not exist, these fractures are not the less to be apprehended, on account of the injury which the spinal marrow and the nerves, vessels, muscles, and viscera within the pelvis are likely to have sustained. These complications, which are exceedingly frequent, may prove indeed directly fatal, or destroy the patient at a period more or less remote from the time of the accident. One terrible accident of this kind, which happened close to my house at Shepperton, proved fatal in half an hour.

When the pelvic viscera and urethra have escaped injury, a cure of the fracture may be effected by means of rest; a position in which all the chief muscles attached to the pelvis are relaxed; and a roller or T bandage. (*Boyer, Mal. Chir.* t. iii. p. 156.) Or the patient may be placed on a double inclined bed; a broad leather bandage may be passed round the pelvis, and buckled firmly in front of it, and the feet secured to the foot-board. (*Earle*.) The grand indication is to obviate the consequences of inflammation of the parts within the pelvis, and even of the peritoneum and abdominal viscera, by copious and repeated blood-letting. Any complaints, respecting the evacuation of the urine and feces, must also receive immediate attention. When there is great contusion, and the bones are badly broken, the patient cannot move nor go to stool, without suffering the most excruciating pain. To afford some assistance in such circumstances, Boyer, in a particular case, passed a piece of strong grith web under the pelvis, and collecting the corners into one, fastened them to a pulley suspended from the top of the bed. This enabled the patient to raise himself with very little effort, so that a flat vessel could be placed under him. In these and other cases, particularly compound fractures and paralytic affections from diseased vertebrae, the use of a bed constructed on the principles suggested by the late Sir James Earle, is of great service. (*See Obs. on Fractures of the Lower Limbs; to which is added, an Account of a Contrivance to administer Cleanliness and Comfort to the bed-ridden.* 1807.) Mr. Earle has also exerted his mechanical ingenuity with great success in the invention of a bed, admirably well calculated for the treatment

of fractures, and other cases, in which it is an object of high importance to enable the patient to empty the bowels, without changing his position.

Sometimes, notwithstanding the rigorous adoption of antiphlogistic measures, abscesses cannot be prevented from forming in the pelvis; particularly, when there are detached splinters driven inwards. These collections of matter should be opened, as soon as a distinct fluctuation can be felt. The splinters may wound the urethra or bladder, and cause an extravasation of urine. Desault extracted a splinter, which had had this effect, from the bottom of a wound, made for the discharge of the effused urine. In these cases, a catheter should be employed without delay, and kept introduced, in order to prevent the urine from collecting in the bladder, and afterwards insinuating itself into the cellular tissue of the pelvis, or even into the cavity of the abdomen. (*Chopart*.) In University College Museum is a specimen of a fracture of the pelvis, which runs through the rami of the ischium and os pubis. The injury caused retention of urine, and laceration of the urethra by one of the fragments, followed by fatal extravasation of urine. An interesting case of fracture of the ossa innominata, attended with rupture of the bladder, and followed by fatal peritonitis, has been recorded by Cloquet. (*Nouveau Journ. de Médecine*, Mars, 1820.) The ossa pubis were forced half an inch from each other. The horizontal branch of the os pubis, and the ascending ramus of the ischium, were broken; the sacrum dislocated from the ossa ilium, and driven forwards within the cavity of the pelvis. The right sacro-iliac synchysis was broken only at its fore part, and its bones still retained their connection. Vast quantities of blood were found extravasated in the lumbar region, and about the pudenda. As soon as the abdomen was opened, three pints of a yellowish fluid, having an urinary smell, immediately gushed out. In this case, catheters of various sizes were introduced, even a syringe adapted to them was used, but nothing could be thus drawn off, but a few drops of blood. The possibility of mistaking a fracture of the acetabulum for a dislocation of the thigh-bone, and the differences of these cases, as explained by Sir A. Cooper, have been mentioned in the article *Dislocation*.

In some well marked cases, however, of fracture of the os innominatum, extending into the acetabulum, Mr. Earle found that the symptoms more nearly resembled those of fracture of the neck of the femur. Thus, in one example of fracture of the acetabulum in two directions, with an extensive comminuted fracture of the ilium, with some displacement, and a fracture of the os pubis in three places, the patient "had lost all control over the left lower extremity, and could not raise it from the bed. There was no visible shortening of the limb; but the foot was everted. Any attempt to rotate the limb caused great pain, and was accompanied with a very sensible crepitus when the hand was applied over the hip-joint." The trochanter on the injured side was not nearly so prominent as on the sound one, and almost on a level with the anterior superior spinous process of the ilium. (*See Med. Chir. Trans.* vol. xx. p. 250.) The patient recovered from these severe injuries; and, after a time, died of disease in the chest. The reparation of the fractures was complete. In University College Museum is a preparation, also exemplifying a

recovery from an equally severe fracture of the pelvis, implicating the ilium, ramus of the left ischium, and the sacrum. The fractures are all united. In the above, and another instance, the particulars of which are given by Mr. Earle, the loss of prominence of the trochanter, and the freedom of motion of the joint, particularly of abduction, were the most marked symptoms. (*See also Wm. M'Tyer on Fractures connected with the Hip-Joint; Glasgow Med. Journ.* No. xiii.)

FRACTURES OF THE THIGH.

The thigh-bone is liable to be broken at any point, from its condyles to its very head; but it is in the middle third of this extent that fractures mostly occur, which are sometimes transverse, but more frequently oblique. The latter direction of the injury makes a serious difference in the difficulty of curing the case, without future deformity, or lameness. Sometimes the fracture is comminuted, the bone being broken in more places than one; and sometimes the case is attended with a wound, communicating with the fracture, and making it what is termed *compound*. As Petit remarks, however, the thigh-bone is less seldom broken into several pieces, than other bones more superficially situated.

A fractured thigh is attended with the following symptoms: acute pain at the instant of the accident; a sudden inability to move the limb; a preternatural mobility of one portion of the bone; a distinct crepitus, if the two ends of the fracture rub against each other; deformity, in regard to the length, thickness, and direction of the limb. The latter change, viz. the deformity, ought to be accurately understood; for, having a continual tendency to recur, especially in oblique fractures, the chief difficulty in the treatment is to prevent it. (*Desault, par Bichat*, t. i. p. 181.)

Almost all fractures of the thigh are attended with deformity. When this is considered, in relation to length, it appears that, in oblique fractures, the broken limb is always shorter than the opposite one; a circumstance denoting, that the ends of the fracture ride over each other. We may also easily convince ourselves, by examination, that the deformity is owing to the lower end of the fracture having ascended above the upper one, which remains stationary. What power, except the muscles, can communicate to the lower portion of the fractured bone, a motion from below upwards? At one end, attached to the pelvis, and, at the other, to this part of the bone, the patella, the tibia, and fibula, they make the former insertion their fixed point, and, drawing upward the leg, the knee, and the lower portion of the thigh, they cause, directly or indirectly, the displacement in question. In producing this effect, the triceps, semi-tendinosus, semi-membranosus, rectus, gracilis, sartorius, &c. are the chief agents.

For the purpose of exemplifying the power of the muscles to displace the ends of the fracture, mention is made, in Desault's works, of a carpenter, who fell from a scaffold, and broke his thigh. The limb, the next day, was as long as the other; but the man had a complete palsy of his lower extremities, and could not discharge his urine. The moxa was applied, the muscles soon regained their power, and then the shortening of the limb began to make its appearance.

Besides the action of muscles, there is another cause of displacement. However firm the bed may be on which the patient is laid, the buttocks, more prominent than the rest of the body, soon form a depression in the bedding, and thence follows an inclination in the plane on which the trunk lies, which, gliding from above downward, pushes before it the upper end of the fracture, and makes it ride over the lower one. The muscles, irritated by the points of bone, increase their contraction, and draw upward the lower part of the bone; and from this double motion of the two ends of the fracture in opposite directions, their riding over each other results.

Transverse fractures are less liable to be displaced in the longitudinal direction of the bone, because, when once in contact, the ends of the fracture form a mutual resistance to each other; the lower end, drawn upward by the muscles, meets with resistance from the upper one, which being itself inclined downward by the weight of the trunk, pushes the former before it, and thus both retain their position in relation to each other.

The deformity of a fractured thigh, in the transverse direction, always accompanies that which is longitudinal; but, sometimes, it exists alone. This is the case, when, in a transverse fracture, one end of the bone is carried outward, the other inward; or, one remains in its place, while the other is separated. The upper end of the fracture is not now, as in the foregoing instance, motionless in regard to the muscular action; for the contraction of the pectineus, psoas, iliacus internus, and upper part of the triceps, draws it from its natural direction, and contributes to displace it.

The deformity of the limb, in regard to its direction, is either the consequence of the blow, which produced the fracture, or, what is more common, of the ill-directed exertions of persons who carry the patient. Thus, an injudicious posture will bend the bone so as to make an angle.

Whatever may be the kind of deformity, the lower end of the fracture may retain the natural position in which it is placed, or else undergo a rotatory motion on its axis outward, which is very common, or inward, which is more unusual. This rotation always aggravates the displaced state of the fracture, and should be attended to in the reduction. (*Desault*, t. i. p. 180. 185.)

Three very different methods of treating fractured thighs are followed. In one, which was recommended by Hippocrates, and is preferred by a vast number of surgeons, the limb is kept in the straight or extended position. In another, the limb is laid upon its side, with the knee bent; a mode which was extolled by Pott, and has had many partisans in this country. To these two positions for fractured thighs is to be added that in which the patient lies upon his back, with his thigh and leg in the bent position, supported on two oblique planes, or surfaces, the apex or angle of which is beneath the ham.

That Pott lost sight of certain advantages of the straight position; that he was blind to the imperfections of the bent posture; and that he exaggerated the power, which we have, of relaxing all the muscles of a limb by position; few reflecting surgeons of the present day will be inclined to deny. Were we to believe the literal sense of several passages in Pott's Remarks upon Fractures, we should suppose it practicable to relax at once, by a certain

posture of the limb, every muscle connected with a fractured bone. In the first vol. of his works, page 389. edit. 1783, he observes, in speaking of what must best answer the purpose of incapacitating the muscles from displacing the fracture: "Is it not obvious, that putting the limb into such position as shall relax the whole set of muscles belonging to, or in connexion with, the broken bone, must best answer such purpose?" and, in the next page, "What is the reason why no man, however superficially acquainted with his art, ever finds much trouble in setting a fractured os humeri? it not because both patient and surgeon concur in putting the arm into a state of flexion, that is, into such a state as relaxes all the muscles surrounding the broken bone?" Also, in page 393, he continues, "Change of posture must be the remedy, or rather, the placing the limb in such manner as to relax all its muscles." Putting out of present consideration the disputed point, whether the relaxed state of a muscle is really the most efficient for the prevention of those spasms, which displace a fracture, and occasion vast suffering (see *J. Houston*, in *Dublin Journ. of Med. Science*, vol. viii. p. 459.), the possibility of perfectly relaxing all the muscles of the limb by any position, so long as different muscles have different uses, different situations, and different attachments to the bones, every one must grant to be only a visionary project. For instance, do not the patient and surgeon, in the case of fractured os humeri, adverted to above, concur in putting the fibres of the triceps and anconeus into a state of tension, at the same moment that they relax the biceps and brachialis internus?

The position of the fractured os femoris, says Pott, should be on its outside, resting on the great trochanter; the patient's whole body should be inclined to the same side; the knee should be in a middle state between perfect flexion, or extension, or half-bent; the leg and foot, lying on their outside also, should be well supported by smooth pillows, and should be rather higher in their level, than the thigh; one very broad splint of deal, hollowed out and well covered with wool, rag, or tow, should be placed under the thigh, from above the trochanter, quite below the knee; and another, somewhat shorter, should extend from the groin to below the knee on the inside, or rather in this posture on the upper side. The bandage should be of the eighteen-tail kind; and when the bone has been set, and the thigh well placed on the pillow, it should not, without necessity (which necessity in this method will seldom occur), be ever moved from it again, until the fracture is united; and this union will always be accomplished in more or less time, in proportion as the limb shall have been more or less disturbed.

Here only two splints are mentioned; but the few surgeons who still adopt this method, usually employ four. After placing the patient in the above position, the necessary extension is to be made. Then the under splint, having upon it a broad soft pad, and an eighteen-tailed bandage, is to be laid under the thigh, from the great trochanter to the outer condyle. The surgeon, before applying the soap plaster, laying down the tails of the bandage, and putting on the other three splints, is to take care that the fracture lies as evenly as possible.

In the foregoing observations, we find Pott directing the leg and foot to be rather higher in their level than the thigh; with what particular

design, I have not myself been able to make out. Whoever meditates upon the consequence of elevating the leg and foot above the level of the thigh, in the bent position, will know, that it is to twist the condyles of the os femoris more outward than is natural. When a patient is placed, according to Pott's direction, upon a common bed, the middle soon sinks so much that the leg becomes situated considerably higher than the thigh, and I am disposed to think, that this is one cause why so many broken thighs were formerly united with the foot permanently distorted outward. The great propensity of the adductor and other muscles to produce this effect, may also serve to explain the frequency of the deformity. It is not merely the depression of the middle of the bed which is disadvantageous: as the weight of the patient's body falls more upon one side of the bed than the other, in this position of the limb, unless the sacking be tight and the mattress very firm, it happens that such a declivity is formed, as to render it exceedingly difficult, if not impracticable, to make the patient continue duly upon his side. Hence, fractured thighs should always be laid upon beds not likely to sink much. When this happens, no rational dependence can be put in the efficacy of the bent position, and, as Desault has explained, the same thing is hurtful also in the straight posture.

Pott's position certainly leaves the leg and foot too moveable and unsupported, and, though it may relax the muscles, which have the greatest power to disturb the coaptation of a fractured thigh, it leaves a mass of muscle unrelaxed, quite sufficient to displace the ends of the bone. Hence, practitioners should endeavour to improve the apparatus employed, so that it may make a permanent resistance to the action of the muscles, and in the straight position such resistance may undoubtedly be made to operate with most effect and convenience.

In the early editions of this Dictionary, I expressed a preference to Pott's method of treating broken thighs. More experience, however, made me convert to the sentiments of Desault on this subject. The terrible compound fractured thighs, which I had under my care in the campaign in Holland in the year 1814, could not have been at all retained by any apparatus put merely upon the thigh itself. The superiority of long splints, extending the whole length of the limb, was in these cases particularly manifest. With such splints, which maintain steady the fracture itself, the knee, leg, ankle, and foot, the patient may, in fact, even be removed upon an emergency from one place to another, without any considerable disturbance of the broken part. But, how could this be done in Pott's position, with short splints, merely applied to the thigh, affording no support to the leg, and not confining the motions of the knee and foot?

It was observed by Desault, that, if we compare the natural powers of displacement with the artificial resistance of almost every apparatus, we shall find, that the disproportion between such forces is too great to let the former yield to the latter. The action of the muscles, however, which is always at first very strong, he conceived might afterwards be gradually overcome by extension being kept up. A power incessantly operating can effect what neither greater power, temporarily applied, can at a time, once accomplish, and the compression of the bandages tends also to lessen the force of

Desault cured an immense number of fractured thighs, without any kind of deformity. This success was chiefly ascribed to the well-combined employment of extension and compression of the muscles. The advantage of keeping the muscles a long while extended, in order to diminish their power, seemed to him particularly evident in the reduction of certain dislocations, as those of the shoulder, in which we often cannot succeed till the muscles have been kept on the stretch for a greater or lesser time. The fracture of the patella and olecranon equally demonstrates the utility of compression for the same purpose; as, when the muscles are not steadily compressed by the bandage, they draw upward the fragment of bone with double or triple force.

To the treatment of fractured thighs in the bent posture, Desault entertained the following objections. the difficulty of making the extension and counter-extension, when the limb is so placed; the necessity of then applying them to the fractured bone itself, instead of a situation remote from the fracture, as, for example, the lower part of the leg; the impossibility of comparing with precision the broken thigh with the sound one, in order to judge of the regularity of its shape; the irksomeness of this position long continued, though it may at first seem most natural; the inconvenient and painful pressure of a part of the trunk on the great trochanter of the affected side; the derangement, to which the limb is exposed when the patient has a motion; the difficulty of fixing the leg firmly enough to prevent the effect of its motion on the thigh-bone; the manifest impossibility of adopting this method, when both thighs are fractured; the unfavourable results of the trials of such posture made in France; and, what is gained by the relaxation of some muscles, is lost by the tension of others.

According to Desault, an apparatus, which does not execute permanent extension, may suffice for transverse fractures; but is always ineffectual, when the division is oblique, because it does not fulfil the twofold indication of drawing downward the lower end of the fracture, and keeping the other one upward. He inculcated, that the object, particularly to be aimed at, was such a disposition that the foot, leg, thigh, and pelvis, should constitute but one whole; so that, though the different parts thereof might be drawn in different directions, yet they would still, with respect to one another, preserve the same mutual relation; and he invented the following apparatus to answer these purposes. A strong splint, long enough to extend from the crista of the os ilium to a certain length beyond the sole of the foot, and rather more than two inches and a half broad, with each of its extremities pierced in the form of a mortise, and terminating in a semicircular meche, is a principal part of Desault's apparatus. It is applied to the exterior side of the thigh, by means of two strong linen rollers, each more than a yard long. The middle part of one roller is applied to the inside of the thigh, at its upper part; its ends are brought to the exterior side of the thigh, passed through the mortise, and knotted on the semicircular meche. Pads are to be previously placed under its middle part, in order to prevent any disagreeable pressure; as well as on the tuberosity of the ischium, which Desault considered as the principal point of action of this band. The inferior part of the leg is next covered

with pads, on which the middle part of the second roller is placed, the extremities of which cross on the instep and upper part of the foot, then on the sole; after which they are conveyed outward, and one end passed through the mortise, and knotted with the other on the niche, with such a degree of force as to pull the inferior portion of the femur downward, and push the splint upward, and, by this means, the pelvis, and superior portion of the fractured bone. On the internal side of the limb is placed a second splint, which extends, from the superior part of the thigh, to a certain distance beyond the foot. A third is placed on the anterior part of the limb, from the abdomen to the knee. The superior extremities of the anterior and exterior splints are fixed by means of a bandage passed round the pelvis. A roller, the middle part of which is placed under the sole of the foot, and the extremities crossed on its superior surface, and fastened to the splints, operates with them in preventing the foot from moving.

Before applying the apparatus, Desault covered the whole limb with linen, wetted with a solution of the acetate of lead. Over these, Scultetus's bandage was put, and a roller round the foot, all wetted with the same lotion. (See *Parisian Chir. Journal*, vol. i. *Œuvres Chir. de Desault*, par Bichat, t. i. Rosalino Gardina, *Memoria sulla Fratture, con alcune Modificazione all' Apparatto di Desault*. 8vo. Palermo, 1814. Boyer, *Maladies Chir.* t. iii.)

In University College Hospital, Desault's method, somewhat modified, and in particular without the employment of the wetted many-tailed bandage, is commonly preferred. Dr. Houston, who is an advocate for the same practice, has lately published some interesting cases and observations, relative to the treatment of fractures generally, and in particular to the question concerning the advantages of one kind of posture over another. Dr. Houston conceives, that they will tend to settle what is the best mode of preventing early spasms, pain, and fever, and of securing for the patient, after the cure, the most seemly and useful condition of the limb; whether that of leaving the broken bone, during the first day, in the predicament in which it has been thrown by the accident, or that of bringing about, and securing, by artificial means, the proper apposition of the fragments, is the more likely to accomplish these objects. He believes, also, that they will enable us to draw a comparison between the advantages of the flexed and straight postures. It appears to him, that no advantage whatever is gained by leaving the ends of a broken bone in any manner out of place. The excuse for this practice, founded on the doctrine of relaxing the muscles to prevent, or relieve spasms, he regards as completely erroneous; and, he insists upon the fact, that relaxation of the muscles, which have a tendency to spasmodic contraction, excites and promotes it; whilst, on the other hand, extension, or stretching of the same muscles, is the most likely means of averting or subduing the spasm. In the spasmodic action of the gastrocnemius, which follows over-exertion of it, he observes, relief is sought in an attempt at elongating the muscular fibres by stretching out the heel. A person in bed, seized with such cramps, will press the heel of the affected limb against the footboard, or get out of bed, in order to accomplish more effectually the same object, by standing with the heel on the ground. In this

case, says Dr. Houston, it is obvious, that the relaxation of the muscle is favourable to the occurrence of spasm, and that extension constitutes a means of relief. The primary cause of spasms of the muscles in fractures he conceives to be the loosening of one or other of their fixed points of attachment; and he thinks it not likely, that, by leaving them in the loosened state, or by giving one set of muscles a greater degree of relaxation than another, a check will be given to irregularity in their movements. On the contrary, it appears to Dr. Houston, both from an examination into the laws of muscular contraction, and from observations of the phenomena, which occur in other cases of disease, as well as in fractures, that the more completely the muscles are extended in length, and secured by their extremities to unyielding points, the less will be their disposition to spasmodic action. The practice of placing a broken limb in the bent posture, does not appear to Dr. Houston the most calculated to avert or check spasms; for, by such posture, the most powerful set of muscles, the flexors, seem to him to be brought into a condition "favouring the energy of their contraction;" whilst the influence of the extensors, in counteracting the effects of such contraction, is weakened nearly in the same degree.

Moderate soft pressure on the surface of a fractured limb, appears to Dr. Houston to assist in the prevention of cramps in the long muscles, "on the same principle, that proper fixtures for the attachment of their distal extremities contributes to that effect. Such pressure may exert its beneficial influence in controlling any irregular action in the muscles, by numbing their sensibility, and producing in them a certain amount of fatigue, which weakens their powers of contraction, as well as by propping together, and keeping steady the broken fragments of the bone." (See *Dublin Journ. of Med. Science*, vol. viii. art. 19.)

Dr. Houston's views of the physiology of muscular action, with reference to fractures of the extremities, make him an advocate for the extended posture, accompanied, if necessary, with extension. The cases, which he has published, are brought forward to prove the efficacy of this practice in preventing the occurrence of spasms, inflammation, and fever; and some of them to exemplify its utility even when circumstances have prevented its adoption, until after the coming on of these symptoms. Dr. Houston finds, that the patient "becomes sooner reconciled to the bed in this posture, than in the flexed one; he can be shifted more readily, so as to vary the points of contact between his body and the bed, and thereby save himself from excoriations, or sloughing of any part; and he can assume the sitting posture, and maintain it with less fatigue, for a considerable time. A better judgment may be formed of the length and shape of the broken limb, by its admitting of a comparison with the sound one; the limb can be kept more steady; and extension, if necessary, can be more readily and effectually practised." (*Houston*, vol. cit. p. 489.)

The double-inclined plane does not appear to Dr. Houston exempted, in any considerable degree, from the ordinary inconveniences, attendant on any other plan of treatment, which has for its object the principle of relaxation, or flexure of the limb; "whilst it is almost totally useless, as a means

either of effecting elongation of a shortened bone, or of giving, in many cases, steady support to the member. Besides, it throws the weight of the body so completely on one part of the buttock, and by its bulk and shape so deprives the patient of the means of relieving himself from such injurious pressure, that excoriation and sloughing of the hips are frequent consequences of its use." (p. 490.)

Dr. Houston also objects to the double-inclined plane for fractures of the thigh, because it has no provision "by which the upper fragment may be steadied against the lower, especially in cases where the lesion in the bone has taken place near the trochanters. The lower piece, together with the knee and leg, are immovably fixed, whilst the upper is left in such a predicament, that the least movement of the buttocks bends it from side to side, and rubs and twists its broken surface against that from which it has been detached. There is no provision in the inclined plane, by which the upper part of the thigh, when bent upon the pelvis, can be secured against the motions communicated to it by that part, such as may be effected in the extended posture by long splints and pads, passing up on the inside close to the perineum, and on the outside, as far along the body as may be thought necessary, securing, thereby, all the parts, so that, in any movement which is made, all must go together, as if they were one solid piece." (Vol. *cit.* p. 492.)

The usual objections to the straight posture in fractures just below the trochanters, on account of the tendency of the upper fragment to be pulled forwards by the psoas and iliacus muscles, were not exemplified in one of the cases of this description, the particulars of which are given by Dr. Houston. "The projection forwards of the upper piece, so remarkable in the first days after the accident, gradually subsided, under gentle pressure on the forepart of the thigh, and the bones finally assumed their natural points of connexion with each other. By the adoption of the extended posture, with the aid of extension, that deformity, so common in fractures of the thigh, permanent eversion of the toes, and I believe also, that of shortening of the limb, will be more probably averted, than can be done under the best directed efforts of the double-inclined plane." By the same plan, likewise, Dr. Houston observes, that pain and excoriation of the heel may be easily prevented, by a narrow pad belaid between the limb and bed, a little above the heel. The apparatus, which this gentleman employs for fractures of the lower extremities, is a modification of that recommended by Desault, and consists of a tailed bandage, two long lateral splints, and splint-cloth, two calico bags containing bran, and broad straps with buckles, together with a footboard, and, if necessary, laces of calico for the purposes of extension. "The tails of the bandage may be two inches and a half broad, and about two feet long. They should be applied neatly around the limb, with due regard to lightness. The application of this bandage tends to steady and support the muscles, and, if much inflammation be present, it may, when very lightly applied, be of use in conveying discutient washes. In a case of compound fracture, the bandage may be left out to facilitate the discharge of matter, and to permit the application of poultices or dressings, without disturbing the other parts of the apparatus. The splints may be made of deal, of

sufficient thickness to prevent their bending, and from $2\frac{1}{2}$ to $3\frac{1}{2}$ inches in breadth, according to the thickness of the limb to which they are to be applied. They should be of equal breadth, as otherwise the limb will turn to the side of the narrow one. In case of necessity for permanent extension, the external splint should be made, as directed by Desault, with a hole and notch at either end, by which to fasten the lac; and it will be advantageous here to have this splint of sufficient length to mount well up along the side of the abdomen, as the higher the point, to which the lac is fastened, the more effectually will the extension be exerted in the axis of the limb." Dr. Houston prefers pads of linen, or calico, filled with bran, and about one third broader than the splints. If permanent extension be necessary, the upper lac, or band for counter-extension, he recommends to be filled in a baglike form with bran, in order to prevent excoriation of the groin. The ends of this lac should be long enough to be carried round the abdomen, after being fastened to the top of the splint, by which means the splint will be effectually secured to the side. In order that the extension of the lower end may be made as much as possible in the line of the axis of the limb, Dr. Houston deems it advantageous to draw the lac through a hole or slit in the centre of the footboard, which will thereby serve as a pulley to give the lac a perpendicular direction, before it is turned towards the extremity of the outer splint, to which it is to be fastened. A piece of leather, introduced between the ankle and the lac, will save the skin from the injurious effects of pressure. The lac may consist of a long strip of calico, doubled up several times into a breadth of about an inch and a half, and smoothed so as to make it lie flatly. The mode of its application may be that usually practised for the reduction of dislocations, by which extension is made equally from both sides of the limb. For other particulars, the reader is referred to Dr. Houston's paper. (See *Dublin Journ. of Med. Science*, vol. viii. art. 19.)

Thus, we find, that Dr. Houston's principles and practice, in relation to fractures of the thigh, are as opposite as possible to those of Pott, and coincide very closely with those of Desault. As no posture will hinder the muscles from displacing the ends of the fracture, I have always recommended that to be generally preferred, in which the most efficient mechanical aid can be employed. The position chosen by Pott, I have therefore long abandoned, and tried sometimes a slightly flexed position, on a well made double-inclined plane, with footboard, and pelvis and thigh straps; but, of late, still more frequently, the straight position. During the first year after the opening of University College Hospital, I tried both plans promiscuously, and nearly every case terminated without deformity; but, as the patients in the straight position appeared to suffer least inconvenience, I have since commonly preferred it. With regard to Dr. Houston's observation, that the double-inclined plane cannot be made to "bind the pelvis and broken fragments together as one piece, only moveable together," it cannot apply to one of proper construction, like that of Amesbury, with a pelvis and thigh strap. I have now a woman under my care in University College Hospital, whose thigh-bone is broken close below the trochanter minor. The extended position was tried for the first few days;

but, as the upper fragment continued to project considerably forwards, the slightly flexed posture, on a double-inclined plane, with a pelvis strap, was adopted; and the ends of the fracture were then kept together without difficulty; and the union of them has taken place very favourably. As for fractures of the leg, the relaxation of the powerful muscles of the calf, seems to me so advantageous in the reduction and subsequent management of these accidents, that I apprehend it will never be renounced, whatever may become the general practice with regard to fractures of the thigh.

Fractures of the femur, near the knee, are recommended by Sir Astley Cooper to be treated in the extended position, with lateral splints.

Instead of the position advised by Pott, or that recommended by Desault and Boyer, some surgeons prefer the posture, in which the patient lies upon his back, with the limb supported in the bent attitude by means of a wooden frame. This machine, in its most simple form, consists merely of boards, ten or eleven inches in breadth, one reaching from the heel to the ham, the other from the ham to the tuberosity of the ischium. Under the knee-joint, they are united at an angle, while a horizontal board connects their lower ends together. Thus they form two sloping surfaces, to which cushions are adapted, and over which the limb can be placed in an easy bent position. Near the edge of the inclined boards, holes are made, furnished with pegs. After the bone has been set, a long splint is applied from the hip to the side of the knee, and another along the inside of the thigh. (See *Sir Charles Bell's Operative Surgery*, vol. ii. p. 189.) The foregoing apparatus does not sufficiently secure the leg and foot from motion, though, with the aid of a roller and a footboard, this advantage might easily be obtained. At present, therefore, the oblique planes of Amesbury and McIntyre are generally preferred, which are more complete, admit of being placed at any angle, and fulfil their purpose with greater efficiency, particularly when the pelvis and thigh straps are employed. Indeed, whatever apparatus be applied, or whatever posture be chosen, the pelvis strap is a most important thing, if the fracture be high up; and without its assistance, as Dupuytren justly remarks, the patient cannot be cured without deformity. (*Clin. Chir. t. i. p. 333.*) The fracture bed, devised by my friend Mr. Earle, is excellently calculated for this mode of treatment, and has a contrivance, by which the patient is enabled to have stools, without moving himself or changing his posture in the slightest degree. (See *Earle's Practical Obs. in Surgery*, p. 125, &c. 8vo. Lond. 1823.)

FRACTURES OF THE NECK OF THE THIGH-BONE.

As this is a subject which has of late years excited considerable discussion, the reader cannot be too particular in noticing, that three distinct kinds of fracture, very different in their nature, treatment, and result, have been generally confounded together under the name of "fractures of the neck of the thigh-bone;" for, much of the dispute, that has prevailed, whether these fractures will unite like those of other bones, seems to have proceeded from the three species of fracture not having been properly discriminated. Two of the cases unite by means of callus, like other fractures; but, the other, as it usually occurs, is conceived by some

surgeons not to admit of a similar mode of union; or, at all events, they declare that such a termination is very difficult to procure. Sir A. Cooper has, therefore, divided these cases, first, into *fractures, which happen through the neck of the bone, entirely within the capsular ligament*; being the examples, in which a union by bone had not, some years ago, presented itself to his notice: secondly, into *fractures through the neck of the bone at its junction with the trochanter major, which fractures are of course external to the capsular ligament*: thirdly, into *fractures through the trochanter major, beyond its junction with the neck of the bone.* (*On Dislocations, &c. p. 114—116.*)

Fractures of the neck of the thigh-bone are infinitely more frequent than dislocations at the hip, and may arise from a fall, either upon the great trochanter, the sole of the foot, or the knee. According to Desault and Dupuytren, the first accident produces the injury much more frequently than the two latter. (*Clin. Chir. t. ii. p. 90. 93.*) The causes are arranged by Dupuytren, according to their greater frequency, as follows: 1. Falls on the great trochanter. 2. Direct violence, as that from gunshot. 3. Falls on the foot or knee. 4. Muscular action, as reported of a negro afflicted with tetanus. Of thirty cases, which were seen by Desault, four and twenty arose from falls on the side of the pelvis. All those, inserted by Sabatier in his interesting Memoir, were the result of a similar accident. In three or four examples, Dupuytren found the acetabulum fractured and forced inwards by the head of the femur, by a fall on the feet or knees. In the most remarkable of these cases, the uninjured head of the thigh-bone had passed entirely into the pelvis; and the neck, which was free from fracture, was so firmly wedged in the opening, that the reduction of this new species of dislocation was exceedingly difficult, even in the dead subject. In children, force, directed against the bottom of the acetabulum, may disjoin the pieces of the os innominatum combining to form it. (See *Dupuytren, Clin. Chir. t. ii. p. 110.*) Sir Astley Cooper observes, that, in London, the fracture within the capsule is most commonly produced by a person slipping off the edge of the foot-pavement. He admits, however, that the accident is frequently caused by a fall upon the trochanter major. (*Surgical Essays*, part ii. p. 35, 36. Also *Larrey, Journ. Complém. t. viii. p. 98. 8vo. Paris, 1820.*) Dupuytren, and all surgeons of experience, recognise the truth of the remark made by Sir Astley Cooper, namely, that a fracture of the neck of the thigh-bone, within the capsular ligament, seldom happens but at an advanced period of life; and the reason of the facility, with which the injury takes place in old persons, he ascribes to the interstitial absorption, which that part of the femur undergoes in individuals past a certain age, whereby it becomes shortened, and altered in its angle with the shaft of the bone. Dupuytren never had a case of fracture of the neck of the femur in a child, and he notices the great rarity of such an accident in young persons. (See *Clin. Chir. t. ii. p. 82.*) He refers, however, to one example in a boy, aged 15, as recorded by Sabatier. (*Mém. de l'Acad. Royale de Méd.*) Another, I think, has been published by Mr. Stanley. (See *Méd. Chir. Trans.*) Possibly some cases, supposed to have been fractures, might have been separations of the epiphyses. (See *Dupuytren, Clin. Chir. t. ii. p. 90.*) Fractures of the

neck of the thigh-bone, within the capsule, are more common in women, than men. (*J. Wilson on the Skeleton*, &c. p. 245. *A. Cooper on Dislocations*, &c. p. 122.)

Almost all the patients under Dupuytren, in the Hôtel Dieu, with fractures of the neck of the femur, were more than fifty years of age; and, he found the frequency of the accident increase with old age. The reason of the rarity and frequency of the accident at different periods of life, is correctly ascribed by him to the anatomical disposition of the parts, which is not the same in different ages and in both sexes. In childhood, the axis of the neck of the thigh-bone approaches that of the shaft; and the great trochanter forms but a slight prominence. Falls on this process were observed by Dupuytren to be the most common cause of the accident; and the frequency of the injury he found to be in a direct ratio to the degree of prominence of the great trochanter, or dependent upon the length of the neck of the bone, and the angle formed by it with the shaft. In children, the trochanter projects but little, being concealed under the prominence of the os innominatum. Hence, in falls upon the side of the pelvis, the violence does not operate upon it. Dupuytren notices, in addition to the above facts, the greater flexibility of the neck of the femur in a child; the diminutive breadth of the pelvis; and the abundance of adipous cellular tissue protecting the great trochanter.

In adults, under a certain age, fracture of the neck of the thigh-bone is rare, yet less so than in children. The phosphate of lime, as Dupuytren observes, has accumulated in the skeleton, though not so copiously as in old subjects; the neck of the femur is much longer; the angle formed with the body considerably more marked; consequently a greater projection of the trochanter, and an increased facility for the operation of the causes productive of fracture of the neck, whether they act from below upwards, or from above downwards. But, as Dupuytren further explains, this length of the neck of the bone, and projection of the great trochanter, differ according to the period of life, the sex, and the individual. In women, the neck of the femur is longer, the great trochanter more prominent, and consequently the frequency of fractures of the former parts greater, than in men. The bulk and fulness of the muscles, which lessen the effect of falls in male adults, of course lessen the frequency of these fractures in him; while, on the other hand, the accident is common in those male adults, whose conformation approximates to that of women in the breadth of the pelvis, the length of the neck of the femur, and the projection of the great trochanter. (See *Dupuytren, Clin. Chir. t. ii. p. 83—86.*)

Dupuytren adverts also to the generally greater quantity of subcutaneous fat in women, than in men, as diminishing the effect of falls on the great trochanter; but, when the emaciation is equal in both sexes, the anatomical circumstances above mentioned, he says, must render women more liable than men to fracture of the neck of the femur.

In advanced life, the pelvis retains its extreme width, the great trochanter is prominent, the neck of the femur inclined to a right angle, the organised substance of the bones lessened, and the phosphate of lime so redundant as to render the bones very brittle. These circumstances, together with the di-

minished quantity of adipous cellular tissue, and the flaccidity and atrophy of the muscles, account for the frequency of the accident in old men.

The circumstances enumerated by Dupuytren, as making women of advanced age more liable to this fracture, than men, are the following: the greater length of the neck of the thigh-bone; its lesser obliquity in relation to the shaft; the greater projection of the trochanter major, and the greater brittleness of the osseous texture, in the former, than the latter. In aged women, also, there is frequently considerable emaciation. (See *Clin. Chir. t. ii. p. 87.*)

The division is more frequently transverse than oblique; the neck being sometimes, in the former case, wedged in the body of the bone, as Desault found in several instances; a model of one of which, in wax, is preserved at Paris, and the natural specimen of which was in the possession of Bichat. A fracture of the neck of the thigh-bone is sometimes complicated with one of the trochanter major.

With respect to the diagnosis of a fracture within the capsular ligament, an acute pain is felt, a sudden inability to walk occurs, and the patient cannot raise himself from the ground. The latter circumstance, however, is not invariable. In the fourth vol. of the *Mém. de l'Acad. de Chirurgie*, a case is related, in which the patient walked home after the accident, and even got up the next day. Desault published a similar example; and several others fell under the observation of Dupuytren. (See *Clin. Chir. t. ii. p. 96.*) The locking of one end of the fracture in the other, affords an explanation of this circumstance.

The diagnosis is not always free from considerable difficulty: some individuals have the rational signs of the accident, and yet are not the subjects of it; while others, who have really encountered it, may not exhibit the symptoms of it. Sometimes a fall producing a contusion of the hip will bear some resemblance to a fracture of the neck of the femur, while the same cause occasioning the latter injury, may not hinder the patient from getting up and walking. Dupuytren concurs with other surgeons in ascribing this fact to the fracture being situated within the capsular ligament, and the fragments not being displaced, but the lower wedged in the upper. Then the circumstances of their becoming separated after a longer or shorter time, and of the fracture then being rendered manifest, he imputes to the fragments changing their situation with respect to one another, either in consequence of the weight of the body, the action of the muscles, or the removal of some portion of the fragments themselves. I think, however, with Mr. R. W. Smith, that it is more frequently owing to the fibrous covering of the neck giving way after a certain time (see *Dubl. Journ. of Med. Science*, vol. vi. p. 213.); and his observation seems well founded, that a sudden retraction, at a period more or less remote from the receipt of the injury, denotes a fracture within the capsule. The shortening and rotatory displacement of the limb, arising from the displacement of the fragments, then leave no doubt of the fracture, provided they are connected with no other cause than a fall a few days previously. Sometimes, as Dupuytren adds, the two foregoing signs do not occur, till fifty, sixty, or eighty days after the commencement of the treatment by rest and extension, owing to the callus having yielded to the contraction of the muscles, or

the weight of the trunk. Dupuytren further explains, that the internal fragment may be wedged in the external one, directed either forwards, or backwards, that, when it happens, the shortening of the limb is only to the extent that one fragment is impelled into the other; and that this may account, in some cases, for the occasional inversion of the foot, which is an exception to what is usually noticed. (See *Clin. Chir. t. ii. p. 97—100.*)

Another remark made by Dupuytren is perfectly correct, namely, that, when there is displacement, the nature of the accident is easily made out; but, that, when no displacement exists, a suspicion may be entertained of the fracture; yet there can be no certainty about it. When the shortening of the limb is only to the extent of a few lines, the discrimination of it from what is produced by the ascent of the pelvis from a contusion, is attended with difficulty; but the diagnosis is plainer, if the retraction amounts to half an inch, an inch, or an inch and half, or two, or three inches. The latter degrees of shortening rarely occur, but consecutively, and when the patient has attempted to walk. (*Dupuytren, Clin. Chir. t. ii. p. 103.*)

* The dissections made by Dr. Colles, led to the discovery, that sometimes the solution of continuity does not extend completely through the neck of the femur. (See *Dublin Hospital Reports*, vol. ii.) Three cases proving this fact are adduced; a fact, which at once explains the ability of some patients to walk directly after the injury, and the absence of all retraction of the limb. According to Mr. Amesbury, incomplete oblique fractures of the neck of the femur are easily produced in the recently dead subject. (*On Fractures of the Upper Third of the Thigh-bone*, p. 3.)

A shortening of the limb almost always takes place; the "leg becomes," according to Sir Astley Cooper, "in a case of fracture within the capsule, from one to two inches and a half shorter than the other; for the connexion of the trochanter major with the head of the bone, by means of the cervix, being destroyed by the fracture, the trochanter is drawn up by the muscles, as high as the ligament will permit, and consequently rests upon the edge of the acetabulum, and upon the ilium above it." (*On Dislocations*, &c. p. 117.)

With respect to the degree of retraction specified by Sir Astley Cooper, as attendant on fracture of the neck of the femur, within the capsular ligament, its correctness is not admitted by some surgeons; Mr. R. W. Smith, of Dublin, declares that it is completely opposed to the result of his experience; nor does he conceive it possible, that the capsule of the hip-joint could admit of displacement to the extent of two inches and a half, without being extensively torn; an occurrence very rare indeed; and, if, as is frequently the case, the fibrous reduplications, which constitute the periosteum of the neck of the bone, remain entire, or nearly so, retraction may be almost completely prevented. In several instances of recent fracture of the neck of the femur, within the capsule, Mr. Stanley found this to be the case. (See *Med. Chir. Trans.* vol. xiii.) Mr. R. W. Smith refers also to the statements of Boyer and Earle, in support of the same view; and he adds, "But when the fracture is external to the capsule, there is an opportunity for retraction occurring to its greatest degree: there is, in fact, nothing to prevent the full force of muscular action upon the lower fragment of the bone, while, at the same time,

the upper is forced downwards by the weight of the body." (See *Dublin Journ. of Med. Science*, vol. vi. p. 207.)

Mr. Smith excepts from this observation, the case in which the upper fragment is driven into the cancellated texture of the lower, the ascent of which is not only prevented, but sometimes the restoration of the limb to its original length. Here the degree of shortening will be much less than what is usually the result of a fracture external to the capsule; and this relative position of the fragments, Mr. Smith conceives, ought to be suspected, whenever unusual difficulty is experienced in detecting crepitus, and extending the limb to its original length.

Mr. Smith corroborates his remarks by a reference to fifteen examples of fracture of the cervix femoris, in the museum of Richmond Hospital. Thirteen of these are taken from patients who died in the hospital; and the degree of shortening in each case was carefully noted. With the exception of No. 9., the shortening did not exceed one inch in any case of intra-capsular fracture; and reached that extent in only one instance; nor, with the exception of No. 10., was it ever less than one inch and a half in the extra-capsular fracture. (See *Dub. Journ. of Med. Science*, vol. vi. p. 209.) With respect to No. 9., an intra-capsular fracture, in which the shortening equalled one inch and a half, the accident had occurred some years before the measurement was made, and the neck of the bone had been absorbed. In general, the degree of shortening, when the fracture is within the capsule, I believe, with Mr. Smith and others, often depends upon the extent to which the fibrous reduplications have been torn. According to this gentleman's investigations, the degree of shortening, when the fracture is within the capsular ligament, varies from a quarter of an inch to one inch; when external to the capsule, from one inch and a half to two inches and a half. At the same time, the great differences in the direction of the solution of continuity, must have, as Dupuytren has admirably explained, vast influence upon the degree of retraction, as well as upon the rotatory displacement of the limb. (See *Clin. Chir. t. ii. p. 113.*) The action of the muscles drawing upward the lower end of the fracture, the weight of the trunk in propelling downward the pelvis and upper end of the fracture, are the two causes of the shortening of the limb. In general, a slight effort suffices for the restoration of the natural length of the limb; but, the shortness recurs almost as soon as the extension ceases. "This evidence of the nature of the accident continues," as Sir A. Cooper correctly remarks, "until the muscles acquire a fixed contraction, which enables them to resist any extension, which is not of the most powerful kind." (*Surgical Essays*, part ii. p. 31.) Goursault, Sabatier, and Dupuytren found, that sometimes the shortening of the member did not take place till a long while after the accident. Dupuytren refers to examples in which several hours, and even from two to thirty days, elapsed, before any displacement of the fragments took place, and which was then produced either by the patient's own movements, or by the surgeon's examination of the part. (*Clin. Chir. t. ii. p. 96.*) In opposition to the common belief, that the limb is shortened, Baron Larrey asserts, that the member is at first actually lengthened. (*Journ. Complém. t. viii. p. 99.*) This statement I have never seen confirmed, and it is contradicted by

daily experience. And, to prove how widely Larrey differs from Sir A. Cooper, the following passage will suffice. "In order to form a still more decided judgment of this accident (says the latter writer) after the patient has been examined in a recumbent posture, let him be directed to stand by his bedside, supported by an assistant, so as to bear his weight upon the sound limb. Immediately he does this, the surgeon observes most distinctly the shortened state of the injured leg, the toes resting on the ground, but the heel not reaching it, the everted foot and knee, and the diminished prominence of the hip." (*Surgical Essays*, part ii. p. 34.) The lessened projection of the trochanter major arises from its not being supported by the neck of the bone, as it always is in the natural state of the parts. A swelling is observable at the upper and front part of the thigh, always proportioned to the retraction, of which it appears to be an effect.

The projection of the great trochanter is almost effaced. Directed upwards and backwards, this eminence becomes approximated to the crista of the os ilium; but, if pushed in the opposite direction, it readily yields; and, when it has arrived at its natural level, the patient becomes capable of moving his thigh.

The knee is a little bent. Abduction of the limb always occasions acute pain, and it is noticed by Sir A. Cooper, that the rotation inwards is particularly painful, because the broken extremity of the bone then rubs against the capsular ligament. (Vol. cit. p. 33.) If, while the hand is placed on the great trochanter, the limb is rotated on its axis, this bony projection may be felt revolvng on itself, as on a pivot, instead of describing, as in the natural state, the segment of a circle, of which the neck of the femur is the radius. This symptom, which was first particularly noticed by Desault, is very manifest when the fracture is situated at the base of the neck; less so when at its middle; and it is not very perceptible when the breach is near the head of the bone. In the rotatory motions, the lower fragment rubbing against the upper one, produces a distinct crepitus, which, however, is not an invariable symptom. In fact, as Sir A. Cooper has explained, it is not discoverable while the patient is lying upon his back with the limb shortened; but, if the leg be drawn down, so as to bring the limbs to the same length, and rotation be then performed, especially inwards, the crepitus is sometimes observed, in consequence of the broken ends of the bone being thus brought into contact. (*On Dislocations*, &c. p. 121.)

It appears to Mr. Amesbury, that the head of the bone moves so readily in the acetabulum, "that the least impetus, even through the periosteum and reflected membrane (supposing them to be entire), will cause it to move simultaneously, with the shaft; and, if it should do so in the same relative proportion, crepitus cannot be felt. If crepitus be not elicited by bending the limb upon the pelvis, the surgeon may try to produce it by causing the limb to be gently rotated, while he endeavours to fix the head of the bone by pressing it, with his fingers, back against the acetabulum." (*On Fractures of the Upper Third of the Thigh-bone*, p. 15.)

The toes are usually turned outward; a position which Sabatier considers as the inevitable effect of the fracture, though Paré and Petit noticed that it did not constantly occur. Two cases,

adduced by these illustrious surgeons, were not credited by M. Louis; but the experience of Desault fully confirmed the possibility of inversion of the limb. As Sir A. Cooper has remarked, three or four hours generally elapse before the turning of the limb outward is rendered most obvious by the fixed contraction of the muscles. (*Surgical Essays*, part ii. p. 32.) The inversion of the limb, however, in fractures of the neck of the femur, is rare; Dupuytren, in his immense practice, never having seen it but once or twice. (*Clín. Chir.* t. ii. p. 105.) Mr. R. W. Smith has met with three cases, in one of which the injury was within the capsule. (*Dub. Journ. of Med. Science*, vol. vi. p. 215.)

Mr. Langstaff dissected a case, in which the great toe was in the first instance everted, but subsequently turned inwards when the patient began to use the limb. "The preparation shows the fracture to have been within the capsular ligament, close to the head of the bone, and gives a decided refutation to the opinion of the length of the broken portion attached to the trochanter being the cause of the inversion, inasmuch as this part has been removed by absorption. The point of the foot was everted, whilst it retained its proper length, and only became inverted by a wise provision of nature to assist progression after it had begun to be shortened. This circumstance received great illustration in the person of Henry West, a boy from whom Mr. White, of the Westminster Hospital, removed the head, neck, and part of the trochanter of the left thigh-bone, in consequence of serofulous disease of the hip-joint, attended by abscess. He recovered after the removal of the bone. The thigh is three inches and a half shorter than the other, and the toes turned inwards, not only in walking, but when he lies on his back in a quiescent posture, or prepared for sleep." (*Guthrie, Med. Chir. Trans.* vol. xii. p. 109.) The possibility of the foot being turned inwards directly after the accident is the subject that now more immediately interests us. Of this occurrence an example is reported by Mr. Stanley. "A middle-aged man fell in the street, and his hip struck the curbstone. The immediate consequences were, that the limb was inverted and shortened to the extent of an inch, and no crepitus could be discovered. It was presumed that a dislocation had occurred, and accordingly an extension of the limb was made; and so great was the constitutional irritation occasioned by the repeated trials to reduce the supposed dislocation, that the man died about five months from the time of the accident. In the dissection of the hip, a fracture was found, extending obliquely through the middle of the neck of the femur, but entirely within the capsule. A portion of fibrous and synovial membrane on the anterior side of the neck of the bone had escaped laceration."—"In a male subject, that had been brought for dissection, it was observed, that the left lower extremity was turned inwards and considerably shortened. On examining the hip, a fracture was found, extending through the neck and shaft of the femur. The neck had been broken at its junction with the shaft, and a fracture had extended from the upper part of the trochanter major downwards at the posterior side of the femur, a little below the trochanter minor. The upper part of the shaft was thus split into two portions, one of which was of sufficient magnitude to include the trochanter minor, and nearly the whole of the trochanter major.

"In the two last cases, it may be asked, to what cause the inversion of the limb should be attributed? Whether to the direction of the fracture? If not, whether there be any other circumstance adequate to its explanation? In the instance of fracture within the capsule, the portion of the synovial and fibrous membrane which had escaped laceration on the anterior side of the neck of the bone might probably prevent the limb from being turned outwards; but (says Mr. Stanley) why it should have been turned inwards, I confess myself unable to explain. In the instance of fracture without the capsule, by considering the direction of the fracture, in reference to the attachments of the muscles, we obtain an explanation of both points. For, as nearly the whole of the muscles that rotate the thigh outwards were connected with the separated portion of bone, they must have ceased to influence the limb in one direction, and of course have left their antagonists at liberty to turn it in the other; and the fractured surfaces being permitted to unite, without any change in the position of the limb, the inversion would become permanent." (*Med. Chir. Trans.* vol. xiii. p. 508.) Respecting one part of this statement, I think with Mr. Smith (*Dub. Journ. &c.* vol. vi. p. 215.), that the circumstance of the fibrous membrane remaining entire upon the front of the neck of the bone, would scarcely account for the limb not being everted. The merit of having first explained the cause of the inversion of the foot in certain fractures on the outside of the capsular ligament is due, I believe, to Mr. Guthrie. "When (says he) the fracture has taken place in such a manner as to be external to the insertion of these rotators outwards, yet sufficiently within the insertion of the glutæus medius and minimus, so as not to deprive them of their due action, the toe will be turned inwards, and must always be so; or remain without any alteration of position, according to certain variations in the inclination of the fracture, affecting the power of these muscles." In the instance recorded by Mr. Guthrie, the little trochanter was broken off; but whether it be an essential complication, he conceives, must be determined by future observation. (*Vol. cit.* p. 112.) The principles on which this gentleman founds his explanation, have since been corroborated by the particulars of a case that was examined by Mr. Syme. (*See Edin. Med. Journ.* April, 1826.) The reason of the foot being occasionally inverted, even when the fracture is quite within the capsular ligament, still remains, however, a point in surgery requiring explanation. The eversion or inversion of the limb, Dupuytren ascribes to the obliquity of the fragments. If the internal fragment incline backward, and the external one forward, then, says he, eversion will take place; but, on the contrary, if the fracture be oblique in the inverse direction, there will be inversion of the limb. (*Clin. Chir.* t. ii. p. 109.)

Mr. Porter had an opportunity of dissecting the hip-joint, in a case where the patient, an old female, died the day after the accident. When first brought to the hospital, she could bend the knee and draw up the foot by the action of the muscles of the limb alone. Afterwards she lost this power. The limb was not shorter than the other; neither was the toe everted. At the *post mortem* examination, the limb was from a quarter to half an inch shorter than the other, and "the foot was in a state of semi-eversion." The capsule was found perfect, and, on dividing it posteriorly, a transverse fracture of the

neck of the femur was detected close to the head of the bone, and, of course, entirely within the capsule. The fragments were but little displaced, *being held together by the synovial membrane and periosteum.* These latter were partially detached, and a portion of the lower surface of the neck of the bone denuded; but the fibres, removed from the bone, were gathered together into a bundle, forming a kind of ligament of a triangular shape; the bone being at the edge of the head, the apex at the point of reflexion of the synovial membrane on the capsule. *This appeared to be very tense and strong, and made considerable resistance to a separation of the fragments.* "This case is interesting, as proving, that, in fractures completely within the capsule, the limb is not at all, or but slightly, shortened; and that the chief obstacle to such shortening, is the periosteum of the neck, and the reflected synovial membrane." (*W. H. Porter, in Dub. Journ. of Med. Science*, vol. x. p. 243.)

The dislocation upon the dorsum of the ilium, that into the sciatic notch, and fracture of the neck of the femur, *attended with inversion of the foot*, are to be distinguished from each other, according to Mr. Guthrie, by comparison, or a due estimate of the degree of inversion. In the first case, the inversion is complete, the great toe resting against the instep of the opposite foot; in the second, it is less complete, the great toe resting against the ball of the corresponding toe of the opposite foot; and in the third, it is still less complete. And, as Mr. R. W. Smith justly observes, the nature of the injury is rendered still more evident by observing the facility with which, in the case of fracture, the foot may be everted, the thigh flexed upon the abdomen, and the limb restored to its natural length by extension; and comparing its free, loose, powerless condition, with its almost immovably fixed-state in dislocation. (*See Dub. Journ. of Med. Science*, vol. vi. p. 218.) The accident most liable to be confounded with dislocation upon the dorsum ili, is fracture through the trochanters, with inversion of the foot. (*R. W. Smith, Op. et vol. cit.* p. 229.)

The ordinary position of the toes outward is commonly, and I believe correctly, imputed to the action of the rotator muscles, and the adductors. Bichat conceived, however, that, if this doctrine were true, such position ought always to exist; and he reminds us, that all the muscles, which proceed from the pelvis to the trochanter and upper part of the outer fragment, are, with the exception of the quadratus, in a state of relaxation, by the approximation of the femur to their point of insertion; and that the contracted muscles would not allow the foot to be so easily turned inward again. Hence Bichat thought it probable, that the weight of the foot itself might pull the limb into the position in which it is commonly found. On the other hand, it is remarked by Sir A. Cooper, that any one may satisfy himself that the rotation of the limb outwards is in part owing to the muscles, by feeling the resistance which is made to rotation inwards, which resistance, however, he thinks, may in some measure depend upon the length of the portion of the neck of the femur, which remains attached to the trochanter major, and rests against the ilium. (*Surgical Essays*, part ii. p. 32.)

In addition to the foregoing observations respecting the diagnosis, it is to be remembered, that a fracture within the capsular ligament seldom happens but at an advanced period of life, and is much

more frequent in women than men. (Sir A. Cooper on Dislocations, &c. p. 123.)

The observations of Boyer, R. W. Smith, Porter, and others, prove, that a fracture of the neck of the thigh-bone, on the outside of the capsular ligament, is attended with a greater shortening of the limb than a fracture within it. A fracture on the outside of the capsule is frequently met with in persons under fifty, though it may and does occur in older subjects. Also, while the fracture within the capsule takes place from very slight causes, this is generally the result of great violence, severe blows, falls, and the passage of heavy carriages over the pelvis. The crepitus can be easily felt, without previously drawing down the limb, and the case is characterised by greater suffering than what is usually noticed when the fracture is within the capsule. But the most important circumstance, in which a fracture on the outside of the capsule differs from one within it, is in its readily admitting of bony union, which it is much more difficult to accomplish in the latter case. (See Sir A. Cooper on Dislocations, &c. p. 185, &c.)

In an oblique fracture through the trochanter major, without injury of the neck of the bone, the leg is very little, and sometimes not at all, shortened; the foot is benumbed; the patient cannot turn in bed without great difficulty and pain: in some cases, the detached portion of the trochanter is drawn forwards towards the ilium; in others, it falls towards the tuberosity of the ischium; but, in general, it is widely separated from that portion which remains connected with the neck of the bone. The foot is considerably turned outwards, and a crepitus not readily detected. This accident may happen at any period of life: it unites readily; and the patient recovers, with a very good use of the limb. (Vol. cit. p. 158.)

Many years ago, it was supposed that fractures of the neck of the thigh-bone could not be cured without some shortening of the limb, and lameness. Ludwig, Sabatier, and Louis, broached this doctrine, and imputed the circumstance to the destruction of the neck of the bone. That this commonly happens, has been well ascertained. In several specimens which Mr. Crosse examined in different museums at Paris, whether imperfect union, or no union at all, had followed the fracture, this absorption of the neck of the bone had taken place to a great extent, and in some to so great an extent, that the articulating surface of the bone which plays in the acetabulum, rested between the trochanters consolidated to the body of the bone by ligamentous union, and the thickening of the surrounding parts, whilst all the intervening neck of the bone was absorbed. (See *Sketches of the Medical Schools of Paris*, by J. G. Crosse, p. 90.) M. Roux has also nearly always found the neck of the femur shortened and deformed after its reunion. (*Parallèle de la Chir. Angloise avec la Chir. Française*, p. 178.) The specimens in the museum of University College, exhibit the usual disappearance of more or less of the same part. Desault, however, in his practice, is said to have rarely met with instances of lameness from such a cause.

A question, formerly much agitated (see Earle's *Practical Obs. in Surgery*, Lond. 1823; and Amesbury's *Obs. on the Nature and Treatment of Fractures of the Upper Third of the Thigh-Bone*,

&c. Lond. 1829, ed. 2.), was, whether reunion by bone ever follows cases, in which the fracture is entirely within the capsule, and the head of the bone insulated, except at its attachment to the acetabulum by the round ligament? Many years ago, the decision of the French surgeons was in the affirmative, and they believed the fact to be actually demonstrated by preparations in their museums. M. Roux sent a specimen to Sir A. Cooper, with the hope of producing conviction; but, this eminent surgeon was not satisfied with the evidence, because the traces of reunion in that preparation appeared to him to indicate a sort of fracture, where the internal fragment still retained some connexion with the capsular ligament. (Roux, *Parallèle de la Chirurgie Angloise*, &c. p. 179, 180.) In fact, it was a case, in which the fracture happened at the junction of the cervix with the trochanter. Sir A. Cooper never denied the possibility of what M. Roux and others alleged, but only stated, that in all the examinations which he had then made, of *transcervical fractures of the cervix femoris*, within the capsular ligament, he had never met with a bony union, or with any which did not admit of motion of one bone upon the other. (*Surgical Essays*, part ii. p. 39.) Since that period, however, Sir Astley Cooper has satisfied himself that osseous union sometimes takes place, and he has in his own collection, a most unequivocal specimen of it, which he was kind enough to show to me, about two years ago. The possibility of bony union is now universally acknowledged; but the cure in this way, is far less frequent, than that by means of a ligamentous connexion. Sir Astley Cooper ascribes the common want of bony union to the fragments not being in contact, and duly pressed against each other, and to the little action in the head of the bone separated from the cervix, "its life being supported solely by the ligamentum teres, which has some few vessels ramifying from it to the head of the bone." These vessels, though neither large, nor numerous, may yet, according to Amesbury and Dupuytren, be adequate to the nutrition of the upper fragment. Besides, it is observed by Dupuytren, that the synovial membrane, which invests the cartilage, forms a little cul-de-sac at its base, and is distinctly covered by portions of reddish cellular tissue, in which there are many vessels. (See *Clin. Chir. t. ii. p. 118.*) Mr. Mayo gives two cases, exemplifying the appearances usually found on dissection; and observes, "there are features in them, which make it sufficiently clear, that the absence of bony union does not result from imperfect nutrition, or inadequate supply of blood to the separated portion." (*Outlines of Human Pathology*, p. 9.) This gentleman concurs with Dupuytren, Cruveilhier, and others, that, in the union of the shafts of long bones, the surrounding tissues take a prominent part in the act of reparation. But, in the fracture of the neck of the thigh-bone, within the capsule, these tissues are excluded by the untorn synovial and capsular membranes, from communicating with the fracture. "They are sometimes, indeed, seen to make the ordinary effort towards reparation of the adjacent fracture. Thus, a portion of an ossified provisional callus, is often met with external to the attachment of the capsular membrane to the neck of the femur. But, the effort is ineffectual; the callus cannot reach

the fracture, whether it remains entirely disunited, or is glued together by an exudation from the ends of the broken bone. In the cases, in which union takes place, (continues Mr. Mayo) I believe the process of ossification to be extremely slow. Such instances occur in those only, who are not greatly advanced in life at the time of the fracture; and in whom, through the care with which the joint is kept at rest, direct union by soft substances, takes place between the separated portions. Nothing, in truth, is then wanted for the restoration of the part, but time. The connecting soft substance will certainly, in time, ossify from the adjoining bones; not rapidly, as when the process stretches onwards from a provisional callus, but slowly, as when it spreads across a cranial fissure. The reason why so few specimens are met with of united fracture within the capsule, is, that this accident commonly happens to aged people; and aged people want both constitutional power and time for that slow and difficult process of reparation, which is independent of provisional callus." (Mayo, *ib.*) For the particular appearances found in the dissection of many of these cases, I must refer to the statements of Dr. Colles (*Dublin Hospital Reports*, vol. ii.), and to Sir Astley Cooper's own account, from which it seems, that in most instances, "no ossific union is produced; that nature makes slight attempts for its production upon the neck of the bone, and upon the trochanter major, but scarcely any upon the head of the bone; and that, if any union is produced, it is by ligament only." (Vol. cit. p. 46. Also, *Mayo's Outlines of Human Pathology*, p. 9.) Mr. Wilson's observations are all in support of the same explanation (*On the Skeleton*, p. 247.); and he adverts to two preparations in the museum of the College of Surgeons, which were supposed to be proofs of a bony reunion of the neck of the femur, subsequently to a fracture within the capsular ligament; but (says Mr. Wilson), "I have very attentively examined these two preparations, and cannot perceive one decisive proof, in either, of the bone having been actually fractured." One of these cases was published by Mr. Liston, in the *Edin. Med. and Surgical Journ.* Lastly, Dr. Colles of Dublin dissected several cases, in which the neck of the femur had been broken: in one, where the injury was within the capsular ligament, "no effort of nature had been made to create a reunion between the two pieces of the fracture, and the stability of the limb had depended upon the strength of those ligamentous bands, by which each piece was connected with the capsular ligament of the joint, aided, no doubt, by the extraordinary thickness which the capsular ligament had acquired." (*Dublin Hospital Reports*, vol. ii. p. 336.) In the two first instances, reported by this author, "The broken surfaces moved on each other, and were converted into a state approaching to ivory. No attempt had been made to reunite the fracture, and the pieces of bone were held in apposition only by new ligamentous productions from the capsular ligament, which were inserted into the external surfaces of each piece. In No. 3, there had been a slight attempt made at reunion. In Nos. 7, 8, and 9, we observed a phenomenon, which, I believe, is now for the first time mentioned, a fracture of only part of the bone. No. 6, presented us with that mode of reunion, which some have supposed the most perfect, of which this fracture is susceptible. While

Nos. 10. and 11. exhibit a mode of reunion very little inferior to callus in point of firmness, but very different in its nature, and which, I conceive, is peculiar to the fracture of the neck of the femur." Dr. Colles also found, that, in all these cases (except, perhaps, No. 5.) the capsular ligament was not lacerated. In every instance, however, there was an increased thickness of the capsule, and a removal of all, or the greater part, of the neck of the bone. "Although the ligamentous bands seem, in a majority of instances, to have proceeded from the capsular ligament, yet, it is evident from No. 6. that these may arise merely from the broken surfaces of the bone; for, in this case not a single fibre was attached to the capsular ligament, the new bond of union being covered by the reflected portion of the synovial membrane or periosteum of the neck. We have an illustration of this in Ruysch, tab. 1. Thes. 9." In Nos. 10. and 11. the fragments were united by a cartilaginous substance. In Nos. 7, 8, and 9. the unbroken portion of the neck was so softened, that it more resembled cartilage than bone, and, in this state, "it was laid down upon the fractured surface, and united to it." (Dr. Colles, in *Dublin Hospital Reports*, vol. ii. p. 353—355.) In the museums at Paris, are some preparations, which the professors used to exhibit at their lectures, in order to prove that bony union may succeed a fracture within the capsule. These specimens were carefully examined by Mr. Crosse, but none of them proved to him, that bony union ever follows where the head of the bone becomes insulated, excepting at its attachment to the pelvis by the ligamentous tere. (*Sketches of the Medical Schools at Paris*, p. 93.) On the other hand, Boyer observes, that experience fully proves the possibility of uniting such fractures of the neck of the thigh-bone, as are situated within the capsular ligament; but, he acknowledges, that there are certain circumstances, which may prevent this desirable event. "From all that has been hitherto said on the prognosis of a fracture of the neck of the femur, we may conclude (says Boyer) that this fracture is more serious than that of any other part of the same bone, because the difficulty of keeping it reduced is greater. That it may in general be reunited, especially in young healthy subjects (in whom, however, be it observed, the accident hardly ever occurs); but, more easily, when it is situated near the base of the neck, than near the head of the bone. That the languid vitality of one of the fragments, and the impossibility of ascertaining whether the coaptation be exact, make the cure slow, and the time necessary for their consolidation uncertain. That the neglect of means adapted to maintaining the limb in its proper length and natural straightness, and the fragments sufficiently motionless, may cause them to unite by an intermediate substance. Lastly, that the situation of the fracture near the head of the femur; the complete laceration of the elongation of the capsule investing the neck of the bone; the great age of the patient; and, particularly, the constitution labouring under some diathesis, which affects the osseous system; may render the cure absolutely impossible: that, in this circumstance, one of the fragments is more or less destroyed by the friction of the other against it, and in the joint a disease is formed, which tends to carry off the patient." (*Mat. Chir. t. iii. p. 284.*)

Boyer lays much stress on the complete laceration of the continuation of the capsule over the neck of the bone, as an occurrence preventive of union. But, he thinks, it does not frequently happen, because the capsular ligament hinders much displacement of the fragment. (*Op. cit.* p. 278.) As for Baron Larrey, he entertains no doubt of the possibility of uniting fractures of the neck of the femur within the capsular ligament, and concludes his tract on this subject with the case of General Fririon, who was perfectly cured after an injury of this description. (See *Journ. Complém.* tom. viii. p. 148.)

After the very numerous and careful dissections performed by Sir A. Cooper and Dr. Colles, with the view of ascertaining the state of the joint, after fractures of the neck of the thigh-bone, little doubt can be entertained, that where the fracture is transverse, and within the capsular ligament, a bony reunion, though not impossible, is at least so rare an occurrence as not to be calculated upon. Those who look upon it as a thing more frequent and easy of accomplishment, have probably not duly discriminated from the foregoing kind of case, either fractures extending more or less in the direction of the axis of the neck of the bone, or other fractures external to the capsular ligament. How much, however, the safety of a practitioner's reputation will depend upon the prognosis which is given, must be quite evident; for in the transverse fracture within the capsule, lameness is almost sure to follow, though its degree cannot at first be exactly estimated. (*Sir A. Cooper, Surgical Essays, part ii.* p. 51.)

So far as I am able to judge, Sir Astley Cooper has been the means of introducing a great deal of discrimination into this subject, and, without his able exertions, the important differences in the nature, symptoms, and curableness of the various kinds of fractures of the neck and upper part of the thigh-bone, depending upon their exact situation and direction, might yet have continued very imperfectly comprehended. This remark is made, without any intention of deducting from the merits of Desault, Platner, and Mr. John Bell, all of whom long ago expressed their opinion, which, as we know, extends rather beyond the bounds of accuracy, that a fracture within the capsular ligament would not admit of union by callus. (*C. Bell on Injuries of the Spine and Thigh-Bone.* 4to. Lond. 1824. p. 52, &c.)

Mr. Amesbury believes, that all fractures of the neck of the thigh-bone admit of union, whether they be situated quite within the capsular ligament or not, and whether the reflected portion of that ligament be ruptured or not; and he ascribes the usual want of success, not to the nature of the injury, not to the insufficient circulation in the pelvic portion of the bone, but to the imperfection of the mechanical means employed in the treatment. As, however, the important point under consideration, namely, whether transverse fractures of the neck of the femur, situated entirely within the capsular ligament, admit of bony union, is one that can only be determined by experience, Mr. Amesbury follows up his arguments by a reference to several cases.

The first case adduced was under the care of Mr. Gribbe of Holburn, and is described by Mr. Langstaff, who has the preparation: "The woman was about 50 years of age when the accident

occurred. The foot was everted, and there was shortening of the limb at this time; and, after death, it was shorter than the other full two inches and a half. She was confined to bed nearly twelve months: during the remainder of her life, which was ten years, she walked with crutches. This (says Mr. Langstaff, alluding to the preparation) is a specimen of fracture of the neck of the thigh-bone within the capsular ligament: the principal part of the neck is absorbed; the head and remaining portion of the neck were united principally by bone, and partly by a cartilaginous substance. The capsular ligament was immensely thickened, and embraced the joint very closely. The cartilaginous covering of the head of the bone and acetabulum had suffered partial absorption; the internal surface of the capsular ligament was coated with lymph. On making a section of the bone, it was evident that there had been a fracture of the neck within the capsular ligament, and that union had taken place by osseous and cartilaginous media." (See *Med. Chir. Trans.* vol. xiii.) Mr. Amesbury then adverts to Dr. Brulatour's case, reported in the same volume of the latter work. The patient, Dr. James, died about nine months after the injury. The following appearances presented themselves. 1. The capsule a little thickened. 2. The cotyloid cavity sound. 3. The interarticular ligament in a natural state. 4. The neck of the femur shortened: from the bottom of the head to the top of the great trochanter was only four lines, and from the same point to the top of the small trochanter six lines. 5. An unequal line surrounded the neck, denoting the direction of the fracture. 6. At the bottom of the head of the femur, and at the external and posterior part, a considerable bony deposit had taken place. A section of the bone was made in a line drawn from the centre of the head of the femur to the bottom of the great trochanter, so as perfectly to expose the callus. The line of bone, indicated by the callus, was smooth and polished as ivory. The line of callus denoted also, that the bottom of the head of the femur had been broken at its superior and posterior parts.

In another example, communicated to Mr. Amesbury by Mr. Chorley, of Leeds, a gentleman died twelve months after the accident, and, on examining the hip, the synovial covering was found united with the shortened neck of the bone nearly at the head. Here nature had also thrown out broad ligamentous bands, one on each side of the joint. They were firmly united to the head of the bone. When the soft parts had been removed, the head of the bone was seen depressed in a line with the shaft. The fracture was slightly oblique, commencing at the upper part close against the cartilaginous covering of the head of the bone, and extending downward and outward, so as to terminate in a point at the lower surface of the neck, one inch from the cartilaginous covering of the head. The posterior surface of the shell of the neck had the appearance of having been splintered, so as to make a part of the fractured end of the pelvic portion extend in one situation a little on the outside of the capsular ligament, and where no union had taken place.

In a fourth instance, where the necks of both thigh-bones had been broken at different periods, the parts were examined after the patient's decease. On the right side, the fracture extended through

the neck of the bone, in a direction downward and outward. In one part, a portion of the reflected membrane remained entire; but was separated from the neck of the bone in such a manner as not to prevent the retraction of the limb. The head of the bone was somewhat excavated; and that portion of the neck attached to the trochanter was partially absorbed. There was no soft substance between the surfaces of the fracture. A bond of union, however, consisting of fibrinous matter, adhered to the sides of the ends of the fracture, and, in one part, it was strong. No surgical attempt had been made to unite the fracture on the right side. On the left, the neck of the bone had been broken within the capsule, and was firmly united. The cervix was nearly absorbed; and the head was depressed, so as to ~~be~~ within about two lines of the trochanter minor, to which it was united at its base by a small short process of bone. Strong bands of ligament were seen connecting the pelvic portion of bone to the capsule, which had become thickened, and much smaller than natural. There had been a longitudinal fracture of the trochanter major, but quite independent of the injury of the cervix. The fracture of the latter part was united with the head, about two inches and a half below its natural situation; which leads Mr. Amesbury to believe, that what he terms the close coverings of the neck of the bone had been nearly or quite divided. A longitudinal section of the head and neck of the bone showed that the fracture had taken place close to the head. The uniting callus had become cancelled; but, he says, that the direction of the fracture could be seen "by the situation of the trochanter portion of the neck, when examined in different parts of its circumference." (*See Amesbury on Fractures, &c. p. 43, &c.*)

These, and other cases and dissections, sufficiently establish the possibility of bony union in fractures entirely within the capsular ligament. But this is not the ordinary mode of union; and no doubt is now entertained about many preparations, exhibited as specimens of it, not being good and authentic ones. The rapidity, with which absorption proceeds in the head and neck of the thigh-bone after fractures, brings about such changes as must soon greatly obscure the exact original situation and direction of the injury, and particularly the question, whether the injury reached also to the outside of the capsular ligament. That fractures extending beyond the capsular ligament may be united by bone, is admitted by all parties, as well as the fact, that those entirely within the capsule are often united with the intervention of fibrous or ligamentous bands. In confirmation of this circumstance, I have already cited the dissections performed by Dr. Colles of Dublin; and, in further proof of it, I refer to the preparations in the museum of the College of Surgeons at Edinburgh, as specified by Mr. B. Bell of that city. (*On Diseases of the Bones, p. 205, &c., 1828.*)

Having spoken of the nature of fractures of the neck of the thigh-bone, within and without the capsular ligament, I come next to the consideration of the proper practice to be adopted. In the first description of the injury, as osseous union is rare, ought we to endeavour to keep the fragments as nearly in a state of apposition as possible, and subject the patient to rest and confinement, with

the view of promoting the other modes of union, so well pointed out in Dr. Colles's paper? Or, should we, as Sir A. Cooper does, avoid confining the patient to any long, or continued extension, "as being likely to be productive of ill health, without the probability of producing union?" Yet, it appears both from this gentleman's own statements, and from those of Dr. Colles, Mr. Langstaff, Mr. B. Bell, and others, that though a bony union cannot always be effected, other connecting means may be established; and the more perfect these are, the less will be the subsequent lameness. So long, therefore, as these facts are incontrovertible, I should be disposed to recommend surgeons to do every thing in their power to keep the limb quiet, and in a desirable posture, for a due length of time. On this point, all surgeons must, on reflection, be unanimous. It is one that I have always insisted upon in my surgical writings, and it is one that is very properly defended by Mr. Amesbury. For this purpose, sometimes Desault's or Boyer's apparatus, with the limb in the straight posture; sometimes the double inclined plane, with the limb in the bent position, and the patient on his back; and sometimes, in America, Hagedorn's ingenious plan of using the sound limb, as the part to which the long splint, and footboard, with numerous perforations, should be attached, in order that the length of the injured limb, and the right position of it and the foot, may be effectually maintained; are preferred. Sir A. Cooper merely places one pillow under the whole length of the limb, and puts another transversely, under the patient's knee, so as to keep the limb in an easy bent position. In a fortnight, or three weeks, the patient is allowed to sit upon a high chair, and, in a few more days, he begins to take exercise upon crutches. After a time, these are laid aside, a stick substituted for them, and, in a few months, this assistance may be dispensed with. At the end of the treatment, a shoe must be worn with a sole of equal thickness to the diminished length of the limb. (*Surgical Essays, part ii. p. 50.*) On this plan, of course, no bony union can be expected, and, I prefer the doctrine of Dupuytren and Langstaff, that full time should be afforded for the chance of osseous union being completed, and efficient means adopted to keep the limb quiet and in the best position. From one hundred to one hundred and forty days are specified by Dupuytren as necessary for the consolidation of the callus. (*Clin. Chir. t. ii. p. 99.*)

In the treatment of such fractures of the neck of the femur as are situated on the outside of the capsular ligament, Sir A. Cooper prefers the position in which the patient lies on his back, with the injured limb in a bent posture, supported on what is termed the double inclined plane. When the limb has been placed over this machine, in an easy bent position, a long splint, reaching above the trochanter major, is applied to the outer side of the thigh, and fastened to the pelvis with a strong leathern strap, so as to press one portion of bone towards the other. The lower part of the splint is also fastened to the outside of the knee with a strap. The limb is to be kept as quiet as possible for eight weeks, at the end of which time the patient may leave his bed, if the attempt should not cause too much pain; but the splint is to be continued another fortnight. (*Surgical Essays, part ii. p. 59.*)

Dupuytren laid the patient on his back; bent

the thigh on the pelvis, and the leg on the thigh. He then reduced the displaced outer fragment. He disapproved of continued and forcible extension; and preferred a double inclined plane, composed of several pillows rolled firmly up into the form of bolsters, placed one above the other, and secured together by stitching. Along this double plane he placed another pillow lengthwise, extending from the hip to the heel. The leg and thigh were retained in their places by sheets folded round the limb after the manner of a cravat, and fastened to the bedposts. When consolidation had taken place, the double inclined plane was gradually lowered.

In University College Hospital I have, in many cases, successfully employed the double inclined plane with a pelvis strap; but have latterly tried still more extensively the straight position and long splints with equal success, and, perhaps, more comfort to the patient.

Pott's method of treatment, with reference to these cases, is now entirely renounced. The bad effects and painful consequences of having the whole weight of the trunk operating upon the fractured ends of the bone, which are often not properly in contact, are too obvious to need any comment. Yet, this injudicious pressure was made in the position recommended by Pott, which also forbids the use of long effective splints, and all assistance from moderate continued extension.

A fracture of the neck of the thigh-bone may be complicated with a dislocation of the head of the bone. (See J. G. Haase, *De Fractura Colli Ossis Femoris, cum Luxatione Capitis ejusdem Ossis conjuncta*. Lips. 1798.)

For further information, the following authors may be consulted. C. G. Ludwig, de Collo Femoris ejusque Fractura Programma. Lips. 1755. *Bellon*, in Mém. de l'Acad. de Chir. t. iii. *Atken's* and *Goock's* Machines are described in *B. Bell's* Surgery, vol. iv. *Sabatier*, in Mém. de l'Acad. de Chir. t. iv. *Ducrocq*, Mal. des Os, t. i. *Unger*, in *Richter's* Bibl. b. vi. p. 520. *Theden*, Neue Bemerkungen, &c. th. 2. *Brunninghausen*, über den Bruch des Schenkelhalses, &c. Würzb. 1789. *Van Griseher*, über die Entstellungen des Rückgrats, und über der Verrenkungen und Brüche des Schenkelbeins, aus d. Holland. *Hedenus*, in *Bernstein's* Darstellung des Chir. Verbandes, tab. xlii. fig. 82. and 83. *M. Hagedorn*, über der Bruch des Schenkelhalses, &c. Leipzig. 1808. *J. N. Sauter*, Anweisung die Beinbrüche der Gliedmassen, vorzüglich die complicirten, und den Schenkelhalsbruch nach einer neuen, &c. Methode, sicher zu heilen, 8vo. Konstanz. 1812. *J. Wilson*, on the Structure and Physiology of the Skeleton, &c. p. 243, &c. 8vo. Lond. 1820. *Dr. Colles*, in Dublin Hospital Reports, vol. ii. *Sir A. Cooper*, Surgical Essays, part ii.; and on Dislocations, &c. 4to. 1822. With Appendix, i. 23. *H. Earle*, Practical Obs. on Surgery, 1823. *Boyer*, Mal. Chir. t. iii. *John Bell*, Principles of Surgery, 4to. 1801. p. 549, &c. *Sir C. Bell*, on Injuries of the Spine and Thigh-Bone, 4to. 1824. *Baron Larrey*, in Journ. Complém. t. viii. p. 146. *G. Langstaff*, Cases of Fractured Neck of the Thigh-Bone within the Capsular Ligament, with the Dissections and Obs. in Med. Chir. Trans. vol. xlii. *E. Stanley*, Cases of Injuries of the Hip-Joint, Op. et vol. cit. *G. J. Guthrie*, on the Diagnosis and on the Inversion of the Foot in Fracture of the Neck, &c. of the Thigh-Bone, vol. cit. p. 103. *John Henshaw*, Op. cit. vol. xix. *Syme*, in Edin. Med. Journ. April, 1828. *B. Bell*, on Diseases of the Bone, 1828. *J. Ameybury*, Obs. on Fractures of the Upper Third of the Thigh-Bone, &c. 2d ed. 1829. *R. W. Smith*, on the Diagnosis of Fractures of the Neck of the Femur; Dublin Journ. of Med. Science, vol. vi. p. 205. *W. H. Porter*, Op. cit. vol. x. p. 243. *M. le Baron Duvernoy*, Leçons Orales de Clinique Chir. t. ii. art. 2. 8vo. Paris. 1832. *Herbert Mayo*, Outlines of Human Pathology, chap. i. sup. Lond. 1835.

OBLIQUE FRACTURES OF THE EXTERNAL OR INTERNAL CONDYLE OF THE FEMUR INTO THE JOINT.

In these cases, Sir A. Cooper prefers the straight position, because the limb presses the extremity of

the broken condyle into a line with that which is not injured. The limb is to be put in the extended posture upon a pillow, and evaporating lotions and leeches are to be used for the removal of the swelling and inflammation. "When this object has been effected, a roller is to be applied around the knee, and a piece of stiff pasteboard, about sixteen inches long, and sufficiently wide to extend entirely under the joint, and to pass on each side of it, so as to reach to the edge of the patella, is to be dipped in warm water, and applied under the knee, and confined by a roller. When this is dry, it has exactly adapted itself to the form of the joint, and this form it afterwards retains, so as best to confine the bones. Splints of wood or tin may be used on each side of the joint; but they are apt to make uneasy pressure. In five weeks, passive motion of the limb may be gently begun, to prevent ankylosis." (*Surgical Essays*, part ii. p. 101.; also *Treatise*, p. 221.) A compound fracture of the external condyle is recorded, a portion of which was, after a time, extracted, and the case ended so favourably, that the patient, who was a boy, was able to bend and extend the leg without pain.

For fractures, just above the condyles, Sir A. Cooper recommends the bent position, without which, he says, deformity is sure to follow. He advises the limb to be placed over the double inclined plane, and a roller applied round the lower portion of the femur. (p. 103.)

FRACTURES OF THE PATELLA

May be produced either by the action of external bodies, or by that of the extensor muscles. In the latter case, the fall is subsequent to the fracture, and, as Camper has remarked, it is mostly only an effect of it. For instance, the line of gravity of the body is, by some cause or another, inclined backward; the muscles in front contract to bring it forward again; the extensors act on the patella; this breaks, and the fall ensues. That it is the action of the muscles, and not the fall, which usually breaks the knee-pan, is well ascertained. Sometimes the fracture occurs, though the patient completely succeeds in preventing himself from falling backward, as we find exemplified in two cases reported by Sir A. Cooper. (*Surgical Essays*, part ii. p. 85.) A soldier broke the patella in endeavouring to kick his serjeant; the olecranon has been broken in throwing a stone. In the operating theatre of the Hôtel-Dieu, both the knee-pans of a patient were broken by the violent spasms of the muscles, which followed an operation for the stone. The force of the muscles occasionally ruptures the common tendon of the extensor muscles, or, what is more frequent, the ligament of the patella. Of these cases, Petit, Desault, and Sabatier, met with examples. When the patella is broken longitudinally, the cause is always outward violence. (*Œuvres Chir. de Desault*, t. i. p. 252.)

A transverse fracture of the patella may also originate from a blow, or fall, on the part; but, in all common cases, it is produced by the violent action of the extensor muscles of the leg. It is only of late years, however, that the true mode, in which the bone is usually broken, has been understood. For the production of a transverse fracture of the knee-pan, the extensor muscles of the leg need not act with a convulsive force, their ordinary

action being strong enough to produce the effect in question, when the body is inclined backward, and the patient is in danger of falling upon his occiput. In this state, the thigh being bent, the extensor muscles of the leg contract powerfully, in order to bring the body forwards, and prevent the fall backwards; and the patella, whose posterior surface then rests only by a point against the fore part of the condyles of the femur, is placed between the resistance of the ligament binding it to the tibia, and the action of the extensor muscles. A fracture now happens the more easily, because, by the flexion of the knee, the line of the extensor muscles, and that of the ligament of the patella, are rendered oblique, with respect to the vertical axis of this bone, which is bent backwards at the point where it rests upon the condyles. (See *Boyer, Mal. Chir.* t. iii. p. 322.; *C. Bell's Operative Surgery*, vol. ii. p. 201, 8vo. Lond. 1809; *A. Cooper's Surgical Essays*, part ii. p. 86.) By violent spasmodic action of the extensor muscles, however, the patella may be broken transversely, while the limb is perfectly straight. A very singular case is mentioned by Sir A. Cooper, where a patella, which had been formerly broken, and united by ligament, was again divided into two portions, in consequence of the destruction of the uniting medium by ulceration. (Vol. cit. p. 100.) A case is also on record, where the ligamentous uniting substance was so incorporated with the skin, that, when the latter happened to be lacerated, the knee-joint was laid open, and amputation became necessary. (*C. Bell, Op. Surgery*, vol. ii. p. 204.)

In transverse fractures, there is a considerable separation between the two fragments of the bone, every perceptible to the finger, when the hand is placed on the knee. This separation is not occasioned equally by both portions; the upper one, embraced by the extensor muscles, is drawn upward very forcibly by them, the patella no longer resisting, while the inferior portion, being merely connected with the ligament below, is not moved by any muscle, and can only be displaced by the motions of the leg, to which it is attached. Hence, the separation is least when the limb is extended, being then only produced by the upper fragment; greatest, when the limb is bent, because both pieces contribute to it; and it may be increased or diminished, by bending the knee more or less.

As Boyer has particularly noticed, the laceration, or not, of the tendinous expansion, upon the front of the patella, makes a material difference in these cases, because it is a part of great importance in the cure. According to this author, a portion of it in simple fractures of the patella, generally escapes laceration, and the separation of the fragments is then not very considerable; but the violent action of the extensor muscles, a full subsequent to the fracture, or the bending of the knee too much, may separate the pieces of bone far from each other, and rupture the tendinous expansion. (*Mal. Chir.* t. iii. p. 328.) According to Sir A. Cooper, "when the ligament is but little torn, the separation will be but half an inch; but under great extent of injury, the bone is drawn five inches upwards, the capsular ligament, and tendinous aponeurosis covering it, being then greatly lacerated." (*Surgical Essays*, part ii. p. 84.)

The upper portion of bone may be moved trans-

versely, and pain is thus excited, but no crepitus can be felt, as the two pieces of bone are not sufficiently near each other. When the swelling of the knee, consequent to fractures of the patella, is great, the symptoms of the injury may be more or less obscure. However, in consequence of the inability of the extensor muscles to move the leg, except in a few cases where the fracture is very low, the patient cannot stand without difficulty, and is unable to walk.

In the treatment, the chief indications are to overcome the action of the extensor muscles of the leg, and to keep the fragments as near each other as possible, partly by a judicious position of the limb, and partly by mechanical means. The first indication is fulfilled by relaxing the above-mentioned muscles; 1st, by extending the leg; 2dly, by bending the thigh on the pelvis, or, in other words, raising the femur, so that the distance between the knee and anterior inferior spinous process of the ilium, and brim of the acetabulum, may be as little as possible; which object, however, will also require the body to be raised, and the pelvis somewhat inclined forwards, so that the rectus may be perfectly relaxed. In short, as Richter long ago advised, the patient should be almost in a sitting posture, the trunk forming a right angle with the thigh. (*Bibl. Chir.* b. vi. p. 611. Göttingen, 1782.) 3dly, the muscles are to be compressed with a roller. The second indication, or that of placing and maintaining the fragments in contact, or as nearly so as circumstances will allow, is in a great measure already answered by the above-recommended position of the limb, and trunk; but it is not perfectly fulfilled, unless the upper portion of the bone be also pressed towards the lower fragment, and mechanically held in this situation by the pressure of an apparatus, or bandage. And, in pushing the upper fragment towards the lower one, the surgeon should always be careful, that the skin be not depressed and pinched between them.

After putting the patient to bed upon a mattress, and in the desirable posture, with the limb confined, supported, and raised, as above directed, upon a well-padded hollow splint, Sir A. Cooper applies at first no bandage to the knee, but covers it with linen wet with a lotion, composed of liq. plumbi acet. dilut. ʒv. and spir. vin. ʒj. If, on the succeeding day, or two, there be much tension, or ecchymosis, leeches should be applied, and the lotion continued; but the employment of a bandage is not to commence until the tension has subsided; for Sir A. Cooper assures us, that he has seen the greatest suffering, and such swelling as threatened gangrene, produced in these cases by the too early use of a roller. Instead of a circular bandage, placed above and below, the broken bone, and drawn together with tape, &c. so as to bring the upper fragment towards the lower one, this experienced surgeon prefers the following method.—A leathern strap is buckled round the thigh, above the broken and elevated portion of bone, and from this circular piece of leather, another strap passes under the middle of the foot, the leg being extended, and the foot considerably raised. This strap is brought up to each side of the patella, and buckled to the leathern band already applied to the lower part of the thigh. It may also be fastened to the foot, or any part of the leg, with tapes. The limb is to be confined in this

position five weeks, if the patient be an adult, and six if advanced in years. Then a slight passive motion is to be begun, and to be gently increased, from day to day, until the flexion of the knee is complete. (*Surgical Essays*, part ii. p. 91.) But, although the impropriety of making any constriction of the knee with a bandage, while the skin is swelled and inflamed, must be obvious, the surgeon ought to be apprised, that such swelling and inflammation ought not to occasion the least delay in placing the limb in the right posture, and pressing the upper fragment towards the lower one. Mohrenheim ascribes the lameness formerly so frequent after this fracture, partly to the custom of not thinking of bringing the pieces of bone together until the swelling had subsided, and partly to the fashion of bending the joint too soon, with the view of preserving its motion. But, says he, nothing can be clearer, than that it is most advantageous to attend to the union of the fracture first, and to the flexibility of the joint afterwards. (*Beobachtungen*, b. ii. 8vo. 1783.) Boyer has likewise remarked, that the uniting substance is apt to yield, and become lengthened, by bending the knee too early, and he therefore never allows this motion to be performed before the end of two months. When the ligamentous substance is long, and the patient very slow in regaining the use of the extensor muscles, he should sit every day on a table, and endeavour to bring them into action; and as this increases, a weight may be affixed to the foot, as Hunter, Sheldon, &c. recommend.

Nothing keeps the leg more surely extended, than a long, broad, excavated splint, with a suitable pad, applied to the posterior part of the thigh and leg, and fixed there with a roller, while the thigh itself is to be bent by raising the whole limb, from the heel to the top of the thigh, with pillows, which, of course, must form a gradual ascent from the tuberosity of the ischium to the foot.

The broken patella commonly unites by means of a ligamentous substance, instead of bone. However, that an osseous union may follow a transverse fracture of the patella, and still more frequently a perpendicular one, is a fact of which there is not now the slightest doubt. Thus, Lallemand has published an unequivocal specimen of a transverse fracture united by bone, with the history of the case, and the appearances after the death of the patient from some other affection. (*Boyer, Mal. Chir.* t. iii. p. 365, &c.) In the collection of Dr. William Hunter, there is one well marked instance of the bony union of a transverse fracture of the patella, and other examples have been seen in the dead subject by Mr. Wilson. (*On the Structure, Physiology, &c. of the Skeleton*, p. 240.) In Sir Charles Bell's museum were likewise similar specimens, one or two of which are now in the museum of University College. (*On Injuries of the Spine and Thigh-Bone*, p. 57, 58.) The reason why transverse fractures of the patella do not commonly unite by callus, is not owing to the want of power in this bone to produce an osseous connecting substance; for, as Larrey has several times noticed, if the fragments are kept in perfect contact by means of a suitable apparatus, their bony reunion becomes so complete, that scarcely any vestige of the injury can afterwards be traced. (*Journ. Complém.* t. viii. p. 114.) Indeed, it is a fact, on which Larrey

dwells, as affording a proof that callus is produced not by the periosteum, but by the vessels of the bones themselves. And, what must add strength to the purport of the foregoing remarks, is the consideration, that perpendicular or longitudinal fractures of the patella, which are not liable to any displacement from the action of the extensor muscles of the leg, readily admit of bony union. (*Wilson on the Structure and Physiology, &c. of the Skeleton*, p. 239.) This is a statement which, I think, could not be rendered doubtful by any experiments made on animals, without the advantages of quietude and proper treatment. Yet, there are other facts related, which prove that, both in longitudinal and transverse fractures, a ligamentous union is generally produced, when the fragments are separated; but, if these are not drawn asunder, an osseous union takes place. Thus, in one case, reported by Sir A. Cooper, one third of the patella was separated from the rest of this bone, and had united by ligament, a free motion being left between the fragments. (*Surgical Essays*, part ii. p. 94.) The same gentleman divided the patella longitudinally in a dog, without extending the division into the tendon above, or the ligament below, so that the fragments could not be separated. In three weeks, a close bony union was the result. (p. 95.) A case is also related, in which a gentleman fractured the patella transversely, and the lower portion likewise perpendicularly. The transverse fracture united as usual, by ligament; the perpendicular one, by bone. (p. 96.) Sir Charles Bell gives another explanation of the cause of union being by bone or ligament. In the common case, says he, of fracture of the patella by the sudden action of the quadriceps extensor, the pieces are separated without that degree of violence which is necessary to produce reunion by bone. But, when the patella is broken by a blow, or kick, there is not only less retraction, but "the injury, bloody effusion, tumefaction, and rigidity of the parts, resemble that which attends the fracture of any other bone, and the fragments unite by bone." (*On Injuries of the Spine, &c.* p. 58.)

The incorrect notions, formerly entertained, respecting the inconveniences of an exudation and projection of the callus into the joint after a fracture of the patella, and especially when the fragments are kept in contact, were long ago refuted by Pott and Sheldon. (*Pott's Chir. Works*, vol. i. p. 332. ed. of 1808. *Sheldon's Essay on the Fracture of the Patella, &c.* 8vo. Lond. 1789.) On the contrary, as Sir A. Cooper particularly remarks, "the internal articular surface of the bone preserves its natural smoothness." (*Essays*, part ii. p. 80.) How such doctrine of a superabundant callus could be reconciled with the doubts about a bony union being ever possible, appears difficult of explanation.

Pott, and some others, thought that an interspace between the two pieces of the patella, with a certain length of the connecting substance, might be advantageous in the motion of the joint; but Desault, Boyer, Sir A. Cooper, Sir J. Earle, and others, have always found, that the greater the distance between the two pieces of the bone, the greater is the difficulty afterwards in walking up a rising, or over an unequal ground.

In the treatment of a longitudinal, or perpendicular fracture of the patella, the leg should be kept

extended, leeches used, and a cold lotion applied. After a few days a roller is to be put round the limb, and then a laced knee-cap, with straps buckled round the limb above and below the patella. (*Sir A. Cooper*, vol. cit. p. 96.) The experience of Dupuytren confirms the fact, that a longitudinal fracture of the patella is soon firmly consolidated. (*Annuaire Méd. Chir. de Paris*, p. 94. 4to. Paris, 1819.) Compound fractures of the patella frequently terminate in the death of the patient, unless amputation be performed early. The injury, however, does not invariably lead either to the loss of life or limb. I saw a case in St. Bartholomew's Hospital, in the year 1820, under Mr. Vincent, where the patella was broken to pieces, and the opening so extensive, that the fingers readily passed into the joint; yet, after a tedious confinement, the formation of abscesses, and the separation of several fragments of bone, the patient recovered with a stiff joint. In general, however, I believe, with Sir A. Cooper, that in compound fractures of the patella, if the laceration be extensive, or the contusion very considerable, amputation will be required: but, if the wound be small, the patient not irritable, and no sloughing of the integuments, or ligament, likely to occur, it will be best to try to save the limb. (Vol. cit. p. 99.) The wound should be reunited as speedily as possible, and advantage taken of evaporating lotions, perfect rest in a desirable posture, a very low regimen, leeches, venesection, and saline opening medicines. Since the above remarks were first drawn up, I saw another case of bad compound fracture of the patella in St. Bartholomew's Hospital, where it had been about a month. No fragments of bone had then been removed, but a good deal of matter issued daily from the wound, and the patient was in considerable danger of losing his limb, or even his life.

In addition to the works already cited, consult *D. H. Merdounis de Patella*, Oest. Gussak. Læssionibus, et Curatione. Frank. 1697. *P. Camper, Diss. de Fractura Patellæ*, et Olecrani, 4to. 1786. Comité. 1789. *Burrer*, in v. Siebold, Chiron, 3. l. p. 64. *T. Alcock*, in Trans. of the Associated Apothecaries, &c. vol. i.

FRACTURES OF THE LEG

May be transverse or oblique. The first case is most common in children and in adults, who meet with fracture of the tibia above the lower fourth of the bone. (See *Sanson*, in *Dict. de Méd. et de Chir. Pratiques*, t. viii. p. 557.) Experience proves, that the bones of the leg are much more frequently broken together, than singly; a fact ascribed by Boyer to the strength of the knee and ankle-joints. (*Mal. Chir.* t. iii. p. 360.) The direction of an oblique fracture of the tibia is often from below upward, and from within outward, the end of the upper fragment mostly presenting itself under the skin at the front and inner part of the leg. In these cases, the longitudinal displacement of the fracture is less constant, than the horizontal and angular. However, when it does happen, the inferior fragments are drawn outward and backward, whilst the superior project internally and forward. The angular displacement may be produced either by the action of the posterior muscles of the leg, or the weight of the foot, and, in both cases, the angle projects forwards. But it may be directed posteriorly, if the heel be too much raised. A rotatory displacement, most commonly happening in the direction outwards, is produced

by the inclination of the foot; but, if this be turned too much inwards, the rotatory displacement will be in that direction. A longitudinal displacement cannot so easily take place in transverse fractures, on account of the considerable extent of the surfaces of bone; but, in oblique fractures, the inferior fragments are almost always drawn upward by the action of the posterior muscles of the leg, in which position of the parts the lower ends of the superior fragments project forwards, and may be felt by the hand. Sometimes, however, when the solution of continuity is obliquely downward and outward, the anterior projection will be produced by the lower pieces. In both kinds of displacement, the pointed ends of the bones may tear and penetrate the integuments, and cause a compound fracture.

The usual symptoms, denoting a fracture of both bones of the leg, are a change in the direction and shape of the limb, pain, and incapability of walking, or bearing upon the limb, mobility of the fractured pieces, and a distinct crepitus.

Fractures near the knee are not very subject to displacement, on account of the thickness of the tibia at that part; but they are more dangerous than those of the middle of the bone, because often followed by inflammation of the knee-joint. Fractures, close to the ankle, are also severe accidents. Oblique fractures are more difficult of management than transverse, and, when the displacement is considerable, the integuments are in danger of being torn by the projecting points of the superior portion of the tibia.

To bad compound fractures of the leg most of the observations, already delivered on compound fractures in general, are applicable.

When the size of the tibia is compared with that of the fibula, and the close connection of these bones to each other is remembered, an opinion might be formed, that the first could never be broken without the second. Experience, however, proves the contrary; and reasons for this fact may be deduced from the consideration, that the tibia is the bone which supports the weight of the body, and that it is situated at the fore part of the limb, simply covered by the skin, and much exposed to the effects of direct violence. (See *Boyer, Mal. Chir.* t. iii. p. 373.) The fibula is, as it were, out of the line in which the weight of the body is transmitted to the foot. Its elasticity, which continues until old age; the few efforts sustained by it in the greater part of its length; the manner in which it is protected in front by the muscles in the interosseous space, and by the tibia itself; behind, by the muscles of the calf; and externally by the peronei; are all circumstances tending to weaken the effect of external violence upon it, and to lessen the number of its fractures. Yet, Dupuytren calculated, that they were more frequent, than usually stated, and that those of the lower end of it, in relation to other fractures of the leg, were as one to three. (See *Clin. Chir.* t. i. p. 189.) Fractures at any point of the three upper thirds of the tibia can scarcely happen, except from direct violence, as that from a gunshot wound, a blow, or the passage of a heavy body over the leg. But the lower fourth is exposed both to the action of direct causes, and to fractures by *contra-coup*, as they are termed, like those which happen from a fall on the sole of the foot from a considerable height. Fractures of the lower end

of the tibia alone are not common; the fibula being almost always broken at the same time. (*Sanson, Dict. de Méd., et de Chir. Pratiques*, t. viii. p. 557.) When the tibia alone is broken, the fracture is frequently transverse. When the injury happens near the knee, the great extent of the fractured surfaces prevents any considerable displacement of the fragments; and the fibula, acting as a support on the external side, contributes also to this effect. Boyer, however, saw one instance, in which the tibia had been broken by the kick of a horse, and the fragments displaced in the direction of the axis of the bone, which displacement could not be rectified, and the bone remained permanently arched.

The absence of displacement sometimes obscures the diagnosis of fractures of the tibia, and the difficulty is further increased by the little pain and inconvenience occasionally attending such a fracture, with which the patient has been known even to walk.

Whenever there is reason to suspect the accident, in consequence of a blow or a fall on the leg, the part should be minutely examined. The fingers are to be moved along the anterior surface and sharp edge of the tibia, the slightest inequality in which may be easily perceived, on account of their being covered only by the skin; and the motion of the pieces may be distinguished, by grasping the opposite ends of the bone, and pushing them in contrary directions. However, this motion, and the crepitus, are not always very plain, on account of the fibula not allowing the fractured portions to be sufficiently moved on one another.

In a review of the position and strength of the two bones of the leg, it will appear, that the tibia supports alone the whole weight of the body, every shock directed in the axis of the limb, and many kinds of force applied also in the transverse direction, without operating upon any particular point. Hence, the frequency of fractures of the tibia; and, if the fibula is generally broken likewise, the latter injury is subsequent to the other, and takes place because this slender bone is not capable of bearing the weight of the body, the impulse of external violence, and even the action of the muscles, after the tibia has given way. (*Dupuytren, Annuaire Méd. Chir. des Hôpitaux de Paris*, p. 15. 4to. Paris, 1819.) On the other hand, as the same distinguished surgeon remarks, the fibula being principally designed as a support for the outside of the foot, it is particularly when this function is to be executed and its lower end has to make resistance to efforts made in that direction, that it is fractured; and, if the lower part of the tibia be also sometimes broken by the same force, it is almost always consecutively, and not by the effect of a direct and simultaneous action upon the two bones. (p. 17.) All fractures of the fibula, however, are not caused in the preceding manner; and Dupuytren concurs with Boyer, Sir C. Bell, and all the best writers on this subject, in dividing these cases into two kinds: First, those in which the force is applied directly to the bone itself; Secondly, the more important and serious cases, in which the force operates upon the fibula, through the medium of the foot. With respect to the first class of cases, the situation of the fibula on the outer side of the leg, a situation which would seem to expose it much to external

violence; its slenderness; the interspace left between it and the tibia, at the middle part of the leg; and the way in which each end of it rests upon the latter bone; would lead one to expect that its middle portion must often be broken; yet the case is less frequent than might be apprehended. And, as Dupuytren observes, there are two reasons for this fact; viz. the protection which the fibula receives from the peronæi muscles, and the rarity of circumstances capable of producing a fracture by a direct cause. These fractures, which are not usually attended with deformity, and, in some cases, even do not hinder the patient from bearing upon the foot, cannot for the most part be ascertained, unless attention be paid to the manner in which the accident was produced, and to the presence of ecchymosis, and of more or less pain in the part which has been struck or pressed upon; together with a degree of irregularity of the fibula, perceptible by the fingers. and a more or less distinct moveableness and crepitus of the ends of the fracture.

The usual causes of this sort of fracture are blows on the fibula, gunshot wounds, the fall of heavy bodies on the outside of the leg, or the passage of them over the same part. The foot is generally twisted, either inwards or outwards, and, in most instances, the accident is easily cured by means of rest, without being accompanied by any of the symptoms so often complicating other fractures of the fibula, produced by distortion of the foot. (*Dupuytren*, vol. cit. p. 40.) A striking analogy may be remarked between fractures of the central part of the fibula, and those of the corresponding portion of the ulna, and this in respect to causes, symptoms, treatment, and consequences. Fractures of the middle of the ulna, like those of the body of the fibula, are always occasioned by blows or falls on the fractured part, or by violence applied directly to the bone. Such fractures are scarcely ever attended with any deformity in the limb, incapacity of moving it, or displacement of the fragments; and just as some individuals are able to walk with a broken fibula, others, notwithstanding a fracture of the ulna, are found capable of using their fore-arm, nearly as well as if it were free from injury. The latter case, like that of a fracture of the fibula, can only be known by the recollection of the way in which the hurt was received, the pain, ecchymosis, irregularities, motion, and crepitus, which last effects are also not very obvious so high up the bone. Like fractures of the body of the fibula, those of the body of the ulna only require rest and discutient applications, and very seldom the bandages, &c. necessary in the treatment of fractures of both bones of the fore-arm, or of the radius alone. (Vol. cit. p. 50.)

Fractures of the fibula from an *indirect* cause may happen from the foot being violently twisted either inwards or outwards. In both instances, the cause of the fracture is a change in the direction of the line, in which the weight of the body is transmitted. In the first case, the said line, instead of following, as it commonly does, the axis of the tibia, and falling upon the astragalus, crosses the lower end of the tibia and the ankle-joint, obliquely from within outwards, and after passing across the malleolus externus, extends to the outside of the member. The parts then supporting the weight of the body are the malleolus externus,

and the lower end of the tibia; besides which state of parts, the same malleolus is subjected to the traction of the external lateral ligaments, which operate with great force, in consequence of those ligaments being now nearly at a right angle with the lower end of the fibula, while this process itself is in contact with the astragalus, which is propelled from within outwards by the tibia. The latter bone, being thicker and stronger than the fibula, generally resists, and, if the malleolus internus sometimes happens to break, it is secondarily, as an effect of the displacement of the foot outwards.

In the other example, where the foot is twisted outwards, the centre of gravity of the body, instead of following its usual course, obliquely crosses the lower end of the fibula, the ankle-joint, and the malleolus internus, and falls on the ground at a greater or lesser distance from the inner edge of the foot. On the one side, the internal lateral ligaments and malleolus, and on the other, the lower end of the fibula, are then the parts which have to bear the weight of the whole body, and the force of the muscles; and they are also the parts which are torn and fractured; first, the internal lateral ligaments, or the malleolus; and, secondly, the lower portion of the fibula. (*Annuaire Méd. Chir. de Paris*, 1819. p. 66, 67.) Some of the symptoms of a fracture of the fibula, from an indirect cause, depend upon the fracture of that bone, and others upon the dislocation of the foot. They are divided by Dupuytren into two kinds; viz. *presumptive*, and *characteristic*. The first are, the way in which the patient received his hurt; a noise, or sort of crack heard by him at the instant of the injury; a fixed pain at the lower part of the fibula; a difficulty, or inability of walking; more or less swelling round the ankle, especially about the malleolus externus, and lower portion of the fibula. The *characteristic symptoms* are, an irregularity and unnatural moveableness of some point of the lower end of the fibula; a crepitus, which can be more or less distinctly felt by pressing upon and moving the part; mobility of the whole foot transversely, or horizontally; a facility of bringing the lower end of the fibula towards the tibia by pressure; a change in the point of incidence of the axis of the limb upon the foot; distortion of the foot outwards, and sometimes backwards; rotation of the same part upon its axis from within outwards; an angular depression, more or less manifest, at the outer and lower part of the leg; projection of the internal malleolus; disappearance of almost all these symptoms, as soon as reduction is effected by a force applied to the foot; and their immediate recurrence when such force is discontinued, particularly if the limb be in the extended posture. (Vol. cit. p. 68.)

In considering the varieties of simple fracture of the fibula, the first, to which Dupuytren adverts, is that in which the bone is broken *more than three inches above the extremity of the malleolus externus*; a case, *neither accompanied nor followed by any displacement of the foot*, and almost always produced by the direct application of violence to the broken part of the bone.

A second variety of simple fractures of the fibula is when the bone has been broken, either by direct, or indirect force, within three inches from the end of the malleolus externus, and when

the foot is not displaced, though much displacement is possible, and, indeed, often arises from the slightest effort, or movement, made by the patient. The most frequent point of injury is about two inches and a half above the extremity of the outer malleolus. This is generally the place of a fracture, caused by a twist of the foot outwards; but, the accident may happen lower down, as is commonly seen, when the fracture is occasioned by a twist of the foot inwards.

These fractures of the fibula, abstractedly viewed, are not of much importance in themselves; but with reference to the manner in which they facilitate the dislocation of the foot, they are very serious.

Amongst the most frequent complications of fractures of the fibula, are the rupture of the internal lateral ligaments, the detachment of the point of the inner malleolus, and fracture of the lower part of the tibia. When these injuries originate from a violent twist of the foot outwards, they precede the fracture of the fibula; but, when they are caused by a twist inwards, they follow the breaking of that bone. (*Dupuytren*, Vol. cit. p. 96.)

Besides distortion of the foot outwards, or inwards, as attending certain fractures of the fibula, another complication may be dislocation of the foot backwards, produced by the action of the muscles of the calf, and not by the same causes which broke the bone. However, whenever the malleolus internus has not given way, the dislocation is incomplete, and the foot is inclined outwards as well as backwards. In the complete luxation, Dupuytren considers the bent posture exceedingly advantageous, though he admits that it will not always maintain the reduction.

TREATMENT OF FRACTURES OF THE LEG.

As in cases of fractured thighs, the practitioner may adopt either a bent or a straight position of the limb: in this country, surgeons mostly follow Pott's advice, and select the first one. A few, however, are advocates for the extended position, and amongst them, Dr. Houston deserves to be particularly noticed, on account of the ingenuity of his arguments, the novelty of his views respecting the causes of spasmodic action of the muscles in these cases, and the facts which he brings forward. (See *Dublin Journ. of Med. Science*, vol. viii.) But, notwithstanding his objections, to the bent position, experience has taught me, that it is, generally speaking, the most advantageous for a broken leg. The strong muscles of the calf, are the powers which tend to displace the ends of the fracture, and their relaxation is a thing of the first-rate importance. It is quite different in the thigh, where the muscles are so numerous, that the attempt to relax, by any position of the limb, all such as have the power of displacing the fragments, would be in vain. I am ready to acknowledge, however, that, in Pott's method, the apparatus is defective, inasmuch as it does not keep the knee-joint from moving; yet it is certain, that such motion has not so injurious an effect upon fractures of the leg, as it has upon those of the thigh. When the case is complicated with a wound, which cannot be dressed in the bent posture of the limb without great disturbance of the fracture, the straight position ought unquestionably to be preferred. With respect to

one of Pott's objections to this position, viz. that it makes the knee stiff for a long while afterwards, I suspect that we should not lay much stress upon the circumstance; because, as Boyer has correctly observed, it is always the joint situated below the fracture that is thus affected.

In the fracture of both tibia and fibula (says Pott), the knee should be moderately bent; the thigh, body, and leg, being in the same position as in the broken thigh. If common splints be used, one should be placed underneath the leg, extending from above the knee to below the ankle, the foot being properly supported by pillows, bolsters, &c.; and another splint of the same length should be placed on the upper side, comprehending both joints in the same manner.

The strong muscles of the leg being relaxed, the surgeon is to make such extension as seems requisite, for bringing the ends of the fracture into even apposition. Then he is carefully to raise the leg a little way from the surface of the bed, by taking firm hold of the limb, above and below the fracture, and elevating the broken bones together, in such a way as shall keep both the upper and lower portions as nearly as possible on the same level. At this moment an assistant should put exactly beneath the leg the under splint, which has been previously made ready, by covering it with a soft pad, and laying over this an eighteen-tailed bandage. The limb is now to be gently depressed, till it rests on the apparatus. The surgeon, before proceeding further, must once more observe that the ends of the bones are evenly in contact. Being assured of this important point, he is to apply a piece of soap-plaster, and lay down the tails of the bandage. Another soft pad, well-filled with tow, is next to be put over the upper surface of the leg, and over that the other splint, and then the straps are to be fastened.

This mode of treatment, as preferred by Pott and his followers, is less extensively adopted at the present time, than formerly. The disadvantage of leaving the limb, and especially the knee, moveable, must be self-evident; and whoever has had the opportunity of observing the treatment of fractures of the leg in a slightly flexed position, on M'Intyre's double inclined plane, with the patient on his back, must be fully convinced of its superiority, and greater simplicity. No eighteen-tailed bandage is required. The whole limb, including knee and foot, is kept perfectly steady. A circular hole, as advised by Mr. Liston, is made in the apparatus under the heel, so as to lessen the pressure in that situation, and the chance of ulceration, or sloughing. The apparatus, lined by proper pads, receives the limb; the foot is supported upon the foot-piece, with the intervention of soft materials; and the limb, from the lower part of the thigh down to the toes, is then encircled, together with the double inclined plane and its foot-piece, with common rollers. Of these, we generally employ three: one for the thigh, knee, and upper part of the leg; a second, for the foot, and the leg; and a third, for the central part of the leg, and place of the fracture, which is put on last. One great advantage of this method is, that the central piece of the roller may be removed as often as the surgeon pleases, and the fracture examined, or, if a compound one, the wound cleaned and dressed, without the slightest disturbance of the fracture itself, or any motion of the limb.

Pott's method of treating fractures of the fibula, complicated with luxation of the tibia, is described in the article *Dislocations*. I consider it a very inferior plan, to that followed in University College Hospital with M'Intyre's apparatus. I would make the same observation with respect to Dupuytren's mode, ingenious and scientific as it is. Pott's method of treatment is not calculated to prevent the falling-in of the lower extremity of the fibula towards the tibia. In a fracture of the lower end of the fibula, when the foot is brought into the state of extreme adduction, it draws by means of the lateral ligaments the point of the outer malleolus in an inward direction, and, consequently, the fractured portion corresponding to it is drawn outwards from the tibia. It is on this principle, that Dupuytren's mode of treating this accident is founded. In all cases, then, a fracture of the fibula, accompanied with luxation of the astragalus inwards, (that is, with distortion of the foot outwards,) requires an apparatus, which maintains the foot turned inwards, and the inferior fragment of the fibula raised from the tibia, and in the direction of the superior fragment. The simple apparatus recommended by Dupuytren is as follows: a cushion, a splint, and two bandages are the whole of it. The cushion, made of linen, and stuffed two thirds full of hair-balls, or chaff enclosed in bags in the usual manner, should be two feet and a half in length, four or five inches in breadth, and three or four inches in thickness. The splint is to be from twenty to twenty-three inches in length, and three inches broad. Lastly, the two rollers should each be from four to five yards in length. The cushion, doubled in the form of a wedge, should be applied on the internal side of the fractured limb, its base below, and resting on the internal malleolus, without passing beyond it; its summit above on the internal condyle of the femur. The limb is thus protected from the splint, which derives from the pad a support, that keeps it at the distance of several inches from the internal margin of the foot, and at the same time tends to throw the tibia outward. The splint, applied along the cushion,* should extend six or seven inches below it, which will be about four inches below the internal margin of the foot. These parts of the apparatus being thus disposed, should then be fixed by one of the bandages passed round the limb below the knee, when the portion of the splint extending below the cushion will leave between itself and the foot an interval of several inches, and furnish a *point d'appui* to which the foot may be drawn from without inwards. In order to affect this purpose, the second bandage should be drawn from this point over the instep and heel, alternately embracing the splint and the parts of the limb just indicated, in circles gradually lessening, and forming the figure of the cypher 8 with the crossing part on the splint. Thus, the apparatus acts on the principle of a lever of the *first kind*, in which the *point d'appui* is the base of the cushion, a little above the malleolus internus, and in which the resistance, as well as the power acting on the fracture, are in the extremities of the foot. The foot thus drawn must yield to the action of the lower bandage, while the tibia, pressed by the base of the cushion, must be propelled outwards with the astragalus. Lastly, it is evident, that as the lower fragment of the fibula is drawn downwards by the external lateral ligaments of the ankle, a tilting movement must be produced on the external surface of the astragalus,

contrary to that which displaced it. With the view of obtaining a complete reduction, Dupuytren says, that the surgeon must not confine himself to drawing the foot in a perpendicular line under the limb; it must be brought as much inwards, as it had been turned outwards by the peroneal muscles.

After the foot has been retained a good while in this forced state of adduction, if it should not return to its ordinary position, the defect may be easily remedied by applying the preceding apparatus to the outer surface of the leg and foot.

When, with a fracture of the fibula, the foot is drawn backwards and upwards, Dupuytren applies the splint and cushion to the back part of the leg down to the heel. One roller is applied below the knee; and a second round the lower end of the tibia and splint. A square pad should always be put between the lower bandage and the tibia. Of 207 cases of fracture of the fibula, comprising all the varieties of this accident treated in the above way, by Dupuytren, 202 were cured; the remaining five died, three of them from the consequences of the injury itself, or from complications independent of it.

Seven tenths of them happened to the right leg; six tenths arose from violent adductive motions of the foot; three tenths from similar abductive movements; and one tenth from blows, or the passage of some heavy body over the external and inferior part of the limb. With respect to the seat of the fracture of the fibula; in five tenths it was two inches from the lowermost point of the external malleolus; in three tenths, below this point; and in two above it. Cases, within two inches of the external malleolus, were often complicated with displacement of the foot; the others but rarely. (See Dupuytren, in *Annuaire Méd. Chir. des Hôpitaux de Paris*, 4to. Paris, 1819.; also, in *Leçons Orales de Clin. Chir.* t. i. art. 10. p. 189.)

Although fractures of the middle and upper parts of the fibula are often overlooked, and neglected, there is no displacement, and no ill consequences ensue; but things are different with regard to fractures of the lower end of the bone. In an example of fracture of the lower end of the fibula, that was mistaken for a sprain, the patient was permitted to walk about before an union had taken place. The consequences were a distortion of the foot, and a tendency to a dislocation of it inwards, followed by such severe symptoms as nearly led to amputation. After a confinement of eight months, the limb was saved; but the ankle continued stiff, and of course the patient was yet a cripple. (See *J. Chiquet, Pathologie Chir.* p. 45.) Some interesting particulars of the dissection of a case of dislocation of the ankle, and fracture of the fibula, which had been neglected for three or four weeks, the limb being in continued exertion all this time, were published by Mr. Lawrence. (See *Med. Chir. Trans.* vol. xvii. p. 58.) The patient was a lunatic, who died about nine months after the accident in a state of most furious mania. The tibia had partially lost its bearing on the astragalus. The outer half only of its inferior articular surface rested on the latter bone. The inner portion, with the malleolus internus, formed an unnatural prominence on the inside of the ankle. The fibula had been broken just above the external malleolus, and the fracture had been consolidated by a large formation of bony matter, which had made the lower extremity of the bone nearly equal in size to that of the tibia, and had

anchylosed it to the latter. Amongst other changes, the superior convex surface of the astragalus had become partially flattened; and the cartilaginous covering was rubbed off it on the outside, where the broken end of the fibula had come in contact with it. The internal lateral ligament was greatly thickened, and formed a hard fibro-cartilaginous mass, in which some bony matter was deposited. Its attachment to the tibia was nearly as thick as the end of the thumb, and extended to that part of the inferior surface of the bone, which projected over the inner edge of the astragalus. The ligaments, connecting the external malleolus to the foot, were unaltered. The anterior articular convexity of the astragalus was partly raised out of the cavity of the navicular bone, apparently from the former bone having been subjected to unusual pressure on the back and outer part of its upper surface, in consequence of the altered bearing of the leg.

In an oblique fracture of the head of the tibia, extending into the knee-joint, Sir A. Cooper recommends the straight position, in which the femur has the good effect of keeping the articular surfaces of the tibia even. A roller is to be used for pressing one fragment towards the other; a pasteboard splint is also to be applied with the same view; and early passive motion of the joint is to be practised, in order to prevent anchylosis. When the fracture is oblique, but does not reach into the joint, he prefers placing the limb on the double inclined plane. (*Surgical Essays*, part i. p. 103.; and *On Dislocations*, &c. p. 235.)

FRACTURES OF THE SCAPULA.

Fractures of the body of the scapula are not common; a circumstance explicable by its deep and covered position, and its great mobility. Nor could such an accident arise without considerable direct violence. However, some parts of the scapula being more superficial, and of a form more likely to be acted upon by external bodies, are more frequently fractured: such are the acromion, and inferior angle. Fractures of the coracoid process, and of the neck of the scapula, are not common; for, though these parts may appear in the skeleton likely to be often broken, their deep situation in the living subject generally saves them. Indeed, as Boyer says, they generally require great violence to break them, and then the contusion of the soft parts is a worse injury than the fracture itself: thus, this author has seen the coracoid process broken by the blow of the pole of a carriage, and the patient lost his life from the violence at the same time inflicted upon all the soft parts about the shoulder. (*Mat. Chir.* t. iii. p. 161.) The acromion is more frequently broken than any other part of the scapula, and the accident is most commonly produced by a blow, or fall on the shoulder. The fracture is almost always transverse, and may occur either towards the apex, or base of the acromion. The outer fragment is drawn downward by the weight of the arm, and the contraction of the deltoid muscle, while the trapezius and levator scapulae draw the rest of the bone upward and backward. The roundness of the injured shoulder is lost, and part of the attachment of the deltoid being broken off, the head of the os humeri sinks towards the axilla, as far as the capsular ligament will permit. On tracing the acromion from the spine of the scapula to the clavicle, the surgeon will feel a de-

pression just at their junction. The distance from the sternal end of the clavicle to the extremity of the shoulder is lessened. The natural form of the shoulder may be restored by raising the arm by the elbow; but the deformity returns immediately the arm is suffered to fall again. The accident may be distinguished from a dislocation, if the surgeon raise the shoulder by pushing the humerus upwards, when a crepitus will be perceptible to the surgeon's hand applied over the acromion, on the limb being rotated. (*Sir A. Cooper on Dislocations, &c.* p. 455.)

When the lower angle is broken, the serratus major anticus draws it forward, while the rest of the scapula remains in its natural situation; or, if the angular portion be considerable, the teres major, and some fibres of the latissimus dorsi, contribute to its displacement forward and upward.

When the coracoid process is fractured, the pectoralis minor, coraco-brachialis, and short head of the biceps, concur in drawing it forward and downward.

When the neck of the scapula is fractured, the weight of the arm makes it drop down so considerably, as to give the appearance of a dislocation; but, the facility of lifting the os brachii upward, the crepitus, and the falling of the limb downward again, immediately it is unsupported, are circumstances clearly marking that the case is not a dislocation. According to Sir Astley Cooper, the crepitus is best perceived through the medium of the coracoid process. The degree in which the glenoid cavity and the head of the humerus descend, he observes, depends very much upon whether the ligaments, between the under part of the spine of the scapula and the glenoid cavity, are lacerated or not. (*On Dislocations, &c.* p. 459.)

Sometimes great pain, and a crepitus are experienced, on moving the shoulder-joint, after an accident; and yet the spine, the neck of the scapula, and all the above parts, are not broken. In this circumstance, it is to be suspected, either that a small portion of the head of the os brachii, or a little piece of the glenoid cavity of the scapula, is broken off; which latter occurrence, I think, is not very uncommon.

When the inferior angle is broken, the part remains motionless, while the rest of the scapula is moved; and it is so separated, that no mistake can be made.

Fractures of the spine and body of the bone are all attended with a crepitus; and, in the first cases, an irregularity of the injured part may generally be felt.

Fractures of the body of the bone, are mostly accompanied by much contusion of the soft parts, and sometimes by injury of the thoracic viscera. They are always occasioned by direct violence. Sometimes they are vertical, but most commonly transverse. Those of the acromion and lower angle are more troublesome to keep right; but the most serious cases are fractures of the coracoid process and neck of the bone, which cannot be kept right without great difficulty, and are said to be frequently followed by a considerable stiffness of the arm, inability to raise it, its atrophy, and even paralysis. In other respects, the danger of fractures of the scapula depends less upon the solution of continuity in the bone, than the contusion of the soft parts, or injury of the thoracic viscera. How-

ever, when the fracture is comminuted, and the splinters are forced into the subscapularis muscle, abscesses may form under the bone, and, according to Boyer, require a perforation to be made in it (*Mat. Chir. t. iii. p. 165.*); a proceeding, which I cannot bring myself to think would ever be judicious, as making a depending opening in the soft parts must be far better practice. In military surgery, the scapula is often injured by sabre-cuts; but, as Dr. Hennen remarks, this bone, when preserved from motion, is found in these cases to unite with great readiness, and without future inconvenience. (*Principles of Military Surgery, p. 48. ed. 2.*)

When the scapula is fractured longitudinally, or transversely, it is merely necessary to fix the arm to the side by means of a bandage, which includes the arm and trunk, from the shoulder to the elbow. Thus, the motions of the shoulder, which are only concomitant with those of the arm, are prevented. A sling, with one or two circles of a roller round the trunk and lower part of the humerus would answer every purpose.

When the inferior angle is broken, and drawn downward and forward by the serratus major anticus, the scapula must be pushed toward the fragment, by inclining the arm itself inward, downward, and forward, where it is to be kept with a roller. The fragment is also to be kept backward as much as possible, with compresses and a roller, and the arm is to be supported in a sling.

The fractured acromion requires the arm to be so raised, that the head of the os brachii will push up the acromion, while an assistant pushes the scapula forward and downward, in a contrary direction to that of the arm. To maintain this position, a circular bandage is to be applied round the arm and body.

Desault used to apply also a wedge-shaped cushion under the axilla, before putting on the bandage, in order to make the head of the os brachii project more upward, on bringing the arm near the side; but Sir Astley Cooper finds that a cushion, so placed, does harm, by throwing the head of the os humeri outward, and widely separating the acromion from the spine of the scapula. He approves of raising the elbow, and keeping the arm fixed. He also relaxes the deltoid muscle, by means of a cushion, put between the elbow and the side, the elbow inclining a little backwards: the limb is to be bound to the chest in this position with a roller. The union may take place by bone, but, owing to the difficulty of maintaining the coaptation, the uniting substance is generally ligamentous. (*See Sir A. Cooper on Dislocations, p. 455.*)

When the coracoid process is fractured, the muscles attached to it are to be relaxed, by bringing the arm forward towards the breast, and confining it there in a sling; while the shoulder is kept downward and forward, and a compress confined just under the broken part, with a roller.

The treatment of a fracture of the neck of the scapula consists in keeping the head of the os humeri outwards, by means of a thick cushion in the axilla; in keeping the glenoid cavity and arm raised with a sling; and in preventing all motion of the arm by binding it to the trunk with a roller. In some of these cases, the apparatus, proposed by Mr. Earle, might be useful. (*Pract. Obs. in Surg. 1823.*)

FRACTURES OF THE CLAVICLE.

This bone, being long and slender, unsupported at its middle, and protected externally only by the integuments, is very often broken. Its serving to keep the scapula at a proper distance from the sternum, and as a point of support for the os brachii, every impulse of which it receives, fully accounts for the fact.

It may be broken at any part; but its middle, where the curvature is greatest, is most frequently the situation of the injury. It is not very often fractured at its scapular extremity. However, a direct force, falling on the shoulder, may break any part of the clavicle, on which it immediately acts; and then the soft parts will be contused, or even lacerated.

A comminuted fracture may be thus occasioned, and, if the violence be very great, the axillary nerves may be injured. Mr. Earle mentions an instance, in which the axillary plexus of nerves was crushed by a comminuted fracture of the clavicle, and paralysis of the arm occasioned. The limb was afterwards incapable of bearing changes of temperature, exposure to cold bringing on sloughing, while immersion of the hand in warm grains, for some time, caused the whole hand and forearm to be covered with vesications. (See *Med. Chir. Trans.* vol. vii. p. 173.; and *Two Lectures on Burns*, p. 6. 8vo. 1832.) The fall of a heavy body on the shoulder often gives rise to a paralysis of the arm. I am not aware of any case, in which the subclavian vessels have been wounded by the spicula of a broken clavicle.

When the fracturing force is applied to the ends of the bone, as in a fall on the point of the shoulder, or on the hands, while the arms are extended, the clavicle may be bent, and fractured so obliquely, that the broken portions protrude through the skin.

The symptoms differ, according as the fracture happens to be situated between the scapular end of the bone and the coraco-clavicular ligaments, or between the insertion of these ligaments, and its sternal extremity. In the first case, the two fragments being fixed by the ligamentous bands, which connect them on one side with the coracoid process, and, on the other, with the acromion, are but little or not at all displaced; and the arm may yet have in the clavicle a sufficient point of support for the execution of its motions. Still, on careful examination, the outer end of the bone will be perceived to be somewhat depressed; but, if the humerus and shoulder be pushed up, it will assume the same direction as the rest of the bone. A crepitus is also generally distinguishable, when the surgeon applies his hand to the place of the fracture, and alternately raises and depresses the shoulder.

In the second, and far more frequent, case, or that in which the fracture is situated between the insertion of the coraco-clavicular ligaments, and the sterno-clavicular articulation, the displacement is much more considerable; and be it remembered, that the external portion of the clavicle is always that which is displaced. The internal part cannot be moved out of its natural situation, by reason of the costo-clavicular ligaments, and of its being drawn in opposite directions, by the sterno-cleido-mastoidæus, and pectoralis major, muscles. The external portion, drawn down both by the weight of the arm, and the action of the deltoid muscle,

and forward and inward by the pectoralis major, is carried under the internal portion, which projects over it. The broken clavicle no longer keeping the shoulder at a due distance from the sternum, the arm falls forward towards the breast. The patient finds it impossible to put his hand to his forehead, because this act makes a semicircular motion of the humerus necessary, which cannot be done while that bone has not a firm point of support. The shoulder and upper extremity may be observed to be nearer the breast, than those of the opposite side. The motion of the pieces of bone on one another may be felt, as well as the projection of the end of the internal portion. When the shoulder is moved, a crepitus may also be perceived; but this is productive of great pain, and the diagnosis is so obvious, that it is quite unnecessary.

For the reduction, the two indications are, to push outwards and backwards the scapular fragment, and to bring it to the level of the sternal part.

The ancients, and many moderns, have supposed, that, in order to set a fracture of the clavicle, the shoulder should be drawn back, and fixed in that position. The patient was placed on a low stool, so that an assistant might put his knee between the shoulders, which he drew back at the same time with both hands, while the surgeon applied the bandage which was to keep the parts in this position. But, when the shoulders are thus drawn towards one another, the scapula is obviously pushed towards the sternum, and with it the external portion of the clavicle, which passes under the internal fragment.

The figure of 8 bandage has commonly been used for maintaining the parts in this position. While the assistant keeps back the shoulders, as above described, the surgeon is to apply one end of a roller to the armpit on the side affected, and then make it cross obliquely to the opposite shoulder, round which it is to pass, and from this to the other shoulder, about which it is to be applied in the same manner, and afterwards repeatedly crossed before and behind. The tightness, with which it is necessary to apply this bandage, produces excoriation about the armpits, and the effect is to make the ends of the fracture overlap each other; the very thing which it is wished to avoid. Boyer remarks, that the iron cross proposed by Heister, the corset described by Brador in the *Mém. de l'Acad. de Chir.*, and the leather strap recommended by Brunninghausen, are only modifications of the figure of 8 bandage, and are not at all better.

Desault advised extension to be made by means of the limb, which is articulated with the fractured bone. This is done by converting the humerus into a lever, by carrying its lower end forward, inward, and upward, pushing the shoulder backward, upward, and outward, and putting a cushion in the armpit to serve as a fulcrum.

Desault used to put in the armpit a hair or flock cushion, five or six inches long, and three inches and a quarter thick at its base. Two strings are attached to the corners of the base, which is placed upward: they cross the back and breast, and are tied on the shoulder of the other arm. The cushion being thus placed in the armpit, and the forearm bent, Desault used to take hold of the patient's elbow, and carry it forward, upward, and inward, pressing it forcibly against the breast. By this

manœuvre, the humerus carries the shoulder outward, the ends of the fracture become situated opposite each other, and all deformity is removed. An assistant is to support the arm in this position, while the surgeon is to place one end of a roller, nine yards long, in the armpit of the opposite side, and then apply the bandage over the upper part of the arm, and across the back to the same situation. The arm and trunk are to be covered with circles of the roller, as far down as the elbow, drawing the bandage more tightly, the lower it descends. Compresses, dipped in camphorated spirit, having been placed along the fractured bone, Desault took a second roller, of the same length as the first, and put one end of it under the opposite armpit, whence it was carried across the breast over the compress and fracture, then down behind the shoulder and arm, and after having passed under the elbow, upward on the breast. Desault next brought it across to the sound shoulder, under and round which he passed it, for the purpose of fixing the first turn. He then conveyed the roller across the back, brought it over the compresses, carried it down in front of the shoulder and arm, under the elbow, and obliquely behind the back to the armpit, where the application began. The same plan was repeated, until all the roller was spent. The apparatus was secured by pins, and the hand kept in a sling.

Boyer's apparatus for fractured clavicles is more simple than that of Desault. The cushion is to be applied under the arm. The apparatus consists of a girdle of linen cloth, which passes round the trunk on a level with the elbow. It is fixed on by means of three straps and as many buckles. At an equal distance from its extremities are placed externally on each side two buckles, two before and two behind the arm. On the lower part of the arm, is to be laced a piece of quilted cloth, five or six fingers broad. Four straps are attached to it, which correspond to the buckles on the outside of the girdle, and serve both to keep the arm close to the trunk, and from moving either backward or forward.

The methods of Desault and Boyer, though judicious and scientific, are not much adopted in this country. The principles of treatment, inculcated by Desault, however, are excellent; but his manner of bandaging the arm and shoulder is rather complicated, and, in women, particularly inconvenient. We learn, from Dr Reese, that, in the United States, till very lately, fractured clavicles were almost universally treated on Desault's plan. When the bandage was properly applied, it was found, indeed, adequate to fulfil all the necessary indications; but its complexity, its liability to be deranged, and the pressure it made upon the mammae in female patients, rendered a substitute for it in many cases desirable. In 1816, Dr. S. H. Coale, of Baltimore, therefore, invented an apparatus, which, in his hands, was entirely successful in bad cases of oblique fracture of the clavicle. It was made of leathern straps, and buckles, performing the triple purposes for which Desault's bandage was adapted; and its simplicity, as well as permanency, together with its adaptation to female patients, has brought it into general use in the Southern States of the Union. An improvement on Desault's mode of applying the bandage has been suggested by Dr. Stephen Brown, of New York, and is adopted in many parts of the United States.

(See *Am. Med. Recorder*, vol. iv.; and *Reese's Am. ed. of this Dict.*) A simple and good apparatus for fractures of the clavicle, and those of the neck of the scapula, was proposed many years ago by Mr. Earle. (See *Pract. Obs. on Surgery*, p. 187, &c.) It is also calculated for cases of dislocated clavicle, and other injuries of the shoulder.

In England, the common figure of 8 bandage, with a sling, is still very generally preferred, except in oblique, or difficult cases. When the fracture is external to the coraco-clavicular ligaments, it answers perfectly; but, in some other instances, it is prudent to attend more strictly to the indications pointed out by Desault. If surgeons understand why the shoulder should be kept outward, as well as backward and upward, in order to bring the fragments into the best apposition, they will have no difficulty in accomplishing it with a thick wedge-shaped pad, or sling, and a roller; and, if not with these means, at all events with Boyer's or Earle's apparatus.

Whatever method is followed, one principal indication, is always to prevent the weight of the arm from drawing downward the external fragment; and for this purpose, in England, a sling is generally preferred to bandages, or any of the apparatus sold in the shops.

I cannot quit this subject without cautioning surgeons never to fall into the error of supposing the rising end of a broken clavicle to be that which is displaced. Although this is truly in its right situation, it has often been made, by injudicious pressure, to protrude through the integuments, one or two instances of which have fallen under my own observation.

FRACTURES OF THE OS BRACHII, OR HUMERUS.

This bone may be fractured at any point of its length: at its middle, either of its extremities, or above the insertion of the pectoralis major, latissimus dorsi, and teres major. The last case is termed fracture of the neck of the humerus; but that denomination has not the merit of being strictly anatomical. It is possible, however, that what is strictly called the neck of the humerus, may be fractured, particularly by a gunshot wound. By neck of the humerus, is understood that circular narrowing which separates the tuberosities from the head.

Fractures of this bone may be transverse or oblique, simple or compound. Transverse fractures of it below the insertion of the deltoid muscle, are attended with but little displacement, for the brachialis internus and the triceps, being attached posteriorly and anteriorly to both fragments, counteract one another, and admit only a slight angular displacement. When the fracture takes place above the insertion of the deltoid muscle, the inferior portion is first drawn outward and then upward on the external side of the superior.

Oblique fractures are always attended with displacement, whatever be the part of the bone broken. The inferior portion being drawn upward by the action of the deltoid, biceps, coraco-brachialis, and long portion of the triceps, glides easily on the superior, and passes above its lower extremity. Finally, fractures of the neck of the humerus are always attended with displacement, produced by the action of the pectoralis major, latissimus dorsi, and teres major, which, being at-

tached to the lower portion near its superior extremity, draw it first inward and then upward, in which last direction it is powerfully urged by the biceps, coraco-brachialis, and long portion of the triceps. In this case, the superior portion itself is directed a little outward by the action of the infraspinatus, supra-spinatus and teres minor, which make the head of the humerus perform a rotatory motion in the glenoid cavity.

The shortening and change in the direction of the limb, the crepitus, which may be very distinctly perceived by moving the broken pieces in opposite directions, the pain, and impossibility of moving the arm, &c., joined to the history of the case, render the diagnosis sufficiently plain.

Fractures of the neck of the humerus, however, are not so easily ascertained, and, from want of attention, have been frequently confounded with dislocations. Yet, the diagnostic symptoms of these two accidents are very different.

On this part of the subject, some admirable observations were made by Dupuytren. Every person, he remarks, who meets either with a dislocation, or a fracture of the upper end of the humerus, has fallen upon the corresponding side of the body; but, the position of the limb at the moment of the fall, has not been the same in both cases; and this difference commonly determines the kind of injury, which is to follow, and furnishes the means of recognising it. If, in falling, the patient separates his arm from the side, and puts out his hand to weaken the effects of the fall, the accident will be a dislocation of the head of the humerus, without fracture. On the contrary, if the arm be kept close to the side, as in an unexpected fall, or when the hand is confined in the breeches pocket, the weight of the body then acts upon the cushion of the shoulder, and if there is any displacement, it arises from a fracture of the head, or upper part of the humerus. If the case be a dislocation, the hand having struck the ground, is usually marked by mud, dirt, abrasions, or ecchymosis: if a dislocation, the violence having operated directly on the cushion of the shoulder, the hand is free from those appearances, and the part of the dress covering the deltoid, presents traces of having come in contact with the ground; or the skin of the shoulder exhibits marks of contusion. In dislocation, ecchymosis is situated at the internal and forepart of the arm; in fracture, it is upon the very cushion of the shoulder. In dislocation, ecchymosis is less frequent than in fracture. In both accidents, the acromion is prominent, but more so in dislocation; and in fracture, the deltoid is shortened, and, as it were, swollen. In fracture, the vacancy under the acromion is less than in dislocation, and the prominence in the axilla much less. In dislocation, there is no crepitation — no ready moveableness of the limb, as in fracture. Dislocation requires greater efforts for its reduction, for the maintenance of which it is sufficient to confine the arm close to the side; but, in fracture of the upper part of the humerus, an apparatus is indispensable to hinder the muscles from reproducing the displacement. A fracture, without displacement, may be mistaken for a simple contusion. The crepitus, and mobility felt in the injured part, on rotating the lower portion of the humerus, are the only means of ascertaining the nature of the accident; but care must be taken not to be deceived

by the kind of crackling felt in examining the shoulder after a severe contusion, and which arises from inflammation of the articular surfaces, and a deficiency of synovia. (See Dupuytren, in *Clin. Chir.* t. iii. p. 106.)

In a simple fracture of the body of the humerus, the prognosis is generally favourable; but fractures near the elbow are liable to be followed by more or less stiffness of the joint, often very difficult of removal.

In ordinary fractures of the humerus, some practitioners apply two pieces of soap-plaster, which together surround the limb, at the situation where the accident has happened: while others deem such application useless. In University College Hospital, we never resort to it. Extension, if necessary, being made by an assistant, who at once draws the lower portion of the bone downward, and bends the elbow, the surgeon is to apply a roller round the limb. The external splint is to extend from the acromion to the outer condyle, and being lined with a soft pad, it cannot hurt the limb by pressure. The internal splint is to reach from the margins of the axilla to a little below the inner condyle, and is to be well guarded with a pad, filled with tow, or any other soft materials.

Some surgeons are content with the application of two splints; but, though the two, above described, are those on which we are to place the greatest reliance, yet, as the cylindrical form of the arm conveniently allows us completely to include this part of the limb in splints, I consider the employment of four better: one on the outside, one on the inside, one on the front, and another on the back of the arm. These are to be carefully fixed in their respective situations by means of tape or a roller. Throughout the treatment, the elbow and whole of the fore-arm are to be quietly and effectually supported in a sling.

FRACTURE OF THE HEAD OR NECK OF THE OS BRACHII.

Indisputable facts prove the possibility of the anatomical neck of the bone being fractured, and C. Larbaud showed Bichat the humerus of a young man, aged 17, the head of which bone was accurately detached from its body, by a division which had passed obliquely through the upper part of the tuberosities. Another example, proved by dissection, was recorded by Delpech. (*Chirurgie Clinique*.) An instance of this kind was pointed out to me in the spring of 1821, in St. Bartholomew's Hospital. The patient was a boy, whose elbow had been strongly kept up, on the supposition that the case was a fracture of the neck of the scapula, and, consequently, the irregular end of the humerus formed a remarkable projection in front of the acromion, yet capable of being pushed back, where, however, it would not remain. When the accident is produced by a direct blow or fall on the fleshy part of the shoulder, the deltoid is sometimes contused and affected with ecchymosis. Even blood may be effused from some of the ruptured articular veins, or arteries, and form a collection, which Desault recommended to be speedily opened, though the reason of such practice, as a general thing, must be questionable, because large extravasations of blood about the shoulder are usually very soon absorbed.

Sir Anley Cooper has seen this accident both in old and in young persons; but, according to his observation, it rarely occurs in middle age. In the young, he says, it happens at the junction of the epiphysis, where the cartilage is situated; and, in the old, it arises from the greater softness of this part of the bone. (*On Dislocations*, &c. p. 459.)

An acute pain is experienced at the moment of the fall; sometimes the noise of something breaking is heard: There is always a sudden inability to move the limb, which, left to itself, remains motionless. But, on external force being applied, it readily yields, and admits of being moved, with the greatest ease, in every direction. Such motion is attended with severe pain, and, if carried too far, may cause ill consequences, as has been observed in patients in whom the fracture has been mistaken for dislocation.

Below the acromion a depression is remarkable, always situated lower down than that which attends a dislocation. If we place one hand on the head, while the lower part of the bone is moved in various directions with the other hand; or if, while extension is made, an assistant communicates to the bone a rotatory motion, the following circumstances are perceived. 1. The head of the humerus remains motionless. 2. A more or less distinct crepitus is felt, arising from the two ends of the fracture rubbing against each other. These two symptoms are characteristic of the accident; but the swelling of the joint may prevent us from detecting them.

Sometimes there is no displacement of the ends of the fracture, and then, as most of the symptoms are absent, the diagnosis is still more difficult. In general, however, the ends of the fracture are displaced, and, in this circumstance, it is the lower one, which is out of its proper position, and not the upper one, which is of little extent, and is not acted upon by many muscles.

The displacement is, generally, not very perceptible, in regard to length, unless the fracture be very oblique, and its pointed spicula irritate the muscles, and make them contract with increased power; or unless the blow, which was violent, continued to operate after the bone had been broken, and forced the ends of the fracture from their state of apposition. In this way, the body of the humerus has been drawn or driven upward, so as to protrude through the deltoid muscle, and integuments, far above the height of the head of the bone.

But commonly, as Petit observes, the weight of the limb powerfully resists the action of the muscles, and the displacement of the fracture is more liable to be transverse. In this circumstance the lower end of the fracture is displaced outward or inward, and rarely in any other direction. In the most frequent case, the elbow is separated from the trunk, and cannot be brought near it without pain; and in the instance of the bone being displaced outward, the limb has a tendency to the opposite direction. According to Sir A. Cooper, the upper end of the main portion of the humerus sinks into the axilla, where it can be felt, and the deltoid is drawn down by it, so that the roundness of the shoulder is diminished. (*On Dislo-*

according as the fracture is displaced inward or outward. If the surgeon put his hands on the situation of the fracture, it is rather to examine the state of the ends of the broken bone, than to accomplish a thing seldom required, namely, what is implied by the term coaptation.

In the treatment, the three indications are, 1. To render the arm and shoulder immovable: 2. To bring either outward, or inward, the lower end of the fracture: 3. To draw downward the same.

The following articles composed Desault's apparatus. 1. Two long rollers. 2. Three strong splints, of different lengths, and from two to three inches broad. 3. A cushion, three or four inches thick at one of its ends, terminating at the other in a narrow point, and long enough to reach from the axilla to the elbow. 4. A sling to support the forearm. 5. A towel to cover the whole of the apparatus.

The reduction having been effected, the assistants are to continue the extension. Then the surgeon is to take the first roller, which is to be wet with the liq. plumbi acet. dil., and he is to fix one of its heads by applying two circular turns to the upper part of the forearm. The bandage is now to be rolled moderately tight round the arm upward, making each turn overlap two thirds of that which is immediately below it. When the roller has reached the upper part of the limb, it must be doubled back a few times to prevent the folds, which the inequality of the part would create. The bandage is afterwards to be carried twice under the opposite axilla, and the rest of it, rolled up, is to be brought up to the top of the shoulder, and committed to the care of an assistant.

The first splint is to be placed in front, reaching from the bend of the arm, as high as the acromion. The second, on the outside, from the external condyle to the same height. The third, behind, from the olecranon to the margin of the axilla. The cushion, interposed between the arm and thorax, serves as a fourth splint, which becomes useless. An assistant applies these parts of the apparatus, and holds them on by applying his hands near the bend of the arm, in order not to obstruct the application of the remainder of the bandage.

The surgeon takes hold of the bandage again, and applies it over the splints with moderate tightness, and the bandage ends at the upper part of the forearm, where it began.

While the assistants still keep up the extension, the surgeon is to place the cushion between the arm and trunk, taking care to put the thick end upward, if the fracture be displaced inward; but downward, if this should be displaced outward, which Desault found most common. Then the cushion is to be fastened with two pins to the upper part of the roller.

The arm is to be brought near the trunk, and fixed upon the cushion, by means of the second roller, applied round the arm and thorax. The turns of this bandage should be rather tight below, and slack above, if the fracture be displaced inward; but, if outward, they should be slack below, and tight above.

The forearm is to be supported in a sling, and the whole of the apparatus is to be enveloped in a napkin, which will prevent the bandages from being pushed out of their places.

Reduction takes place of itself, on employment of this force, methodically directed,

Should the lower fragment project inward, the thick end of the cushion will remove it farther from the chest. The bone will be kept at this distance from the side by the turns of the bandage, which being tight downward, will act upon the limb as a lever, the fulcrum for which will be the cushion, and the resistance, the action of the *pectoralis major*, *latissimus dorsi*, and *teres major*.

When the lower end of the fracture is drawn outward, the contrary effect will be produced, both from the pressure exercised by the bandage on the upper end of the displaced portion of the bone, and from the situation of the elbow, which is kept outward by the thick part of the cushion. The outer splint will also prevent the lower end of the fracture from being displaced outward, both by its mechanical resistance to the bone, and by its compressing the deltoid muscle, which is the chief cause of such displacement. All displacement of the lower end of the fracture, forward, or backward, is prevented by the back splint; and as for the longitudinal displacement, which is already prevented by the weight of the limb, it is still more effectually hindered by the compression of the muscles of the arm, both by the splints and roller. (*Sec Œuvres Chir. de Desault, t. i.*)

Sir Astley Cooper recommends a roller to be applied from the elbow to the shoulder joint; two splints to be bound on the inner and outer sides of the arm with a roller; a cushion to be placed in the axilla in order to throw out the head of the bone; and gently supporting the arm in a sling; for if the elbow be much raised, the bones will overlap, and the union be attended with deformity. (*On Dislocations, &c. p. 461.*)

FRACTURES OF THE LOWER END OF THE HUMERUS, WITH SEPARATION OF THE CONDYLES.

This accident is not uncommon, and Desault, in particular, had frequent occasion to meet with it. In University College Hospital, I have also noticed some examples of it.

Whatever its causes may be, the two condyles are usually separated from each other by a longitudinal division, which, extending more or less upward, is bounded by another transverse, or oblique division, which occupies the whole thickness of the bone. Hence, there are three different pieces of bone and two fractures.

Sometimes, the division is more simple; as when, taking a direction outward, or inward, it crosses obliquely down the lower end of the humerus, terminates in the joint, and only detaches one of the condyles from the body of the bone.

In the first case, the deformity is greater, and the fractured part is more moveable. When pressure is made, either before, or behind, on the track of the longitudinal fracture, the two condyles, becoming further separated from each other, leave a fissure between them, and the fractured part is widened. The fore-arm is almost always in a state of pronation. On taking hold of the condyles, and moving them in different directions, a distinct crepitus is perceived.

In the second case, the separation of the condyles from each other is not so easy; but a crepitus can always be distinguished, on moving the detached condyle. In one case, in which

only the external condyle was broken, Desault found the limb always supine.

In both cases, an acute pain, the almost inevitable effect of bending, or extending, the fore-arm; an habitual half-bent state of this part of the limb, and sometimes a subsequent swelling of it, together with more or less tumefaction round the joint, are observable. When the blow has been violent, or a pointed piece of the bone protrudes through the flesh, the accident may be complicated with a wound, splinters of bone, &c. I have known two cases of this kind, which required amputation.

When the condyles of the humerus are obliquely broken off, just above the joint, the appearances, as described by Sir Astley Cooper, are those of a dislocation of the radius and ulna backwards; but the nature of the case is evinced by the circumstance of the displacement recurring, as soon the extension is stopped, and also by the crepitus, generally perceptible, when the radius is rotated upon the humerus. (*On Dislocations, &c. p. 481.*)

The old writers consider the communication of a fracture with a joint, a fatal kind of complication. Swelling and inflammation of the adjacent parts; continuance of pain after the reduction; large abscesses; even mortification of the soft parts, and caries of the bones, are, according to such authors, the almost inevitable consequences of these fractures, and anchylosis the most favourable termination. Paré, Petit, Fleister, Duverney, all give this exaggerated picture. However, analogous fractures of the olecranon and patella prove, that this representation is magnified beyond truth.

The detached condyles, being drawn in opposite directions by the muscles of the arm and fore-arm, commonly remain unmoved between these two powers, and are but little displaced. External force may, however, put them out of their proper situation, and they may then be displaced forward, or backward, or they may separate from each other sideways, leaving an interspace between them. Hence, the apparatus should resist them in these four directions; and this object is easily accomplished by means of four splints, kept on with a roller. The two lateral splints are particularly necessary, when the condyles are separated from the body of the bone, with an interspace between them. If one of them be still continuous with the humerus, no splint on this side will be requisite.

Desault recommends the front and back splints to be flexible at their middle part, which should be applied to the bend of the arm and elbow.

The treatment, advised by Sir Astley Cooper, consists in bending the arm, drawing it forwards so as to reduce the parts, and then applying a roller. The best splint for this case is one formed at right angles, the upper portion of it being placed behind the upper arm, and the lower under the fore-arm. He also directs the application of a splint to the fore part of the upper arm. The splints are to be fixed with straps; evaporating lotions used; and the arm kept in a bent position in a sling. In a fortnight, if the patient be young, and, in three weeks, if he be an adult, passive motion may be gently employed for the purpose of hindering an anchylosis. (*On Dislocations, &c. p. 482.*) According to this distinguished surgeon, when the internal condyle is broken off obliquely,

the ulna loses its natural support, and projects backward.

FRACTURE OF THE FORE-ARM.

The fore-arm is more frequently broken than the arm, because external force operates more directly upon it than the latter part, especially in falls on the hands, which are frequent accidents. Bichat, in his account of Desault's practice, mentions, that fractures of the fore-arm often held the first place in the comparative table of such cases, kept at the Hôtel-Dieu.

We know, that the fore-arm is composed of two bones, the ulna and radius. The last is much more liable to fractures than the first, because it is articulated with the hand by a large surface, and all the shocks, received by the latter part, are communicated to it. The situation of it also more immediately exposes it to such causes as may break it. However, both the bones are frequently broken together.

FRACTURES OF BOTH BONES,

May occur at the extremities, or middle of the fore-arm. They are frequent at the middle, very common below; but, seldom happen at the upper part of it, where the numerous muscles, and the considerable thickness of the ulna, resist causes, which would otherwise occasion the accident. The bones are usually broken in the same line, but sometimes in two different directions. The fracture is almost always single; but, in a few instances, it is double: Desault was one day called to a patient, over whose fore-arm the wheels of a cart had passed, so as to break the bones, at their middle and lower part, into six distinct portions. The middle ones, notwithstanding they were quite detached, united very well, with hardly any deformity.

Baron Dupuytren, in all his extensive practice, never met with a dislocation of the wrist; but the great frequency of fractures of the radius is convincingly proved by some records, to which he refers. In 1829, out of 109 fractures brought to the Hôtel-Dieu, 23 were of the fore-arm, 16 being of the radius, 5 of both bones, and 2 of the ulna. In 1830, in 97 fractures, 22 were of the fore-arm, 16 being of the radius alone, 4 of both bones, and 2 of the ulna. Fractures of the lower end of the radius, the cases apt to be mistaken for dislocations, seem to occur at all ages; for, in 14 examples, alluded to by Dupuytren, the ages of the patients varied between 8 and 88; but, in young subjects, a separation of the epiphysis is more likely to occur than a fracture. Several instances of this fact have presented themselves in University College Hospital. The right radius appears to be more frequently broken than the left; for, in 97 cases, 59 happened to the right arm. (See *Clin. Chir.* t. iv. p. 181.)

These accidents are most commonly occasioned by direct external violence; but, sometimes they are produced by a counter-stroke, which is generally the case, when the patient falls on his hand. But, in this instance, as the hand is principally connected with the lower broad articular surface of the radius, this bone alone has to sustain almost the whole shock of the blow, and hence is usually the only one broken.

In 14 examples of broken radius, referred to by Dupuytren, 3 were caused by falls upon the

back of the hand; and 11 by falls upon the palm. These facts refute one of Cruveilhier's inferences, that the radius cannot be fractured by a fall upon the back of the hand. (*Clin. Chir.* t. iv. p. 182.)

The symptoms indicating fractures of the fore-arm are not likely to lead the surgeon into any mistake; motion at a part of the limb, where it was previously inflexible; a crepitus, almost always easily felt; sometimes a distinct depression in the situation of the fracture; occasionally a projection of the ends of the fracture beneath the skin; pain on moving the part; a noise sometimes audible to the patient at the moment of the accident; an inability to perform the motion of pronation and supination; and an almost constantly half-bent state of the fore-arm.

There is one case, however, in which, the fracture being very near the wrist-joint, similar appearances to those of a dislocation may arise; which last accident, with respect to the radio-carpal articulation, however, is one of great rarity. (See DISLOCATION.) But attention to whether the styloid processes are above, or below, the deformity, will discover whether the case be a fracture, or dislocation. In a fracture, the part is also more moveable, and there is a crepitus. (*Œuvres Chir. de Desault*, t. i.) According to Boyer, the two cases may be distinguished by simply moving the hand; by which motion, if there be a luxation without fracture, the styloid processes of the radius and ulna will not change their situation; but, if a fracture exist, they will follow the motion of the hand.

The connection of the two bones of the fore-arm, by the interosseous ligament, which occupies the interspace by which they are separated, and the manner in which the muscles attached to both are inserted into them, render any displacement of the broken pieces in the longitudinal direction very difficult; and, in reality, such displacement is seldom observed, and never in any considerable degree. When it does take place, it is to be ascribed to the cause of the fracture, rather than to muscular contraction. On the contrary, in the transverse displacement, the four pieces approach one another, and the interosseous space is diminished, or entirely obliterated near the seat of the fracture; attended with evident deformity of the part. There is likewise an angular displacement, which the fracturing cause always produces, either forward or backward.

In the treatment of a fracture of both bones, the fore-arm is to be bent to a right angle with the arm, and the hand placed in a position between pronation and supination. An assistant then takes hold of the patient's four fingers, and extends the fractured parts, while another assistant makes counter-extension by fixing the humerus with both his hands. By these means, the operator is enabled to restore the bones to their natural situation, and to push the soft parts into the interosseous space, by a gentle and graduated pressure on the anterior and posterior sides of the arm.

Boyer used to keep the bones in their place by applying first on the anterior and posterior sides of the fore-arm two longitudinal and graduated compresses, the base of which was in contact with the arm. The depth of these compresses should be proportioned to the thickness of the arm, increasing as the diameter of the arm diminishes.

Boyer also employed a single-headed roller, and made three turns of it on the fractured part; then descending to the hand by circles partially placed over one another, and enveloping the hand by passing the bandage between the thumb and index finger. The bandage was next carried upward in the same manner, and reflected, wherever the inequality of the arm might render it necessary. The compresses and bandage being thus far applied, he laid two splints, one anteriorly, the other posteriorly, and applied the remainder of the bandage over them. The compresses and splints should be of the same length as the fore-arm. It would be useless to employ lateral splints. They would counteract the compresses and two other splints, by lessening the radio-cubital diameter of the arm, and, with the action of the pronators, tend to push the ends of the fracture into the interosseous space. The surgeon's attention should be particularly directed to preserve the interosseous space; for, if this be obliterated, the radius cannot rotate on the ulna, nor the motion of pronation or supination be executed; and this object may be obtained with certainty by applying the compresses and splints in such a manner, that the fleshy parts may be forced into, and confined in, the interosseous space, and by renewing the bandage every seven or eight days. In general, the longitudinal compresses, used by Boyer, for preserving the interosseous space, are not resorted to in England, where care is taken not to let the circles of the roller on the fore-arm be too tight, which would have the injurious effect of compressing the ends of the fracture into the interosseous space.

If the fracture be simple, and the contusion inconsiderable, the patient need not be confined to bed, but may walk about, with his arm in a sling.

FRACTURES OF THE RADIUS

Are the most frequent of those of the fore-arm, as proved by records noticed in the foregoing section. The radius being almost the sole support of the hand, and placed in the same line with the humerus, is, for both these reasons, more exposed to fractures than the ulna. These, whether transverse or oblique, near its middle part or extremities, may be caused by a fall or blow on the fore-arm: sometimes by a fall on the back of the hand (see *Dupuytren, Clin. Chir. t. iv. p. 182—184.*), or, as happens in most cases, by a fall on the palm of the hand. When likely to fall, we extend the arm, and let the hand come first to the ground; in which case, the radius, pressed between the hand on the ground, and the humerus, from which it receives the whole momentum of the body, is bent, and, if the fall be sufficiently violent, broken more or less near its middle part. When, after an accident of this kind, pain, and difficulty of performing the motions of pronation and supination supervene, the probability of a fracture of the radius is very strong. The truth is fully ascertained by pressing with the fingers along the external side of the fore-arm. Also, in endeavouring to perform supination or pronation of the hand, a crepitus and a motion of the broken portions will be perceived. When the fracture takes place near the head of the radius, the diagnosis is more difficult, on account of the depth of soft parts over that part of the bone. In this case, the thumb is to be placed under the external condyle

of the os humeri, and on the superior extremity of the radius, and at the same time the hand is to be brought into the prone and supine positions. If, in these trials, which are always painful, the head of the radius rests motionless, there can be no doubt of the bone being fractured. Here the causes of displacement are the same as in fractures of the fore-arm; it can never take place, except in the direction of the diameter of the bone, and is effected principally by the action of the pronating muscles. The ulna serves as a splint in fractures of the radius; and the more effectually, as the two bones are connected with one another throughout their whole length.

Fractures of the lower end of the radius deserving particular notice, as often erroneously supposed to be dislocations of the wrist, may be transverse, or oblique, and be situated from three to six lines, or an inch, from the articular surface. The consecutive displacement will have a greater resemblance to a true dislocation, the nearer the fracture is to the wrist. *Dupuytren* met with some cases, in which the articular surface of the radius was comminuted. In general, fractures of the lower end of the radius take an oblique direction from above downwards, and from the dorsal to the palmar surface. (See *Clin. Chir. t. iv. p. 183.*) Such fractures are mostly simple; but now and then compound. Occasionally the lower fragment is split vertically in two pieces. In a few rare cases, besides a fracture of the radius, the ulna is dislocated, and projects through the skin. (*Dupuytren, vol. cit. p. 190.*)

In general, when the radius alone is fractured, no extension is requisite. During the treatment, the elbow is to be bent, and the hand put in the mid-state, between pronation and supination; that is to say, the palm of the hand is to face the patient's breast. Having reduced the ends of the fracture, when they appear to be displaced, the soap-plaster is to be applied, and over this a slack roller. This bandage is, indeed, of no utility; but it makes the limb seem to the unknowing bystanders more skilfully put up, than if it were omitted, and, as it does no harm, the surgeon may honestly apply it. However, no one can doubt, that tight bandages may act very perniciously, by pressing the radius and ulna together, causing them to grow to each other, or, at all events, making the fracture unite in an uneven manner. Only two splints are necessary; one is to be placed along the inside, the other along the outside, of the fore-arm. Soft pads must always be placed between the skin and the splints, in order to obviate the pressure of the hard materials, of which the latter are formed. The inner splint should extend to about the last joint of the fingers; but not completely to the end of the nails; for many patients, after having had their fingers kept, for several weeks, in a state of perfect extension, have been a very long time in becoming able to bend them again.

Sometimes, it may be proper to apply a compress just under the ends of the fracture, to prevent their being depressed towards the ulna too much, the consequence of which has occasionally been the loss of the prone and supine motions of the hand.

In setting a fractured radius, the hand should be inclined to the ulnar side of the fore-arm. When the fracture is towards the wrist, the hand

and lower fragments have a tendency to displacement outwards, towards the radial side of the fore-arm. If attention be not paid to prevent this, the union takes place with deformity, and the motions of supination and pronation are imperfect. (See *Dupuytren, Clin. Chir. t. iv. p. 214.*) The mechanical contrivances, employed by this celebrated surgeon to keep the hand in the right position, are there described.

FRACTURES OF THE ULNA

Are less frequent than those of the radius, and take place generally at its lower extremity, which is most slender, and least covered. The fracture is almost always the result of a force acting immediately on the part fractured; as, for instance, when, in a fall, the internal side of the fore-arm strikes against a hard resisting body. On applying the hand judiciously to the inside of the fore-arm, this fracture is easily ascertained by the depression at that part, in consequence of the interior portion being drawn toward the radius by the action of the pronator radii quadratus. This displacement, however, is less considerable than what takes place in fractures of the radius. The superior portion of the ulna remains unmoved. (*J. L. Petit.*)

In this case, the assistant, who makes whatever little extension may be necessary, should incline the hand to the radial side of the fore-arm, while the surgeon pushes the flesh between the two bones, and applies the apparatus, as in the preceding case. In all fractures of the bones of the fore-arm, and, particularly in those which are near the head of the radius, a false ankylosis is to be apprehended, and should be guarded against by moving the elbow gently and frequently, when the consolidation is advanced to a certain point.

Fractures of the fore-arm always require the part to be kept quietly in a sling.

FRACTURES OF THE OLECRANON

Happen either at its base, its centre, or its extremity; but, the second case is the most frequent. The division is almost always transverse, though occasionally oblique. The accident is very rarely produced by the action of the muscles, but almost always, by external violence, directly applied to the part in a blow, or fall upon the elbow.

With regard to symptoms, the contraction of the triceps, being no longer resisted by any connection with the ulna, draws upward the short fragment, to which it adheres, so as to produce, between it and the lower one, a more or less evident interspace. This interspace is situated at the back of the joint, and may be increased or diminished at will, by augmenting the flexion of the fore-arm, and putting the triceps into action, or extending the limb. Another symptom is a difficulty, or impossibility of extending the fore-arm, the necessary effect of the detachment of the triceps from the ulna. It appears from the dissections made by Sir Astley Cooper, that the extent of the separation depends upon the degree of laceration of the capsular ligament, and of that portion of ligament which proceeds from the side of the coronoid process to that of the olecranon. (*On Dislocations, &c. p. 487.*) It must be owing to the untorn state either of the latter part, or of the aponeurosis covering the olecranon, that patients occasionally retain the power of extending the fore-arm, as is exemplified in the case reported by Mr. Earle,

where, on the sixth day after the accident (and not before), this power was destroyed by a sudden flexion of the fore-arm. (*Practical Obs. p. 147.*) The fore-arm is constantly half-bent, the biceps and brachialis having no antagonists. The olecranon is more or less drawn up higher than the condyles of the humerus, which latter parts, on the contrary, are naturally situated higher than the olecranon, when the fore-arm is half-bent. The upper piece of bone may be moved in every direction, without the ulna participating in the motion. Besides these symptoms, we must take into the account, the considerable pain experienced, and the crepitus perceptible, when the fragment is approximated to the surface from which it is detached.

The indications are to push the retracted portion of the olecranon downwards, and to keep it in this position, at the same time that the ulna is made to meet it, as it were, by extending the fore-arm. According to Desault, however, the fore-arm should not be completely extended, as, when the pieces of bone touch at their back part, they leave a vacancy in front, which is apt to be followed by an irregular callus, prejudicial to the free motion of the elbow. Hence, it was his practice to put the arm between the half-bent and the completely extended state, and to maintain this posture by means of a splint along the fore part of the arm. But, as position operates only on the lower part of the olecranon, the upper one requires to be brought near the former, and fixed there, which is, doubtless, the most difficult object to effect, because the triceps is continually resisting.

Desault used to adopt the following method:—

The fore-arm being held in the above position, the surgeon is to begin applying a roller round the wrist, and to continue it as high as the elbow. The skin, covering this part, being wrinkled in consequence of the extension of the limb, might insinuate itself between the ends of the fracture, and consequently it must now be pulled upward by an assistant. The surgeon is then to push the olecranon towards the ulna, and confine it in this situation with a turn of the roller, with which the joint is then to be covered, by applying it in the form of a figure of 8.

A strong splint, a little bent, just before the elbow, is next laid along the arm and fore-arm, and fixed by means of a roller. The limb is then to be evenly supported on a pillow.

The cure of the fractured olecranon is seldom effected by the immediate reunion of its fragments; there generally remains a greater or lesser interspace between them, which is filled up by a substance, not of a bony consistence. Indeed, the tenour of the remarks and experiments lately published by Sir Astley Cooper on this subject, is to represent the broken olecranon as similarly circumstanced with respect to bony union, as the fractured neck of the femur. He has seen union by bone effected in the living subject; but this was when the fracture had taken place very near the shaft of the ulna. The ligamentous substance, he says, which generally forms the bond of union, when it is of considerable length, often has one, or even several apertures in it. The arm is observed to be weakened, in proportion to the length of the ligament. (*On Dislocations, &c. p. 489.*)

Camper laid great stress upon the inability of keeping the arm perfectly extended; he found

patients recover sooner and better, when the elbow was kept half bent, and the joint gently exercised at as early a period as possible. "Agglutinationem scilicet motiri non debet chirurgus, sed sublati tumore ac inflammatione quiete et remediis aptis, cubitum quotidie prudenter movere, ut unio per tricipitis tendinem, seu per concretionem membranosam formetur, et os oasi non admoveatur. Verbo quemadmodum C. Celsus in *Med. lib. viii. c. 10. § 4. p. 537. de cubito fracto præcepit. Quod si ex summo cubito quid fractum sit, glutinare id vinciendo alienum est, fit enim brachium immobile, ac, si nihil aliud quam dolore occurrendum est, idem qui fuit ejus usus est."* (*Camper de Fractura Patellæ*, p. 66. Hagæ, 1789.) Mr. Earle is also an advocate for placing the limb in a slightly bent position. (*Pract. Obs. p. 165.*) The late Mr. Sheldon, however, does not concur with Desault and Camper, respecting the position of the limb during the treatment, but insists upon the utility of keeping the fore-arm perfectly extended.

When there is much swelling, Sir A. Cooper employs leeches and evaporating lotions for two or three days; but, when not much violence has been done to the limb, he applies a bandage at once. He places the arm in a straight position, presses down the fragment until it touches the ulna, and, after putting a slip of linen along each side of the joint, puts a roller round the limb above and below the olecranon. By tying the slips of linen, which pass under the rollers, these are drawn nearer together, and the fragment of the olecranon is thus kept as near as possible to the ulna. Lastly, a splint, well padded, is applied along the front of the arm, and secured with a bandage, which is frequently wetted with spirit of wine and water. (*On Dislocations, &c. p. 490.*)

Baron Dupuytren applied what is termed the uniting bandage, with a compress above the upper fragment, and an anterior splint. (*See Clin. Chir. t. i. p. 328.*)

On an average, the olecranon becomes firmly united about the twenty-sixth day. (*Desault.*) In a month, the splint is to be removed, and passive motion begun. (*A. Cooper.*) I have seen a case, in which the upper fragment was ankylosed to the humerus.

FRACTURE OF THE CORONOID PROCESS.

Two examples of this accident are noticed by Sir Astley Cooper: in one case, seen by him several months after its occurrence, the same appearances presented themselves as were remarked by the surgeon who first attended the patient; namely, the ulna projected backwards whilst the arm was extended, but it could be drawn forwards, and the elbow bent, without much difficulty, when the deformity disappeared. In the other instance, which was met with in the dissection-room, the coronoid process, which had been broken off, was united by ligament, and so moveable, that, when the fore-arm was extended, the ulna glided backwards upon the condyles of the humerus. Sir Astley Cooper is of opinion, that the case admits of no other mode of union: he recommends keeping the arm steadily in the bent position for three weeks. (*On Dislocations, &c. p. 484.*)

FRACTURES OF THE CARPAL AND METACARPAL BONES, AND PULANGES OF THE FINGERS.

The bones of the carpus, when broken, are

usually crushed, as it were, between very heavy bodies, or the limb has been entangled in powerful machinery, or suffered gunshot violence. It must be obvious, therefore, that, as the soft parts are also seriously injured, these cases are generally followed by severe and troublesome symptoms, and sometimes require the performance of amputation, either immediately or subsequently. When an attempt is to be made to save the part, the chief indications are to extract splinters of bone, and prevent inflammation, abscesses, and mortification. The parts may at first be kept wet with a cold evaporating lotion, any wound present being lightly and superficially dressed; but, afterwards, as soon as all tendency to bleeding is over, emollient poultices may be applied over the dressings instead of the lotion. The dressings themselves, however, should not be removed for the first three or four days, all unnecessary disturbance of the crushed parts being highly injurious. Should abscesses form, early openings should be practised, so as to prevent the matter from extending up the fore-arm. Duly supporting the hand and fore-arm in a sling is of the greatest importance. The metacarpal bones of the little finger and thumb are more frequently broken than the other three. A fracture of a metacarpal bone is generally produced by violence applied directly to the part, as no force, capable of causing the accident, can well act upon the two ends of the bone so as to break it. The fracture may be simple, but more commonly it is compound, the soft parts being wounded and lacerated by the same violence which has injured the bone. In most cases, also, unless the force has operated by a very limited surface, more than one metacarpal bone is fractured. At first, the same kind of treatment is requisite as in the preceding cases, and, after the inflammation has subsided, a hand-board, or splint, may be employed. When the hand is very badly crushed, amputation is indicated.

In fractures of the finger-bones, the treatment consists in applying pasteboard, or placing the hand on a flat splint, or finger-board, and keeping the part at rest in a sling.

For Fractures of the Cranium, see HEAD, Injuries of.

For information on fractures generally, consult J. L. Petit, *Traité des Maladies des Os*. 8vo. Paris, 1723. et nouv. ed. par M. Louis, 2 t. 12mo. 1767. Duvcrney, *Traité des Maladies des Os*. 8vo. Paris, 1751. Jonathan Wathen, *The Conductor and Containing Splints; or a Description of two new-invented Instruments, for the more safe Conveyance, as well as the more easy and perfect Cure, of Fractures of the Leg*, 2d ed. 8vo. Lond. 1767. W. Sharp, in vol. lvii. of the *Philosophical Trans.* part II. 1767. Pott, on Fractures and Dislocations, 2d ed. 1778. T. Kirkland, *Obs. upon Pott's General Remarks on Fractures*, &c. 8vo. Lond. 1770; also, Appendix to the same, 8vo. Lond. 1771. Cases in Surgery, by C. White, edit. 1770. J. Aitken, *Essays on several Important Subjects in Surgery, chiefly on the Nature of Fractures of the Long Bones of the Extremities*, 8vo. 1771. Boyer, *Traité des Mal. Chir. t. iii.* (*Œuvres Chir. de Desault*, par Bichat, t. i. *Parts of the Parisian Chir. Journal.* Sir J. Earle, *Obs. on Fractures of the Lower Limbs; to which is added, an Account of a Contrivance to administer Cleanliness and Comfort to the Bed-ridden, or Persons confined to Bed by Age, Accident, Sickness, or other Infirmary*, 8vo. Lond. 1807. *Assalini, Manuale di Chirurgia*, parte prima, Milano, 1812. M. le Baron Dupuytren, *Des Fractures ou Courbures des Os des Enfants*, in *Bulletin de la Faculté de Méd. Paris*, 1811. *Idem*, sur la Fracture de l'Extrémité inférieure du Péroné, les Luxations, et les Accidents qui en sont la suite, in *Annuaire Méd. Chir. de Paris*, 4to. Paris, 1819. *Idem*, on Fractures of Various Bones, in *Lectures Orales de Clin. Chir.* 4 tomes, 8vo. Paris, 1832-1834. M. Roux, *Relation d'un Voyage fait à Londres en 1814, où Paral-*

Maie de la Chir. Angloise avec la Chir. Française, p. 173, &c. Paris, 1815. *Med. Chir. Trans.* vol. ii. p. 47, &c. i. vol. v. p. 358, &c.; vol. vii. p. 103. *Sketches of the Medical Schools of Paris*, by J. G. Crosse, p. 87, &c. *Sir Astley Cooper*, on Dislocations and Fractures of the Joints, 4to. Lond. 1822; and *Obs. on Fractures of the Neck of the Thigh-Bone*, 1823. *H. Barle*, *Practical Obs. in Surgery*, 8vo. 1828. *W. Gibson's Institutes and Practice of Surgery*, 8vo. vol. i. Philadelphia, 1824. *Sir C. Bell*, on Injuries of the Spine and Thigh-Bone, 4to. Lond. 1824. *J. Amesbury*, on Fractures of the Upper Third of the Thigh-Bone, and Fractures of long standing, ed. 2. 8vo. Lond. 1829. *G. W. Hind*, a Series of Plates, illustrating the Causes of Displacement in the Various Fractures of the Bones of the Extremities, fol. 1835.

FRÆNUM LINGUÆ. In infants, the tongue is sometimes too closely tied down, by reason of the frænum being extremely short, or continued too far forwards. In the latter case, the child will not be able to use its tongue with sufficient ease in the actions of sucking, swallowing, &c., in consequence of its point being confined at the bottom of the mouth. Though this affection is not unfrequent, it is less common than is generally supposed by parents and nurses. When the child is small, and the nurse's nipple large, it is common for her to suppose the child to be tongue-tied, when, in fact, it is only the smallness of the child's tongue that prevents it from surrounding the nipple, so as to enable it to suck with facility. Mothers also commonly suspect the existence of such an erroneous formation, whenever the child is long in beginning to talk.

The reality of the case may always be easily ascertained by examining the child's mouth. In the natural state, the point of the tongue is always capable of being turned upward, towards the palate, as the frænum does not reach along above a quarter of an inch of the lower part of the tongue from the apex. But, in tongue-tied children, by looking upon one side, we may see the frænum extending from the back part to the very point, so that the whole length of the tongue is tied down, and unnaturally confined.

The plan of cure is to divide as much of the frænum as seems proper for setting the tongue at liberty. The surgeon presses up the tongue against the palate with his left thumb and fore-finger. The incision should be directed downwards, away from the tongue, and not be carried upward, or backward, lest the raninal veins, or arteries be cut; an accident that has been known to prove fatal. For the same reason, the scissors used for this operation should have no points. If the fore-finger and thumb prevent the parts from being seen, the tongue must be pressed up with a spatula, or a director, that has a slit in which the frænum may be placed, as long ago preferred by J. L. Petit. (See *M. Velpeau*, in *Nouv. Élém. de Méd.*, Op. t. ii. p. 67. 8vo. Paris, 1832; and *M. Malgaigne*, *Manuel de Méd. Opér.* p. 435. ed. 2. 12mo. Paris, 1837.) I think the following piece of advice, offered by a modern author, may be of service to practitioners, who ever find it necessary to divide the frænum linguæ: "It is not the relations of the trunk of the lingual artery alone, which the student ought to make himself acquainted with. He will do well to study the position of the *arteria ramina* in respect to the frænum linguæ. This information will teach him the impropriety of pointing the scissors upward and backward, when snipping the frænum; an operation, by the by, oftener performed than needed. He will learn, that the raninal artery lies just above the attach-

ment of the frænum; so that, if he would avoid it, he must turn the points of the scissors rather downward; if he do not, the artery will probably suffer." (*A. Burns*, *Surgical Anatomy of the Head and Neck*, p. 239.)

When an infant has the power of sucking, this proceeding should never be resorted to, even though the frænum may have the appearance of being too short, or extending too far forwards. (*Fab. Hildanus*, *centur. iii. obs. 28. Petit*, *Mal. Chir.* t. iii. p. 265. edit. 1774.)

Although the operation of dividing the frænum linguæ is, for the most part, done without any bad consequences, surgeons should remember well, that it is liable to dangers, especially when performed either unnecessarily or unskilfully. Besides the fatal events which have occasionally resulted from wounding the raninal arteries, the records of surgery furnish us with proofs, that the mere bleeding from the raninal veins, and the small vessels of the frænum, may continue so long in consequence of the infant's incessantly sucking, as to produce death. In such cases, the child swallows the blood as fast as it issues from the vessels, so that the cause of death may even escape observation. But, if the body be opened, the stomach and intestines will be found to contain large quantities of blood. (See *Dionis*, *Cours d'Opérations de Chirurgie*, 7c *Démonstration. Petit*, *Maladies Chir.* t. iii. p. 282, &c.)

Another accident, sometimes following an unnecessary or too extensive a division of the frænum, consists in the tongue being thrown backward over the glottis into the pharynx, where it lies fixed, and causes suffocation. The observations of Petit on this subject are highly interesting. (See *Op. cit.* t. iii. p. 267, &c.)

Lastly, it should be known, that an infant's inability to move its tongue, or suck, is not always owing to a malformation of the frænum. Sometimes the tongue is applied and glued, as it were, to the roof of the mouth, by a kind of mucous substance; and, in this case, it should be separated with the handle of a spatula. By this means, infants have been saved, which were unable to suck during several days, and were in imminent danger of perishing from want of nourishment. (See *Mém. de l'Acad. de Chir.* t. iii. p. 16. éd. 4to.)

See particularly *Petit*, *Traité de Maladies Chir.* t. iii. p. 260, &c. *Dionis*, *Cours d'Opérations*, 7c *Démonstr. Sabatier*, *Médecine Op.* t. iii. p. 132, &c. *Lasus*, *Pathologie Chir.* t. ii. p. 454. *Richter*, *Anfangsgr. der Wundarzn.* b. iv. kap. ii. p. 11. éd. 1800. *Also*, *A. L. M. Velpeau*, *Nouv. Élém. de Méd.* Op. t. ii. p. 65. 8vo. Paris, 1832. *J. F. Malgaigne*, *Manuel de Méd. Op.* p. 464. 12mo. éd. 2. Paris, 1837.

FRAGILITAS OSSIUM. A morbid brittleness of the bones. Although it may take place at different periods of life, it is remarked to be more common in childhood and in persons of advanced age. (See *B. Bell* on *Diseases of the Bones*, p. 74.)

Boyer imputes *mollities ossium* to a deficiency of lime in their structure; *fragilitas ossium* to a deficiency of the soft matter naturally entering into their texture. This is not the view usually adopted. One modern writer considers preternatural brittleness and flexibility of the bones, as the results of different degrees of the same cause. One degree produces brittleness; a greater degree flexibility, with greater brittleness; the most aggravated form,

mollities ossium. (See *Mayo's Human Pathology*, p. 19.) The diseases, termed *rickets* and *mollities*, however, as we shall find by a reference to those articles, are at all events combined with other pathological changes and circumstances. Boyer states, that a certain degree of *fragilitas ossium* necessarily occurs in old age, because the proportion of lime in the bones naturally increases as we grow old, while that of the organized part diminishes. Hence, the bones of old persons more easily break than those of young subjects, and are longer in uniting again. In old age, the cortex of the bones is thinner, and both in it and the cancelli, the quantity of phosphate of lime diminished. This is one cause of the frequency of fracture of the neck of the thigh-bone in elderly persons. (See *Mayo, Op. cit.* p. 17.) As Mr. Wilson observes, however, they never are found so friable and fragile, as to crumble like a calcined bone, but, on the contrary, they contain a large quantity of oil; a fact particularly noticed by Saillant (see *Hist. de la Société de Méd.* 1776. p. 316.); and when dried after death, they are so greasy as to be unfit to be preserved as preparations. Their organized vascular part is diminished, but their oily animal matter is increased. (*On the Skeleton and Diseases of Bones*, p. 258.)

In persons who have been long afflicted with cancerous diseases, the bones sometimes become as brittle as if they had been calcined. Saviard and Louis relate cases of this description. (*Obs. Chir. et Journ. des Savans*, 1691. *Obs. et Remarques sur les Effets du Virus Cancereux*, Paris, 1750. *Pouteau, Œuvres Posthumes*, t. i.) Two remarkable instances of this kind were published by Mr. Salter of Poole. In the first, the patient, a female aged 82, felt the right thigh suddenly break as she was standing at her drawers. For several months previous to the accident, she had had constant and very severe pain in the part of the bone which was broken, and she had been long afflicted with a cancerous ulceration of the mamma. After death, the bone was so flexible, that no bony union could have taken place. A regular dissection of the limb was not allowed. In Mr. Salter's second case, the patient was also a female, 56 years of age, and, for five months preceding the accident, had laboured under violent pain of the right thigh, and a thickening of the periosteum a little above the patella. As her friends were putting her into a cart, the bone snapped about three inches below the trochanter. For several years she had had a scirrhus of the left breast. This had been removed, and the wound healed, but afterwards broke out in the form of cancerous ulceration. In this stage, the fracture took place, and was followed in about three months by her death. Mr. Salter removed the thigh-bone, and brought it home for examination; but, previously to its removal, the affected limb was observed to be considerably shorter than the other, and flexible at its middle, and a good deal deformed by a projection just below the trochanter major. The muscles of the thigh were pale and shrunk; a bloody fluid escaped from the capsular ligament of the knee-joint, and two or three clots of pure blood were in the articular cavity. On removing the patella, a small ulcer was discovered in the upper and external part of its articular surface. The thigh-bone was remarkably soft throughout its whole length, and the knife could be pushed

through it at any part, but, at its middle, it was most conspicuously deficient in earthy matter. At about three inches from either extremity, it could be bent in any direction; and it was on the upper part of this portion that the fracture had taken place; but the precise situation of it was not distinctly visible, and Mr. Salter conceives, that there had been no complete separation, like what occurs in common fractures. The distortion did not arise from any overlapping, but from a bending of the bone. The muscles about the upper part of the limb were confounded together into an uniform mass of a pale red colour, firm and cartilaginous, with bony spiculae thickly dispersed through them, and puriform matter slightly tinged with blood issuing from the out surfaces. The integuments had suffered no change. In the situation of the swelling noticed above the patella, the tendon of the cruralis was much thickened and altered in texture, and a considerable quantity of pus came from under it; the subjacent periosteum was also much thickened, and readily detached. The parietes of the bone were here nearly absorbed, and the medullary cavity was filled with a bloody pulsatious substance. (See *Med. Chir. Trans.* vol. xv. p. 186.) It is justly inferred by Mr. Salter, that, as these cases corresponded in so many points, the predisposing cause of fracture was probably the same in both. Both the patients laboured under cancer of the breast; and both suffered much from previous pain and lameness. These cases, it is to be remarked, were rather specimens of *mollities ossium*, or preternatural flexibility of the bones affected; and seem to have differed from some examples of fragility on record, not only in their cause, but in the circumstance of no attempt at ossification having taken place in the broken or flexible parts. They resemble, in some respects, Mr. Howship's case; yet differ in the affection being restricted to one bone, and being the sequel of a cancerous disease of the breast. In University College Hospital, I remember a woman who had long laboured under cancer of the breast, and in whom several spontaneous fractures had occurred at different periods. She was treated in this hospital, first, for a fracture of the humerus, and afterwards for one of the clavicle. In this case, every fracture ultimately united.

Mr. Louis mentions a nun who broke her arm by merely leaning on a servant; and in the *London Medical Journal* an account is given of a person, who could not even turn in bed, without breaking some of his bones. One of Professor Gibson's patients, residing near Trenton in the United States, has a son, 19 years of age, who from infancy has been subject to fractures from the slightest causes, owing to an extraordinary brittleness of the bones. "The bones of the arm, fore-arm, thigh, and leg, have all been broken repeatedly, even from so trivial an accident as catching the foot in a fold of carpet whilst walking across the room. The clavicles have suffered more than any other bone, having been fractured eight times. What is remarkable, the boy has always enjoyed excellent health, and the bones have united without difficulty or much deformity." (*Institutes, &c. of Surgery*, vol. i. p. 370.)

Similar cases are mentioned by Mr. B. Bell. A child, he observes, fractures a limb. The fracture unites, and is consolidated perhaps in less than the usual period. Some time after-

wards, on lifting a moderate weight, or on giving the limb a slight twist, it is again broken, and again unites. Mr. Bell saw this occur three times in different parts of the right humerus of a child five years of age, within the short period of eighteen months. "Several similar cases," he says, "have been under my care: in all of them, the patients seemed to enjoy robust health, were apparently unaltered by scrofula, and their fragile bones united in a shorter space of time, than I have generally observed to be the case in individuals whose bones were tougher." (*On Diseases of Bones*, p. 71.) The same author has been able to discern in only two cases of fragility a palpable deviation from the healthy structure of the bones affected. The subject of one case was a gentleman at the middle period of life, who fractured his humerus in unscrewing a music-stool. The fracture was comminuted, and did not unite. The arm was at length amputated by Mr. George Bell at the shoulder. On examining the limb, the muscles around the fractured bone were found in a pulpy state. The bone, surrounded with blood, partly fluid and partly coagulated, was almost friable, and its whole surface perforated by innumerable, small, irregularly shaped holes, giving it a reticulated appearance. (*Op. cit.* p. 72.)

In the latter stages of syphilis, the bones sometimes become remarkably brittle. (*Ephem. Nat. Cur.* dec. ii. ann. iii. obs. 112. *Walther, Museum Anat. t. ii. p. 29.*)

In bad cases of scurvy, the bones are occasionally so brittle, that they are broken by the slightest cause, and do not grow together again. (*Boettcher von den Krankh. der Knochen*, p. 68.) In the museum of University College is a specimen of fragility from scrofula; the humerus having broken in two places from merely shampooing the limb.

Dr. Good was once present at a church, in which a lady, nearly seventy-two years old, broke both the thigh-bones by merely kneeling down; and, on being taken hold of to be carried away, had an os humeri also broken, without any violence, and with little pain. Hardly any constitutional disturbance ensued, and in a few weeks the bones united. (*Study of Medicine*, vol. v. p. 332. ed. 3.)

The fragilitas ossium of old age is incurable: but, in children, the tendency depends on some other constitutional disease, and can only be cured by a removal of the latter. (See *Boyer on Diseases of the Bones*, vol. ii.)

For additional remarks on brittleness of bones, see FRACTURE.

Consult *Waldshmidt*, *Dis. de Fractura Ossium sine Causa violenta externa*. Kilon. 1721. *Accel. Chir. Vorfälle*, b. ii. p. 126. *Courtauld*, *Nouvelles Obs. Anat. sur les Os*, p. 64. 12mo. Paris. 1705. *Marcellus Donatus*, lib. v. c. i. p. 528. *Walther, Museum Anat.* vol. ii. p. 29. *Schmucker*, *Vermischte Schriften*, b. i. p. 385. *Kentish*, in *Edin. Med. Comment.* vol. i. Hist. de l'Acad. des Sciences, 1765. p. 65. *Hist. de la Soc. Royale de Médecine*, 1777 and 1778. p. 224. *Journ. de Méd. t. lxxvii. p. 267*; t. lxxxiv. p. 216. *Isngfamm*, *Pract. Hemerk. über Knochen*, pp. 363. 415. 466. *Fabricius Hildanus*, cent. ii. obs. 66, 67, 68.; cent. v. obs. 89. *D'Aubenton*, *Description du Cabinet du Roi*, t. iii. *Meckren*, *Obs. Med. Chir.* p. 341. *Amst.* 1682. *Weidmann*, *de Necrosis Ossium*, p. 2. *Francosurti*, 1788; and the writings of *DuRoi*, *Pelle*, and *Pringle*. *Couch's Obs. Appendix*. *J. Wilson*, on the Skeleton, &c. p. 258. 8vo. Lond. 1820. *Gibson's Institutes of Surgery*, vol. i. p. 370.; and vol. ii. p. 76. Philadelphia, 1825. *B. Bell*, on Diseases of the Bones, p. 71. *Edin.* 1828. *Seller*, in *Med. Chir. Trans.* vol. xii. *Hewship*, in *Edin. Med. Chir. Trans.* vol. ii. *Harbert Mayo*, *Outlines of Human Pathology*, p. 18. 8vo. Lond. 1835.

FUNGUS. Any sponge-like excrescence. Gra-

ulations are often called *fungous*, when they are too high, large, and unhealthy.

FUNGUS HÆMATODES. (From *fungus*, and, *alma*, blood.) So named by Hey. *Milthike Tumour*; *Monro. Spongoid Inflammation*; *Burns. Soft Cancer*; *Auct. Var. Medullary Sarcoma*; *Abernethy. Fungoid Disease*; *Sir. A. Cooper. Matière Encéphaloïde, ou Cérébriforme*; *Laennec. Fungus Medullaris*; *Maunoir. Cephaloma*; *Carswell.*

This disease, accurately described only of late years, was formerly generally confounded with cancer. The public are indebted to J. Burns, of Glasgow, for the first interesting account of it: and the subsequent writings of Hey, Freer, Laennec, Andral, Carswell, Wardrop, Langstaff, and others, have made us still better acquainted with the subject.

It is unquestionably one of the most alarming diseases incidental to the human body, because we know of no specific remedy for it; and an operation can only be useful (if it can be useful at all) at a time when it is very difficult to persuade a patient to submit to it. Indeed, when the diseased part is within reach of operation, and extirpated at an early period, a recovery hardly ever follows; for, experience proves, that it is not a disease of a local nature, but almost always extends to a variety of organs and structures at the same time, either to the brain, the liver, or lungs, &c. It is of the utmost consequence to be aware of this fact, since we should otherwise be induced to attempt many hopeless operations, and deliver a prognosis that might cause disappointment and censure. In a large proportion of patients, affected with fungus hæmatodes, the general disorder of the system is indicated by a peculiarly unhealthy aspect; a sallow, greenish yellow colour of the skin, which is frequently covered with clammy perspiration; constant troublesome cough; difficulty of breathing, &c.

Fungus Hæmatodes was the name introduced by Hey. J. Burns has called the disease *spongoid inflammation*, from the spongy elastic feel which peculiarly characterizes it, and which continues even after ulceration has taken place. The expression, fungus hæmatodes, is by no means an eligible one; because the disease is not always followed by a protrusion of a bleeding mass; never until the disease has reached an advanced stage; and then the substance, which projects, is not truly a fungus, but the medullary matter itself.

If, with Dr. Carswell, we regard fungus hæmatodes as a species of carcinoma, then we may comprehend the disease under his general definition of the latter, as consisting in the formation or deposition of a peculiar substance, which presents great variety of consistence, form, and colour; possesses a vascular organization of its own; gives rise to the gradual destruction, or transformation of tissues; affects successively or simultaneously a greater or less number of organs; and has a remarkable reproductive tendency. Dr. Kerr defines fungus hæmatodes, "as a morbid condition of the body, evinced by the development of an elastic uneven tumour, or tumours, not painful in their early stage, and becoming so only by implication with surrounding parts; tending to ulceration; and by ulceration presenting to view a soft and spongy fungus, rapid in its growth, readily bleeding in vascular textures, and emitting a peculiar serous discharge, of a very

fecid odour, more or less coloured with blood." (*Cyclop. of Pract. Med.* art. *Fungus Hæmatodes*.) As I have already observed, however, the protrusion is not a fungus, nor is its structure truly spongy; the disposition to hæmorrhage, likewise, depends, as Dr. Carswell has pointed out, less upon the vascularity of the surrounding parts, than upon its own vascularity, and the thinness of the coats of its blood-vessels.

The consistence of fungus hæmatodes, or medullary sarcoma, varies in different cases, and sometimes at different points of the same tumour; being sometimes more dense than brain, or even as compact as boiled udder, while, in other instances, its softness is equal to that of the foetal brain, or the milt of a fish; neither is the colour always the same in every case; and it is frequently different at various points of the same mass. Generally, it is like that of the medullary substance of the brain; but sometimes it is redder in particular places, or the medullary matter is broken down and blended with blood, and there may then be within the swelling clots of blood. It was the doctrine of Laennec, that the soft consistence of all carcinomatous formations is invariably preceded by a hard condition, of them. This opinion is not entirely renounced at the present time, though the investigations of M. Andral and Dr. Carswell clearly prove that it ought to be so. "The carcinomatous deposit, besides being modified in its consistence by the tissues in which it is contained, is equally so in consequence of a difference in its composition: it may be either hard or soft at this period; and consequently the latter state is not necessarily preceded by the former." (See *Illustrations of the Elem. Forms of Disease*, fasc. iii.) Dr. Carswell illustrates this fact by reference to what happens in the cellular tissue and on serous surfaces; and more especially on the surfaces of sores, formed by the destruction of protruded portions of tumours, or after the removal of the breast, eye, or testis, affected with carcinoma. In all these situations, he observes, the deposited substance may present, at the same stage of its formation, the opposite extremes of consistence; being in one case as hard as cartilage, and more or less transparent, and in another, as soft as brain, and quite fluid, and opaque.

One very important pathological fact, in relation to this subject, is the frequency of scirrhus, medullary sarcoma, and fungus hæmatodes, originating in the same morbid state, and passing from one to the other in this order, as specified by Dr. Carswell. Indeed, he adds, we often meet with all the varieties of scirrhus and medullary cancer (termed by him cephaloma), not only in different organs of the same individual, but even in a single organ. I have now seen many cases, proving the truth of these statements; yet, probably, the doctrine is correct, which represents fungus hæmatodes as a distinct malady, "although it may be consequent upon, or complicated with, other alterations of structure. When it occurs in young subjects, it is always primary, or is not preceded nor attended by the carcinomatous formation. But in persons past the meridian of life, in whom only scirrhus-cancer, or cancer, is met with, the fungoid structure is sometimes produced consecutively, or, in an advanced stage of it, and thus occasionally exists as a secondary complication with that disease, or as one of the advanced changes of structure, consequent upon the constitutional vice." (See Dr.

Copland's Dict. of Pract. Med. art. *Fungoid Disease*.) The same writer adds that, in a few instances, other morbid formations, besides this, have been found associated with the cerebriform structure, as fibrous tumours, serofulous matters, pus, melanosis, hydatids, and earthy deposits. Dupuytren notices a form of fungus hæmatodes, which is pulsatory, and combined with erectile tissue; which latter circumstance, he says, may render the disease susceptible of a favourable change by the ligature of the artery, whose branches keep up the circulation in it; while the other elementary matters, found in it in greater, or lesser quantity, as the scirrhus and cerebriform, are a great impediment to the success of this method of relief. (See *Clin. Chir.* t. iv. p. 59., and *Andral, Anat. Pathol.* t. i. p. 219.) The bloodvessels, which enter scirrhus and medullary sarcoma, vary greatly in number, and sometimes considerably in bulk. They are rarely perceptible in any of the varieties of scirrhus, and are but few in the organized and mammary sarcoma, which are considered by Dr. Carswell as varieties of medullary sarcoma (cephaloma); while, in ordinary medullary sarcoma, they are often so numerous, as to form the greater portion of the brain-like tumour, in which they ramify. In the latter disease, they are described by the latter eminent pathologist, as varying in diameter from the breadth of a hair to that of a line, and to present that peculiarity of distribution, always more or less conspicuous in newly formed bloodvessels, which is, that their ramifications communicate with a common trunk at its opposite extremities, in the same manner as the hepatic and abdominal divisions of the vena portæ do with the trunk of this vessel. They are frequently varicose; their coats are remarkably delicate, and they have altogether much more of a venous, than of an arterial, character. According to Dr. Carswell's researches, they appear to be formed apart from the vascular system of the surrounding textures, as they can be seen to originate in small red points, situated at the centre, or at the circumference of the carcinomatous mass, which first assume the appearance of slender streaks of blood, and afterwards acquire a cylindrical arrangement and ramiform distribution, thereby constituting what may be denominated the proper circulation of medullary sarcoma, or cephaloma. The communication between these vessels and those of the organ, in which the medullary substance is contained, is frequently very imperfect; a circumstance, which, together with the delicacy of their structure, renders them extremely liable to congestion and rupture. The most minute divisions of these vessels terminate by penicillated extremities in the carcinomatous matter, where they communicate with veins and arteries belonging to the affected organ. The latter vessels, which Dr. Carswell regards as forming what may be termed the collateral circulation of medullary sarcoma, are seldom so conspicuous as the former; though cases now and then occur in which they constitute the greater part of the vascular structure of the disease. They are described by the same excellent pathologist, as proceeding in a radiating direction from the pedunculated attachment of a tumour; or as arising along its circumference in the cellular tissue, separating it from the neighbouring parts. It is, he observes, by means of these vessels, that the materials required for the nutrition and growth of such tumours are supplied; and causes, inter-

rupting this collateral circulation, will occasion the partial or complete destruction of these and other tumours. (See *Carswell's Illustrations of the Elem. Forms of Disease*, fasc. iii.)

According to the same high authority, nerves have never been detected in this, or any other variety of cancer, as a *new formation*, though they are sometimes included within agglomerated tumours, or even a single tumour, that has happened to form in a situation through which they pass. In some cases, the nerves have participated in the change of structure; but, according to Dr. Copland, they have not been found changed beyond the limits of the tumour. In the eye, the structure of the optic nerve is constantly altered; and, in a case, referred to by Mr. Wardrop, the anterior crural nerve passed into the centre of the diseased mass, and was so completely lost in it, that it was impossible to distinguish one structure from the other. Observations of this kind led M. Maunoir to suppose, that the medullary matter was actually a collection of nervous pulp; an idea very inconsistent with the well known insensibility of such medullary matter. M. Lobstein, in combating the doctrine of M. Maunoir, declares, that he has seen cases, in the early stage of which the nerves passed through the tumour without undergoing any change.

A very common character of medullary tumours is to be lobular, the lobules being closely compacted together, and enclosed in remarkably fine cysts, the presence of which may be demonstrated by macerating the soft substance, and washing it away, or dissolving the medullary matter with the aid of alkalis. This lobulated and encysted structure, is generally noticed in cases where the tumour is near the surface of the body. These cysts, in which the medullary matter is often contained, are externally fibrous and cellular, but internally they present, as Dupuytren remarks, a completely serous organization, and here a serosity exhales from them. Sometimes the medullary matter originates from, and is adherent to, a single point of the cyst; while, in other instances, it adheres almost to every part of the interior of the cyst, which is itself closely connected to the surrounding textures. Under these circumstances, the cyst is fibro-cellular, or entirely fibrous. (See *Dupuytren, in Clin. Chir. t. iv. p. 57.*)

Dr. Hodgkin has advanced the doctrine, that the presence of a serous membrane, having a cystiform arrangement, is necessary for the production of cancerous and some other kinds of tumours. The existence of the cyst, he believes, precedes the formation of the morbid substance, and constitutes the seat and origin of the disease. (See *Med. Chir. Trans. vol. xv.*) Although Dr. Carswell admits, that this mode of origin is sometimes exemplified, he mentions facts, which leave no doubt, that it is only accidental, and not essential. Cysts, he observes, partake of the structure and functions of serous membrane, and consequently are subject to similar diseases. "If therefore such cysts should exist in an individual having the cancerous diathesis, they may, in the same manner as a natural serous membrane, become the seat of any variety of carcinoma. But, although carcinomatous tumours, such as those described by Dr. Hodgkin, are found contained in cysts, attached, single, or in groups, and covered by a reflected serous membrane, these tumours may, and frequently do, not originate in the cysts. They may

form in the cellular tissue external to the cysts, and, during their development, project inwards, carrying before them, as their common envelop, the internal and serous lining of the latter. Such, in fact, is seen to be the origin of these tumours in most of the cysts, represented by Dr. Hodgkin in the work referred to. They are situated external to the cyst, are supplied with vessels which do not belong to it, and are placed in the same circumstances as tumours formed in the cellular tissue, when no cyst is present.

"As an objection to the general application of the cystic origin of tumours, it may be observed, that the presence of cysts in the liver, walls of the stomach, lungs, kidneys, brain, lymphatic glands, spleen, and blood, is not to be detected at any period of the development of carcinoma; and, therefore, when they do occur in other organs, as the ovaries, testes, mammæ, &c., they must be regarded as a mere coincidence, or as a consequence of the disease, and not as a cause, or necessary condition of it." (See *Carswell's Illustrations of the Elem. Forms of Disease*, fasc. ii.)

A very interesting fact, in relation to fungus hæmatodes, or medullary sarcoma, is that of the occasional presence of the cerebriform substance in the veins and absorbents. A similar fact is noticed with regard to scirrhus cancer. Dr. Carswell believes, that the carcinomatous and medullary matter is formed in the blood, whether met with in this fluid alone, or in other parts at the same time; and he supports his view upon the facts,—1st, That the morbid substance is found in the vessels, which ramify in these malignant tumours, or their vicinity. 2dly, That it is found in those vessels which communicate with the diseased parts of an organ. 3dly, That it is sometimes met with in vessels, having no direct communication with another part, that is the seat of the same disease. After noticing that the venous and capillary divisions of the vascular system are those, in which the carcinomatous substance has been observed, Dr. Carswell describes the forms under which it appears in the blood, and which are exceedingly various; "sometimes perfectly similar to those which mark its presence in the substance or on the surface of organs. In large veins, such as the vena portæ and its branches, the emulgent vein, &c., it may present the lardaceous, mammary, medullary, or hæmatoid characters, all in the same venous trunk. These varieties of the carcinomatous formation may be found mixed together in minute quantities, or isolated into masses so conspicuous, that we can readily distinguish them from one another. Sometimes, they lie merely in contact with the internal parietes of the vein; at other times, they are united to the latter by means of a thin layer of colourless fibrine; or minute blood vessels pass from the one into the other, and are often very numerous, and remarkably conspicuous in the cerebriform matter." It seems to Dr. Carswell, that the presence of an organized product in the blood can have no other origin, than the blood itself, and that such a product cannot be introduced into this fluid by absorption. (See *Illustrations of the Elem. Forms of Disease*, fasc. ii.)

By some pathologists, a different view is taken of this part of the subject, and they maintain, that, when the carcinomatous or medullary matter is found in the blood, it has been absorbed. On this principle, the extension of the disease is even

attempted to be in part accounted for. But, the frequently organized state of the product in the blood, and its occasional existence there without any traces of a similar formation in any other part of the system, are arguments strongly confirming the accuracy of Dr. Carswell's statements. This gentleman's doctrine is not, however, universally adopted. Thus, Dr. Copland observes that the formation of the cerebriform matter in the blood, and its subsequent deposit in the parts, which are its seats, "cannot be supported by the history and progress of the local and constitutional affections. If it were previously formed in the blood, wherefore is it often deposited only in one situation? Wherefore is it not excreted by the emunctories? Wherefore does it not always affect a number of parts simultaneously? Wherefore is it never found in the arteries, and so frequently in the absorbents and veins proceeding from the seat of the disease?" These and other questions, Dr. Copland maintains, cannot be answered consistently with Dr. Carswell's doctrine. (See *Dict. of Pract. Med. art. Fungoid Disease.*) With respect to the medullary substance never being met with in the arteries, Mr. Hey states, that in a case of fungus hæmatodes of the thigh, "the femoral artery was filled with matter, resembling stiff coagulated blood, which prevented the blood from flowing through the divided vessel."

According to the researches of Lobstein, the firmer the tumour, and the earlier the stage of it, the greater the proportion of gelatine to the albumen in it. On the other hand, when the morbid substance is of the consistence of soft brain, the albumen in it is in much greater quantity than the gelatine. I have already explained, however, that the firm and soft conditions of the disease are, by no means, any certain proof of its early and advanced stages, since the morbid substance is frequently from the first of the same consistence, which it exhibits in the end.

Fungus hæmatodes, or medullary cancer, is much more frequently met with in young, than old persons; children of the most tender years being often its victims. I am not aware of any records, by which a judgment might be formed of the comparative frequency of the disease in the two sexes. In my practice, more instances of it, in external situations, have presented themselves in males, than females. The testis, as is universally acknowledged, is oftener the seat of it, than the mamma. Speaking of it, however, more generally, I can offer no opinion of its comparative frequency in the two sexes. Dr. Kerr leans to the supposition, that females are more frequently the subjects of it than males. (See *Cyclop. of Pract. Med. art. Fungus Hæmatodes.*)

It is a common remark, that the persons, whom it attacks, are generally of a sallow complexion, lax fibre, and weak circulation. Yet, when the disease is in the early stage, and limited to some external situation, as, for instance, to one of the limbs, there may be no other apparent fault in the health; and the patient may be neither sallow, nor debilitated. A fine, stout, healthy looking lad was brought a few months ago to University College Hospital, who had a medullary tumour, as large as an orange, upon the lower border of the latissimus dorsi. The same case exemplified also one character of medullary tumours, meriting particular notice, viz. the extraordinary rapidity with which they sometimes increase, even though the skin may

not have ulcerated. In this boy, the tumour, which I have mentioned, enlarged so much in the course of a week, that it not only extended completely across the axilla, but far up into its cavity. But the progress of the disease is not always quick; and at one time it may be very slow, and at other periods surprisingly rapid. Generally, when it is liberated from a part of its coverings by ulceration, or when it returns in a part, in which an attempt has been made to extirpate it by operation, the growth of the protruding medullary mass is very quick.

Fungus hæmatodes has frequently attacked the eyeball, the upper and lower extremities, the testicle, and the mamma. But the uterus, ovary, liver, spleen, brain, lungs, thyroid gland, hip and shoulder joints, and various other parts and organs, may be seats of the disease.

It is in this medullary form of disease, that a vascular organization is most conspicuous; and as the coats of the vessels, with which it is supplied, are remarkably delicate, the circulation of the blood through them is readily interrupted; hæmorrhage from congestive rupture takes place; and the effused blood is mixed in less or greater quantity with the brain-like matter. (See *R. Carswell's Illustrations of the Elem. Forms of Disease*, fasc. ii.) The appearances thus produced, are termed hæmatoid. By M. Roux, Dr. Carswell, and all writers who employ the expression *soft cancer*, fungus hæmatodes, or medullary sarcoma, is regarded, either as closely allied to cancer, or as actually a variety of it. Under the generic term of carcinoma, indeed, Dr. Carswell comprehends scirrhus; the common vascular or organized sarcoma of Abernethy; also his pancreatic, mammary, and medullary sarcoma; and fungus hæmatodes, or the latter disease in an advanced stage, with a portion of the mass of the disease protruding. Dr. Carswell's reasons for this classification are:—1st, That all these diseases "often present in the early periods of their formation, certain characters common to all of them. 2dly, They all terminate in the gradual destruction, or transformation, of the tissues which they affect. 3dly, They have all a tendency to affect several organs in the same individual. 4thly, They all possess, although in various degrees, the same reproductive character." When medullary cancer is not of immoderate size, and situated directly under the integuments, its surface is generally at first smooth, but after a time uneven, or lobulated; the colour of the skin not altered; the part has a soft elastic feel; and it seems as if an indistinct fluctuation were perceived in it.

FUNGUS HÆMATODES OF THE LIMBS.

In the extremities, the disease begins with a small colourless tumour, which is soft and elastic, if there be no thick covering over it, such as a fascia: but, otherwise, it is tense. At first, it is free from uneasiness; but, by degrees, a severe acute pain darts occasionally through it, more and more frequently, and, at length, becomes incessant. For a considerable time, the tumour is smooth and even; but, afterwards, it projects irregularly at one or more points; and the skin at these places becomes of a livid red colour, and feels thinner. In this situation, it easily yields to pressure, but instantly bounds up again. Small openings now form in these projections, through which is discharged a thin bloody matter. Al-

most immediately after these tumours burst, a small fungus protrudes, like a papilla, and this rapidly increases, both in breadth and height, and has exactly the appearance of a carcinomatous fungus, and frequently bleeds profusely. The matter is thin, and exceedingly fetid, and the pain becomes of the smarting kind. The integuments, for a little way round these ulcers, are red, and tender. After ulceration takes place, the neighbouring glands swell, and assume exactly the spongy qualities of the primary tumour. If the patient still survive the disease in its present advanced progress, similar tumours form in other parts of the body, and the patient dies hectic.

After death, or amputation, the tumour is found to consist of a soft substance, somewhat like the brain, of a greyish colour, and greasy appearance, with thin membrane-like divisions running through it, and cells, or abscesses, in different places, containing a thin bloody matter, occasionally in very considerable quantity. There does not seem uniformly to be any entire cyst, surrounding the tumour; for, it very frequently dives down betwixt the muscles, or down to the bone, to which it often appears to adhere. The neighbouring muscles are of a pale colour, and lose their fibrous appearance, becoming more like liver than muscle. The bones are mostly carious in the vicinity of the disease.

The growth of medullary tumours near the surface of the body, is sometimes preceded by a blow on the part; but, in general, the exciting cause is perfectly obscure, the disease appearing to begin spontaneously, though in connection with some unknown peculiarity, or modification of the constitution, without which, no circumstances would be capable of inducing it: when we see a patient sallow, and enfeebled in this disease, such change of the complexion, and the debility manifested, are not to be regarded as causes, but only as effects of the disease on the general health. (*J. Burns on Inflammation*, vol. ii.)

Mr. Hey recorded several cases of fungus hæmatodes. If I notice the principal circumstances relative to one of these, they will suffice to inform the reader of the form in which this terrible affliction presented itself in this gentleman's practice.

A young man, aged twenty-one, two years before, applying to Mr. Hey, perceived a small swelling on the inside of the right knee, not far from the patella. This tumour was moveable, and did not impede the motion of the joint: it was not discoloured, but was painful when moved or pressed upon. It continued in this state half a year; and then, the man having hurt his knee against a stone, it gradually increased in bulk, but did not exceed the size of an egg. The skin was now discoloured with blue specks, which were taken to be veins. He could still walk with ease, and follow his business.

Two months before his admission into the Leeds Infirmary, he met with a fall, and violently bent his knee, but did not strike it against any thing. The tumour began immediately to enlarge; and, within a few hours it extended half way up the inside of the thigh. About a fortnight after this accident, the skin burst at the lowest part of the tumour, and discharged some blood. A dark-coloured fungus, about the size of a pigeon's egg, here appeared; and, a few weeks afterwards,

the skin burst at another part of the large tumour, and some blood was again discharged. From the fissure arose another fungus, which had increased, in the course of the last week, to the size of a small melon, and now measured eight inches from one side of its base to the other. The base of the fungus frequently bled, especially when the man allowed his limb to hang down.

The whole tumour was now of an enormous size, being nineteen inches across, when the measure was carried over the last-mentioned fungus. From its highest part in the thigh to the lowest part, just below the knee, it measured seventeen inches, without including the fungus. The base of the tumour at the knee, exclusive of that part which ran up the thigh, measured twenty-four inches in circumference. The tumour was situated on the inner side of the limb, and was distinctly defined. The skin, covering the disease, was in some places livid, and had several fissures and small ulcerations upon it; but had not burst asunder, except in the two places above described. The tumour was soft, and gave a sensation of some contained fluid, when gently pressed with the hands alternately in opposite directions. The patient said he had walked without pain in his knee, a week before his admission into the infirmary; and he had lost very little blood in his journey to Leeds. He complained of the greatest uneasiness in the highest part of the tumour. It had become hot and painful in the night-time, for some days past. His pulse was 114 in a minute; his tongue was clean; and his appetite had been good, till the last few days. He had never felt any pulsation in the tumour.

In a consultation it was determined, that the tumour should be laid open, by cutting off a portion of the distended integuments; and that, after removing the contents, if the sac should be found in a sound state, the disease should be treated as a simple wound; but if in a morbid state, amputation of the limb should be immediately performed.

A large oval piece of the integuments being removed, the tumour was found to contain a very large quantity of a substance not much unlike coagulated blood, but more nearly resembling the medullary part of the brain in its consistence and oily nature. It was of a variegated reddish colour, in some parts approaching to white, and, as blood issued from it, Mr. Hey conceived it was organized. This mass was partly diffused through the circumjacent parts in innumerable pouches, to which it adhered, and was partly contained in a large sac of an aponeurotic texture, which was connected with the capsule of the knee-joint. There was a great and universal effusion of blood from the internal surface of the sac, and from the pouches containing this morbid mass.

Amputation of the limb was immediately performed, on finding such to be the nature of the case. Mr. Hey, unfortunately however, left a portion of the diseased surface behind on the inner part of the thigh, and hoping that a small narrow portion of the upper part of the sac would soon become a clean sore, and not impede the cure, he made the circular incision two inches below its higher part.

On examining the amputated limb, the vastus internus was found to be brown, and much softer than the other muscles, which were healthy. There were many small portions of blood extra-

vasated in the substance of this muscle. The sac was formed on the aponeurotic covering of the muscle, and ended below where this aponeurosis begins to cover the capsular ligament of the knee. The two fungous substances, above described, appeared to have been only extensions of the morbid mass, where this had made its way through the sac and the integuments. The joint of the knee, and muscles of the leg, were perfectly sound.

I need not detail all the particulars after the operation. Suffice it to say, the man suffered a great deal of constitutional disorder. After a few weeks, the granulations upon the stump became good, and the cicatrization was nearly completed at the end of the sixth week after the amputation. At this period, the small and superficial portion of the upper part of the great sac, which Mr. Hey had unfortunately left, was now healed; but a tumour, now about four inches in length, and between two and three in breadth, had gradually risen at the lower and under part of the thigh, beneath the cicatrix. This contained a soft substance, exactly similar, as far as the touch could discover, to that which had filled the large sac. This tumour became painful, and sometimes discharged a bloody serum, sometimes dark-coloured blood, through four or five small open g's the cicatrix.

Mr. Hey laid open the tumour, and removed its contents; but no advantage was gained by this proceeding. The interior surface was found to be too much diseased to produce good granulations. Blood continued to ooze out of the wound for a few days. Then the inner surface became covered with a blackish substance, which gradually extended itself, and formed a new fungus. A variety of escharotics were applied to destroy the fungous and morbid surface of the wound, but to no purpose; the growth of the fungus always exceeded the quantity destroyed. Undiluted sulphuric acid, applied freely, had very little effect.

An attempt was once more made to cut away the disease; but, on examining the wound carefully, after the contained substance was removed, the muscular substance was found degenerated into a hard mass, which felt somewhat like cartilage. The adipose membrane was also diseased, and formed into large cells, which had contained the fungous substance. Hence, another amputation seemed the only resource.

After this operation the whole surface of the stump seemed sound, except the principal artery, which was filled with a somewhat stiff matter, resembling coagulated blood, which prevented its bleeding. The inside of the vessel, on being touched with the scalpel, felt hard, and communicated a sensation like that of scraping bone.

The man was sent home as soon as his state would admit of it; but he died consumptive about six months afterwards. Besides this instance, in the thigh, Mr. Hey relates cases of fungus hæmatodes, situated in the female breast, in the leg, in the neck (extending from the jaw to the clavicle, and producing suffocation), on the back part of the neck, on the back part of the shoulder, and at the extremity of the fore-arm, near the wrist.

"If I do not mistake (says Mr. Hey), this disease not unfrequently affects the globe of the

eye, causing an enlargement of it, with the destruction of its internal organization. If the eye is not extirpated, the sclerotic bursts at the last, a bloody sanious matter is discharged, and the patient sinks under the complaint." (p. 283.)

Besides some cases, in similar situations, to those mentioned by Mr. Hey, one is related by Mr. Burns, in which the hip-joint was the seat of this terrible affection. After detailing the progress of the case to the poor man's death, this author states, that he found, on dissection, the hip-joint completely surrounded with a soft matter, resembling the brain, enclosed in thin cells, and here and there cells full of thin bloody water: the head of the thigh-bone was quite carious, as was also the acetabulum. The muscles were very pale, and almost like boiled liver, having completely lost their fibrous appearance, and muscular properties. The same sort of morbid mischief was also found within the pelvis, most of the inside of the bones on the affected side being carious. An attempt had been made, before the patient died, to tap the bladder; but, the trocar had only entered a cell filled with bloody water, and situated in a mass of the soft brain-like substance.

I have already stated enough in explanation of the dreadful nature of fungus hæmatodes. Little can be said of the treatment; for, we know not of one medicine that seems to have the least power of putting a stop to the disease, which, when left to itself, has always proved fatal, with the exception of the rare cures by mortification of the parts, as illustrated in one example, related by Schmidt, where a medullary tumour of the eye mortified, the sloughs were detached, the eyeball collapsed, and a small knob, consisting almost entirely of the contracted sclerotica, was the only remnant of this dreadful form of disease. A case of fungus hæmatodes of the left cheek is alleged, by Dr. Schutte, to have terminated favourably by the process of mortification and sloughing. (See *Graf's Journ.*) Under Mr. Cline, there was a woman whose breast healed up after the diseased mass had been thrown off by sloughing. (*Lancet*, vol. ii. p. 401.) With a few exceptions of this kind, we have no reason to believe that there is the smallest chance of any spontaneous amendment, much less of a cure. Also, in some of the cases just now cited, it is not known whether any relapse followed.

We have seen that, when the chief part of a fungus hæmatodes is cut away, and only a small portion of its cyst left behind, the fungus is reproduced from this part, and soon becomes as formidable, nay, more formidable, than it was before, and this, notwithstanding the application of the most powerful escharotics. Neither the hydrargyrus nitratus ruber, the hydrargyrus muriatus, the antimonium muriatum, nor the undiluted sulphuric acid, has always been able to repress the growth of such fungus. (Hey.)

No known remedy has the power of checking or removing the complaint. Friction, with anodyne liniments, sometimes gives relief in the early stages; but it does not retard the progress of the disease. Mercury and iodine have been alleged to do so, but I have never seen an instance of it.

In short, the only chance of cure consists in extirpating the whole of the distempered parts,

removing not only the soft, brain-like, fungous substance, but every particle of the cysts, sacs, or pouches, in which it may be contained. The result of such proceedings is also for the most part unsuccessful, the disease returning in the same situation, or manifesting itself soon afterwards in others. Experience proclaims this discouraging truth so loudly, that many of the best surgeons now decline to undertake any operation in cases of this description; for, if the attempt fails, the patient is put to unnecessary pain, and his life is abridged by the more rapid and deplorable form in which the disease reappears. At all events, an operation is justifiable only in the early stages, while the disease is entirely local, if it ever be so, — a circumstance much to be doubted. After the neighbouring glands have become affected, all chance of recovery is destroyed. Nor should the knife be resorted to for the removal of any external medullary tumour, when there is any sign of the existence of other tumours of the same nature in any of the viscera, glands, or other deep-seated organs. It is sometimes difficult to persuade patients, at an early period, to submit to amputation, or extirpation, because the pain and inconveniences are considerable; but if circumstances then warrant the performance of the operation, it should be urged with all the force, which a conviction of its absolute necessity, and the fatal peril of delay, ought to inspire.

The attempts to cure a medullary tumour on a limb by cutting it away have been attended with such ill success, that many surgeons deem it advisable not to follow this method, but to amputate the limb at once. The annexed views of the matter appear to me to be most judicious and rational. First, that if an attempt be made to cut away the tumour, and save the limb, the surgeon must be careful to remove, at the same time, a considerable quantity of the soft parts in the circumference of the swelling. Secondly, that the earlier this is done, the more likely is it to succeed. Thirdly, that after the tumour has been taken out, an attentive examination of the surface of the wound should be made, and every suspicious part, or fibre, be cut away. Fourthly, that, should the disease still recur, amputation ought to be instantly performed. Fifthly, that caustics should never be applied to this disease. Sixthly, that, even when one of these operations effectually extirpates the distemper in the limb itself, the patient's entire recovery is always rendered exceedingly uncertain, by reason of the viscera, and other deep-seated parts, being frequently affected at the time of the operation; with the same sort of disease, which state of them, though invisible, is often denoted by a sallow complexion, debility, indigestion, emaciation, and hectic.

I will quit this part of the subject with stating some of the principal differences between this form of malignant disease and scirrhus. A scirrhus tumour is, from its commencement, hard, firm, and incompressible, and is composed of two substances; one hardened and fibrous, the other soft and inorganic. The fibrous matter is the most abundant, consisting of septa, which are paler than the soft substance between them. A scirrhus tumour situated in a gland, is not capable of being separated from the latter part, so much are the two structures blended. A scirrhus, in another situation, sometimes condenses the surrounding

cellular substance, so as to form a kind of capsule, and assume a circumscribed appearance. When a scirrhus swelling ulcerates, a thin ichor is discharged, and a good deal of the hard fibrous substance is destroyed by the ulceration; other parts become affected, and the patient dies from the increased ravages of the disease, and its irritation on the constitution. Sometimes, though not always, after a scirrhus has ulcerated, it emits a fungus of a very hard texture. Such excrescence, however, is itself at last destroyed by the ulceration. Cancerous sores, also, frequently put on for a short time, in some places, an appearance of cicatrization. On the other hand, fungus hæmatodes, while of moderate size, is a soft elastic swelling, with an equal surface, and a deceitful feel of fluctuation. It is, in general, quite circumscribed, being included within a capsule. The substance of the tumour, instead of being for the most part hard, consists of a soft, pulpy, medullary matter, which readily mixes with water. When ulceration occurs, the tumour is not lessened by this process, as in scirrhus; but a fungus is emitted, and the whole swelling grows with increased rapidity. Cancerous diseases are mostly met with in persons above forty years of age, while fungus hæmatodes generally afflicts young subjects. (*Wardrop*.) Many dissections have now proved, that the substance of fungus hæmatodes may contain cellular septa, which include the pulpy, medullary matter.

Fungus hæmatodes, in its early stage, is generally attended with less acute pain than what is experienced in cases of scirrhus. The tumour also has a less definite boundary than a scirrhus, and it is more difficult to say, where the diseased structure terminates, and where the healthy commences. When the disease is in the breast, there is less tendency, than in scirrhus cases, to disease in the axillary glands, which may remain sound, though the disorder in the breast may have advanced to suppuration and ulceration. In the breast, the disease is also much quicker in its progress, than scirrhus. (*Edw. A. Cooper, Lancet, vol. ii. p. 399.*)

In cases of external cancer, the viscera are not in general affected at the same time with cancerous disease; but in the majority of examples of fungus hæmatodes, this distemper is found affecting in the same subject a variety of parts. In addition to the outward tumour, we find swellings of a similar nature, perhaps, in the liver, the lungs, the mesenteric glands, or even in the brain.

FUNGUS HÆMATODES OF THE EYE

Presents three stages. In the first, the exterior form of the eye is unchanged, and the disease is perceived through the cornea and pupil. In the second, the form of the eye is altered; the organ is enlarged, and its tunics are ready to give way. In the third (or fungous stage), the eye has burst, and the tumour protrudes. (*See Mackenzie on Dis. of the Eye, p. 647. ed. 2.*)

The first symptoms are observable in the posterior chamber, an appearance like that of polished iron presenting itself at the bottom of the eye. (*Scarpa on Diseases of the Eye, p. 505. ed. 2.*) The pupil becomes dilated and immoveable, and, instead of having its natural deep black colour, it is of a dark amber, and sometimes of a greenish hue. The change of colour becomes gradually

more and more remarkable, and at length is discovered to be occasioned by a solid substance, which proceeds from the bottom of the eye towards the cornea. The surface of this substance is generally rugged and unequal, and ramifications of the central artery of the retina may sometimes be seen running across it. The front surface of the new mass at length advances as far forwards as the iris, and the amber, or brown appearance of the pupil, has, in this stage, been known to mislead surgeons into the supposition of there being a cataract, and cause them to attempt couching. The disease continuing to increase, the eyeball loses its natural figure, and assumes an irregular knobby appearance. The sclerotica also loses its white colour, and becomes of a dark blue, or livid hue. Sometimes matter now collects between the tumour and the cornea. The latter membrane in time ulcerates, and the diseased mass begins to protrude. In a few instances, it makes its way through the sclerotica, and is then covered by the conjunctiva. The surface of the excrescence is irregular, often covered with coagulated blood, and bleeds profusely from slight causes. When the fungus is very large, the most prominent parts slough away, attended with a fetid sanious discharge. In the course of the disease, the absorbent glands, under the jaw, and about the parotid gland, may become contaminated. On dissection, a diseased mass is found extending forwards from the entrance of the optic nerve, the vitreous, crystalline, and aqueous humours being absorbed. The retina is annihilated, and the choroid coat propelled forwards, or quite destroyed. The tumour seems to consist of a sort of medullary matter, resembling brain. The optic nerve is thicker and harder than natural, of a brownish ash-colour, and destitute of its usual tubular appearance. In other cases, the nerve is split into two or more pieces, the interspaces being filled up with the morbid growth. (Wardrop.) Nay, as Mr. Travers has stated, the optic ganglion, tractus opticus, and thalamus, have been repeatedly found diseased, and the surrounding adipose substance of the orbit affected to a considerable extent in places also where there was no direct communication with the diseased contents of the globe. (Synopsis of the Diseases of the Eye, p. 221.) Even the brain has been observed to share in the disease, sometimes dark-red spots appearing on the dura mater; sometimes small spots, containing a fluid like cream, being found between the pia mater and tunica arachnoides. Mr. Travers has a preparation, exhibiting a genuine example of the disease affecting the anterior right lobe of the cerebrum, and protruding the eye from its socket, while the eye itself was perfectly free from disease. (Op. cit. p. 223.) When the lymphatic glands at the angle of the jaw are enlarged, as they frequently are, they are also found converted into a kind of medullary matter, similar to that which composes the diseased mass in the eyeball. When the skin bursts over a diseased absorbent gland, a sloughy ulcer is produced; but no fungus is emitted, unless the affection of the gland with fungus hæmatodes be primary. In University College Hospital, a poor Irishman was under my care in the autumn of 1836, who had a large medullary tumour, covering all the submaxillary region, and which, probably, at first, had been merely an absorbent gland. In this case, after ulceration of the skin, protrusion of the medu-

lary substance, and sloughing of it, a this fetid discharge, occasional hæmorrhage, and extreme emaciation and weakness, preceded the patient's death.

Fungus hæmatodes of the eye was formerly not discriminated from scirrhus cancer. We learn from Bichat, that more than one third of the patients on whom Desault operated for supposed carcinoma of the eye were under twelve years of age. Twenty out of twenty-four cases of fungus hæmatodes of the eye, with which Mr. Wardrop has been acquainted, happened to children under twelve years of age. Now, as cancer is rather a disease of aged than young persons, and we find, from Mr. Wardrop, that fungus hæmatodes of the eye mostly affects persons under twelve years of age, it is tolerably certain, that most of Desault's cases, reported to be cancers of the eye, were in fact the equally terrible disease now engaging our consideration. It is observed by Dr. Mackenzie, that the greatest number of cases has been observed in children from two to four years of age. Sometimes the disease occurs a few months after birth. In one instance, he saw it in an infant only nine weeks old, and the mother had noticed it six weeks earlier, so that the disease was probably congenital. On the other hand, it has been known to attack adults, or even persons of advanced age. (See Mackenzie on Dis. of the Eye, p. 652. ed. 2.) Another experienced gentleman in this department of surgery, states, however, that he has never yet seen a perfect example of fungus hæmatodes of the eye in an individual more than five years old. (R. Middlemore on Dis. of the Eye, vol. ii. p. 388.) According to Mr. Travers, the only parts of the eye and its appendages, subject to be primarily attacked by cancer, are the lachrymal gland, conjunctiva, and eyelids; while the evidence of many cases has assured him that fungus hæmatodes may originate in any texture of the eye, with the exception of the lens and cornea. (Synopsis, &c. p. 216. 222. and 421.) This account, however, differs from that delivered by Mr. Wardrop, and Professor Scarpa, who describe the disease as first commencing in the retina, and particularly at the point where the optic nerve enters the eye. "For (says the latter author), on the first appearance of the yellowish, or greenish spot, the retina on examination is found to be entirely deficient, or, in other words, to have degenerated into the malignant fungus. It is also found, that the choroid membrane, while the fungus hæmatodes is in its incipient state, does not appear to have suffered any remarkable alteration in its texture, and that it is only at a more advanced period of the disease, that this membrane becomes thickened, and separated from its connection with the sclerotica. The choroid membrane, even in the most advanced stage of the disorder, preserves, more than all others, its natural texture." (On the Principal Diseases of the Eye, p. 507. ed. 2.) Dr. Mackenzie has observed, that the sclerotica appears to suffer less than any other part of the eye, and that in every case where the disease affected the eyeball, "we were ignorant of its existence before either the optic nerve, or retina, was changed." Mr. Middlemore also declares his belief, that the disease begins either in the retina or optic nerve. (On Diseases of the Eye, vol. ii. p. 402.)

The lachrymal gland is sometimes absorbed;

in other instances, projected from the orbit; but, according to Mr. Middlemore's experience, it does become affected with fungus hæmatodes. (Vol. cit. p. 407.)

In cases of fungus hæmatodes, the sight of young subjects is generally destroyed before the attention of parents is excited to the distemper. Frequently, however, a blow, followed by ophthalmia, precedes the growth of the diseased mass: When no external violence has occurred, the first symptom is a trivial fulness of the vessels of the conjunctiva, the iris becoming, at the same time, extremely vascular, and altered in colour, and the pupil dilated and immoveable. There is seldom much complaint made of pain; but the child is sometimes observed to be languid and feverish. In adults, fungus hæmatodes of the eye generally comes on without any apparent cause, though sometimes in consequence of a blow. At first the tunica conjunctiva is slightly reddened, and vision indistinct. The redness and obscurity of sight increases slowly, and an agonizing nocturnal headache is experienced; the eye bursts, and the humours are discharged.

The time of the greatest pain is at the period when the eyeball is greatly distended by the diseased mass, and previously to the rupture of the cornea. This is the time when convulsions are disposed to occur. (See *R. Middlemore on Diseases of the Eye*, vol. ii. p. 395.)

With regard to the cure of fungus hæmatodes of the eye, the only chance of effecting this desirable object depends upon the early extirpation of the diseased organ. It must be acknowledged, however, that most of the operations, in which the morbid eye has been removed, have hitherto proved unsuccessful, owing to a recurrence of the disease. The reason of such ill success may be imputed to the optic nerve and other parts being almost always in a morbid state before an attempt is made to remove the eye. One case, however, described by Mr. Travers, as having its seat in the ocular texture connecting the conjunctiva to the cornea, was operated upon, and no recurrence of the disease had occurred a twelvemonth afterwards. No other texture was affected more than the contiguity and extent of the disease explained. (*Synopsis*, &c. p. 413.) The most successful extirpation of an eye in an advanced stage of this disease, and, perhaps, almost the only satisfactory one at present on record, is that which was performed by Mr. Wishart, the cure remaining complete eighteen months after the operation. (See *Edin. Med. Journ.* vol. xix. p. 51.)

Donega operated in another case, as is alleged, with success. The disease had existed six months; and the patient was an infant, twenty months old. (See *Ponizza, sul Fungo Midollare dell' Occhio*. Pavia, 1826.) Some observations have been made by Mr. Lawrence on these cases, tending to raise a doubt of their having been examples of fungus hæmatodes. (*On Diseases of the Eye*, p. 683.) The operation has nearly always been found to fail, when the disease is advanced so far, that the posterior chamber is filled by the fungous mass. With the very few exceptions which there are to this statement, it may be correctly said, that, as no internal medicines, nor external applications, afford the least hope of checking any form of the fungus hæmatodes, it is manifest that, when the

distemper of the eye exceeds certain bounds, the miserable patient is placed beyond the reach of any effectual aid from surgery. In a case, which I saw in April, 1821, in the London Eye Infirmary, the disease formed a diseased mass, as large as an orange, accompanied with enlarged lymphatic glands over the parotid. The patient was an infant. In this instance, Mr. Lawrence used, as a local application, the liquor opii sedativus, prepared by Battley, which was found to lessen considerably the child's sufferings.

See *Wardrop's Obs. on Fungus Hæmatodes*. Scarpa, on the Principal Diseases of the Eye, chap. 21. *Sawnders*, on Diseases of the Eye; and *B. Travers's Synopsis of the Diseases of the Eye*, 8vo. Lond. 1820. *G. Frick*, on Diseases of the Eye; 8vo. Lond. 1826. *W. Lawrence*, on Diseases of the Eye, 8vo. Lond. 1833. *R. Middlemore*, on Diseases of the Eye, vol. ii. 8vo. Lond. 1835. *W. Mackenzie*, on Diseases of the Eye, 8vo. Lond. 1835. *Ponizza*, sul Fungo Midollare dell' Occhio. Pavia, 1826. *Wishart*, in *Edin. Med. and Surgical Journ.* vol. xix.

Under the terms BRONCHOCLE, MAMMA, TESTICLE, and TUMOUR, will be found descriptions of fungus hæmatodes, or medullary sarcoma, in organs not particularly noticed in the preceding article.

See *Dissertations on Inflammation*, by *J. Burns*, vol. ii. *Hey's Practical Obs. in Surgery*, ed. 3. *John Abernethy*, *Surgical Obs.* 8vo. Lond. 1804. *G. Freer*, on Aneurisma, 1807. *Obs. on Fungus Hæmatodes*, or Soft Cancer, by *James Wardrop*, 8vo. Edin. 1809. This last publication is highly deserving of attention; the disease in different organs being well described, and its character discriminated from that of scirrhus cancer.

A case of this disease is related in vol. v. of the *Lond. Med. Journ.* It was the consequence of an attempt to cure a ganglion by means of a seton, and it proved fatal. *Abernethy's Surgical Obs.* 8vo. Lond. 1804. See also a Case of diseased Testicle, accompanied with Disease of the Lungs and Brain, by *H. Earle*, in *Medico-Chirurg. Trans.* vol. iii. p. 59, &c., in which vol. four other cases are recorded by *Mr. Lawrence*, p. 71. et seq. and one by *Mr. Langstaff*, p. 277.; which last I remember to have visited in company with this gentleman and *Mr. Lawrence*, a short time before the patient died. Also *Langstaff's Cases and Obs.* in the 8th and 9th vols. of the same work. *Ph. J. Roux*, Voyage fait à Londres en 1814; ou Parallèle de la Chirurgie Angloise avec la Chirurgie Française, p. 211, &c. *Dupuytren*, *Clin. Chir.* t. iv. p. 53. *Wm. Kerr, M.D.*, in *Cyclopedia of Practical Medicine*. *Lacaze*, *Dict. des Sciences Méd.*, art. Encéphaloides. *C. Bell*, *Surgical Obs.* part. iv. *Hodgkin*, in *Med. Chir. Trans.* vol. xv. *Robert Carruall*, in *Illustrations of the Elementary Forms of Disease*, fasciculi 2 & 3. 4to. Lond. 1833. *Andral*, *Anat. Pathol.* t. xi. p. 219. *J. J. Lobstein*, *Anat. Pathol.* t. xi. p. 419. *Crouvelhier*, *Anat. Pathol.* liv. iv.—viii.; and *Essai sur l'Anat. Pathol.* t. i. *James Copland, M.D.*, *Dict. of Practical Med.* art. Fungoid Disease, 8vo. 1837.

FURUNCULUS. (from *furo*, to rage.) A boil, so named from the violence of the heat and inflammation attending it. A peculiar inflammation, beginning, as Dupuytren believed, in one or more of the prolongations of the interareolar cellular tissue of the cutis.

A boil is a circumscribed, very prominent, hard, deep red, inflammatory swelling, which is exceedingly painful, and commonly terminates in slow and imperfect suppuration. The figure of the tumour is that of a cone, the base of which is considerably below the surface of the skin. Upon the most elevated point of the boil, a small whitish speck presents itself, between the fourth and the eighth day. After the apex of the tumour has turned white, it softens, and then a very small aperture is formed in it, from which a little pus, mixed with blood, is discharged, and within which, a portion of dead cellular tissue, the core, may be perceived. By Dupuytren, and other French pathologists, the manner in which this is produced, is

explained as follows: a boil is only an inflammation of the prolongations of cellular tissue, which penetrate between the areolæ of the cutis, accompanied by the vessels and nerves, distributed to the surface of the skin. With this inflammation is combined that of the cutis itself, and consequently, these cellulo-vascular and nervous prolongations suffer constriction, partly from their own enlargement, and partly from the increased narrowness of the openings through which they pass. Hence, their nutrition is interrupted, and they are converted into a slough, called the *core*. (See *M. Solm, in Dict. de Méd. et de Chir. Pratiques, art. Furoncle*; also *Dupuytren, in Clin. Chir. t. iv. p. 210.*)

The complaint is not attended with fever, except when the tumour is larger than usual, situated on a sensible part, or when several boils occur at the same time in different places. In the last circumstances, they often produce in children, and even in irritable adults, restlessness, loss of appetite, spasms, &c. When boils are situated in the perineum, between the anus and the scrotum, there may be difficulty in making water. Sometimes, when placed on the nape of the neck, shoulder, or thigh, they excite inflammation of the lymphatic vessels and glands of the neck, armpit, or groin. (See *Rayer, Mal. de la Peau, t. ii. p. 548.*) They rarely exceed a pigeon's egg in size, and may originate on any part of the body, though it is most common for them to take place on the nates, the thighs, the armpit, the nape of the neck, the back, and in other regions where the skin is thickest, and the prolongations of the cellular tissue most developed.

Young persons, and especially those of plethoric habits, are most subject to boils. The disease occurs with most frequency in the spring. (*Lassus, Pathologie Chir. t. i. p. 16.*) It is sometimes accompanied by a disordered state of the gastric organs. (*Nosographie Chir. t. i. p. 124. edit. 2.*) Frequently boils arise without any evident cause, and apparently in healthy constitutions. At other times, they follow eruptive diseases and typhus. (*W. Gibson, Institutes, &c. of Surgery, p. 48. vol. i.*) In many cases, several boils present themselves, either at once, or in succession, on various parts of the body.

The suppuration attending a boil is never perfect, and the matter which forms, is frequently tinged with blood. The central portion of dead cellular tissue, or the *core*, is mostly detached about the tenth or twelfth day, leaving an open cylindrical cavity, extending from the apex to the base of the tumour. The pain now ceases; the skin contracts; the cavity becomes obliterated; and the cure is completed in about a fortnight. (See *Rayer, Mal. de la Peau, t. ii. p. 547.*)

The experiments of Dumeril and Bretonneau prove, that a boil may sometimes be stopped by an early application of caustic; a plan, however, rarely tried.

In a very few cases, perhaps, it may be proper to try to resolve boils, by means of bleeding, gentle evacuations, low diet, and cold applications. In the generality of instances, suppuration must be promoted, by the use of emollient poultices. The tumour, when allowed to burst, generally does so at its apex. However, as the opening is long in forming, and too small to allow the sloughy cellular substance to be discharged, it is

best, as soon as matter is known to exist in the tumour, to make a free opening with a lancet, and immediately afterwards to press out the matter and dead cellular tissue. This having been accomplished, healthy pus will be secreted, and the part will granulate and heal.

For the purpose of stimulating the cavity, and causing it to fill up, Professor Gibson, of Philadelphia, has sometimes employed a lotion of nitrate of silver.

Where there is reason to suppose the gastric organs to be in a disordered state, an emetic should be given in the early part of the treatment, and afterwards small repeated doses of any of the mild purging salts.

When an indolent hardness continues, after the inflammatory and suppurative state of boils has been removed, the part should be rubbed with camphorated mercurial ointment.

Besides the above acute boil, authors describe a chronic one, which frequently occurs in subjects who have suffered severely from the small-pox, measles, lues venerea, scrofula, and in constitutions injured by the use of mercury. The chronic boil is commonly situated upon the extremities, is of the same size as the acute one, has a hard base, is not attended with much pain, nor any considerable discolouration of the skin, until suppuration is far advanced, and the matter is seldom quite formed before the end of three or four weeks. Sometimes several boils of the chronic kind occur together, or follow one another in the same patient. The discharge is always thinner than good pus, and when the boil is large, and has been long in suppurating, a great deal of sloughy cellular tissue must be cast off, before the sore will heal.

The principal thing, requisite in the local treatment of all furunculous and carbuncular tumours, is to make an early free opening into them, and to press out the matter and sloughs, employing emollient poultices, till all the mortified parts are detached and removed, and afterwards simple, or more or less stimulating dressings.

See *Pearson's Principles of Surgery. Richter, Anfangsgründe der Wundarten. b. 1. Lassus, Pathologie Chir. t. i. p. 15. W. Gibson's Institutes of Surgery, vol. 1. Philadelphia, 1824. C. J. M. Langenbeck, Nosologie, &c. b. 1. p. 357. Gott. 1822. M. J. Chetius, Handb. der Chir. b. 1. p. 74. Heidelb. 1826. Dupuytren, Clin. Chir. t. 1. p. 110. Rayer, Maladies de la Peau, t. ii. p. 546. 8vo. Paris, 1826.*

GANGLION. (Γαγγλίον.) In surgery, an encysted tumour, formed in the course of a tendon, or its fibrous sheath. It is, as I have said, an encysted, circumscribed swelling, commonly free from pain, causing no alteration in the colour of the skin, and formed upon tendons in different parts of the body, but most frequently upon the hand or wrist. A French gentleman consulted me, who had one upon the upper part of his foot, which created a considerable weakness in the motion of the ankle. A ganglion has been met with over the tendon of the trochlearis, and also that of the external head of the gastrocnemius. (*Aston Key, in Guy's Hospital Reports, vol. i. p. 416, 417.*) An example is recorded, in which a ganglion, situated exactly over the arteria radialis and the arteria superficialis volæ, was at first supposed to be an aneurism. (See *Edin. Med. and Surg. Journ. for April, 1821.*)

Ganglions often possess considerable elasticity. They may occur unpreceded by any accident, but, frequently are the consequence of bruises and

spontaneous. When opened, they are sometimes found to be filled with a viscid transparent fluid, resembling white of egg, or rather jelly. As Mr. Aston Key has observed, the contents of a ganglionic tumour differ from those of a common bursa mucosa. The latter secretes a fluid like ordinary synovia; the ganglion most usually contains a substance like the outer layers of the crystalline lens, soft, viscid, and nearly solid. (See *Guy's Hospital Reports*, vol. i. p. 415.)

Different pathological views are entertained respecting the formation of ganglions. In France, these tumours are regarded as dropsies or hydroceles of the sheaths of tendons. Most of them, it is observed, form over small compact joints, like those of the carpus and tarsus, possessing little motion, and covered by dense fibrous layers; or else, in the course of the sheaths of the tendons of the hand, or foot. In these small arthrodial joints, and in the sheaths of tendons, the synovial membrane being covered by strong fibrous textures, cannot undergo any uniform distension by an accumulation of their secretion, which causes a protrusion of the synovial membrane at some interspace of the fibrous investment, which, however, extends over other parts of the internal cyst. It is also alleged, that the ganglion has a communication with the interior of the fibrous sheath. (See *Bégin*, in *Dict. de Méd. et de Chir. Pratiques*, art. *Ganglion*.) Mr. Aston Key joins in representing ganglions as consisting of a double bag: the outer one tendinous and firm; the inner, like a synovial one, thin and secreting; but that, in most instances, the outer one cannot be separated from the inner. However, he differs from M. Bégin in regarding a ganglion as a new structure. (*Guy's Hospital Reports*, vol. i. p. 415.)

Stimulant applications sometimes succeed in curing ganglions, and, at one time, frictions with oleum origani, or with liniment of camphor, strengthened with tinct. canthar., were a common method. Of late years, friction with iodine liniments and the ointment of hydriodate of potash, has also had extensive trials. I have often seen the tumours lessened by these means, but seldom cured; for, no sooner has the friction been discontinued, than the fluid in the cyst has accumulated again.

Compression is often employed. Persons with ganglions have been recommended to press upon them strongly with their thumb, several times a day. After this has been repeated very often, the tumour has sometimes disappeared. Another method is to make pressure on ganglions by means of a piece of sheet-lead, bound upon the part with a bandage. In conjunction with this treatment, frictions with stimulating liniments, or camphorated mercurial ointment are usually tried.

Setons have been introduced through ganglions, with the view of curing them. This method, however, in a few examples, has excited the growth of a malignant fungus. (*Med. Journ.*, vol. v.)

For the ganglion of the tendinous investment of the patella, a seton is occasionally employed by Mr. Key. "Blisters, stimulating plasters, and pressure with a bandage (he observes), are often resorted to, with advantage. The more effectual plan of dispersing them altogether, is to puncture them with a lancet, to let out the contained fluid, and to employ firm pressure with a bandage and plaster. If this does not prove permanently suc-

cessful, the seton becomes the most ready, the most mild, and the most effective remedy." (*Op cit.* vol. i. p. 417.)

Ganglions may be cured by pressure sufficient to rupture the cyst; and some authors have recommended putting the hand affected upon a table, and then striking the ganglion several times with the fist, the back of a book, or a mallet. The cyst of a recent ganglion may also be burst, by compressing it strongly with the thumbs, with or without the intervention of a piece of money; the fluid is effused into the adjacent cellular membrane; and, pressure being now employed, the opposite sides of the cavity become united by the adhesive inflammation, and the recurrence of the disease is prevented. On this principle, Sir Astley Cooper has often cured the disease.

For many years, I have adopted the plan of curing ordinary ganglions by making a small puncture in them, discharging their contents, and then applying pressure. I have never seen any unpleasant effects follow this practice, and it is almost always successful. In 1825, Mr. Wm. Cumin, of Glasgow, published some cases and observations in favour of this method. He made the puncture with a cataract needle. (See *Edin. Med. Journ.* No. lxxxiv. p. 95.) I have usually drawn the skin a little towards one side, and then made a small opening in the ganglion with a lancet. In the treatment of ganglions situated on the back of the wrist, Mr. Aston Key also prefers a small puncture. For those which occupy the base of the palmar side of the fingers, he considers the puncture the only remedy; for the cyst cannot be ruptured, and blisters rarely answer. (See *Guy's Hospital Reports*, vol. i. p. 416.)

When ganglions resist all attempts to disperse, or palliate them; when they become extremely inconvenient, either by obstructing the functions of a joint, or causing pain; they should be carefully dissected out, by first making a longitudinal incision in the skin covering them, then separating the cyst on every side from the contiguous parts, and, lastly, cutting every particle of it off the subjacent tendon or fascia.

The operation being accomplished, the skin is to be brought together with sticking plaster, and a compress placed over the situation of the tumour, with the view of healing the wound and the cavity by adhesion.

When the ganglion has burst, or is ulcerated, it is best to remove the diseased skin, together with the cyst; and of course the incision must be oval, or circular, as may seem most convenient. The great object is not to allow any particle of the cyst to remain behind, as it would be very likely to throw out a fungus, and prevent a cure. In *Warner's Cases of Surgery* is an account of two considerable ganglions, which this gentleman, in imitation of Celsus and Paulus Ægineta, thought it right to extirpate. These had become adherent to the tendons of the fingers. In the operation, he was obliged to cut the transverse ligament of the wrist; and the patients, who before could not shut their hands, nor close their fingers, perfectly regained the use of these parts. Mr. Gooch relates a case of the same kind, which had been occasioned by a violent bruise, three or four years before. The tumour reached from the wrist to the middle of the hand, and created a great deal of pain. Mr. Gooch extirpated it, and then restored

the position of the hand, and free motion of the joint, by the use of emollient applications, and suitable pressure, made with a machine constructed for the purpose.

Other cases, confirming the safety of cutting out ganglions, are recorded in the London Medical Journal for 1797, p. 184; by *Eller*, in *Mém. de l'Acad. des Sciences de Berlin*, t. II. ann. 1746; *Schmucker*, in *Chir. Wahrnehmungen*, b. I. p. 332; *Girard*, *Lupulologie*. See *Warner's Cases in Surgery*. *Chirurg. Works of B. Gooch*, vol. II. p. 376. *Bickler*, *Anfangsgr. der Wundarzn.* b. I. Lassus, *Pathologie Chir.* t. I. p. 399. *Dict. des Sciences, Méd.* t. XVII. p. 311. *Cumia*, in *Edin. Med. and Surgical Journ.* No. 84. *C. Aston Key*, in *Guy's Hospital Reports*, vol. I. 8vo. Lond. 1836.

GANGRENE (from *γαλνω*, to feed upon). So named for its eating away the flesh. Authors have generally distinguished mortification into two stages: the first, or incipient one, they name *gangrene*, which is attended with a sudden diminution of pain; a livid discoloration of the part, which after being yellowish, becomes of a greenish hue; a detachment of the cuticle, under which a turbid fluid is effused; and lastly on touching the part, a crepitus is perceptible, owing to the generation of air in the gangrenous parts.

When the part has become quite cold, black, fibrous, incapable of moving, and destitute of all feeling, circulation, and life; this is the second stage of mortification, termed *sphacelus*. Gangrene, however, is frequently used synonymously with the word mortification. (See *Mortification*.)

GASTROCELE (from *γαστήρ*, the stomach, and *κέλη*, a tumour). A hernia of the stomach.

GASTRORAPHIA, or **GASTRORAPHÆ**. (from *γαστήρ*, the belly, and *ραφή*, a suture.) A suture of the belly, or some of its contents.

Although the term *gastrophæ*, in strictness of etymology, signifies the sewing up of any wound of the belly, yet Mr. S. Sharp informs us, that, in his time, the word implied, that the wound of the abdomen was complicated with another of the bowels.

The operation of sewing up a wound in the bowels, can only take place when they fall out of the abdomen, and the wound in them is visible. And, indeed, even in these circumstances, the employment of sutures is a practice, the propriety of which is questionable, as will be further considered in the article *Wounds*.

Gastrophæ, or merely sewing up a wound of the parietes of the abdomen, is usually done with the common interrupted suture (see *Sutures*), but formerly sometimes with the quilled one.

In two or three days, the sutures may generally be removed, and sticking plaster alone employed. (See *Wounds of the Abdomen*.)

M. Pibrac, in the third volume of the *Mém. de l'Acad. Royale de Chir.*, records several interesting cases, which fully prove that wounds of the belly readily unite by means of a suitable posture and a proper bandage, without the practice of *gastrophæ*. These cases, however, are less decisive and convincing (if possible to be so) than the relations of the Cæsarean operation, the extensive wound of which has often been healed by simple means, after the failure of sutures.

Under certain circumstances, however, it may be essentially necessary to practise *gastrophæ*. For instance, were a large wound to be made across the parietes of the abdomen, a suture might become indispensably requisite to prevent the protrusion of the bowels. Yet even in this case, the sutures

should be as few in number, as possible. (See *Sutures*.)

I shall conclude this article with a fact, perhaps more curious than instructive, related by M. Bordier, of Pondicherry, in the *Journal de Médecine*, vol. XXVI. p. 538. An Indian soldier, angry with his wife, killed her, and attempted to destroy himself by giving himself a wound with a broad kind of dagger in the abdomen, so as to cause a protrusion of the bowels. A doctor of the country, being sent for, dissected between the muscles and skin, and introduced a thin piece of lead, which kept up the bowels. The wound soon healed up, the lead having produced no inconvenience. The man was afterwards hanged, and M. Bordier, when the body was opened, assured himself more particularly of the fact.

GLAUCOMA (from *γλαυκός*, bluish green,) is generally defined to be a greenish opacity of the vitreous humour, attended with the loss or a considerable impairment of sight. (*Weller on Dis. of the Eye*, transl. by *Monteith*, vol. II. p. 27.) Mr. Lawrence describes the colour as sea-green, clear green, muddy green, or yellowish green. (*On Dis. of the Eye*, p. 389.) As will be presently explained, however, the vitreous humour is not invariably implicated in some of the cases, perhaps incorrectly classed with glaucoma. Mr. Guthrie represents the disease as essentially consisting in an alteration of the component parts of the vitreous humour, accompanied with derangement of the structure of the hyaloid membrane, retina, and tunica choroidea, the vessels of which are always more or less varicose. (*Operative Surgery of the Eye*, p. 214.) Professor Beer considers the subjects of glaucoma, and the cataracta viridis, or glaucomatosa, together. He observes, that these diseases occur rather frequently, not only as true effects of inflammation of the eye, but sometimes quite unpreceded by this affection. Although glaucoma may continue for a long time as the only disorder, without the crystalline lens being changed in the slightest degree; yet Beer has never seen the case reversed, and the lens become altered as it does in glaucoma first, and the vitreous humour afterwards. In what this author describes as gouty ophthalmia, glaucoma is said to come on with the following symptoms: the iris is not observed to expand, but rather to become contracted; the pupil is not equally dilated, but extends more towards the canthi, the iris at length becoming scarcely perceptible towards each angle of the eye, especially the outer one, and the pupil of course assuming something of the appearance which is seen in the eye of a ruminating animal. In a case, however, which I once saw in the London Eye Infirmary, under Mr. Lawrence, it was particularly remarked, that the diameter of the pupil was not greatest in the transverse direction; a circumstance, which Beer's account would lead us to expect as constant. And it merits notice, that as the iris shrinks towards the margin of the cornea, its pupillary edge is inverted towards the lens, so that its smaller circle completely disappears. In this very dilated state of the pupil, a grey greenish opacity is perceived, seeming to be very deep, and arising from a real loss of transparency in the vitreous humour. At this period, the lens evidently becomes opaque, acquiring a sea green hue, and the cataracta viridis, or glaucomatosa, now swells and appears to project forwards into the anterior chamber. The

pain then becomes more incessant and violent; the varicose affection of the eyeball seriously increases; and the eyesight, which began hourly to diminish from the moment when the pupil was first observed to be in any degree expanded and opaque, and the iris motionless, is now so entirely destroyed, that not the slightest perception of external light remains, though the patient may vainly congratulate himself on discerning luminous appearances produced within the eye itself, in the form of a fiery, shining circle, especially when the organ is gently pressed upon. An eye in this condition (says Beer) has really a look as if it were dead, the cornea being as flaccid and void of lustre as in a corpse. Finally, when these symptoms have attained their utmost pitch, an atrophy of the eyeball follows, and the painful sensations about the organ cease. In corpulent individuals, however, they still continue with greater violence. Sooner or later, the other eye is also attacked with arthritic iritis, or ophthalmia, or becomes affected with glaucoma, which is ushered in by violent and incessant headach. (Beer, *Lehre von den Augenkrankheiten*, b. i. p. 581, &c. 8vo. Wien, 1813.) According to this author, glaucoma and the green cataract are never the consequences of any description of ophthalmia, but what he terms arthritic. (b. ii. p. 255. Wien, 1817.) Mr. Lawrence inclines to Beer's opinion; for, he observes, that glaucoma appears to him to be a chronic form of arthritic inflammation of the internal tunics; and, he adds, that it certainly occurs more frequently in gouty persons than others. (*On Dis. of the Eye*, p. 390.) By another experienced practitioner, glaucoma is also stated to be frequently combined with arthritic inflammation. (See Mackenzie on *Dis. of the Eye*, p. 825, ed. ii.) On the other hand, Mr. Guthrie regards the inflammation as really an unhealthy disorganising inflammation, not necessarily dependent upon, nor connected with gout. (*Operative Surgery of the Eye*, p. 216.) I have stated that glaucoma is usually regarded as an opacity of the vitreous humour. The following, however, were the particulars observed by Dr. Mackenzie in the dissection of several glaucomatous eyes. 1. The lens of a yellow, amber, or reddish brown colour, especially towards its centre; its consistence firm, and its transparency perfect, or nearly so. In some cases, however, the reddish brown colour of the central part of the posterior lamellæ was so deep as considerably to impair its transparency. 2. The vitreous humour in a fluid state; perfectly pellucid, colourless, or slightly yellow: no trace of hyaloid membrane. 3. The choroid coat, and especially the portion of it in contact with the retina, of a light brown colour, with little or no appearance of pigmentum nigrum. 4. In the retina, no trace of limbus luteus, or foramen centrale. (See Mackenzie on *Dis. of the Eye*, p. 827, ed. ii.)

In some other cases which Mr. Middlemore had an opportunity of dissecting, the vitreous humour was of a yellow tinge, as remarked by Scarpa in his examinations; and the lens had undergone no other alteration, than such as generally takes place in advanced life, being of a green, deep yellow, or amber. The vitreous humour was not much increased in quantity. The choroid pigment was in a great measure absent; and the septa of the hyaloid membrane were absorbed. (See Middlemore on *Dis. of the Eye*, vol. ii. p. 7.)

This gentleman describes two varieties of glaucoma: first, that which occurs in old age, and is productive of mere impairment of vision, without any material degree of pain, and, as he believes, without any inflammation; but in which the transparency of the vitreous humour is always diminished, and its colour altered, either to a yellowish or greenish tinge. Secondly, that variety which takes place from inflammation of the septa of the vitreous humour, which is marked by symptoms of a more or less severe character; is often attended with chronic inflammation of other deeply seated textures, and usually leads to the total destruction of vision. Hence, says Mr. Middlemore, the appearances of the membranes and humours will not always be the same.

In Mr. Lawrence's valuable treatise are collected the particulars of other dissections of glaucomatous eyes by Walther, Eble, and Rosas. In the eyes of a man examined by Walther, the lens and vitreous humour were in the normal state, and perfectly transparent. In the retina were numerous black and partly reddish spots, roundish, and of various size. In a glaucomatous eye dissected by Eble, the covering of the uvea was reddish brown, instead of the usual dark pigment. The vessels of the choroid were varicose in several places; and the pigment, which was much lighter than natural, had disappeared in several places. The retina was extraordinarily soft. The capsule was partially opaque; and the lens small, firm, and of amber colour. The whole vitreous humour had a yellowish tint; and there were scattered through it twenty or thirty points of a grey, brownish green, or sea green colour. In another case, that of a man of 70, who had frequently experienced arthritic inflammation of the eyes, the vitreous humour was partially thickened, and firmer. The retina exhibited some varicose enlargements, and it was of a dark grey colour.

On this part of the subject, Mr. Lawrence offers the following judicious reflections: "From the preceding pathological facts, we may conclude, that the vitreous humour is not originally and essentially the seat of glaucoma; we may perhaps draw the further inference, that affections, in some respects different, are included under that term. When we consider the numerous gradations between the acute internal arthritic ophthalmia which destroys sight at once, and the imperfection of vision which comes on in glaucoma, properly so called; also, that difference of morbid changes may be expected, according to the stage of the complaint; we shall not be surprised at finding, that the results of examination are not always alike." (See Lawrence on *Dis. of the Eye*, p. 392.)

In glaucoma, the pupil is green, or yellowish green; and, if the eye be looked at laterally, no discolouration is seen. In cataract, the pupil is grey, or greyish white, and it has the same appearance in whatever direction it is viewed. In glaucoma, the loss of vision is not in direct proportion to the change of colour in the pupil. With an inconsiderable change, vision may be entirely destroyed, or seriously impaired; but in cataract, there is a direct proportion between the degree of opacity and the injury to sight. In cataract, vision is best in a weak light; in glaucoma, it is stronger in a powerful light, because as the retina is less sensible, more light is required to make an impression on it. (Lawrence, *Op. cit.* p. 393.)

Glaucoma, after it is conjoined with a varicose disease of the eyeball, is set down by Beer as incurable. According to Weller, when the vitreous humour first begins to be muddy, the disease may sometimes be checked. (*On Dis. of the Eye*, vol. ii. p. 29.)

Beer states, that no treatment will avail in checking glaucoma, and preventing complete amaurosis. The prognosis is unquestionably most unpromising. I have seen many cases of glaucoma treated, but never with success. Mr. Lawrence holds out more encouragement than Beer, and recommends antiphlogistic treatment; as cupping; active purgatives; mercury, long continued, but not used so as to cause salivation; a regulated diet, and repose of the organ. (*On Dis. of the Eye*, p. 394.) Counter-irritation has also been found useful, and especially frictions with antimonial ointment between the shoulders. Arthritic inflammation of the eye is often greatly benefited by tonics, as precipitated carbonate of iron and sulphate of quinine. After depletion, one very experienced practitioner sanctions the trial of them in glaucoma. (See *Mackenzie on Dis. of the Eye*, p. 330, ed. ii.) On the principle of there being a superabundance of dissolved vitreous humour, the same gentleman conceives that occasionally puncturing the sclerotica and choroid, with a broad iris knife, might prove serviceable. He also states, that he has known glaucoma operated upon for cataract, and the removal of the amber coloured lens followed by a considerable accession of vision. But as he had also known violent inflammation ensue, he does not venture to recommend this proceeding for general adoption. A grooved cataract needle, as recommended by Mr. Middlemore, seems to me the best instrument for puncturing the vitreous humour. Mr. Middlemore finds that no remedies will interrupt the progress of *senile glaucoma*, and he deems no treatment requisite, unless circumstances denote that the affection is rendered worse by the existence of chronic inflammation of the septa of the vitreous humour or neighbouring textures. If this be the case, he would employ mild purgatives, and, perhaps, a little mercury, with permanent counterirritation and the avoidance of all exertion of the eye, particularly in artificial light, or on minute objects.

In the *acute or inflammatory glaucoma*, Mr. Middlemore is an advocate for antiphlogistic treatment, followed up by a seton, or blister to the temple, or above the eye-brow. Sometimes he excites slight irritation on the skin of the temple, with nitrate of silver. Occasionally he has punctured the vitreous humour with a very fine grooved needle. He advises this to be done, whenever there is much local pain, evidently depending on the tension of the globe, "and particularly when vision is nearly destroyed, and the opposite organ is becoming similarly affected." In one or two cases, where the muddiness of the vitreous humour was evidently consequent on inflammation, Mr. Middlemore, after the subsidence of the latter affection, discharged the greater part of the turbid fluid with the needle, in the hope that the new secretion would be more transparent; and, he states, that he has practised this operation with the greatest advantage to the patient's vision. (See *ft. Middlemore*, *op. cit.* vol. ii. p. 19—20.) The dilatation of the pupil with belladonna sometimes improves vision; when this partly remains; but,

the benefit is merely temporary; and sometimes it causes an increased confusion of sight.

See also, Tr. G. *Benedict*, de Morbis Humoris Vitreæ, 4to. Lips. 1829. G. J. *Guthrie*, on Operative Surgery of the Eye, 8vo. ed. 2. Lond. 1827. C. H. *Waller*, on Dis. of the Eye, tr. by G. C. *Monro*, 2 vols. 8vo. 1821; or rather the last German ed. 8vo. 1826. Also, *Jones*, Ophthalmologia, Fasc. I. W. *Lawrence*, on Dis. of the Eye, 8vo. Lond. 1832. W. *Mackenzie*, in Glasgow Med. Journ. vol. iii. p. 259; and a Treatise on Dis. of the Eye, ed. 2. 8vo. Lond. 1835. Ph. Tr. *Waller*, Abhandl. Augn., &c.; Landsh. 1810. *Ebbe*, in Ammon's Zeitschrift, vol. i. Z. *Middlemore*, on Dis. of the Eye, vol. ii. 8vo. Lond. 1835.

GLEET. By the term *gleet* is commonly understood a continued running, or discharge, after the inflammatory symptoms of a clap have for some time ceased, unattended with pain, scalding in making water, &c. Mr. Hunter remarks, that it differs from a gonorrhœa in being uninfectious, and in the discharge consisting of globular bodies, contained in a slimy mucus, instead of serum. He says, that a gleet seems to take its rise from a habit of action which the parts have contracted. The disease, however, sometimes stops of itself, even after every method has been ineffectually tried. This probably depends upon accidental changes in the constitution, and not at all upon the nature of the disease itself. Mr. Hunter had a suspicion, that some gleets were connected with scrofula. Certain it is, the sea-bath cures more gleets than the common cold bath, or any other mode of bathing; and a cure may sometimes, but not always, be accomplished by an injection of diluted sea-water.

Gleets are often attended with a relaxed constitution. They also sometimes arise from other affections of the urethra, besides gonorrhœa. A stricture is almost always accompanied with a gleet; and so sometimes is disease of the prostate gland.

It is remarked by Mr. Hunter, that if a gleet does not arise from any evident cause, and cannot be supposed to be a return of a former gleet, in consequence of a gonorrhœa, either a stricture or diseased prostate gland is to be suspected: an inquiry should be made whether the stream of urine is smaller than common, whether there is any difficulty in voiding it, and whether the calls to make it are frequent. If there should be such symptoms, a bougie, rather under the common size, should be introduced; and, if it passes into the bladder with tolerable ease, and the patient is nearly fifty, or upwards, the disease is probably in the prostate gland, which should next be examined. (See *Urethra*, *Strictures of*; and *Prostate Gland*.)

Balsams, turpentine, and the tinctura canth. given internally, are of service, especially in slight cases; and when they are useful, they prove so almost immediately. Hence, if they had neither lessened nor removed the gleet in five or six days, Mr. Hunter never continued them longer. The same observation applies to cubebs, so celebrated as a remedy for gonorrhœa and gleet, and the common dose of which is ʒij in any convenient fluid three times a day. As the discharge, when removed, is apt to recur, such medicines should be continued for some time after the symptoms have disappeared.

When the whole constitution is weak, the cold bath, sea-bath, bark and steel medicines may be given.

With regard to local applications, the astringents commonly used are, lotions of sulphate of zinc, alum, or acetate of lead.

Irritating applications consist either of injections, or bougies. Violent exercise may be considered as having the same effect. Such applications should never be used till the other methods have been fully tried, and found unsuccessful. They at first increase the discharge, and, on this account, are sometimes abandoned too early. Two grains of the oxy muriate of mercury, dissolved in eight ounces of distilled water, make a very good irritating injection. In irritable habits, such an application may do great harm, and therefore, if possible, the capability of the parts to bear its employment, should first be made out.

Bougies sometimes act violently, but Mr. Hunter thought them more efficacious than injections. A simple unmedicated one is generally sufficient, and must be used a month or six weeks, before the cure can be depended upon. Bougies, medicated with camphor or turpentine, were formerly employed for the cure of gleet; they did not require so long a trial as common bougies: at present, I believe, they are not used by any surgeon of eminence. Whatever bougies are employed should be under the common size.

Mr. Hunter knew a gleet disappear on the breaking out of two chaneres on the glans. Gleets have also been cured by a blister on the under side of the urethra, and by electricity.

In every plan of treatment, rest, or quietness, is generally of great consequence; but, after the failure of the usual modes, riding on horseback will sometimes immediately effect a cure.

Regularity and moderation in diet are to be observed.

Intercourse with women often causes a return or increase of gleet; and, in such cases, it gives suspicion of a fresh infection; but, the difference between this and a fresh infection is, that here the return is almost immediately after the connexion.

Gleets in women are cured nearly in the same manner as those of men. Turpentine, however, have no specific effect on the vagina; and the astringent injections used should be stronger than those intended for male patients.

GLOSSOCATOCHUS (from *γλῶσσα*, the tongue, and *κατέχω*, to depress). The ancient glossocatochus was a sort of forceps, one of the blades of which served to depress the tongue, while the other was applied under the chin.

GOITRE. See *Branchiocele*.

GONORRHEA. (from *γόνι*, the semen, and *ῥέω*, to flow). Etymologically, an involuntary discharge of the semen; but always, according to modern surgery, a discharge of purulent infectious matter, from the urethra in the male, and from the vagina and surfaces of the labia, nymphæ, clitoris, and, as is alleged to have been made out by the late M. Cullerier, sometimes even from the lining of the uterus in the female subject. (See *Diet. de Méd. et de Chir. Pratiques*, t. iv. p. 149.)

Dr. Swediaur, after censuring the etymological import, as conveying an erroneous idea, says, if a Greek name is to be retained, he would call it *blennorrhœa*, from *βλῆν*, saucus, and *ῥέω*, to flow. However, as most of the moderns consider the discharge as pus, not mucus, the etymological import of *blennorrhœa* is as objectionable as that of *gonorrhœa*. Mr. Howship has repeatedly examined the discharge with a microscope, but without per-

ceiving any essential difference between such discharge and the pus effused from an ulcer. (*On Complaints affecting the Secretion and Excretion of the Urine*, p. 266.) In English, the disease is commonly called a *clap*, from an old French word *clapais*, which were public shops, kept and inhabited by single prostitutes, and generally confined to a particular quarter of the town, as is even now the case in several of the great towns in Italy. In German, the disorder is named *das tripper*, from dripping; and in French, *une chaudepisse*, from the heat and scalding in making water.

Mr. Wallace, of Dublin, objects to the terms *gonorrhœa* and *blennorrhœa*, and proposes to name the disease *catarrhal primary syphilis*. (*On Venereal Disease and its Varieties*, p. 233. London 8vo. 1833.)

When an irritating matter of any kind is applied to a secreting surface, it increases that secretion, and changes it from its natural state to some other. In the present instance, it is changed from mucus to pus.

Till about the year 1753, it was generally supposed, that the matter from the urethra, in cases of gonorrhœa, arose from ulcers in the passage; but, about that time it was ascertained, that pus might be secreted without a breach of substance. It was first accidentally proved, by dissection, that pus might be formed in the sac of the pleura, without ulceration: and Mr. Hunter afterwards examined the urethra of malefactors and others, who had been executed, or died, while known to be affected with gonorrhœa, and demonstrated, that the canal was entirely free from every appearance of ulcer.

The time when a gonorrhœa first appears, after infection, is extremely various. It generally comes on sooner than a chancre. Mr. Hunter had reason to believe that, in some instances, the disease began in a few hours; while, in others, six weeks previously elapsed; but he had known it begin at all the intermediate periods. However, it was his opinion, that about six, eight, ten, or twelve days after infection, is the most common period. In an immense majority of cases, M. M. Rattier and Cullerier have found the period between the third and seventh day after coition, as that in which a gonorrhœa most frequently commences. (See *Diet. de Méd. et de Chir. Pratiques*, art. *BLENNORRHOË*.)

The surface of the urethra is subject to inflammation and suppuratation, from various other causes besides the venereal poison; and sometimes discharges happen spontaneously, when no immediate cause can be assigned. Such may be called *simple gonorrhœa*, having nothing of the venereal infection in them.

M. M. Cullerier, and Rattier assert, that an intense gonorrhœa may occur from venereal excess, between two individuals, whose genitals are perfectly sound, and that either one or both parties may experience the disorder. They declare that they have had many opportunities of verifying this fact. Amongst other patients, they visited one woman, who apparently enjoyed perfect health, and yet communicated gonorrhœa to all who had connexion with her. They mention also a girl who gave a most severe clap to a young man, though she never had had any venereal complaint herself, and was found on examination to be quite free

from disease, (*See Dict. de Méd. et de Chir. Pratiques*, art. BLENNORRHOÏE.) These statements agree with those made many years ago by several surgeons of the British army. (*See Venereal Disease*.) I may here observe, however, that the secretions from the pudenda may not be healthy, and yet no appearances of disease may admit of detection even by ocular examination of the parts.

Mr. Hunter knew of cases, in which the urethra sympathized with the cutting of a tooth, and all the symptoms of a gonorrhœa were produced. This happened several times to the same patient. The urethra has been suspected to be sometimes the seat of the gout; and Mr. Hunter was acquainted with instances of its being the seat of rheumatism. These occurrences M. M. Cullerier and Ratier have never noticed, and when they do happen, are deemed by them to be merely accidental coincidences. (*See Dict. de Méd. et de Chir. Pratique*, art. BLENNORRHOÏE.)

Mechanical and chemical irritations of the urethra, or of those surfaces of the female pudenda which are the seat of gonorrhœa, may excite it. Contusion and forcible distention of the female pudenda will bring it on. In cases of violation of female children, a discharge usually follows; and hence the person accused of the crime, is commonly alleged to have been guilty also of infecting the injured party. But, it is of importance, as a subject of medical jurisprudence to be aware, that the discharge frequently arises in the party violated from the causes above specified, without the prisoner having had any venereal complaint himself. Were this fact not remembered, a guilty person might be acquitted, on the ground that he could not have infected the child, as it was ascertained that he had no disease about him.

Men who cohabit with leucorrhœal women, or at the period of the menses, or lochia, often experience a discharge from the urethra, in consequence of such connexion. M. M. Swediaur, Cullerier, and Ratier have all ascertained by experiments, that acute inflammation of the urethra, and a purulent discharge may be excited by injecting into the passage diluted liquid ammonia. (*See Dict. de Méd. et de Chir. Pratiques*, art. BLENNORRHOÏE.) What experienced surgeon is unaware of a discharge from the urethra being often excited by the mechanical irritation of bougies? These facts make it perfectly obvious, that a discharge from the urethra is not necessarily a venereal complaint, or is any way connected with the syphilitic poison.

Although catarrhal syphilis, (as Mr. Wallace terms gonorrhœa), occurs mostly on the mucous or muco-cutaneous surface of the genital organs, he remarks, that it may take place on any surfaces of these descriptions to which the venereal poison has been applied, as those of the eye, rectum, &c. (*See Wallace on Ven. Dis.* p. 236.) This gentleman seems thus to advocate the identity of the poisons of syphilis, and one species of gonorrhœa; but, he observes, that as "we are not at present acquainted with any symptoms, upon which we can always rely with confidence, to distinguish discharges, produced by other causes of irritation, we must not think of attributing to this poison all, or even a majority of the discharges of this kind, which we meet with in practice." (*ib.*)

When a secreting surface has once received the inflammatory action, its secretions are increased and visibly altered. Also, when irritation has produced inflammation, and an ulcer in the solid parts, a secretion of matter takes place, the intention of which, in both, seems to be to wash away the irritating matter. But, in inflammations, arising from specific or morbid poisons, the irritation cannot be thus got rid of; for, although the first irritating matter be washed away, yet, the new matter has the same quality as the original had; and, therefore, upon the same principle, it would produce a perpetual source of irritations, even if the venereal inflammation, like many other specific diseases, were not, what it really is, kept up by the specific quality of the inflammation itself. This inflammation seems, however, to be only capable of lasting a limited time, the symptoms peculiar to it vanishing of themselves, by the parts becoming less and less susceptible of irritation; and the subsequent matter can have no power of continuing the original irritation, for otherwise there would be no end to the disease. The time, which the susceptibility of the irritation lasts, must depend upon difference in the constitution, and not upon any difference in the poison itself.

Mr. Hunter believed, that the venereal disease only ceased spontaneously, when it attacked a secreting surface, and produced a mere secretion of pus, without ulceration. Such were some of the sentiments of this great man, who was a firm believer in the identity of the poisons of syphilis and gonorrhœa; but this idea, and the hypothesis about the impossibility of any spontaneous cure of venereal sores, are now mostly relinquished.

The first symptom of gonorrhœa is generally an itching at the orifice of the urethra, sometimes extending over the whole glans. A little fulness of the lips of the urethra, the effect of inflammation, is next observable, and soon afterwards a running appears. The itching changes into pain, more particularly at the time of voiding the urine. There is often no pain till some time after the appearance of the discharge, and other symptoms; and in many gonorrhœas, there is hardly any pain at all, even when the discharge is considerable. At other times, a great degree of soreness occurs long before any discharge appears. There is generally a particular fulness in the penis, and more especially in the glans. The glans has also a kind of transparency, especially near the beginning of the urethra, where the skin being distended, smooth, and red, resembles a ripe cherry. The mouth of the urethra is, in many instances, evidently exoriated. The surface of the glans itself is often in a half-exoriated state, consequently very tender; and it secretes a sort of discharge. The canal of the urethra becomes narrower, which is known by the stream of urine being smaller than common. This proceeds from the fulness of the penis in general, and either from the lining of the urethra being swollen, or in a spasmodic state. The fear of the patient, while voiding his urine, also disposes the urethra to contract; and the stream of urine is generally much scattered and broken, as soon as it leaves the passage. There is frequently some degree of hæmorrhage from the urethra, perhaps, from the distention of the vessels, more especially when

there is a *chordee*, or a tendency to it. Small swellings often occur, along the lower surface of the penis, in the course of the urethra. These Mr. Hunter suspected to be enlarged glands of the passage. They occasionally suppurate, and burst outwardly, but now and then in the urethra itself. Mr. Hunter has also suspected such tumours to be ducts, or lacunæ of the glands of the urethra distended with mucus, in consequence of the mouth of the duct being closed, in a manner similar to what happens to the duct leading from the lachrymal sac to the nose, and so as to induce inflammation, suppuration and ulceration. Hardness and swelling may also occur in the situation of Cowper's glands, and end in considerable abscesses in the perinæum. The latter tumours break either internally or externally, and sometimes in both ways, so as to produce fistulæ in perinæo.

A soreness is often felt all along the under side of the penis, frequently extending as far as the anus. The pain is particularly great in erections; but the case differs from *chordee* by the penis remaining straight. In most cases of gonorrhœa, erections are frequent, and even sometimes threaten to bring on mortification.

The natural slimy discharge from the glands of the urethra is first changed, from a fine transparent ropy secretion, to a watery whitish fluid; and the lubricating fluid, which the passage naturally exhales, becomes less transparent: both these secretions, becoming gradually thicker, assume more and more the qualities of common pus.

The matter of gonorrhœa often changes its colour and consistence, sometimes from a white to a yellow, and often when the inflammation is severe, to a greenish colour. When the inflammation is very high, shreds of lymph are sometimes discharged with the urine. (Wallace.)

These changes depend on the increase and decrease of the inflammation, and not on the poisonous quality of the matter itself; for an irritation of these parts, equal to that produced in a gonorrhœa, will produce the same appearances. Mr. Wallace finds, that the less the inflammatory action, the less alkaline the discharge. (*On Venereal Disease*, p. 244.)

The discharge is produced from the membrane of the urethra, and from the lacunæ, but, in general, only for about two or three inches from the external orifice. Mr. Hunter says, seldom further than an inch and a half, or two inches at most. This he terms the specific extent of the inflammation. Whenever he had an opportunity of examining the urethra affected with gonorrhœa, he always found the lacunæ loaded with matter, and more visible than in the natural state. Before the time of this celebrated man, it was commonly supposed, that the discharge arose from the whole surface of the urethra, and even from the glands, the prostate, and vesiculæ seminales.

But, if the matter were secreted from the pus would collect in the bulb, and thence be emitted in jerks; and be in the bulbous part of the but stimulating it to action, especially a kind of irritation and inflammation is violent, some of the urethra often burst, and a discharge of blood. Sometimes such blood is only

just enough to give the matter a tinge. In other instances, erections cause an extravasation, by stretching the part.

When the inflammation goes more deeply than the membranous lining, and affects the reticular, or spongy structure of the urethra, it produces in it an extravasation of coagulable lymph, the consequence of which is a *chordee*. (See *Chordee*.)

Mr. Hunter suspected that the disease is communicated or creeps along from the glands to the urethra, or, at least, from the lips of the urethra to its inner surface, as it is impossible that the infectious matter can, during coition, get as far as the disease extends. He mentions an instance, in which a gentleman, who had not cohabited with any woman for many weeks, to all appearance caught a gonorrhœa from a piece of plaster, which had adhered to his glans penis, while he was at a privy abroad: the infection is accounted for by supposing, that some person, with a clap, had previously been to the place, and had left behind some of the discharge, and that the above gentleman had allowed his penis to remain in contact with the matter, till it had dried.

Many symptoms, depending on the sympathy of other parts with the urethra, sometimes accompany a gonorrhœa. An uneasiness, partaking of soreness and pain, and a kind of weariness, are felt about every part of the pelvis. The scrotum, testicles, perinæum, anus, and hips, become disagreeably sensible, and the testicles often require to be suspended. So irritable, indeed, are they in such cases, that the least accident, or even exercise, which would have no effect of this kind at another time, will make them swell. The glands of the groin are often affected sympathetically, and even swell, but they do not suppurate, as they generally do when they inflame from the absorption of matter. Mr. Hunter has seen the irritation of a gonorrhœa so extensive, as to render the thighs, buttocks, and abdominal muscles painful. He knew one gentleman, who never had a gonorrhœa without being immediately seized with universal rheumatic pains. Gonorrhœal rheumatism is now recognised as a frequent and a severe complaint.

When the disorder, exclusive of the affections from sympathy, is not more violent than has been described, Mr. Hunter termed it a *common*, or *simple venereal gonorrhœa*; but, if the patient is very susceptible of such irritation, or of any other mode of action, which may accompany the venereal, then the symptoms are in proportion more violent. In such circumstances, the irritation and inflammation sometimes exceed the specific distance, and extend through the whole urethra. There is often a considerable degree of pain in the perinæum; and a frequent, though not a constant, symptom, is a spasmodic contraction of the accelerators urinæ, and rectores muscles. In these cases, the inflammation is sometimes considerable, and goes deeply into the cellular tissue, but without producing any effect, except swelling. In other instances, it goes on to suppuration, often becoming one of the causes of fistulæ in perinæo. Thus, Cowper's glands may suppurate, and the irritation often extends even to the bladder itself.

When the bladder is affected, it becomes more susceptible of every kind of irritation. It will

not bear the usual distention, and, therefore, the patient cannot retain his water the ordinary time; and, the moment the desire of making water takes place, he is obliged instantly to make it, with violent pain in the bladder, and still more in the glans penis, exactly similar to what happens in a fit of the stone. If the bladder be not allowed to discharge its contents immediately, the pain becomes almost intolerable; and even when the water is evacuated, there remains, for some time, a considerable pain, both in the bladder and glans.

*Sometimes, though rarely, when the bladder is much affected, the ureters, and even the kidneys sympathise; and Mr. Hunter had reason to suspect, that the irritation might be communicated to the peritonæum, by means of the vas deferens.

Mr. Hunter mentions a case, in which, while the inflammatory symptoms of a gonorrhoea were abating, an incontinence of urine came on; but, in time, spontaneously subsided.

A very common symptom attending a gonorrhoea, is a swelling of the testicle. (See HERNIA HUMORALIS, and TESTICLE.)

Another occasional consequence is a sympathetic swelling of the inguinal glands. (See BUBO.)

A hard chord is sometimes observed, leading from the prepuce along the back of the penis, and often directing its course to one of the groins, and affecting the glands. At the part of the prepuce where the chord takes its rise, there is most commonly a swelling. This sometimes happens when an excoriation and a discharge from the prepuce, or glans penis, exist. In one case, Mr. Howship suspected the large vein on the dorsum of the penis to be inflamed and thickened. (*On Complaints affecting the Secretion and Excretion of the Urine*, &c. p. 266.)

Thus, the symptoms of gonorrhoea, in different cases, seem to be subject to infinite variety. The discharge often appears without any pain; and the coming on of the pain is not at any stated time after the appearance of the discharge. There is often no pain at all, although the discharge is in considerable quantity, and of a bad appearance. The pain often goes off, while the discharge continues, and will return again. In some cases, an itching is felt for a considerable time, which is sometimes succeeded by pain; though, in many cases, it continues till the end of the disease. On the other hand, the pain is often troublesome, and considerable, even when there is little or no discharge. The neighbouring parts sympathize, as the glands of the groin, the testicle, the loins and pubes, the upper parts of the thighs, and the abdominal muscles. Sometimes the disease appears a few hours after the application of the poison; sometimes not till six weeks have elapsed. Lastly, it is often impossible to determine, whether the case is a venereal discharge, or rather one produced by the application of infectious matter, or only an accidental discharge, arising from some unknown cause.

GONORRHOEA IN WOMEN.

Gonorrhoea in women is a much less painful complaint than in men, and less subject to complications, as bubo, retention of urine, &c. The complaint may not generally prevent the patient from following her usual occupations, and the

menses are as little affected by it, as it is by them.

The disorder is not so easily ascertained in them as in men, because they are subject to a disorder called *fluor albus*, or *leucorrhœa*, which resembles gonorrhoea. A mere discharge in women is less a proof of the existence of a gonorrhoea, than even a discharge without pain in men. The kind of matter does not enable us to distinguish a gonorrhoea from a *fluor albus*; for, in the latter affection, the discharge often puts on all the appearance of pus. Pain is not necessarily present, and therefore forms no line of distinction. The appearance of the parts often gives us but little information; "for," says Mr. Hunter, "I have frequently examined the parts of those who confessed all the symptoms, such as increase of discharge, pain in making water, soreness in walking, or when the parts were touched, yet I could see no difference between these and sound parts. I know of no other way of judging, in cases where there are no symptoms sensible to the person herself, or where the patient has a mind to deny any uncommon symptoms, but from the circumstances preceding the discharge; such as her having been connected with men supposed to be unsound, or her being able to give the disorder to others; which last circumstance, being derived from the testimony of another person, is not always to be trusted to, for obvious reasons." But, though there may sometimes be great difficulty in forming a judgment of some of these cases, the surgeon may frequently come to a right conclusion by recollecting, as Mr. Dunn has reminded me, that, besides the difference depending on the suddenly severe symptoms of gonorrhoea, *fluor albus* may be known by the great debility; the sinking of the stomach; the weariness of the limbs; the pain of the back, always increased by the erect posture; the severe headaches; the painful menstruation, together with the very gradual increase of the disease.

From the manner in which the disease is contracted, it must principally attack the vagina, a part not endowed with much sensation. In many cases, however, it produces a considerable soreness on the inside of the labiæ, nymphæ, clitoris, carunculæ myrtiliformes, and meatus urinarius. In certain cases, these parts are so sore, that they will not bear to be touched; the person can hardly walk; the urine gives pain in its passage through the urethra, and when it comes into contact with the above-mentioned parts.

The bladder, and even the kidneys, occasionally sympathize. The mucous glands on the inside of the labia often swell, and sometimes suppurate, forming small abscesses, which open near the orifice of the vagina.

According to Mr. Hunter, the venereal matter from the vagina sometimes runs down the peritonæum to the anus, and produces a purulent discharge, or even ulceration, in that situation. The disease in women may wear itself out, as in men; but it may exist in the vagina for years, if the testimony of patients can be relied on.

TREATMENT OF GONORRHOEA.

As Mr. Hunter supposed, that every form of the venereal disease arose from the same cause, and we have a specific for some forms, that it might be conceived or expected, this would be a

certain cure for every one; and, therefore, that it must be no difficult task to cure the disease, when in the form of inflammation and suppuration in the urethra. Experience teaches us, however, that gonorrhoea is the most variable in its symptoms, while under a cure; and the most uncertain, with respect to its cure, of any form of the venereal disease (if it ever be a form of this disease at all), many cases terminating in a week, while others continue for months under the same treatment.

Whatever differences of opinion may be entertained respecting the cause of gonorrhoea, and particularly with regard to its being excited by the influence of the venereal poison, its inflammatory nature cannot be overlooked; and it is this character of the disorder, which determines, in a great measure, the plan of treatment. The great indication, however, insisted upon by Mr. Hunter, was that of destroying the disposition and specific mode of action in the solids of the parts, and as they become changed, the poisonous quality of the matter produced will also be destroyed. This effects the cure of the disease, but does not always remove the consequence.

Gonorrhoea is incapable of being continued beyond a certain time in any constitution; and, when it is violent, or of long duration, it is owing to the part being very susceptible of such irritation, and readily retaining it. As no specific remedy for gonorrhoea is known, it is fortunate that time alone will effect a cure. Mr. Hunter was inclined to think medicine not of the least use, in nine cases out of ten. But even this would be of some consequence, if the cases, capable of being benefited, could be distinguished. Surgeons of the present day, however, have less dependency on this subject, than the distinguished man, whose opinion I have just now cited.

The means of cure, generally adopted, are of two kinds, internal remedies, and local applications; but, whatever plan is pursued, Mr. Hunter inculcates the doctrine, that we are always to attend more to the nature of the constitution, or to any accompanying disease in the parts themselves, or parts connected with them, than to the gonorrhoea itself.

When the symptoms are of the common inflammatory kind, known by the extent of the inflammation not exceeding the specific distance, Mr. Hunter found irritating applications less dangerous, than when irritable inflammation is present: they seemed to him capable of altering the specific action; but, to produce this effect, their irritation must be greater than that of the original injury; and, as M.M. Cullerier and Rater observe, they must be tried at the very beginning of the case. The parts will afterwards recover of themselves, as from any other common inflammation.

Mr. Hunter believes, however, that in the beginning the soothing plan is generally the best. If the inflammation be great, and of the irritable kind, no violence is to be used, for it would only increase the symptoms; and he states, that nothing should be done that can tend to stop the discharge, as it would not put a stop to the inflammation.

But, if the disease has begun mildly, an irritating injection may be used, in order quickly to get rid of the specific mode of action. This application will increase the symptoms for a time; but, when it is left off, they will often abate, or

wholly disappear; and, after such abatement, astringents may be used, the discharge being the only thing to be removed.

When itching, pain, and other uncommon sensations are felt for some time before the discharge appears, Mr. Hunter diffidently expresses his inclination to recommend the soothing plan, instead of the irritating one, in order to bring on the discharge, which is a step towards the resolution of the irritation; and he adds, that to use astringents would be bad practice, as, by retarding the discharge, they would only protract the cure. When there are strictures or swelled testicles, astringents should not be used; for, while there is a discharge, such complaints are relieved.

Mr. Hunter thus expresses himself in regard to the effect of mercury in gonorrhoea: "I doubt very much of mercury having any specific virtue in this species of the disease; for I find that it is as soon cured without mercury as with it, &c. So little effect, indeed, has this medicine upon a gonorrhoea, that I have known a gonorrhoea take place (while the patient was) under a course of mercury, sufficient for the cure of a chancre. Men have also been known to contract a gonorrhoea when loaded with mercury for the cure of a lues venerea; the gonorrhoea, nevertheless, has been as difficult of cure as in ordinary cases."

Mr. Hunter does not say much in favour of evacuants, diuretics, and astringents, given internally. He allows, however, that astringents, which act specifically on the parts, as the balsams, conjoined with any other medicine, which may be thought right, may help to lessen the discharge, in proportion as the inflammation abates.

Local applications may be either internal to the urethra, external to the penis, or both. Those which are applied to the urethra seem to promise most efficacy, because they come into immediate contact with the diseased parts. They may be either in a solid or fluid form. A fluid is only a very temporary application. The solid ones, or bougies, may remain a long while, but in general irritate immediately, from their solidity alone; and Mr. Hunter says, the less bougies are used when the parts are in an inflamed state, the better. At present, bougies are rarely used in gonorrhoea, in consequence of their tendency to bring on a swelling of the testes.

The fluid applications, or injections, in use, are innumerable, and gonorrhoea frequently gets well with many of various kinds. They often have an immediate effect on the symptoms, and hence must have power; though the injection which possesses the greatest power is unknown. As injections are only temporary applications, they must be used often, especially when found useful, and not of an irritating kind.

Mr. Hunter divides injections into four kinds, the *irritating*, *sedative*, *emollient*, and *astringent*. According to his doctrines, irritating injections of every kind, act in this disease upon the same principle; that is, by producing an irritation of another kind, which ought to be greater than the venereal; by which means the venereal is destroyed and lost, and the disease cured, although the pain and discharge may still be kept up by the injection; effects, however, which will soon go off, when the injection is laid aside. In this way bougies also perform a cure. Most of

the irritating injections have an astringent effect.

Irritating injections should never be used when there is considerable inflammation present; especially in constitutions which are known to be incapable of bearing much irritation; nor should they be used when the inflammation has spread beyond the specific distance; nor when the testicles are tender; nor when, upon the discharge ceasing quickly, these parts have become sore; nor when the perinæum is very susceptible of inflammation, and especially if it formerly should have suppurred; nor when there is a tendency in the bladder to irritation, known by the frequency of making water.

In mild cases, and in constitutions which are not irritable, such injections often succeed, and remove the disease almost immediately. The practice, however, ought to be attempted with caution, and not, perhaps, till milder methods have failed. Two grains of the hydrargyrus muratus, dissolved in eight ounces of distilled water, form a very good irritating injection; but an injection of only half this strength may be used, when it is not intended to attempt a cure so quickly. If, however, the injection, even in that proportion, gives considerable pain in its application, or occasions a great increase of pain in making water, it should be further diluted.

Sedative injections will always be of service, when the inflammation is considerable, and they are very useful in relieving the pain. Perhaps, the best sedative is opium, as well when given by the mouth, or anus, as when applied to the part affected, in the form of an injection. But, even opium will not act as a sedative in all constitutions and parts; but, on the contrary, often has opposite effects, producing great irritability. Lead may be reckoned a sedative, so far as it abates inflammation, while, at the same time, it acts as a gentle astringent. Fourteen grains of acetate of lead, in ℥viij of distilled water, make a good sedative astringent injection.

Drinking freely of diluting liquors may have a sedative effect, as it in part removes some of the causes of irritation, by rendering the urine less stimulating to the bladder, when the irritation is there, and to the urethra in its passage through it. The vegetable mucilages of certain seeds and plants, and the emollient gums, are recommended. Mr. Hunter does not entertain much opinion of their efficacy, though some of his patients told him, that they experienced less uneasiness in making water, when their drink was impregnated with mucilaginous substances.

Emollient injections are the most proper, when the inflammation is very severe; and they probably act by first simply washing away the matter, and then leaving a soft application to the part, so as to be singularly serviceable, by lessening the irritating effects of the urine. Indeed, practice proves this; for a solution of gum arabic, milk and water, or sweet oil, will often lessen the pain, and other symptoms.

The irritation at the orifice of the urethra is frequently so great, that the point of the syringe cannot be suffered to enter. In this case, no injection should be used till the inflammation has abated; but, in the meanwhile, fomentations may be employed.

Astringent injections act by lessening the dis-

charge. They should only be used towards the latter end of the disease, and when it has become mild. But if the disease should begin mildly, they may be used at the very beginning; for, by gradually lessening the discharge, without increasing the inflammation, we complete the cure, and prevent a continuance of the discharge called *gleet*.

The apprehension, that injections give a tendency to hernia humoralis, and strictures, has lessened very much the frequency of their use at the present day, though it is to be suspected, with regard to strictures, that the long continuance of the discharge will be more likely than the injection, to produce them. This opinion has been entertained by many good and experienced practitioners, and I observe that it is professed by Mr. Wallace. (*On Ven. Dis.* p. 251.) While much sensibility exists, this gentleman prefers an injection, composed of 15 grs. of nitrate of silver to an ounce of water. When the sensibility has been lessened, he uses an injection of half a grain of muriate of mercury to an ounce of water; or a grain and a half of the sulphate of copper, or acetate of zinc.

On the principle of gonorrhœa being manifestly an inflammatory disorder, it is at first mostly treated, at the present day, by antiphlogistic means. In this country, however, we rarely take blood from the arm, unless the complications of the case require it, as may happen when the inflammation exceeds the specific distance, retention of urine comes on, or inflammation of the testicle occurs. In severe cases, leeches may be applied to the perinæum; and the patient use the warm bath, hip bath, or bidet, under the influence of which he will be able to discharge his urine without pain, or difficulty. If there exists a state of active inflammation, Mr. Wallace applies leeches to the perinæum, or to the body of the penis, or to the internal surface of the prepuce, or to the glans in the neighbourhood of the frænum. "The leech-bites may be covered with a cataplasm, and allowed to bleed as long as convenient. When we wish to stop the bleeding, this may be done by touching the wounds made by the leeches with a pointed piece of nitrate of silver. Any ecchymosis, produced in the penis or scrotum, by the application of leeches, quickly disappears." If the patient prefers it, Mr. Wallace sanctions puncturing one or more of the veins on the dorsum penis. (See *Wallace on Ven. Dis.* p. 247.) If any distress continue, after the antiphlogistic treatment has been persisted in for a day or two, he observes, that the greatest advantage will be derived from full doses of opium and henbane, combined with calomel. In the intervals between the periods of using the warm bath, the penis, scrotum, and perinæum, should be fomented with a decoction of poppy heads. The bowels are to be kept open; a stimulating diet avoided; and mucilaginous diluent beverages taken freely, with the view of rendering the secretion of the urine more abundant, and its quality less irritating to the urethra.

Many modern surgeons have relinquished the use of all injections in the treatment of gonorrhœa, and manage the disease on common antiphlogistic principles. Mr. Howship states, that when injections are used, they are not unfrequently followed by a most distressing and permanent irritability of the bladder. (*On Complaints affecting the Sa-*

cretion and Excretion of the Urine, p. 268.) But, the common objection to them is founded upon the supposition, that they increase the frequency of *hernia humoralis*, and strictures.

Since Mr. Hunter's time, many surgeons have been in the habit of keeping the penis in the incipient inflammatory stage of gonorrhoea, covered with linen, continually wet with the liquor plumbi acetatis dilutus; a practice which is certainly both rational and beneficial. Mr. Abernethy, in his *Lectures on Surgery*, speaks in favour of this method. And some surgeons, amongst whom is my intelligent correspondent, Mr. Dunn, of Scarborough, have seen great relief derived from the use of a suspensor scroti, or double handkerchief, which, combined with rest and the elevation of the penis, the last-mentioned practitioner has frequently found, indeed, of more service than any thing else. A suspensory bandage is believed to lessen the chance of the testicles being attacked by inflammation.

For the relief of the ardor urinæ, and irritable state of the bladder in gonorrhoea, opium, camphor, conium, and hyosciamus, have been extensively employed. Sir Benjamin Brodie informs me, that when the disease is attended with chordee, the vinum colchici frequently has beneficial effects. In consequence of this information, I have sometimes prescribed the vinum colchici, and found it useful in relieving the strangury, ardor urinæ, and irritable state of the bladder.

In the treatment of gonorrhoea, the liquor potassæ is a favourite internal medicine with many practitioners, who begin with prescribing it, and continue its use until the inflammatory stage has subsided. However, according to Mr. Howship, its effects are uncertain, and sometimes it excites uneasiness and irritation about the neck of the bladder, and difficulty of voiding the urine. Hence, whenever he directs this medicine, it is in combination with some aperient, so that it may not remain long in the bowels. (*On Complaints affecting the Secretion and Excretion of the Urine*, p. 269.)

When the glands of the urethra are enlarged, mercurial ointment, or that of the hydriodate of potash, may be rubbed on them, after the inflammation has subsided.

TREATMENT OF GONORRHOEA IN WOMEN.

This is nearly the same as that of the disease in men, but is more simple. When the disorder is in the vagina, injections are best; and after their use, the external parts should be well washed. It is almost impossible for the patient to throw an injection into the urethra, when it is affected. The same injections are proper as for men; but they may be made doubly strong. When the glands of the vagina suppurate, and form abscesses, these should be opened and dressed; but the practice of smearing the parts with mercurial ointment, as advised by Mr. Hunter, is now entirely abandoned.

CONSTITUTIONAL TREATMENT OF GONORRHOEA.

In many strong plethoric constitutions, the symptoms are violent, and there is a great tendency to inflammatory fever. In such instances, opiate systems, though at first productive of relief, sometimes increase the fever, and consequently aggravate all the symptoms. In these cases, the

balsam of capivi, also, sometimes increases the inflammatory symptoms. In a constitution of this kind, the treatment consists chiefly in evacuations, the best of which are bleeding, and gentle purging. The patient must live sparingly, and above all, use little exercise.

In a weak and irritable constitution, the symptoms are frequently violent, the inflammation extending beyond the specific distance, running along the urethra, and even affecting the bladder. Here the indication is to strengthen; and, according to Mr. Hunter, bark alone has been known to effect a cure. All evacuations are hurtful.

A fever has been known to stop the discharge, relieve the pain in making water, and finally cure the disease. On other occasions, Mr. Hunter has seen all the symptoms of gonorrhoea cease on the accession of a fever, and return when the fever was subdued. In other examples, a gonorrhoea, mild at first, has been rendered severe by the coming on of a fever, and, upon its subsidence, the gonorrhoea has ceased. Although a fever does not always cure a gonorrhoea, yet, as it may do so, nothing should be done while it lasts. If the local complaint should continue after the fever is gone, it is to be treated according to symptoms.

A gonorrhoea may be considerably affected by the patient's manner of living, and by other diseases attacking the constitution. Most things which hurry or increase the circulation, aggravate the symptoms; such as violent exercise, drinking strong liquors, eating high-seasoned, indigestible food, some kinds of which act specifically on the urethra, so as to increase the symptoms more than simply heating the body would do; such as pepper, spices in general, and spirits.

In cases which have begun mildly, and in which the inflammation is only slight, or in others, in which the violent symptoms have subsided, such medicines as have a tendency to lessen the discharge, may be given, together with the local remedies before mentioned. Turpentine are the most efficacious, particularly the balsam of capivi, and cubebs. (*See Edin. Med. and Surgical Journ. for January, 1818, and for the same month, 1819; also, H. Jeffery's Pract. Obs. on Cubebs*, 8vo. Lond. 1821.) Of the latter medicine 5 ij may be given thrice in the 24 hours; but with respect to these and all other medicines, which act upon the disease through the medium of the urine, if they succeed at all, it is always within a week or ten days from the beginning of their use; and, therefore, if no amendment take place in this time, they should not be continued. Cantharides, the salts of lead and copper, and alum, have also been recommended.

The opinions entertained by Mr. Hunter, respecting the identity of the infection of gonorrhoea, and that of the venereal disease, led him to prescribe small doses of mercury, in consequence of the possibility of absorption, and with the view of preventing lues venerea.

TREATMENT OF SOME OCCASIONAL EFFECTS OF GONORRHOEA.

Bleeding from the Urethra is sometimes relieved by the balsam capivi. Mr. Hunter did not find astringent injections of use. Ice-cold water, applied to the penis, scrotum, and perineum, is one of the best expedients.

Painful Erections are greatly prevented by taking twenty drops of tinctura opii, or half a drachm of vinum colchici, at bedtime. Hemlock has also some power in this way; and many surgeons, among whom is Mr. Dunn, of Scarborough, have a favourable opinion of camphorated poultices, and of the internal exhibition of camphor.

Chordee. See this word.

Bladder affected. Opiate clysters, the warm bath, and bleeding, if the patient is of full habit, are proper. The excellent effects of the vinum colchici, as stated to me by Sir Benjamin Brodie, I have already noticed. Leeches may be applied to the perineum. When this affection lasts a considerable time, and is not mitigated by common methods, Mr. Hunter advises trying an opiate plaster on the pubes, or the loins, where the nerves of the bladder originate; or a small blister on the perineum. A belladonna plaster would probably act more powerfully than one of opium. In another place, he mentions bark, hemlock, sea-air, and sea-bathing, among the proper means.

Swelled Testicle. See HERNIA HUMORALIS.

Retention of Urine. See URINE, RETENTION OF.

ON THE QUESTION, WHETHER GONORRHOEA IS REALLY A FORM OF THE VENEREAL DISEASE.

Mr. Hunter believed, that the poison of gonorrhoea and the venereal virus were the same. He had seen all the symptoms of lues venerea originate from gonorrhoea only; he assures us, that he had even produced venereal chancres by inoculating with the matter of gonorrhoea; and that he had repeated the experiment in a manner in which he could not be deceived. (p. 293, *et seq.*)

Mr. Hunter's experiments, it is true, have been repeated with a different result; but, as one of his advocates has remarked, can we wonder at this, when we consider from how many causes gonorrhoea may arise, and how impossible it is to distinguish the venereal from any other? (*Obs. on Morbid Poisons*, by J. Adams, M. D. p. 91. ed. 2.)

Another argument, adduced by Hunter, in favour of the poisons of gonorrhoea and chancre being the same, is the probability that the Otaheiteans, had the venereal disease propagated to them by European sailors, who were affected with gonorrhoea; for these can hardly be supposed to have had a chancre, during a voyage of five months without the penis being destroyed. It is impossible, however, to say what time may elapse between the application of the venereal poison to the penis, and the commencement of the ulceration. Therefore, Bougainville's sailors alluded to by Mr. Hunter, might have contracted the infection at Rio de la Plata; but some of the primary ulcers might still have remained unhealed when the ship arrived at Otaheite. But this argument adduced by Mr. Hunter is founded not upon any certain information respecting the origin of the disease in Otaheite, and it implies what is now very commonly disbelieved, viz. that syphilis had only a single commencement in Italy, America, or some other part of the world, from which it has been extended to all other countries. Instead of this doctrine, there is great reason to think, that the disease has had an infinite number of original sources, or beginnings.

In attempting to explain why a gonorrhoea, and a chancre do not equally produce lues venerea, and why the medicine which almost universally cures chancre, has less effect on gonorrhoea; one believer in Mr. Hunter's doctrine says, that we must take into consideration, that the seat of the two diseases is different; that the same cause may produce different effects upon different parts; that the same poison, when mixed with different fluids, may be more or less violent in its operation; and that there may be greater or less attraction of certain fluids to a part, according to its nature and composition. (*Inquiry into some Effects of the Venereal Poison*, by S. Sawrey, 1802, p. 4.) Mr. Sawrey truly remarks, p. 6. that, if the gonorrhoeal matter has clearly and decidedly produced chancre, or contaminated the system in any one instance, the question is determined. It could in no instance produce these effects unless it had the power of doing so. This writer brings forward some cases to prove, that the poison of gonorrhoea may produce gonorrhoea or chancre; but the limits of this work, only afford room to observe, that these instances are by no means decisive of the point, because some objections may be urged against them, as, indeed, Mr. Sawrey himself allows.

Why does not gonorrhoea commonly produce ulceration in the urethra? Mr. Sawrey tries to solve this question, by saying, that the product of the venereal inflammation, the diseased contents of the small arteries of the urethra, are thrown out of these open-mouthed vessels into this canal, without any breach of their texture, which otherwise would be a necessary consequence.

Why does not gonorrhoea equally contaminate the system as chancre? In gonorrhoea, says Mr. Sawrey, the discharge is very plentiful; it is not, in general, attended with ulceration; the poison is much more diluted, and mixed with a mucous and puriform fluid. It is deposited in the urethra, and its lacunae, where little or no pressure is applied, and it finds easy egress out of the canal. In chancre, there is breach of substance, the poison is not much diluted, &c.

Why does not chancre generally in the same person produce gonorrhoea, and gonorrhoea, chancre? Mr. Sawrey, in answer, expresses his belief, that these incidents are not very unfrequent. He says, he has known persons having a chancre, which continued for months, become affected, after that time, with a clap, without any further exposure. His opinion is, that the matter of the chancre had insinuated itself into the urethra, and produced the disease; though he confesses, many would explain the circumstance, by supposing that the chancre and gonorrhoea were both communicated at the same time by two different poisons.

Mr. Hunter conceives, that the presence of one disease renders the adjacent parts less susceptible of the influence of the other.

Another defender of this side of the question is Dr. Swediaur, who endeavours to prove the fallacy of the following positions: 1. *That the poison which produces the clap does never, like that of chancres, produce any venereal symptoms in the mass or lues itself.* 2. *That the poison of the clap never produces chancres, and that the poison of chancres never produces a clap.* 3. *That mercury never contributes to, nor accelerates, the cure of a*

clap; but that, on the contrary, every blennorrhœa may be certainly cured without mercury, and without any danger of leaving a lues behind.

His arguments run thus:—the reason why claps do not, like chancres, constantly produce lues, is, that most of them excite only a superficial inflammation in the membrane of the urethra, without any ulceration. Hence, absorption cannot easily take place, the poison being out of the course of the circulation. But he has seen claps, with an ulcer in the urethra, followed by the most unequivocal symptoms of lues itself. He mentions the urethra being defended with a large quantity of mucus, as the thing impeding the common formation of ulcers, which do occasionally occur when the mucus is not secreted as usual, or is washed away. He asserts, that in many cases, where he had occasion to examine both parties, he was convinced that the chancres were communicated by a person affected with a simple gonorrhœa; and *vice versa*, that a virulent clap had been the consequence of an infection from a person having merely chancres. He says, that if a patient, with a venereal running, does not take care to keep the prepuce and glans perfectly clean, chancres will very often be produced. He owns, that a great many claps are cured without mercury; yet, repeated experience has shown him, a cure cannot always be thus accomplished. Mild cases, without ulcer or excoriation in the urethra, may certainly be radically cured without a grain of mercury; and though mercury should be given, it would not have the least effect; not because the disease does not proceed from the venereal poison, but because it is out of the course of the circulation. He contends, that the topical use of mercury in injections acts usefully even in these cases. But, when a clap is joined with ulceration in the urethra, it is always cured more safely and expeditiously with mercury, and is frequently incurable without it. A lues also follows cases attended with ulcer in the urethra. He allows, that all claps are not venereal. (See *Pract. Obs. on Venereal Complaints*, by J. Sædiæur.)

One argument urged against the identity of gonorrhœal and chancreous virus, is, that gonorrhœa was not described as a symptom, till nearly half a century after the other symptoms of the venereal disease were known. Fallopius is among the first who observed gonorrhœa, as a symptom of the venereal disease. "If, however," says Dr. Adams, "venereal gonorrhœa was unnoticed till about fifty years after the other forms of the disease were described, what does this prove, but that contagious gonorrhœa was so common, as to be disregarded as a symptom of the new complaint? Can there be a doubt, from the caution given by Moses, that gonorrhœa was considered as contagious in his days? During the classical age, we find inconveniences of the urinary passages were imputed to incontinence; and the police of several states, before the siege of Naples, made laws for preserving the health of such as would content themselves with public stews, instead of disturbing the peace of families.

"This is enough to lessen our surprise, that gonorrhœa should be unnoticed for some time after the appearance of the venereal disease. But, so far is it from proving, that the two contagions are different, that the fairest inference we can draw is in favour of their identity. For, if by this time

the venereal disease began to be so far understood, that secondary symptoms were found the consequence of primary ones in the genitals, it is most probable, that the first suspicion of venereal gonorrhœa arose from the occurrence of such secondary appearances, where no other primary symptoms could be traced." (*Adams on Morbid Poisons*, p. 95, ed. 2.)

The sentiments of Mr. B. Bell are quite at variance with those of Hunter, Sawrey, Sædiæur, Adams, &c.; but, my limits will only allow me to enumerate a few of his leading arguments.

If the matter of gonorrhœa, and that of chancre, were of the same nature, we must admit, that a person with a chancre only, can communicate to another, not only every symptom of pox, but of gonorrhœa; and that another, with gonorrhœa only, can give to all, with whom he may have connexion, chancres, with their various consequences. This ought indeed to be a very frequent occurrence; whereas, all allow that it is even in appearance very rare.

On the supposition of the matter of gonorrhœa and lues venerea being the same, the latter ought to be a much more frequent occurrence than the former, from the greater ease with which the matter of infection must, in every instance, be applied to those parts on which it can produce chancres, than that of the urethra, where, instead of chancre or ulceration, it almost always excites gonorrhœa. It is difficult to conceive how the matter, by which the disease is communicated, should find access to the urethra; while all the external parts of the penis, particularly the glans, must be easily and universally exposed to it; and yet gonorrhœa is a much more frequent disease than pox. Cases of gonorrhœa are in proportion to those of chancre, according to Mr. B. Bell's experience, as three to one. It is obvious, that the very reverse should happen, if the two diseases were produced by the same kind of matter.

The grand practical consideration, depending on the possibility of the venereal disease arising from gonorrhœa, is, whether mercurials should not be exhibited, in all cases, with the view of preventing such a consequence.

Waving, on my own part, all attempts to decide the point, whether the matter of a chancre, and that of one species of gonorrhœa, are of the same nature, I shall merely content myself with stating, that so far as my observation and inquiries extend, the majority of the best practitioners consider the exhibition of mercury unnecessary, and consequently improper in gonorrhœa. This fact almost amounts to a proof that, if venereal symptoms do ever follow a clap, they are so rare, and I may add, always so imputable to other causes, that the employment of mercury, as a preventive, would, upon the whole, do more injury, than benefit to mankind; and this, even admitting (what, in my mind, has never been unequivocally proved) that the matter of gonorrhœa is really capable, in a very few instances, of giving rise to the venereal disease. However, a few surgeons will not yet altogether renounce the employment of mercury in gonorrhœa. Thus, Mr. Wallace gives small doses of it, with copaiva, or cubeba, after the active inflammation has subsided. (See *Wallace on Ven. Dis.* p. 248.)

Mr. Carmichael, who is a believer in a plurality of venereal poisons, inculcates the doctrine,

that what he terms the *popular venereal disease*, or that which is characterized by a *popular eruption*, if the skin become affected, originates from a peculiar virus, which gives rise to gonorrhœa, and which is different from poisons supposed by him to excite other forms of the venereal disease. As, however, the simple primary ulcer, excoriation and gonorrhœa very frequently exist together, Mr. Carmichael suspects, that they all arise from the same identical poison. (See *Essay on Ven. Dis.* p. 76. ed. 2. 8vo. Lond. 1825.) At the same time, this gentleman concurs in the common belief, that constitutional symptoms after a gonorrhœa, are very rare. With regard to Mr. Carmichael's views, several facts present themselves. 1. The formation of excoriations and simple sores does not necessarily require the influence of any poison. 2. Sores, capable of imparting every form of constitutional syphilis, are now frequently believed by men of great experience, to present themselves in the form of simple ulcers. 3. Numerous surgeons would ascribe the constitutional symptoms, which, in a small proportion of cases, follow gonorrhœa to the existence of venereal ulceration together with this disease, or, at some period before or after it. 4. The facts that primary venereal sores of every description are capable of healing up spontaneously, and that some of them, being small and superficial, and therefore disregarded, and allowed thus to heal, are considerations which interfere considerably with some of Mr. Carmichael's ingenious conclusions. However, if it were proved, that constitutional symptoms of a peculiar kind, like those specified by Mr. Carmichael, were limited to gonorrhœal cases, then there would be reason for suspecting that their nature must be determined by the influence of a poison, not corresponding to that of other forms of the venereal disease.

J. André, on the Theory and Cure of the Venereal Gonorrhœa, and the Diseases which happen in consequence of that Disorder. 8vo. Lond. 1777. *J. Nevil*, A Description of the Venereal Gonorrhœa, 8vo. Lond. 1754. *J. Chubb*, An Essay on the Gonorrhœa Virulenta, in which the different Opinions respecting the Treatment of the Disease are carefully examined, &c. 8vo. Lond. 1786. *W. Thomas*, An Essay on Gonorrhœa, with some Obs. on the Use of Opium, 8vo. Lond. 1780. *John Hunter*, A Treatise on the Venereal Disease, 4to. 1788. *W. Howley*, The most cogent Reasons why astringent Injections, &c. should be banished, &c. 8vo. Lond. 1800. *J. H. G. Schlegel*, Versuch einer Geschichte des Streites über die Identität des Venus und Trippergiftes, 12mo. Jena, 1796. *Whately*, on the Gonorrhœa Virulenta, 8vo. Lond. 1801. *Pract. Obs. on Venereal Complaints*, by *F. Sævius*, M. D., ed. 3. An Inquiry into some of the Effects of the Venereal Poison, by *S. Saurry*, 1802. *Obs. on Morbid Poisons*, by *J. Adams*, M. D., edit. 2. 1807. *J. C. Jacobs*, Démonstration de l'Identité des Virus de Vérole et de la Gonorrhœe, 8vo. Bruxelles, 1811. *J. F. Hernandez*, Essai Analytique sur la Non-Identité des Virus Gonorrhœique et Syphilitique, 8vo. Toulon, 1812. *R. Carmichael*, Essays on the Venereal Diseases which have been confounded with Syphilis, &c. 4to. Lond. 1814; and his *Obs. on the Symptoms and Specific Distinctions of Venereal Diseases*, 8vo. Lond. 1818. *John Huxship*, On Complaints affecting the Secretion and Excretion of the Urine, 8vo. Lond. 1823. *M. M. Cullerier et Rater*, in *Diet. de Méd. et de Chir. Pratiques*, art. Blennorrhagie. *W. Wallace*, On the Venereal Disease and its Varieties, chap. vi. 8vo. Lond. 1833.

GORGET. An instrument, used in the operation of lithotomy, for the purpose of cutting the prostate gland and neck of the bladder, so as to enable the operator to introduce the forceps and extract the stone. It is, in fact, a sort of knife, at the end of which is a beak, that fits the groove of the staff, and admits of being pushed

along it into the bladder. Besides cutting gorgets, constructed for the preceding design, there are also blunt ones, intended to be introduced into the wound, their concavity then serving as a guide for the forceps into the bladder.

GRANULATIONS. The little conical eminences, which form on the surfaces of ulcers, and suppurating wounds, and serve for filling up the cavities, and bringing nearer together and uniting the margins of ulcers and wounds, healing by what is termed the *second intention*. They receive their name from their granular appearance.

We must here consider the operations of nature, in bringing parts as nearly as possible to their original state, whose disposition, action, and structure have been altered by accident, or disease. Having formed pus, she immediately begins to form a new substance upon surfaces in which there has been a breach of continuity. This is called the *granulating process*, or *incarnation*; and the substance formed, *granulations*.

Granulations are an accretion of animal matter upon the wounded or exposed surface; they are formed by an exudation of coagulating lymph or fibrin, into which blood extends from the subjacent vessels; and these vessels, communicating with the latter, are soon formed in it, so as to render it organised. This substance was analysed in 1822 by Dr. John Davy, who ascertained its fibrinous nature; and it has since been chemically investigated by M. M. Dupuy and Lassaigne, who arrived at the same conclusion. Granulations are extremely vascular; indeed, more so than almost any other animal substance. "That this is the case (says Mr. Hunter) is seen in sores every day. I have often been able to trace the growth and vascularity of this new substance. I have seen upon a sore a white substance exactly similar, in every visible respect, to coagulating lymph. I have not attempted to wipe it off, and the next day of dressing, I have found this very substance vascular; for, by wiping, or touching it with a probe, it has bled freely. I have observed the same appearance on the surface of a bone that has been laid bare. I once scraped off some of the external surface of a bone of the foot, to see if the surface would granulate. I remarked, the following day, that the surface of the bone was covered with a whitish substance, having a tinge of blue. When I passed my probe into it, I did not feel the bone bare, but only its resistance. I conceived this substance to be coagulable lymph, thrown out from inflammation, and that it would be forced off when suppuration came on; but on the succeeding day, I found it vascular, and appearing like healthy granulations." Mr. J. W. Earle, in his inquiry into the nature of inflammation, gives the following explanation of the formation of granulations. "When the globules of the blood have been effused on the surface of a wound, it is clear that, after a time, their continued passage will have established an immense number of furrows, or canals, in that which was at first merely an amorphous layer, or covering of fibrin, which canals must be the continuations of the genuine capillaries and which, like them, must be wholly unprovided with distinct coats, like larger vessels. In proportion as these channels become established, the fibrinous layer is no longer in its original condition, but is pierced by innumerable perforations, which offer a readier egress to the

serum and fibrin, as well as to the globules, so that nearly the whole of the discharge from the surface of a wound, may find its way through them directly, instead of, as previously, by percolation. As the fresh fibrin exudes through the original layer by these channels, or perforations, it will coagulate around them in little heaps, whose central points must be the channels, or continuations of the genuine capillaries, through which it had exuded. As, on the one hand, the colouring matter of the globules was lost, in proportion to the difficulty with which they were forced by the pressure of the *vis a tergo*, through the parenchyma and fibrin, as yet imperforate; so, on the other hand, in proportion now as their passage is facilitated by the establishment of the above-mentioned canals, the globules will advance further into the fibrin, and approach nearer to the surface of the wound, without being deprived of their colouring matter. When this period has arrived, the fibrin, which was at first opaque, and of a dirty white colour, has assumed a jelly-like, and more transparent appearance, (in consequence of its combination with the serum, which is constantly passing through it,) actually contains real blood, and has every character which pertains to granulations." (See *W. Earle, in Lond. Med. Gaz.* 1835, p. 219.) This gentleman afterwards notices, that, although the establishment of the above-mentioned canals, or perforations, admits the red globules nearer to the surface, the continual deposition of fresh fibrin, which coagulates as it exudes, constantly maintains their orifices, as it were, sealed up, so that a new obstruction is uniformly opposed to the final egress of the globules. Through this fresh deposition, the globules are again forced as before, by the pressure of the *vis a tergo*; more fibrin is again deposited, and coagulated, and so on until the wound is filled up. Whoever is desirous of going further into this minute investigation, should consult Mr. J. W. Earle's paper above referred to, and also Gendrin's *Hist. Anat. des Inflammations*, in which latter is a careful description of the formation of granulations on a serous membrane. A lecture by Sir Everard Home, on the conversion of pus into granulations, likewise, merits attention. (See *Phil. Trans.* part 1. 1829.)

The vessels in granulations pass from the original parts to their basis, and thence towards their external surface, in tolerably regular parallel lines. The surface of this new substance has the same disposition to secrete pus, as the parts which produced it. The surfaces of granulations are very convex, the reverse of ulceration, and they present a great many small points, or eminences, so as to appear rough. The smaller such points are, the more healthy the granulations. The colour of healthy granulations is a deep florid red. When livid, they are unhealthy, and have only a languid circulation. Healthy granulations, on an exposed or flat surface, rise nearly even with the surface of the surrounding skin, and often a little higher; but when they exceed this, and take on a growing disposition, they are unhealthy, become soft, spongy, and have no disposition to form skin. Healthy granulations are always prone to unite to each other, so as to be the means of healing parts.

Granulations are not easily formed on the sides of ulcers, nearest the surface of the body. They are not endowed with the same powers as granulations formed past. Hence, they more readily

ulcerate, and mortify. The curious mode in which granulations contract, when sores are healing, and even for some time after they are healed, has been explained in the article *Cicatrisation*. (See *Tracts on the Blood, Inflammation, &c.* p. 473. et seq. 1794.)

It is a question, whether granulations can ever be formed without suppuration? Mr. Hunter seems inclined to think that they may occasionally be produced without it, and he supports his opinion by the relation of the dissection of a limb which had suffered a compound fracture, and in which he observed a substance resembling granulations. Dr. John Thompson, on the other hand, declares, that he has never seen any thing, which he could regard as an example of a granulation, and still less of a granulating surface, where pus was not formed. (See *Lectures on Inflammation*, p. 408.)

The exact process, by which the blood-vessels, nerves, and absorbents of granulations are formed, is still amongst the secrets of nature. The observations of Mr. Hunter on the subject amount only to conjecture. "The growth of nerves, and their development in new-formed flesh, or granulations (says Dr. J. Thompson), is a subject of equal curiosity with the growth of blood-vessels in the same structure. Their existence in granulations is proved by the pain which is felt on our pinching, rubbing, or wiping the surface of a sore. Even the granulations, which arise from the surface of bone, are sensible (a statement not admitted by Sir Astley Cooper), though we are not very well able to prove the sensibility of the larger branches of nerves, from which the newly formed, and sensible nerves and filaments in the granulation are immediately derived. All the difficulties, which I formerly mentioned to you, as occurring in the explanation of the manner in which coagulable lymph, or granulations, are penetrated with blood-vessels, present themselves the moment we begin to reflect on the manner in which the same granulations are provided with nerves; and these difficulties are still increased, when we reflect, that the same granulations are in the course of a few hours provided, not only with bloodvessels and nerves, but also with a system of absorbents. The existence of absorbents in granulations is proved, not only by the changes of bulk, which we see them daily undergo, becoming gradually, in the healthy state smaller, firmer, and more compact, but, also, by the frequent disappearance, in whole, or in part, of a granulating surface, by the process of ulcerative absorption." (See *Thompson's Lectures on Inflammation* p. 419.) According to Sir Astley Cooper, granulations which spring from parts endued with great sensibility, like muscles, are extremely sensitive; but, granulations, which arise from bones, he says, have no sensibility whatever. These observations are qualified with the condition, that the bone be uninfamed, and, it is acknowledged, that granulations, arising from the cancellated structure of bones, are sometimes extremely sensitive. He describes granulations from tendons as quite insensible, and those from aponeuroses and fasciæ as possessing very little sensibility. Every young dresser of sores at an hospital, who has been too lavish of the red precipitate ointment, must have learned from experience, that granulations are furnished with absorbent vessels, and that mercury may be absorbed from the surface of ulcers, and bring on an unvisited-for salivation

of the patient. It is observed by Sir Astley Cooper, that, in recently formed ulcers, the granulations are not good absorbent surfaces; but, that when the sores have existed a good while, they readily take into the system any substance, which may be applied to them. Thus, when old sinuses are injected with a solution of the oxymuriate of mercury, with the view of stimulating them to heal, the patients are sometimes salivated by the mercury being absorbed into the system. Sir Astley has seen the same effect produced by the application of the lotion of lime-water and submuriate of mercury to the surface of ulcers. Indeed, the absorbent power of granulations is frequently the means of producing baneful effects upon the constitution, by the introduction of deleterious substances into the circulation. Thus, arsenic, applied to sores, is often conveyed into the system, and, on this account, is to be regarded as a dangerous external remedy. Sir Astley Cooper quotes one instance, in which the patient seems to have been poisoned, by the indiscriminate application of arsenic to a fungus of the eye. Opium also, when applied to the surfaces of sores, is very readily absorbed, producing similar effects to those which arise from its introduction into the stomach. Thus, when the quantity absorbed is too great, excessive costiveness, extreme pain in the head, and torpor of the system, are the consequences, which require the frequent administration of active purgatives for their removal. A temporary amaurosis has been known to be produced by the absorption of the extract of belladonna, from the surface of irritable malignant ulcers. (F. Tyrrell; A. Cooper's *Lectures*, vol. i. p. 169.)

GUAIAACUM. Many writers of the sixteenth century contended, that guaiacum was a true specific for the venereal disease; and the celebrated Boerhaave, in the eighteenth, maintained the same opinion. Mr. Pearson mentions, that when he was first intrusted with the care of the Lock Hospital, in 1781, Mr. Bromfield and Mr. Williams were in the habit of reposing great confidence in the efficacy of a decoction of guaiacum wood. This was administered to such patients as had already employed the usual quantity of mercury; but who complained of nocturnal pains, or had gummata, nodes, ozæna, and such other effects of the venereal virus, connected with secondary symptoms, as did not yield to a course of mercurial frictions. The diet consisted of raisins, and hard biscuit; from two to four pints of the decoction were taken every day; the hot bath was used twice a week; and a dose of antimonial wine and laudanum, or Dover's powder, was commonly taken every evening. Constant confinement to bed was not deemed necessary; neither was exposure to the vapour of burning spirit, with a view of exciting perspiration, often practised; as only a moist state of the skin was desired. This treatment was, sometimes, of singular advantage to those whose health had sustained injury from the disease, long confinement, and mercury. The strength increased; bad ulcers healed; exfoliations were completed; and these anomalous symptoms, which would have been exasperated by mercury, soon yielded to guaiacum.

Besides such cases, in which the good effects of guaiacum caused it to be erroneously regarded as a specific for the lues venerea, the medicine was also formerly given, by some, on the first attack of the venereal disease. The disorder being thus bene-

fited, a radical cure was considered to be accomplished; and, though frequent relapses followed, yet, as these partly yielded to the same remedy, its reputation was still kept up. Many diseases also, which got well, were probably not really venereal cases. Mr. Pearson seems to allow, that, in syphilitic affections, it may, indeed, operate like a true antidote, suspending, for a time, the progress of certain venereal symptoms, and removing other appearances altogether; but, he observes, that experience has evinced, that the unsubdued virus yet remains active in the constitution.

Mr. Pearson found guaiacum of little use in pains of the bones, except when it proved sudorific; but that it was then inferior to antimony, or ammonia. When the constitution has been impaired by mercury, and long confinement, a thickened state of the ligaments, or periosteum, or foul ulcers, still remaining, Mr. Pearson says, these effects will often subside, during the exhibition of the decoction. He says, it will often suspend, for a short time, the progress of certain secondary symptoms of the lues venerea; for instance, ulcers of the tonsils, venereal eruptions, and even nodes. Mr. Pearson, however, never knew one instance, in which guaiacum eradicated the virus; and he contends, that its being conjoined with mercury neither increases the virtue of this mineral, lessens its bad effects, nor diminishes the necessity of giving a certain quantity of it. He has seen guaiacum produce good effects in cutaneous diseases, ozæna, and scrofulous affections of the membranes and ligaments. (See *Pearson on the Effects of various Articles in the Cure of Lues Venerea*, edit. 2. 1807.) Many of the foregoing observations on the virtues of guaiacum in syphilis, are considerably affected by the fact, now so completely established, that this disease is generally capable, in the end, of a spontaneous and lasting cure. (See *Venereal Disease*.)

GUMMA, a soft tumour, so named from the resemblance of its contents to gum.

GUMS, INFLAMMATION AND ABSCCESS OF. *Gum boil. Parulis.* Inflammation of the gums mostly arises from the irritation of carious teeth, but sometimes from necrosis of a part of the alveolar process, or from the splintering of it, occasioned by the extraction of a bad tooth. Sometimes it originates from exposure to cold, and, in other instances, from mechanical irritation. When the inflammation, arising from the irritation of a decayed tooth, cold, and some other causes, proceeds to suppuration, the case is then an abscess, here termed a *gum boil*. The treatment consists in making an early puncture, for the discharge of the matter, and, after the subsidence of the inflammation, in extracting any bad tooth, concerned in keeping up irritation. The mouth is to be frequently cleansed with an astringent gargle. If a fistula form in the gums, it is to be freely divided, and touched with the nitrate of silver, care being taken, however, before resorting to this measure, to remove any carious tooth, splinter, or dead portion of bone, which latter proceedings will, generally, supersede all necessity for laying open the fistula.

GUMS, TUMOURS OF. A very common disease is a thickening of the gums at some particular point, which puts on the form of an excrescence, and generally assumes a hard callous nature. Some of these swellings are connected

with the pericæstum, or bone, and are disposed to acquire a malignant character; frequently, after they have attained a certain size, the neighbouring part of the bone becomes altered and softened. Other tumours of the gums are merely excrescences from the fibro-vascular texture of these parts, not penetrating deeply, not connected with the bone, periosteum, nor sockets of the teeth, and not malignant. The excrescence of the gums then, termed *epulis*, is of very different character in different cases; but, as many tumours of the gums, apparently trivial at first, become fatal diseases in the end, if neglected in their beginning, the rule in surgery is to attempt their extirpation, before they have made considerable progress.

On this subject Sir Charles Bell has made some interesting remarks. "We see (says he) a small tumour of the gums, stationary for a long time, and claiming no attention, at last forcing its way into the bones of the face, filling up the cells and the cavities of the nose, pressing out the eyes, and rising at last upon the base of the brain itself," so as to destroy the patient. The worst diseases of the gums, according to Sir C. Bell, do not come from the irritation of a bad tooth. "We see a carious tooth, attended with ulcer and gumboil, and abscess in the jaw; with fungous tumour of the gums; even with necrosis of the jaw. We find the inflammation from the same source, amounting in severity of pain to that of *tic-douleur*. But these are of no account, compared in danger with this tumour of which I am treating. This more formidable disease begins when the adjoining teeth are apparently sound, and when we cannot trace it to any common source of irritation. This tumour first shows itself in a small hard prominence of the gum, shooting out betwixt two of the teeth; and the teeth being good is an unfavourable circumstance; for, when they have become loose and are displaced, without being themselves diseased, it implies that the cause is deep, and not to be removed by pulling out the teeth. If the teeth be carious and originally in fault, we have a reasonable expectation of arresting the progress of disease by removing the teeth; but when, independent of the teeth, the tumour has its origin in the membrane of the fang, or in the socket, we cannot hope to extirpate the disease, without removing the whole system of parts," the tooth, the gum, and the adjacent portion of the jaw. (See Sir Charles Bell's *Surgical Obs.* p. 413. 8vo. Lond. 1816.) A perpendicular division of the alveolar process is to be made at a prudent distance from each side of the tumour, and to the requisite depth, with a fine saw, any teeth in the way of its action being previously extracted. Then with a strong pair of forceps, the portion of bone, between the two fissures, is to be broken off. The bleeding, which is copious, may sometimes be stopped by compresses dipped in the tincture of muriated iron, but frequently requires firm and long continued pressure with the hands of a succession of assistants, or even the actual cautery.

Shall we and more superficial kinds of *epulis* may be extirpated with a scalpel, care being taken to let the excision be sufficiently free and deep, and then to scrape the alveolar process, or rub the bottom of the wound with nitrate of silver, which will generally stop the hæmorrhage, and prevent the chance of a return of the excrescence.

When the disease recurs often, as it did six times in a case, mentioned by John Hunter, the removal of the parts must either have been imperfect, or the tumour cancerous, as happened in two examples which fell under his observation. (See J. Hunter on *Natural Hist. &c. of the Human Teeth*, p. 188.)

GUNSHOT WOUNDS receive their name from the manner in which they are produced, being generally caused by hard, obtuse, metallic bodies, projected from cannons, muskets, or some other species of firearm. With such injuries, it is also usual to comprehend a variety of dreadful accidents arising from the explosion of shells, or the violence with which pieces of stones from ramparts, or splinters of wood on board of ship, are driven about. Gunshot wounds are the most considerable of the contused kind; and what is to be said of them, will apply, more or less, to all contused wounds, according to the degree of contusion. They are particularly characterised by, what the French surgeons are fond of calling, a *disorganization* of their surface. The excessive contusion and violence, observable in gunshot wounds, depend upon the rapidity with which the bodies occasioning them are propelled. The parts touched by the ball, are frequently converted into a blackish slough, the colour of which made our ancestors suppose, that bodies, projected by gunpowder, became heated, and actually burnt the flesh with which they came into contact. But reason and experience have now proved, that whatever may be the rapidity of a projectile, it never acquires in its passage any perceptible heat. Indeed, a modern writer asserts, that such a degree of heat as would be requisite to make a ball burn parts in its passage would really melt it. (*Richerand, Nosographie Chir.* t. i. p. 217. edit. 2.) In general, gunshot wounds do not bleed much, except when large blood-vessels are injured, and even not always in this case.

However, "the effects of a gunshot wound differ so materially in different men, and the appearances are so various, according to the nature of the part wounded, and the greater or lesser force with which it has been struck, that no invariable train of symptoms can be laid down as its necessary concomitants. If a musket or pistol-ball has struck a fleshy part, without injuring any material blood-vessel, we see a hole about the size of, or smaller than, the bullet itself, with a more or less discoloured lip, forced inwards; and, if it has passed through the parts, we find an everted edge, and a more ragged and larger orifice at the point of its exit. The hæmorrhage is in this case very slight, and the pain may be inconsiderable, inasmuch that, in many instances, the wounded man is not aware of his having received any injury. If, however, the ball has torn a large vessel, or nerve, the hæmorrhage will generally be profuse, or the pain of the wound severe, and the power of the part lost. Some men will have a limb carried off, or shattered in pieces by a cannon-ball, without exhibiting the slightest symptoms of mental or corporeal agitation; nay, even without being conscious of the occurrence: and when they are, they will coolly argue on the probable result of the injury; while a deadly paleness, instant vomiting, profuse perspiration, and universal tremor, will seize another on the receipt of a slight flesh wound. This tremor, which has been so much talked of, and which to an inexpe-

eye is really terrifying, is soon relieved by a mouthful of wine, or spirits, or by an opiate; but, above all, by the tenderness and sympathising manner of the surgeon, and his assurance of the patient's safety." (See *Hennen's Principles of Mil. Surgery*, p. 33. edit. 2.)

On the other hand, it is correctly noticed by Mr. Guthrie, that the continuance of the constitutional alarm, or shock, ought to excite great suspicion of serious injury; and when wounds have been received in such situations, or bear such appearances, as render it doubtful whether any parts of vital importance have been injured, or not, the manner in which the constitutional perturbation lasts may be assumed as evidence of the fact, when other symptoms more indicative of the injury are wanting; and, under all such circumstances, a very cautious prognosis should be delivered. (*On Gunshot Wounds*, p. 11, ed. 2.)

Respecting the general character of gunshot wounds not to bleed copiously, unless large vessels be injured, it is a fact which necessarily depends upon the degree of contusion usually attending these injuries. But it is also true, as the preceding author has stated, that, although some gunshot wounds bleed but little at first, there is in the greater number of cases more or less of blood; and in wounds of vascular parts, like the face and neck, the quantity lost is often considerable, though the main arterial branches may not be injured. (*Op. cit.* p. 6, ed. 2.)

In gunshot wounds another circumstance is observed, which is often remarked in other cases, viz., when a large artery is partially divided, the bleeding is more profuse and dangerous than when the vessel is completely severed, and the hemorrhage, if not repressed by a tourniquet or other means, will often continue until the patient dies. Thus Mr. Guthrie speaks of three cases, in which life was lost from wounds of the femoral, brachial, and carotid arteries, no effectual means of stopping the hemorrhage having been adopted. In 1830, a young man, at the attack on the Hôtel de Ville, in Paris, received a ball in the upper and inner part of the right thigh, and the femoral artery was wounded; he was conveyed to the Hôtel-Dieu, but lost so much blood in the streets, that, when he reached the hospital, he was in a dying state. (*Dupuytren, Clin. Chir.* t. ii. p. 464.)

Until Ambrose Paré introduced more correct theories, the most false notions prevailed respecting what have been wrongly named, *wind-contusions*. Cannon-balls and bullets sometimes produce dreadful degrees of injury, without occasioning any breach of continuity in the integuments. This observation is so strictly true, that the muscles and bones may actually be crushed and broken to atoms, without the skin being at all wounded. Such cases were for a long while imputed to the violent motion supposed to be communicated to the air by the ball itself. It was imagined, that this elastic fluid, being rapidly displaced by the shock of the projectile, was capable of making such pressure on surrounding bodies, as to destroy their texture. But how could this violent pressure originate in the midst of the open and unbounded atmosphere? If this theory were true, the effect in question would constantly happen, whenever a ball passed near any part of the body. The contrary, however, is so much the case, that pieces of soldiers' and seamen's hats, of their feathers, clothes, and

even hair, are shot away in every battle, without any other mischief being done.

The air does not move with the same rapidity as the ball; but its motion is less in proportion as it is a more subtle matter, and must be too feeble to account for such a violent degree of injury. The air, to which the ball must really communicate the greatest motion, is what is directly before it; and this never bruises the part untouched by the ball itself. It is only the air situated laterally to the shot, that is imagined to do injury, and it cannot be greatly agitated. The violent consequences of sudden explosions, and the effects produced on the organ of hearing, by strong commotions of the air, prove nothing relative to the point in question. (See *Le Vacher, in Mém. de l'Acad. de Chir.* t. iv. p. 22.)

Dr. John Thomson, who visited the continent for the purpose of seeing the wounded after the battle of Waterloo, fully coincides with M. le Vacher and all the moderns upon this subject. "We saw, and were informed of, many instances, in which cannon-balls had passed quite close to all the parts of the body, and had removed portions of the clothes and accoutrements, without producing the slightest injury of any kind. In other instances, portions of the body itself were removed by cannon-balls, without the contiguous parts having been much injured. In one case, the point of the nose was carried off by a cannon-ball, without respiration being at all affected; and in another very remarkable case, the external part of the ear was shot away, without even the power of hearing being sensibly impaired." (See *Thomson's Report of Obs. made in the British Military Hospitals in Belgium*, &c. p. 33. Edin. 1816.)

In proof of the truth of Le Vacher's opinions, I shall merely add one observation that occurred to the notice of many, as well as myself. At the bombardment of the French fleet in the basin of Antwerp in 1814, a cannon-shot shattered the legs of two officers so badly, that the limbs were amputated. These gentlemen were walking at the moment of the accident in the village of Merksam, taking hold of the arm of my friend Assistant-surgeon Stobo, of the 37th regiment, who was in the middle. Now the ball which produced the injury, did not the slightest harm to the latter gentleman, although it must have passed as close as possible to his lower extremities, and most probably between them.

Neither can what have been improperly called *wind-contusions*, be attributed to an electrical shock on the parts, in consequence of the ball being rendered electrical by friction in the calibre of the gun, and giving off the electricity as it passes by; (*Vide Plenk's Sammlungen*, 1 theil. p. 99.) for metals never acquire this property from friction.

The mischief, imputed to the air, is occasioned by the ball itself. Its producing a violent contusion, without tearing the skin, and entering the limb, is to be ascribed to the oblique direction, in which it strikes the part, or, in other instances, to the feebleness with which the ball strikes the surface of the body, in consequence of its having lost the greater part of its momentum, and acting principally by its weight, being, in short, what is called a spent ball. Daily observation evinces, that balls which strike a surface obliquely, do not penetrate, but are reflected; though they may be impelled with the greatest force, and the body

struck may be as soft and yielding as water. This alteration in the course of the ball, not only happens on the surface of the human body, but also in the substance of a limb which it has entered. Thus, a bone, a tendon, &c. may change the direction of a ball which touches them at all obliquely. Hence, the track of a gunshot wound is not always straight, and balls sometimes run under the integuments nearly all round the body, or limb.

The causes of several of the peculiarities, attending gunshot wounds, are to be sought among the laws, by which moving bodies are governed, and by which the mechanical effect of a ball, propelled against any part of the body, must therefore be determined. The form, the momentum, and the direction of the shot, that is received; the position, and the variety of structure, or, in other words, the variety of density and powers of resistance, in the part receiving it, must always be considered, in order to account satisfactorily for the effects which it produces. And though, says Mr. Chevalier, in many cases, a mathematical explication of the course of a ball cannot be given, this arises entirely from the want of data, the laws of matter being fixed and immutable. But, when the data are known, as, for instance, the velocity and direction of the shot, the position of the patient, or of the wounded part at the time of the accident, and the structure of the parts penetrated, a much more probable conjecture of the course of the ball may generally be formed, than if these circumstances had not been regarded.

On the principle of the density and resistance of parts, attempts have been made to explain the reason of the concussion, or shock, which is given, in many instances, to the whole system by gunshot wounds, and which is sometimes represented to be often attended with grave and even alarming effects, extending not only over the injured part, but affecting the system at large. Thus a shot, striking against a tendon, or a bone, in one of the extremities, will produce a greater concussion, than if it struck only against softer parts. A shot, striking a muscle in action, will produce more concussion, than if it struck against the same part of the same muscle at rest; and a shot, striking the head, or wounding the liver, lungs, or intestinal canal, will generally bring on instantaneous derangement of the whole system. (*T. Chevalier on Gunshot Wounds, part i. sect. 7.*)

Respecting the mechanical effects of the concussion, I am disposed to think with Mr. Guthrie, that they have been exaggerated, and that in reality a more accurate explanation of the disorder of the system might be derived from other considerations. "A shot through the lungs (says he) will cause an instantaneous derangement of the whole system; but the resistance afforded by the part has little to do with it: it is the lesion of the organic functions, intimately connected with life, that is the cause of the derangement. In the same manner, I do not conceive, that the general affection of the system depends alone on the shock received, but on the effect the injury committed has on the nervous system." (*On Gunshot Wounds, p. 26. ed. 4.*)

The swiftness of a musket-ball gradually diminishes, from the instant when it quits the gun until the time of its falling upon the ground. The air first offers a certain resistance to it, which causes it to deviate from a straight line, and occasions a dimi-

nution of its velocity. Every thing against which it strikes, deprives it of a part of its rapidity. In order to understand various peculiarities of gunshot wounds, it should also be recollected, that the ball has a double motion; one of projection, which describes a parabolical curve; the other of rotation on its axis, which sometimes continues after the first has ceased. (See *Dupuytren, Clin. Chir. t. ii. p. 437.*)

A ball, when it strikes a part of the body, may cause several kinds of injury. 1. It may only occasion a contusion, without penetrating the part, on account of its being too much spent, or of the oblique way in which it strikes the surface. 2. It may enter and lodge in the substance of a part; in which case, the wound has only one aperture. 3. It may pierce through and through; and then there are two openings, one at the entrance, the other at the exit of the ball. The circumference of the aperture, where the shot entered, is usually depressed or forced inwards; that of the opening from which it came out, elevated, or prominent. At the entrance there is commonly more contusion, and ecchymosis, than at the exit of the ball. The former opening is generally narrower; the latter wider, and more irregular, especially when the round smooth figure of the ball has been changed by its having struck a bone. The aperture, made by the ball, in the clothes, is always much narrower, than that occasioned in the corresponding integuments. 4. A cannon-ball may tear off a whole limb.

Gunshot wounds differ also according to the kind of body projected, its velocity, and the nature and peculiarities of the parts injured. The projected bodies are mostly bullets, sometimes cannon-balls, sometimes pieces of broken shells, and often, on board of ship, splinters of wood.

As is observed by a most eminent practitioner, the effects of gunshot wounds depend very much upon the manner in which the gun has been loaded, and the distance at which it has been discharged. If a fowling-piece is merely loaded with powder without any wad, and fired off very near the person who receives injury, the integuments are violently contused. But, if the same charge be rammed down, the effects will differ according to the degree of resistance, and the distance of the wounded party. The following case occurred in the practice of Dupuytren. Two persons quarrelled; and one of them discharged a fowling-piece, loaded only with powder, at the abdomen of his adversary, who instantly fell dead. The mouth of the gun had been not more than a foot or two from him. Dupuytren having been juridically required to ascertain the cause of death, found the clothes torn, a hole in the parietes of the abdomen more than an inch in diameter, the intestine wounded, and the wad in the middle of the abdomen. Parties attempting suicide sometimes, in their confusion, forget to put the ball into the pistol. The explosion occasions a violent distention of the parietes of the mouth; and though the vertebral column is not injured, the soft palate is lacerated, and sometimes the lower jaw fractured. (*Dupuytren, in Clin. Chir. t. ii. p. 419.*)

The many accidents which occur in the shooting season, should lead every surgeon to remember that small shot acts in two ways: it either strikes in a mass, "*il fait balle*," as the French term it, which depends upon the goodness of the fowling-

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piece and its nearness to the wounded person, or else it is scattered and each shot hits separately. In the first case, its effects are generally more formidable, than those of a single bullet. (See *Dupuytren*, ib.) I lately visited, with Mr. Broxholm, of Sunbury, a young man who, in taking a fowling-piece out of a cart, received its contents at the inner and upper part of the arm, the mouth of the gun being at the moment close to the limb. The shots, in a mass, passed obliquely through it on the outer side of the humerus, occasioning an opening at their entrance not more than an inch and a half in diameter, but one at their exit much larger, and of an irregular triangular shape: This case was not followed by any very severe consequences, a circumstance to be ascribed partly to the patient's good constitution, and partly to the fortunate circumstances of the bone, as well as other important parts, having escaped injury, and no foreign body having lodged in the part. The wound was, however, attended with more laceration than one caused by a single bullet would have been.

Angular, uneven bodies, such as pieces of iron, hammered leaden bullets, cut lead, fragments of bombshells, &c., produce far more dangerous wounds, than round smooth balls. Several persons were wounded at Paris, in the late disturbances, by irregular pieces of balls, which had been broken by striking first against iron bars. (*Clin. Chir.* t. ii. p. 429.) When a leaden ball has been hammered to make it fit the gun, it is lengthened into an oblong irregular body (*un lingot*), which often penetrates in the transverse position, and causes horrible lacerations of every texture which it enters. In sieges, many severe injuries are produced by fragments of stones and brickwork being driven about with immense violence, on being struck by cannon-balls. Even the ground itself is frequently scattered with such force as to cause injuries of a serious nature. Several examples of such occurrences are noticed by M. Larrey, jun. (See *Hist. Chir. du Siège de la Citadelle d'Anvers*, p. 42. &c.) Irregular angular bodies keep up inflammation, until they are discharged, in the course of the suppuration, or they are extracted. But the textures sometimes become habituated to the presence of a ball, which is regular and smooth, and not of too large a size. A ball of this kind has been known to lodge for a considerable time in the brain, the heart, or lungs. Fibrine is first effused around it, and, becoming organized, assumes the character of villous membrane, from which pus exudes, but which is rendered gradually thinner, puts on a smooth appearance, and at length secretes only a little serosity. Sometimes, however, the serous cyst accidentally inflames, an abscess forms, and fistulæ ensue, which continue as long as the cause of the irritation. According to the researches of Dupuytren, wherever balls lodge for a time, and excite inflammation and suppuration, they are enveloped in a cyst, whose structure resembles that of a mucous membrane; and after a certain period, a communication is established between the cavity of the cyst and some point of the surface, or of the interior of the body. On the other hand, when a ball excites neither inflammation nor suppuration, the cyst presents an organization exactly like that of a serous membrane, and contains between it and the ball a limpid serosity. (See *Dupuytren*, in *Clin. Chir.* t. ii. p. 432.) If, after extracting the

ball from such a cyst, the wound be closed and healed by the first intention, a swelling is apt to form, composed of a collection of serous fluid in the cyst which is left. Hence, Dupuytren recommends either the removal of the cyst with the ball, or filling it with lint.

On account of the contusion, which the parts suffer, from the violent passage of the ball through them, a part of the textures surrounding the wound is most commonly deadened, and must afterwards be thrown off in the form of a slough. Hence, such wounds are generally prevented from healing by the first intention, and most of them necessarily suppurate. This does not take place equally in every gunshot wound, nor in every part of the same wound; and the difference commonly arises from the variety in the velocity of the body projected; for, where the ball has passed with little velocity, which is sometimes the case at its entrance, but, still more frequently, at the part last wounded, the injury may sometimes be healed by the first intention. (*J. Hunter*, p. 523.)

I believe that few surgeons of the present day suppose, that the whole track of every gunshot wound must unavoidably suppurate, and slough; but, if this idea prevail, it is plain, from the preceding statement, that the authority of Mr. Hunter cannot be adduced in its support. At the same time I suspect, that few army-surgeons will be inclined to question the correctness of Mr. Hunter's account of the general occurrence of a degree of sloughing, or of the deadened state of a part of the surface of a wound, particularly in the vicinity of the entrance of the ball, or the truth of his observations about the common necessity of the separation of such slough before the parts will heal; and whether the dead parts be thrown off in small fragments with the matter, or larger portions, the fact is still correct. Dupuytren seems, indeed, not to admit Hunter's exception, for he describes the whole surface of the track of the ball as converted into an eschar, several lines thick, which must be thrown off by an inflammatory process, and suppuration. Hence, says he, union by the first intention is impossible, and the attempt at it frequently dangerous. (See *Clin. Chir.* t. ii. p. 450.)

M. H. Larrey, in his account of the gunshot wounds, which occurred at the siege of the citadel of Antwerp, has recorded several cases, where the solutions of continuity were perfectly regular, and more or less like those made by a cutting instrument. Thus, one which was caused by the fragment of a shell, carried away a portion of the integuments of the chest, leaving a wound of a regular and elliptical shape, resembling that produced by an amputation of the breast. Its sides were brought together without sutures, and a cure was speedily accomplished. (See *Hist. Chir. du Siège de la Citadelle d'Anvers*, p. 138.)

Foreign bodies more frequently lodge in gunshot wounds than any others, and are commonly of three kinds. 1. Pieces of clothing, or other things, which the ball forced before it into the limb. 2. The ball itself. 3. Loose splinters of bone. It is only when the ball strikes the naked flesh, touches no bone, and goes quite through the part, that the wound can be free from extraneous matter. Foreign bodies are the cause of numerous unfavourable symptoms, by irritating sensible parts, and exciting pain, inflammation, spasms, hæmorrhage, long suppuration, &c.; and the more un-

even, pointed, and hard they are; the more likely they are to produce these evils. Hence, spiculae of bone are generally the most to be dreaded.

The great obliquity and length of the fissures, produced in the cylindrical bones by musket-balls, are such as are not remarked in any ordinary fractures. When I was with the army in Holland, in the year 1814, I had in the hospital at Oudenbosch, several fatal compound fractures of the thigh, caused by gunshot violence. The fissures in some of these examples were found to extend two-thirds of the length of the bone. This fact is noticed by Mr. Guthrie: "The fractures extend far above and below the immediate part struck by the ball, and, as far as depends upon my information from the examination of limbs that were amputated, further downwards than upwards; so that, from a fracture in the middle of the thigh, I have often seen fissures extend into the condyles, and cause ulceration of the cartilages of the knee-joint," &c. (*On Gunshot Wounds*, p. 190.)

It is commonly stated that, when a cannon-ball tears off a limb, it produces a violent concussion of the whole body, and a general derangement of all its functions. This, however, is by no means always true. I saw, some years ago, in London, a young sailor, whose arm had been completely torn off at the shoulder, by a cannon-ball from one of the forts at Guadaloupe, in March, 1808: he suffered no dreadful concussion of his body, nor were his senses at all impaired. This case was very remarkable, as the scapula was so shattered, that Mr. Cummings, of Antigua, was under the necessity of removing the whole of it. The patient recovered in two months. The axillary artery did not bleed.

One occasional consequence of gunshot wounds is inflammation and suppuration of some internal viscus, especially of the liver. Mr. Rose classes these occurrences amongst the effects of constitutional irritation arising from local injury, and considers them as striking illustrations of the irregular action in the vascular system, to which that irritation may give rise. He is also of opinion that an explanation of the subject may be deduced from the principles laid down by Mr. Travers. (See *Med. Chir. Trans.* vol. xiv. p. 263.; and *Travers's Inquiry concerning Constitutional Irritation*, 8vo. Lond. 1826.) Several cases of the above nature are related in the *Mém. de l'Acad. de Chir.*; and many patients in the Peninsula, who had undergone secondary amputations for gunshot injuries, were destroyed by affections of their lungs, liver, &c. (See *Guthrie on Gunshot Wounds*, p. 74. *et seq.*) The true cause is phlebitis.

From the circumstance of the inner surface of gunshot wounds being often more or less deadened, they are late in inflaming. This explanation of the fact, as delivered by John Hunter, is the best yet offered. The fact itself of traumatic inflammation being at first generally more indolent than that of a common contused wound, was noticed by Paré; and it gives to gunshot wounds, in their first stage, as Dupuytren observes, a deceitful appearance of mildness (see *Clin. Chir.* t. ii. p. 452.); for afterwards, the inflammation, which is often more considerable at the entrance than the exit of the ball, becomes very intense. But when a ball has fractured a bone, which fracture has occasioned great injury of the soft parts, independently of that caused immediately

by the ball itself, the inflammation will come on as quickly as in cases of compound fracture; because the deadened part bears no proportion to the laceration or wound in general. (*J. Hunter*, p. 524.)

From the same circumstance of a part being often deadened, gunshot wounds frequently cannot be completely understood in the first instance; for, in many cases, it is at first impossible to know what parts are killed, whether bone, tendon, or soft part. Nor can this be ascertained till the slough separates, which often makes the wound much more complicated than was previously imagined. For, some viscus, or a part of some viscus, or a part of some large artery, or even a bone, may have been killed by the violence. If a piece of the intestine has been killed, the contents of the bowel will begin to come through the wound when the slough separates. If a portion of a large blood-vessel is killed, a profuse, and even fatal hemorrhage may come on, when the slough is detached, although no material quantity of blood may have been previously lost. (See *Hunter*, p. 525.) Thus, several days after the receipt of the wound, and when all danger from inflammation is over, a bleeding *per anum*, occasioned by the separation of a slough from some internal vessel, may destroy the patient, as happened in a very interesting case reported by Mr. Guthrie. (p. 13. ed. 2.) A soldier of the 2d battalion of the 44th regiment was shot in the ham at the assault of Bergen-op-zoom, in 1814. There was no hemorrhage for ten days; but, at the end of this period, the popliteal artery gave way, and I was obliged to take up the femoral artery, by which means the bleeding was effectually stopped, and the man recovered. This fact, and another related by Baron Boyer (*Annuaire Méd. Chir. de Paris*, p. 364. 4to. Paris, 1819.), prove, that a ligature on the femoral artery may sufficiently check the current of blood through the popliteal artery to put a stop to hemorrhage from a wound in it; and though such practice in some other cases of wounded arteries is inefficient, on account of the facility with which the blood passes through the anastomoses into the part of those vessels below the ligature (see *ARTERIES*), its general success, in gunshot wounds of the ham, would be of infinite advantage, not only on account of the difficulties of taking up the popliteal artery itself (difficulties ably depicted by Scarpa), but because laying open the inflamed and diseased parts would frequently have a fatal termination. Dupuytren and Delpsch, on the latter principle, have in several instances taken up the femoral artery for the stoppage of bleeding from the tibial arteries in compound fractures; and with complete success. In University College Hospital, I took up the popliteal artery for the suppression of repeated and profuse hemorrhage from the posterior tibial artery, which had been divided in a lad, who, as he was cleaning a window, slipped, and his leg passed through the glass, and the posterior soft parts were divided down to the bone. As the bleeding ceased, the wound was dressed, but, in consequence of returns of hemorrhage, the house surgeon made several unsuccessful attempts to secure the ends of the artery, and the wound had at length assumed a formidable appearance, with considerable swelling and tendency to gangrene. I therefore preferred tying the popliteal artery. The result was entirely successful, no recurrence

of bleeding having been experienced. At the same time, I would have surgeons always recollect the important difference between an aneurismal and a wounded artery; for as, in the first case, there is no outlet for the blood, the transmission of this fluid into the part of the vessel below the ligature may keep up a pulsation in the tumour, and retard the cure of the disease, but is attended with no risk of hemorrhage; while the same free passage of the blood into the wounded portion of a large artery would give rise to dangerous bleeding; and hence, the general necessity of applying two ligatures, one immediately above, the other below, the aperture in such a vessel. A single ligature on the brachial artery fails, as I had an opportunity of seeing in Holland, in a case of gunshot wound, where either that vessel, or the commencement of the radial, or ulnar, gave way, on the loosening of the sloughs; and, as there was considerable swelling, œdema, and inflammation of the limb, threatening gangrene, the surgeon, under whose care the patient was, deemed it right to perform amputation.

I should be sorry, if these observations were to hold out any general encouragement of the wrong and dangerous practice of applying only one ligature above a wound in a large artery, or in any recent case of *false diffused* aneurism. The remarks, delivered above, were chiefly intended to refer to gunshot wounds of the ham, with injury of the popliteal artery, and hemorrhage first breaking out several days after the receipt of the wound, when all the parts behind the knee are enormously swelled, and in a state of inflammation and suppuration. Here the hope of avoiding any additional violence, or injury of the diseased parts behind the knee, may be a good reason for taking the chance of stopping the bleeding by a ligature applied to the femoral artery; a reason, however, which would not exist in the case of a recent wound of the popliteal artery with a knife. At the same time, I believe this means of checking the current of blood will not always suffice, and that occasionally either the dangerous expedient of cutting open the swelling in this diseased state of the hum, and of applying a ligature above and below the aperture in the popliteal artery, must unavoidably be encountered, or amputation performed. Why the first plan has answered in some cases, and not in others, may depend upon the size and condition of the wound, or opening in the artery, and, in examples of sloughing, upon the degree in which the tube of the vessel may have been closed by the adhesive inflammation. Some wrong conclusions may also have been made, respecting the trunk of the vessel being wounded or opened, while in fact only a branch of it was concerned.

When the ball moves with little velocity, the mischief is generally less; the bones are not so likely to be fractured; the parts are less deadened, &c. However, when the velocity is just great enough to splinter a bone, which is touched, the splintering is generally more extensive, than if the impetus of the ball had been much greater, in which case a piece is more likely to be taken out. When the ball moves slowly, it is more likely to be turned by any resistance it may encounter in its passage through parts; and hence the wound is more apt to take a winding course.

The track of a ball is generally more or less tor-

tuous, in consequence of the irregular retraction of the different textures, change of the wounded person's attitude, and the deviations of the projectile itself.

When a ball enters a part with great velocity, but is almost spent, before it comes out again, in consequence of the resistance it has met with, there may be a good deal of sloughing about the entrance, and little or none about the exit, owing to the different degrees of celerity with which the ball traversed the parts. (See *Hunter on Inflammation, Gunshot Wounds, &c.*)

The effects of a ball upon a bone are different in different cases. Sometimes they only amount to a contusion of it; but this accident, though slight in appearance, is frequently followed by perilous consequences. The periosteum, if not destroyed, inflames and separates from the bone, and necrosis ensues, to a greater or lesser extent. If the bone be of a spongy texture, the inflammation may spread far in its internal vascular structure. In the skull, the two tables are almost always attacked by necrosis, and the dura mater inflames consecutively. If the force of the projectile be such as to overcome the resistance of the bones, these are broken with greater facility, in proportion as their hardness is more considerable, and their elasticity less. The flat bones, like those of the cranium and the scapula, are sometimes perforated as cleanly as if a portion of them had been taken out with a circular saw. In other instances, they are more extensively broken and comminuted. A ball may break a part of a long bone, like the tibia, without a fracture being produced, extending through all its circumference; but, more commonly, the middle compact portions of the long bones are reduced into numerous fragments of various shape and dimensions. If the projectile retains but very little impetus, or strikes a bone obliquely, this may be fractured, without being at all splintered. Of this, two instances are recorded by Dupuytren. (*Clin. Chir. t. ii. p. 442.*)

Gunshot wounds may have either one or two apertures, according as the ball has lodged, or passed quite through the part. In some cases, the openings are diametrically opposite each other; in others, they are not so, the direction of the ball having been changed by the resistance which it met with from a bone, cartilage, tendon, &c. Thus a ball has been known to enter just on the inside of the ankle, and come out near the knee; to enter the forehead, and come out at the temple, &c. (*Richerand, Nosographie Chir. t. i. p. 219. edit. 2.*) Dr. Hennen mentions an instance, in which a ball entered near the pomum Adami, and, after running completely round the neck, was found in the very orifice at which it had entered. "This circuitous route is a very frequent occurrence, particularly when balls strike the ribs, or abdominal muscles; for they are turned from the direct line by a very slight resistance indeed, although they will at times run along a continued surface, as the length of a bone, along a muscle, or a fascia, to a very extraordinary distance." Dr. Hennen refers to cases, in which the ball traversed almost the whole extent of the body and extremities. "In one instance, which occurred in a soldier, with his arm extended in the act of endeavouring to climb up a scaling-ladder, a ball, which entered about the centre of the humerus, passed along the limb, and over the posterior part of the thorax, coursed among the

abdominal muscles, dipped deep through the glutæi, and presented on the forepart of the opposite thigh, about midway down. In another case, a ball, which struck the breast of a man standing erect in the ranks, lodged in the scrotum." (*Principles of Military Surgery*, p. 34. ed. 2.) Le Vacher saw a case, in which a ball entered the front of the thigh, and came out at the point diametrically opposite, without the femur being broken. Facts of this description are all capable of explanation, by reference to the laws of projectiles, already noticed.

Indeed, as Dupuytren observes, nothing is more diversified and extraordinary than the course of projectiles amidst the textures of the body. In 1830, a combatant, on the *Pont d'Arcole*, was struck by a ball, which entered at the internal angle of the left eye; and the wound, which took a direction backwards, and rather to the right, seemed as if it had gone quite through the head. However, the ball, after passing below the cranium, made its exit above the right shoulder. The man soon recovered, without any dangerous symptoms. Another man was wounded in the head, on the *Pont Notre Dame*; the ball went through his hat, travelled along the right side of the nose, penetrated the upper lip, broke four of the upper teeth, fractured the lower jaw, came out behind the chin, entered again at the root of the neck behind the clavicle, and lodged in the cushion of the left shoulder. This patient died of inflammation of the chest. (See *Clin. Chir.* t. ii. p. 448.)

When there is only one opening, we may infer, that the wound contains a foreign body. An exception to this observation occurs, however, when a ball, instead of tearing the clothes, or linen, carries a portion of them, in the form of a pouch, into the wound, and, when such portion of the clothes is withdrawn, the ball falls out; and if this circumstance be not noticed, the presence of a single opening may lead to the idea, that the bullet is lodged in the part. An instance of this kind is cited by Paré, for the purpose of refuting the former notion, that the ball burnt the parts. A case, in which a piece of a shirt was carried in this manner four inches into the flesh, is mentioned by Mr. Guthrie (p. 20. ed. 2.).

In 1814, a French soldier, wounded under the walls of Paris, was brought to the Hôtel-Dieu. On examining the upper part of the leg, Dupuytren found some cloth forced into the tibia; and on pulling it out, which required considerable effort, a ball was extracted, completely enveloped in a piece of gaiter. Amongst the wounded brought into La Pitié, in July 1830, was one case, in which a ball had penetrated the abdomen, propelling before it a portion of the shirt, which was not torn, and served very usefully to facilitate the extraction of the projectile. (See Dupuytren, in *Clin. Chir.* t. ii. p. 426.) It is possible also for a ball to be stopped immediately it has entered the body, and then to be ejected by the elasticity of the parts, against which it strikes, as the cartilages of the ribs. (Guthrie, p. 19. ed. 2.)

When there are two apertures made by one shot, the ball, or at all events a portion of it, has escaped; but pieces of the clothes, &c. may still be lodged in the part. Care must be taken, however, not to confound with these cases others, in which the plurality of openings has been made by different balls.

This is the common thing, (observes Dr. J.

Thomson), for a ball, in striking against the sharp edge of a bone, to be split into two pieces, each of which takes a different direction. Sometimes it happens, that one of the pieces remains in the place which it struck, while the other continues its course through the body. Of a ball, split by the edge of the patella, I have known one half pass through at the moment of the injury, and the other remain in the joint for months, without its presence there being suspected. In the same manner, I have known a ball divided by striking against the spine of the scapula, and one portion of it pass directly through the chest, from the point of impulse, while the other moved along the integuments, till it reached the elbow-joint. But, the most frequent examples of the division of bullets, which we had occasion to see, were those which were produced by balls striking against the spherical surface of the cranium. It sometimes happens, that one portion of the ball enters the cranium, while the other either remains without, or passes over its external surface. Not unfrequently, in injuries of the cranium, the balls are lodged between its two tables, in some instances much flattened, and altered in their shape, and, in other instances, without their form being changed." From these facts, it must be evident, that even when a gunshot wound has two orifices, the surgeon cannot be certain, that the bullet has not been divided, and that no portion is lodged, unless the entire ball itself happen to be found. (See Thomson's *Obs. in Military Hospitals in Belgium*, p. 37. &c.) This part of the subject is noticed by all the best practical writers, and especially by Barons Larrey and Dupuytren. When a ball strikes against hard substances, it is liable, says Dupuytren, to be changed in its shape, flattened, or broken into fragments, so as to produce injuries, not readily accounted for. Thus, in one case mentioned by him, the ball struck against the sharp edge of the right tibia, and was split into two pieces, each of which passed through the calf of that limb, and then lodged in the calf of the other. Thus, five openings were made by a single ball. (Dupuytren, *Clin. Chir.* t. ii. p. 428.) In July 1830, a Swiss soldier was brought into the Hôtel-Dieu, wounded by a ball, which had fractured the right parietal bone, and been split into two pieces, one of which escaped through the scalp, whilst the other passed through the posterior lobe of the brain, and lodged upon the tentorium. About the same period, another individual was admitted into the same hospital, with the occiput fractured, by a ball which was split, but fixed with the margin of the bone in its cleft. (Dupuytren, *Clin. Chir.* t. ii. p. 444.) A single ball, though not split, may produce several openings. Mr. H. Larrey mentions a case, in which a ball passed through the hand, then the skin of the groin, and next the left buttock, so as to cause six openings. (See *Hist. Chir. du Siège d'Anvers*, p. 67.) Mr. Guthrie once spoke to me of another instance, in which six openings were left by a single ball, that passed through both thighs and the scrotum.

As the ends of the vessels are contused and torn, gunshot wounds have generally at first little propensity to bleed seriously, unless vessels of importance happen to be injured. In the beginning there may even be little hemorrhage; though a considerable artery be so hurt, that it afterwards sloughs, and a dangerous, or fatal, bleeding arises.

Thus (as I have already mentioned), in one of my own patients, who had received a musket-ball through the ham, the popliteal artery gave way about ten days after the injury, and compelled me to take up the femoral artery; and, in the Elizabeth Hospital at Brussels, amongst the patients under the care of my friend Mr. Collier and myself, about a week after the battle of Waterloo, the cases of hemorrhage, on the loosening of the sloughs, were numerous, not at all coinciding with a calculation, that the proportion of such examples, requiring the ligature of arteries, is only three or four in 1000. (*Guthrie on Gunshot Wounds*, p. 8. ed. 2.) In Holland, the truth of Mr. Hunter's observation upon this point appeared to me to be completely confirmed.

It has long been known, that a limb may be torn, or shot off, even near to the trunk of the body, and hardly any hemorrhage arise. We had numerous proofs of this fact after the battle of Waterloo. I had under my care a man of the rifle brigade, whose arm was shattered to pieces as high as the shoulder, yet there was no hemorrhage. I amputated the thigh of a Dutch soldier, whose leg had been completely shot off by a cannon-ball; but there was no hemorrhage before the operation. At Mersham, in 1814, I saw a case, in which the greater part of the clavicle, scapula, and many adjacent parts, had been carried away by a cannon-ball; and yet no bleeding of consequence occurred. The reason why a gunshot wound sometimes does not bleed much, though an artery of magnitude is torn, is because the vessel is nearly in the same state as when torsion has been practised; that is to say, the end of it has been violently stretched, so as to draw out the elastic external coat from the inner ones, which remain in the form of irregular folds, within the mouth of the artery, constituting a kind of barrier against the escape of the blood. But, if the artery be only partly torn through, this change is not sufficiently complete, and a profuse and fatal hemorrhage may immediately follow the wound. The eschar and clot that forms within the vessel, are also additional obstacles to the bleeding.

Sometimes, after a limb has been shot off, the large arteries do not bleed in amputation. "We saw a man (says Dr. Thomson), whose leg had been shot off by a cannon-ball; in amputating his limb above the knee, the arteries of the thigh were not perceived to bleed; nor did any of them afterwards require to be tied. A case, similar to this, also presented itself, in which the arm had been shot away close to the shoulder-joint."

Sometimes the contusion, produced by a cannon-ball, or the passage of a bullet in the vicinity of a large artery, seems to cause a laceration of the inner coat of the vessel, and a subsequent obliteration of its cavity by the effusion of coagulable lymph. Facts in proof of this statement are recorded by Dr. Thomson. (See *Obs. in the Military Hospitals in Belgium*, p. 34, 35.)

In general, the most dangerous kind of hemorrhage from gunshot wounds is that named *consecutive*, or *secondary*. Either the artery has been totally, or partially divided. In the first case, the slough immediately produced by the ball, the clot, which forms in the cavity of the vessel up to the first collateral branch, and (as I should add) the irregular folds of the inner coats, detached from the outer, put a stop to the bleeding. But,

frequently, as soon as the circulation acquires strength, these impediments are overcome, and hemorrhage comes on. In other cases, they continue to be efficient, until the whole internal surface of the wound, and the lacerated and disorganised part of the artery, are detached and loosened, as suppuration advances. But, in this stage, if the end of the obliterated artery is too short, if the adhesive process is incomplete, or the patient moves about too much, the artery will give way. As Dupuytren observes, it is most commonly about the tenth, fifteenth, or even as late as the twentieth day, that these secondary hemorrhages happen, without any particular symptom to give warning of their occurrence, excepting a thin bloody serosity, which is sometimes discharged from the wound. Hence the necessity for the utmost vigilance at the period, when such bleedings are to be expected. They are infinitely more perilous than primary hemorrhages, both on account of the patient's weakened state, and the condition of the arteries and surrounding textures, occasioned by the inflammation. In cases of primary hemorrhage, the artery may be readily distinguished, taken hold of, and tied; and the ligature does not separate before the expiration of several days, when the process of obliteration has been insured. But, in secondary hemorrhages, circumstances are different. The tissues are retracted and converted into a compact mass, and the vessel, which can hardly be discerned, is easily cut through by the ligature, or, at all events, the latter falls off before the obliteration has acquired adequate strength. Hence, bleeding frequently comes on again in the course of a few hours. In cases of this description, Dupuytren observes, there is no other resource but that of taking up the trunk of the artery at a greater or lesser distance from the accidental opening in it. (See *Clin. Chir.* t. ii. p. 465.)

Still later forms of secondary hemorrhage occur in gunshot wounds, complicated with hospital gangrene, or bad compound fractures, which have been in the suppurative stage for weeks, or months. In these last examples, even small arteries may pour out at once, or by repetition, a quantity of blood, sufficient to bring the debilitated patient quickly to the grave. The blood does not issue from one individual vessel, but from the whole surface of the wound, as from a sponge, and is so thin as to resemble blood and water.

Gunshot wounds, particularly those of the limbs, are frequently complicated with broken bones, which are a principal source of danger. The bones are seldom fractured merely in one place; but almost always splintered into numerous irregular pieces, which the violence of the shock often separates from the rest of the bone, and forces into the surrounding soft parts. If, to such mischief, be added that which the soft textures experience from the direct action of the projectile itself, the laceration of muscles, tendons, fasciæ, nerves, and blood-vessels, there will be exemplified, as Baron Dupuytren justly remarks, a combination of every thing bad, which a complicated fracture can be attended with. In no situation is the danger greater, than in the leg and thigh; in the former, on account of the thickness of the muscles and fasciæ; in the latter, on account of the number and size of the bones. The immediate consequence of the fracture; and the presence of splinters, is a violent inflammation, commencing in the

broken part, and propagating itself to the whole limb. The textures, most seriously contused, are frequently seized with gangrene; and, after the sloughs have been detached, extensive portions of bone are left exposed. This is very often noticed in fractures of the leg. The suppuration becomes profuse; the fragments of bone lie inundated in pus, and, becoming denuded, lose their vitality; and the pus itself passes by long sinuses between the layers of muscles, and along the surface of the bone, to a vast distance. If a fragment of bone lie near an artery, its pressure will sometimes cause ulceration of the vessel, and a very late form of secondary hemorrhage. This danger is principally observed in the leg and thigh. M. Pelletan relates a case, in which the bleeding from this cause took place as late as the seventieth day. (See Dupuytren, *Clin. Chir.* t. ii. p. 455.)

This distinguished surgeon divided the spiculae or fragments of comminuted gunshot fractures into *primary*, *secondary*, and *tertiary*. The *primary* are those which are completely detached by the violence, and must perish. They are, to all intents and purposes, foreign bodies, entangled in the flesh, or the bone. In the flesh, they give rise to profuse suppuration; in the bones, to less; and, if not removed, they occasion and keep up fistulae. The *secondary splinters* are such as still retain a connection with the periosteum, or the bone. Some of them lose this connection, and then get into the state of *primary splinters*; while others retain their link, and continue to live. In this circumstance, they become almost always enveloped in the callus, and usefully contribute to its formation. The *tertiary splinters* are badly named, being, in fact, the result of necrosis, and corresponding altogether to what are termed *sequestra*. (See Necrosis.) These remain until detached by the same process, which loosens dead pieces of bone in general. So long as this process is not completed, the ends of the fracture cannot unite; and fistulous apertures continue. If these sequestra are too large to be expelled, they may become surrounded by new bone. In such cases, the limb is generally shortened and deformed; the callus bulky and irregular; and the sequestrum may be felt with a probe passed into one of the fistulous openings. Here the indication is to enlarge the opening, trephine, or remove some of the callus, and extract the dead piece or pieces of bone. (See Dupuytren, *Clin. Chir.* t. ii. p. 457.)

TREATMENT OF GUNSHOT WOUNDS.

When the case is merely one of *contusion*, without wound, or disorganisation of textures, the surgeon may sometimes prevent inflammation, or keep it within due bounds. The cure may then be accomplished, without any solution of continuity in the skin taking place. But, more commonly, as Dupuytren observes, acute inflammation comes on; the parts are rapidly seized with gangrene; and, if the mischief be extensive, death is almost sure to follow. Textures, whose organisation has been much injured by contusion, cannot bear inflammation. The mortification sometimes reaches further than first appearances enable us to foresee, and it is only now that the alarming nature of the case is manifest. As for *wounds*, whether they implicate only the soft parts, or the bones also, they are of a kind, which, in general, must

unavoidably suppurate; but the prospect of cure will be greater, in proportion as their depth is less; as they are free from foreign bodies; and the general condition of the patient is satisfactory. (See Dupuytren, *Clin. Chir.* t. ii. p. 451.)

The first thing, in the treatment of a gunshot wound of a limb, is to determine, whether it be most advisable to amputate immediately, or to undertake the cure of the wound. When a bone, especially at a joint, is very much shattered; when the fleshy parts, particularly the great bloodvessels and nerves, are lacerated; when the whole limb has suffered a violent concussion, and is cold and senseless; there is no hope of preserving it. In this case, it is the surgeon's duty to amputate at once, and not to delay till inflammation, fever, and a tendency to mortification come on. But, besides this violent degree of injury, in which the propriety of amputation is obvious, several lower degrees occur, in which it is often a difficult thing to decide whether the operation be necessary or not. Here the surgeon must look not only to the injury, but also to the patient's constitution, and even to external circumstances, such as the possibility or impossibility of procuring good accommodation, rest, attendance, and pure air. But it is impossible to determine the necessity of amputation by general rules. In every individual case, the surgeon must consider maturely the particular circumstances, before he ventures to decide. The grounds against the operation are, the pain which it causes at a period when the whole system is disordered by a terrible injury; the privation of a limb; and frequent examples, in which nature, aided by judicious surgery, repairs the most horrible wounds. The following are the reasons in favour of the operation. By it the patient gets rid of a dreadful contused wound, which threatens the greatest peril, and which is exchanged, as it were, for a simple incised one. The pain of amputation is not of more moment than the pain which the requisite incisions, and the extraction of foreign bodies, would cause in case the operation were abandoned. In cases of gunshot wounds, the loss of the limb cannot be taken into the account; for the surgeon only undertakes the operation where he designs to save the patient's life by that privation, and anticipates that the part itself cannot be preserved. Even if he should deprive the patient of a limb, that, perhaps, might have been preserved, there is this atonement,—that he can furnish him with an artificial leg, which often proves far more serviceable than the limb would have proved, had it been preserved. Should the operation be fixed on, it is to be immediately performed above the wound. (Richter, *Anfangsgr. der Wundarzn.* b. i.)

When amputation is deemed unnecessary, the surgeon, according to precepts formerly in vogue, is to dilate the wound by one or more incisions. Many of the missile weapons employed by the ancients, when received into the body, required incisions before they could be extracted; and this was the case, not only with regard to darts and arrows, but also with regard to bits of stone, pieces of iron, and leaden bullets, which were thrown by means of slings. Celsus mentions the necessity of enlarging the orifices, through which these bodies had entered, and may therefore be justly regarded as the first, who recommended the practice of dilatation in the treatment of wounds made

by leaden bullets. (*Thomson's Obs. in the Military Hospitals of Belgium*, p. 39.)

Such a dilatation has been said to have numerous advantages: to facilitate the extraction of foreign bodies; to occasion a topical bleeding, and afford an outlet for the extravasated fluid in the circumference of the wound; to convert the fistulous form of the track of the ball into an open wound; and, lastly, to remove the pressure and constriction of unyielding fibrous textures from the subjacent inflamed and swollen parts, and thus prevent gangrene. (See *Dupuytren, Clin. Chir.* t. ii. p. 452. and 475.) With the French surgeons, indeed, the practice of dilating the orifice of almost every gunshot wound seems to be the prevailing one, as may be seen by reference to the treatment of the cases which happened at the siege of the citadel of Antwerp. (*H. Larrey, Hist. Chir. du Siège, &c.* p. 68. &c.) I think, however, that the practice should be generally restricted to the circumstances specified by Dr. Hennen, which will be presently noticed.

Experience proves (*Hunter*, p. 529.) that the utility of such incisions has been overrated; that they generally increase the inflammation, which, in these cases, is so much to be apprehended; that wounds which are not dilated, commonly heal more speedily than others which are; and that there are only a few cases, in which incisions are beneficial. In fact, as Dr. Hennen has correctly stated, the knife is now rarely, if ever, employed in the first instance by English surgeons, except for the purpose of extracting balls, splinters of bone, and other extraneous bodies, or for facilitating the application of ligatures to bleeding vessels. (See *Principles of Military Surgery*, p. 49. ed. 2.)

If afterwards the parts inflame and suffer pressure, or constriction from a fascia, then, however, no surgeon would doubt about the necessity of a free division of the unyielding texture.

The injuries, arising from the practice of indiscriminate dilatation (says Dr. Thomson), were very early pointed out by Botallus; and it is singular, how much the opinions of this author, with regard to this point in military surgery, coincide with those of Mr. Hunter. (*Op. cit.* p. 40.)

The cases of gunshot wounds are various. Sometimes the track of the ball lies superficially under the skin, and only has one opening. When it lies in soft parts, and the ball has neither touched a bone, nor a considerable blood-vessel, all incisions are useless, let the wound have one or two apertures. Though dilating the wound has been practised with the view of giving vent to matter, eschars, and foreign bodies, and even its whole track has been laid open, when superficial; yet, the plan has not received general approbation.

As, when a ball has passed with great force, there is often a real loss of substance in the skin, a portion of which is driven inward before the ball, it follows, that the opening of a gunshot wound must be more capacious than that of a punctured one. By the separation of sloughs, the wound becomes still more dilated, so that not only matter, but foreign bodies, which approach the skin, easily find an exit. Besides, incisions commonly soon close again, and, in a few days, the wound falls into the same state, as if no dilatation at all had been made. (*Hunter*, p. 532.)

Fasciæ, or other fibrous textures are often situated about the orifice of a gunshot wound, and

some surgeons have made it a rule always to divide them completely, lest, when the wound inflames, the tension and confinement of parts should cause violent spasms and nervous symptoms, and afterwards impede the discharge of matter and foreign bodies. When they obviously have the first effects, the propriety of dividing them cannot be doubted: but with a mere expectation of the other evils, the real advantage of the practice is questionable. Here, Mr. Hunter remarks, the method would be very good, if tension and inflammation were not a consequence of wounds, or, if it could be proved, that the effects of dilating a part, that is already wounded, were different from those of the first wound; but, the employment of the knife, being only an extension of the first mischief, must be contradictory to common sense, and common observation. (*On Gunshot Wounds*, p. 534. 4to.)

Perhaps, however, Mr. Hunter carried his objections to the dilatation of gunshot wounds rather too far; for the effects of the dilatation, though certainly amounting to additional injury of textures, are different from those of the first wound, inasmuch as fibrous unyielding textures are freely divided, so that they can now neither dangerously compress and constrict the subjacent inflamed parts, nor confine the purulent matter which must soon form.

The extraction of foreign bodies ranks as one of the most urgent motives for the dilatation of the wound, and, no doubt, it is right to remove at first as many of them as possible. Their lodgment irritates the wound, causes violent nervous and inflammatory symptoms, and copious suppuration; circumstances, which the timely extraction of them may prevent. Yet, let it be remembered, that the extraction of foreign bodies is frequently attended with immense irritation, and that, while they lie too firmly fixed in parts, it is often a matter of impossibility. After the sloughs have separated, and the wound has become widened, suppuration frequently does not prevail long before the extraneous substances become loose, spontaneously approach the skin, and easily admit of removal, perhaps without any dilatation.

Hence, it is generally prudent to extract, at first, only such foreign bodies as are near the external opening, quite loose, and removable without much irritation; or such as press on parts of importance, and thereby excite dangerous symptoms. The surgeon should avoid interfering with those which are deeply and firmly lodged in the wound. He should await suppuration, and the detachment of sloughs; and when the foreign bodies become moveable and apparent, he should extract them, with or without an incision, as circumstances may demand. The examination of the wound ought to be made as much as possible with the finger, which irritates less, and feels more distinctly than a probe. A great variety of instruments have been devised, either for ascertaining the position of balls, and other foreign bodies in gunshot wounds, or for extracting them. But, however numerous and diversified bullet-drawers may be, they all admit of being divided into three kinds. The first are constructed on the principle of a pair of forceps; others are shaped more or less like spoons; and a third description are made on the plan of a cork-screw or worm. These last are only designed for cases, in which the ball is fixed in the substance of a bone, and is quite

immoveable; for, if it were lodged in the soft parts, the pressure, requisite for introducing the screw into it, would injure and lacerate the parts at the bottom of the wound. Bullet-drawers, constructed on the plan of forceps, have the inconvenience of not being adapted for seizing the ball, unless their blades can expand, which always stretches the wound, and creates a great deal of irritation. Forceps have been contrived with blades, which may be introduced separately, and then joined together with a screw. When a ball lies superficially, the fingers, or a small pair of forceps, will extract it most conveniently. And, with respect to bullet-extractors, as Dr. Hennen has justly observed, they are completely superseded by the common forceps, or that of Baron Percy, though unfortunately the aid of instruments is most required in tortuous deep passages, where we can least make use of them. (*Principles of Military Surgery*, p. 76. ed. 2.)

The event of the treatment above recommended, is various. Extraneous substances remaining in the wound, either loosen gradually, and come into view, so as to be easily removable; or they continue concealed, prevent the cure, and give birth to a fistulous ulcer. In some instances the wound closes, and the foreign bodies remain in the limb during life, without inconvenience; and in other cases, after a time, they bring on a renewal of inflammation and suppuration. Sometimes a foreign body varies its situation, sinking down, and afterwards making its appearance at a different part, where it may excite inflammation and suppuration. It may change its place slowly, or quickly; when quickly, it leaves no trace of its passage in the textures, which it travels through; when slowly, it becomes enveloped in a serous cyst. This disposition to change of place appertains, not only to sharp, smooth, oblong bodies, but also to globular ones; though it is generally less, in proportion as they have more of the spherical shape. As Dupuytren observes, these facts should not be lost sight of by the surgeon; for it often happens, that a foreign body, which is distinctly felt on one day at a certain point, may be very far from it on the next. Hence, incisions for the extraction of a ball, are never to be made but from the present information acquired respecting its situation. (See *Dupuytren, Clin. Chir. t. ii. p. 434.*)

When the ball lodges in the wound, it is usually difficult to trace it, as the parts collapse after its passage, and leave an opening in the skin much smaller than the ball itself. The ball does not regularly take a straight direction through the injured part, but, often, a very tortuous one, particularly when the ball is nearly spent. In every case, in which it is not easily discoverable, all painful examinations should be abandoned, and the foreign body left in its situation, until its place is better known, and the first inflammation is over.

Sometimes the ball may be both easily found and extracted. At other times, it lodges on the opposite side of the limb, closely under the skin. According to Mr. Hunter, if the integuments, under which the ball is lodged, should be so contused that they will probably slough, they are to be considered as already dead; and an opening is to be made in them for the extraction of the ball. But, when the ball lies so remotely from the skin that it can only just be felt, and the skin itself is

quite uninjured, no counter-opening ought to be made. The wound heals better when the ball is left in, and far less inflammation takes place in the vicinity of this extraneous body, than about the orifice of the wound. A counter-opening always renders the inflammation at the bottom of the wound, as great as at its orifice. It is better to let the wound heal up, and extract the ball afterwards. (See *Hunter*, p. 541.)

To the justness of this advice, Mr. Guthrie does not assent, who assures us, that he has cut out a great number of balls, which were not more than an inch from the surface, and never found any inconvenience ensue. But, when the ball lies three or four inches from the surface, and cannot be distinctly felt, he thinks, that no incision should at first be made with the view of extracting it. (*On Gunshot Wounds*, p. 94, 95. ed. 2.)

Sometimes, the ball penetrates the spongy part of a bone and lodges firmly in it. When it has only entered superficially, it may sometimes be loosened and extracted, by means of an elevator with a thin and somewhat curved extremity, and when it is more firmly fixed, a screw bullet-drawer will sometimes serve for its removal. Should the attempt fail, the employment of a trepan for the removal of the ball is recommended by some writers; while others, fearful of the irritation, difficulty, and effects of such an operation, and recollecting that balls have sometimes remained fixed in bones for many years, without any serious inconvenience, condemn that practice. On the contrary, Mr. Guthrie lays it down as a general rule, subject to a few exceptions, that a ball should never be allowed to remain in a bone; for, says he, "if a ball lodge in the head of a bone, and is not removed, it generally causes caries of the bone, disease of the joint, amputation, or death. If in the shaft of a long bone, necrosis for the most part follows, with months and years of misery. On a flat bone, caries is equally the result, and if it be surrounded by large muscles, sinuses form in various directions, contractions of the limb take place, and the patient drags on for years, careless of life, and ready to submit to any thing to obtain relief. (*On Gunshot Wounds*, p. 91, 93. ed. 2.) In many of these cases, one thing deserves to be recollected, however, that the necrosis, abscesses, and sinuses are less the effect of the lodgment of the ball, than of the violence originally committed on the parts, against which it has struck. Although Baron Larrey only sanctions the attempt to remove balls with a trephine, when they actually produce dangerous effects (*Mém. de Chir. Mil. t. iv. p. 185.*), I am disposed to believe, that whenever the situation of the ball is such, that it can be removed at once from a bone with tolerable certainty, and without too much irritation, the practice is commendable.

As soon as the requisite incisions have been made, and foreign bodies extracted, the prime objects in the treatment of gunshot wounds are accomplished, and the rest is, in reality, not different from the surgery of other wounds.

With regard to probing gunshot wounds, when it is evident that the shot has passed out, and no particular object can be fulfilled with the probe, it is often better to dispense with such examination, at least till suppuration has come on. The need-

less use of a probe causes unnecessary pain and irritation. But when the ball, or any other extraneous substance, has lodged in the wound, and its situation is not immediately evident, it will often be advisable to search for it at once, in order that it may be extracted, if its situation will allow, before inflammation begins. The surgeon, therefore, considering all the circumstances which can assist him in forming a reasonable conjecture of the course of the wound, must give to a probe that curvature, or form, which he thinks most likely to pass readily along it, and must then proceed to make the examination. But, when this is very painful, and the course of the wound obscure, it will often be better to desist, and renew the search when suppuration has taken place, in which stage it can be undertaken with more ease, and a greater prospect of success. When gunshot wounds are inflamed, the tenderness and swelling of the parts are peculiarly strong reasons against painful probings, or efforts to extract foreign bodies, as long as this state lasts. (See *Chevalier on Gunshot Wounds*, p. 67, 68. edit. 3.)

There is no fact in the practice of surgery better established, than that the cramming of narrow stabs and gunshot wounds with lint is particularly hurtful. The only possible reason for doing so in the latter cases must be to keep the orifice of the wound from healing up, and confining extraneous bodies, matter, &c. The apprehension of this happening at first is quite unfounded; for the inside of the mouth of the injured part is often lined with a slough or eschar, which must necessarily be detached before the parts can heal. The first dressings, therefore, should be quite superficial, and of a mild unirritating nature. On the field of battle indeed, it would be well for many of the wounded, if the surgeon were to content himself with applying simple pledgets, and covering the part with linen dipped in cold water. What is termed the *water dressing*, consisting of lint wetted with cold or tepid water, and covered with a piece of oiled silk, is an excellent first application for gunshot wounds. These methods would prove much more beneficial, than the hasty and indiscriminate use of adhesive plasters, sutures, and tight bandages, from the bad effects of which thousands of soldiers have lost limbs, or lives, which, under more judicious treatment, might have been saved. Hunter used to employ fomentations, pledgets of simple ointments, and frequently, over the latter an emollient poultice. In the suppurative stage of gunshot wounds, poultices are generally considered to be the best applications.

In considering the effects of poultices and cold applications upon gunshot wounds, Mr. Guthrie expresses his decided preference to the use of cold water:—"The inflammation is, in some instances, materially prevented, in many greatly controlled, and, in almost all, very much subdued by it, whilst the suppurative process is not impeded, in the generality of cases, in a degree sufficient to interrupt the subsequent one of granulation. In all simple cases of gunshot wounds, that is to say, flesh wounds, in persons of a healthy constitution, a piece of lint, which has been dipped in oil, or on which some ointment has been spread, is the best application at first to prevent irritation, with two slips of adhesive plaster placed across to retain it

in its situation. A compress, or some folds of linen, wetted with cold water, are then to be applied over it, and kept constantly wet and cold, even by the use of ice, if it can be obtained, and be found comfortable to the feelings of the patient. A roller is of no use, except to prevent the compress from changing its position during sleep, and is, therefore, at that period useful; but, as a surgical application, it is useless, if not positively injurious, because it binds a part, which ought, to a certain extent, to swell, and by pressure causes irritation. Rollers ought not to be applied surgically until after some days have elapsed; and it is inexpedient to employ them in the field of battle, even if they were useful, except where some parts are to be kept in position; because, when they are applied in the first instance, they soon become stiff and bloody, are for the most part cut, and are seldom preserved after the first dressing, so as to become useful at the period when the surgical application of a roller is indispensable." To this just censure of the wrong employment of rollers, Mr. Guthrie annexes some remarks, in which he enters into a general condemnation of poultices, as applications to gunshot wounds, believing, that in many instances, cold water may be employed, with the best effect, during the whole progress of the cure. These remarks are tempered with the following admission:—"Cold water is not, however, an infallible, or even always an advantageous remedy: there are many persons, with whom cold applications do not agree; there are more, with whom they disagree after a certain period; and, in either case, they should not be persisted in. Cold does no good in any stage of inflammation, when the sensation accruing from the first application of it is not agreeable to the feelings of the patient; when, in fact, it does not give relief; for, if it produces a sensation of shivering, or an uncomfortable feeling of any kind, with stiffness of the part, it is doing harm, and a change to the genial sensation of warmth will not only prove more agreeable, but more advantageous. This occurs in general about the period when suppuration has taken place; and cold, in such cases, is preventing the full effect of the action which warmth encourages. Fomentations are then proper: and, if a poultice be preferred for convenience, by day or by night, an evaporating one of bread will be found sufficient. In the spring of the year, the marsh mallow makes an excellent poultice, and so do turnips, gourds, carrots, &c. independently of oatmeal, linseed meal, Indian meal, and other farinaceous substances. In all those cases, where a poultice is resorted to, as much attention is to be paid to the period of removing, as of applying it. It is used to alleviate pain, stiffness, swelling, the uneasiness arising from cold, and to encourage the commencing, or interrupted, action of the vessels towards the formation of matter; and, as soon as the effect intended has been gained, the poultice should be abandoned, and recourse again had to cold water, with compress and bandage." (p. 62—67. ed. 2.) Although I fully coincide with Mr. Guthrie, respecting the general advantage of cold water, the dangers of tight bandages, and the bad effects of continuing poultices too long, I do not join him in many of the sentiments which he has expressed about these last invaluable applications. On the contrary, I appreciate them as the best means, wherever a slough is to be

thrown off, or matter is decidedly forming, and, as these effects are very frequent in cases of gunshot wounds, my own opinion of the utility of cold applications is limited to the first three or four days after the receipt of the injury. Nor ought cold applications ever to be continued, where the torpor, low temperature, and languid circulation in the limb, indicate a risk of gangrene. Hence, when a principal artery is tied, their employment is always wrong and hazardous. At the same time, I have no hesitation in declaring my firm belief, that fifty times more mischief has been done by tight rollers applied to recent gunshot wounds, than by either poultices or cold applications.

Gunshot wounds generally demand the employment of antiphlogistic means, just as other cases, attended with equal inflammation. When they are in the inflamed state, the application of leeches is highly proper. In these cases bleeding is recommended, and in such a manner as if it were of more service in them, than wounds in general. But the necessity for the practice is really not greater than in other wounds, which have done the same degree of mischief, and from which the same quantity of inflammation and other consequences are expected. Bleeding is certainly proper here, just as it is in all considerable wounds, attended with a strong full habit, and great chance of extensive inflammation, and much symptomatic fever. In every instance, however, the practitioner must take particular care not to be too bold in the practice of bleeding; for when the patient is reduced below a certain degree, his strength is inadequate to support the large and long-continued suppurations, which often cannot be avoided. (See *Hunter*, p. 563, 564.)

Gunshot wounds, in crowded military hospitals, especially when they are established in unhealthy, low, damp situations, and due attention is not paid to ventilation and cleanliness, are liable to be attacked by hospital gangrene, a most serious and dangerous complication. (See *Hospital Gangrene*.) Another formidable and generally fatal complication, is traumatic tetanus. (See *Tetanus*.) A third dangerous complication is *erysipelas*, particularly the phlegmonous kind.

The plan of removing the first dressings too soon is as injurious in gunshot wounds as other cases, by creating a premature disturbance of the parts. This observation is particularly true, where dry lint has been used, and it is adherent to the wound. Unless the occurrence of bleeding, severe pain, or other untoward symptoms, were to render a different line of conduct necessary, I think such dressings should rarely be removed before the end of the fourth day. And if cold water has not been continually applied over the lint, so as to keep it moist, or if such lint has not been spread with some mild saline, or dipped in oil, I deem it a good rule to apply an emollient poultice over it the evening preceding the morning on which the dressings are to be first changed. By this means, they will be loosened, and admit of being taken away without pain or irritation. With the same view, plenty of warm water should be squeezed from a sponge, and allowed to fall upon the dressings. Pledgets of oil, or ointment, should generally be taken off earlier than dry lint, for they are less adherent, and, in warm weather, soon become rancid and irritating.

For a few days, the matter seldom assumes a healthy appearance; but as soon as the sloughs separate, it then becomes of a proper quality, and the wound is to be treated as a simple abscess. As Dupuytren remarks, when the patient has got through all the dangers of the earlier stages of gunshot wounds, hemorrhage, gangrene, phlegmonous erysipelas, tetanus, and other perils, still await him. The fractured bones unite with difficulty; sinuses and deep abscesses form in the limb; the periosteum becomes detached; the bones denuded; and attacked by necrosis. Nor is this all the mischief: fractures of bones, abounding in spongy texture, are liable to be complicated with inflammation of the cellululo-vascular membrane, investing the areolæ of that texture, and its numerous veins. This inflammation, which is always followed by necrosis, sometimes extends a great distance, and this more especially in cases where the ball has occasioned a violent concussion of the bone.

Sometimes the healing process does not commence though suppuration has prevailed a considerable time. On the contrary, notwithstanding the exhibition of tonics, and a generous diet, the suppuration ceases to proceed favourably, and the wound becomes unhealthy, and the matter thin. The bones show no disposition to unite, and the patient, reduced by hectic symptoms, is rapidly approaching dissolution. In this state, life may sometimes be preserved by amputation.

OF AMPUTATION IN GUNSHOT WOUNDS.

The 2d edition of this Dictionary, published in 1813, contained all the valuable observations of Baron Larrey in favour of *immediate* amputation, in every instance in which the operation is considered indispensable. Since then, the public have been favoured with several good practical books, in which the propriety and necessity of early or immediate amputation in such cases are urgently inculcated, and the truth of the doctrine is illustrated by additional facts. It is to be observed, however, that for during the last two hundred years, there have always been some advocates for this judicious practice. "Du Chesne (says Dr. J. Thomson) is the first writer on military surgery, in whose works I have found the recommendation to amputate in the severer injuries of the extremities; and it is worthy of remark, that he directs the operation to be performed before inflammation and other constitutional symptoms shall have supervened." (See *Traité de la Cure générale et particulière des Archusades*, par Jos. Du Chesne, Paris, 1624, p. 143.; and *Thomson's Report*, &c. p. 160.) Wiseman not only recommended and practised immediate amputation, but the same thing was not unfrequently done by the military surgeons of his time. (*Chirurgical Treatises*, by R. Wiseman, 3d ed. Lond. 1696, p. 410.) The celebrated Le Dran, in his excellent little manual of military surgery, declared himself an advocate for *immediate* amputation, in all cases in which that operation from the first appears to be indispensable. Le Dran has, at the same time, stated briefly, but most distinctly, the comparative advantages of that practice, with those which may be expected by delay. (See *Traité ou Réflexions tirées de la Pratique sur les Plaies d'Armes à feu*, par H. F. Le Dran, à Paris, 1737.) Ranby, who was serjeant-surgeon to King George II., entertained similar opinions to

those of Le Dran, with regard to the utility of immediate amputation. In order to give immediate relief to the wounded, and to facilitate the performance of the necessary operations, Ranby proposed, that the surgeons, during battle, should be collected into small bodies, and stationed in the rear of the army. (See *The Method of treating Gunshot Wounds*, by John Ranby, ed. 3. p. 29. Lond. 1781.)

After the battle of Fontenoy, in the year 1756, the Royal Academy of Surgery in France offered a prize for the best dissertation on the gunshot injuries requiring immediate amputation, and on other cases of the same nature, where the operation, though deemed inevitable, might be delayed.—“*L'amputation étant absolument nécessaire dans les plaies compliquées de fracas des os, et principalement celles qui sont faites par armes à feu, déterminer les cas où il faut faire l'opération sur le champ, et ceux où il convient de la différer, et en donner les raisons.*” The prize was adjudged to M. Faure, the main object of whose paper was to recommend delaying the operation. This side of the question has found some modern advocates of distinguished talents and celebrity. Suffice it to mention the names of Hunter, Baron Percy, and Lombard. It is, however, only justice to M. Faure to state, that, though he regarded immediate amputation as full of danger, he admitted that there were several kinds of injuries of the extremities, in which it was indispensably and immediately required. “The enumeration (says Dr. Thomson) which this author has given of these injuries is more full and distinct than any which had been published before his time; and, what may appear singular, it does not differ, in any essential respect, from the enumerations given by later writers, who, in combating his opinions, have represented him as an enemy to amputation in almost all injuries of the extremities.” (See *Obs. made in the Military Hospitals in Belgium*, p. 169.)

In 1792, Baron Percy, who was a few years ago at the head of the medical department of the French army, published a book, in which he gives a preference to delaying amputation at first, even in cases where it is certain that the operation cannot ultimately be dispensed with. (See *Manuel de Chirurgien d'Armée*.) So late as 1804, Lombard, professor in the Military Academy of Strasbourg, defended the doctrines of M. Faure. (See *Clinique Chir. des Plaies faites par Armes à feu*.)

Although, in France, the Academy of Surgery thought proper to decree the prize to M. Faure, whose doctrine thus received the highest approbation, yet, in that country, very opposite tenets were set up by some men of distinguished talents and extensive military practice. Thus Le Dran, in his work on gunshot wounds, published in 1737, expressly states, “That when the amputation of a limb is indispensably necessary in the case of a gunshot wound, it ought to be done without delay.” (*Aphorism 9*.) De la Martinière in particular also wrote some excellent arguments in reply to Bilguer; arguments which, I think, would do honour to the most accomplished surgeon of the age in which we live. (*Sur le Traitement des Plaies d'Armes à feu*, in *Mém. de l'Acad. de Chir.* t. xi. p. 1. edit. in 12mo.) M. Boucher, of Lisle, was an advocate for the same side of the question. (See *Obs. sur des Plaies d'Armes à feu*, &c., in

Mém. de l'Acad. de Chirurgie, tom. v. p. 276. &c. edit. in 12mo.) Schmucker, who was many years surgeon-general to the Prussian armies, published in 1776 an essay on amputation, in which he particularly mentions, that, during his stay at Paris, in 1738, the surgeons of the Hôtel-Dieu had been in the habit of performing immediate amputation in severe injuries of the extremities. He also declares himself an advocate for operating immediately in all cases, in which amputation from the first appears to be necessary, and insists, in a particular manner, on the increased danger which he had seen arise from the operation during the second period. He gives (as Dr. J. Thomson has observed) a minute and circumstantial enumeration of those injuries, both of the upper and lower extremities, in which he conceived amputation to be necessary, and in many of which he had actually performed it with great success. Schmucker appears to Dr. Thomson to have given a better account, than any preceding military surgeon, of the injuries of the thigh; and from the results of his experience, he was led to believe, that, though compound fractures of the lower part of the thigh-bone might, in favourable circumstances, be cured without amputation, yet that this operation is peculiarly necessary in all cases in which the fracture is situated in or above the middle of that bone. (J. L. Schmucker, *Vermischte Chirurgische Schriften*, b. i. Berlin, 1785.) With the foregoing high authority we have to join one of not less celebrity, namely, that of Baron Larrey, who has proved most convincingly, that when amputation is to be done in cases of gunshot wounds, nothing is so pernicious as delay. (See *Mém. de Chir. Militaire*, t. ii. p. 451. &c.)

The principles inculcated by Baron Larrey are, in point of fact, the same as those which were so strenuously insisted upon by Pott, whose principal remarks on the necessity of amputation in certain cases, are detailed in another part of this publication. (See *Amputation*.) Pott, indeed, was not an army-surgeon, and what he says was not particularly designed to apply to military practice; but he has represented, as well as any body can do, the propriety of immediate amputation for injuries, which leave no doubt that such operation cannot be dispensed with.

Mr. John Bell, amongst the moderns, appears likewise to have much merit, for the able manner in which he defended the propriety of early amputation, long before the sentiments of later writers were ever heard of. He distinctly states, that “amputation should, in those cases where the limb is plainly and irrecoverably disordered, be performed upon the spot.” (See *Discourses on the Nature, &c. of Wounds*, p. 488. edit. 3.) In short, notwithstanding all the modern pretensions to novelty upon this interesting topic, we must acknowledge, with Dr. Thomson, that the evidence in favour of the advantages of immediate amputation has always preponderated over that for delay. (See *Report of Obs. &c.* p. 225.)

The strongest body of evidence upon this matter, is undoubtedly adduced by Baron Larrey, whose situation, at the head of the surgical department of the French armies, afforded him most numerous opportunities of judging from actual experience. “Upon this subject (says he), now that twenty years of continual war have carried our art to the highest pitch of perfection, there can only be one

opinion. It is after having incessantly directed the medical service all this time in quality of head-surgeon and inspector-general of the armies, that I proceed to discuss the different opinions delivered in the Academy, and to settle definitively this great question, which I regard as the most important in military surgery.

"If we are to be told that the amputation of a limb is a cruel operation, dangerous in its consequences, and always grievous for the patient, who is thereby mutilated; that, consequently, there is more honour in saving a limb, than in cutting it off with dexterity and success; these arguments may be refuted by answering, that amputation is an operation of necessity, which offers a chance of preservation to the unfortunate, whose death appears certain under any other treatment; and, that if any doubt should exist of amputation being absolutely indispensable to the patient's safety, the operation is to be deferred, till nature has declared herself, and given a positive indication for it. We are also justified in adding, that this chance of preservation is at the present day much greater, than at the epoch of the Academy of Surgery. We learn from M. Faure, that of about three hundred amputations, performed after the battle of Fontenoy, only thirty were followed by success, whilst on the contrary (says Baron Larrey), we have saved more than three-fourths of the patients, on whom amputation has been done, and some of whom also had two limbs removed." This improvement is ascribed by Larrey, 1. To our now knowing better how to take advantage of the indication and favourable time for amputating. 2. To the better method of dressing. 3. To the mode of operating being more simple, less painful, and more expeditious, than that formerly in vogue.

To the preceding authorities against deferring amputation, in cases of gunshot wounds requiring such operation, I have to add Mr. Guthrie, whose opportunities of observation, during the late war in Spain, were particularly extensive. In his work he has detailed the opinions of many eminent foreign and British surgeons, respecting the propriety, or impropriety, of the doctrine of immediate amputation; and he has introduced some good criticisms, particularly on Bilguer's statement of the success, which was experienced in the Prussian hospitals, from not performing the operation. Mr. Guthrie, however, does not recommend amputation to be done immediately, if the patient be particularly depressed by the shock of the injury directly after its receipt; a piece of advice which I believe has in reality been at all times followed, not only in respect to amputations, in cases of gunshot wounds, but all other severe local injuries. "I believe it to be (says Mr. Guthrie), a stretch of fancy in those surgeons who conceive, that, if the knife followed the shot in all cases, the patient would have the best chance of success. No one will deny, that, if the shot performed a regular amputation; it would not be better than to have to do it afterwards: but, if they mean to say the operation should in general be performed immediately after the injury, I can only oppose to them the facts above stated, and the general result of my experience, which is decidedly in favour of allowing the first moments of agitation to pass over before anything be done; a period extending from that to one, six, or eight hours, according to the difference of constitution, and the different injuries that

have been sustained. But, from one to three hours will in most cases be found sufficient." (*On Gunshot Wounds*, p. 226. edit. 2. Lond. 1820.) In the first edition of this gentleman's book, some little want of precision rather concealed his exact meaning, with respect to the period of time, which should generally be allowed to transpire between the receipt of the injury and the performance of amputation; but after all the disposition to controversy upon this point, it appears there is little to fight about, as there is rather a misunderstanding than a difference of opinion. All acknowledge the advantage of doing the operation immediately, when the patient is not faint and depressed by the shock of the accident; all admit the prudence of deferring the use of the knife in other cases until the constitution has revived sufficiently to be capable of bearing the removal of the limb. (See *A. C. Hutchison, Pract. Obs. in Surgery*, 8vo. Lond. edit. 2. and his *Further Observations on the proper Period for Amputating in Gunshot Wounds*, 1817; *Quarrier, in Med. Chir. Trans.* vol. viii.; and *Deswar, in Med. Chir. Journ.* April 1819.)

"Formerly (observes one of the best surgeons which modern times has produced), military surgeons were accused of being too ready to amputate. The experience which I have had, chiefly in 1814, 1815, and 1830, have proved to me the little foundation for this reproach; how many disasters we should have to blame ourselves for, in declining too frequently to amputate; and I do not fear to lay it down as a principle, that, in complicated gunshot-fractures, a greater number of individuals are lost by deferring the operation, than that of limbs saved." (*Dupuytren, in Clin. Chir.* t. iv. p. 238.) This important remark is followed by the particulars of cases, illustrative of its truth. (See also *H. Larrey, Hist. Chir. du Siège d'Anvers*, p. 250.; and *A. L. M. Velpeau, Nouv. Élém. de Méd. Opér.* t. i. p. 282. et seq.)

So far as my experience goes, when the necessity of amputation is undoubted, all delay is improper beyond the short period during which the faintness immediately arising from the injury usually lasts. In the campaign in Holland, 1814, the most successful amputations were those done in the field-hospitals directly after the arrival of the patients, or rather, as Dr. Hennen has expressed it, with as little delay as possible. "While hundreds are waiting for the decision of the surgeon, he will never be at a loss to select individuals, who can safely and advantageously bear to be operated upon, as quickly as himself or assistants can offer their aid; but he will betray a miserable want of science, indeed, if, in this crowd of sufferers, he indiscriminately amputates the weak, the terrified, the sinking, and the determined. While he is giving his aid to a few of the latter class, encouragement and a cordial will soon make a change in the state of the weakly or the terrified; and a longer period and more active measures, will render even the sinking proper objects for operation." (*On Military Surgery*, p. 45. éd. 2.) It appears from some returns collected by Mr. Guthrie, that in the Peninsular the comparative loss, in secondary or delayed operations, and in primary or immediate amputations, was as follows:—

	Secondary.	Primary.
Upper extremities . . .	12 to . . .	1
Lower extremities . . .	3 to . . .	1

The great success attending amputation on the field of battle, was also convincingly proved after the battle of Toulouse. Here, of 47 immediate amputations, 38 were cured, while of the 51 delayed operations, on that occasion, 21 had fatal terminations. (P. 42—44, ed. 1.) After the attack on New Orleans, out of 45 primary amputations, 38 patients recovered, while only 2 of 7 secondary amputations terminated in the preservation of the patients. (*Op. cit.*, p. 294, edit. 2.)

* OF IMMEDIATE AMPUTATION.

When a limb that has received a gunshot wound cannot be saved, amputation should be immediately practised. The first four-and-twenty hours, Baron Larrey observes, are the only time that nature remains tranquil (I should say, she does not remain quiet so long), and we must hasten to take advantage of this period.

In the army, a variety of circumstances make the urgency for amputation still greater. 1. The inconvenience attending the transport of the wounded from the field of battle to the military hospitals, in carriages badly suspended, the jolting of which would produce such disorder in the wound, and in the whole body, that most patients would die in the journey, especially if it were long, and the weather either extremely hot or cold.

2. The danger of a long continuance in the hospitals; a danger which amputation materially diminishes, by changing a gunshot injury into a wound that may be speedily healed, and reducing the causes of fever, and hospital gangrene.

3. The cases in which there is a necessity for abandoning the wounded. In this circumstance, it is of importance to have amputated; for, after the operation, the patients may remain some days without being dressed, and the dressings are afterwards more easy.

OF CASES IN WHICH AMPUTATION SHOULD BE DONE IMMEDIATELY.

First case.—A limb carried away by a cannon-ball, or the explosion of a howitzer, or bomb, requires amputation without loss of time: the least delay puts the patient's life in danger. In this case, the necessity of the practice is inculcated by M. Faure himself, as well as by Schmucker, Richter, Larrey, Dr. Thomson, H. Larrey, junior, (*Hist. Chir. du Siècle d'Anvers*, p. 263.), and every judicious writer upon gunshot wounds.

When a cannon-ball has torn off a limb, amputation of the stump should be performed, in order to procure the patient an even, smooth incision, instead of an irregular, jagged, and highly dangerous wound. As the limb has commonly suffered a violent concussion, is almost bereft of sense, and power of motion, and the bone frequently has a fissure extending some way upward, amputation is sometimes recommended to be done, if possible, above the nearest joint. Were the operation not done, this kind of injury would require large and free incisions, for the extraction of foreign bodies, the shortening of projecting muscles and tendons, and the discharge of abscesses; and, as these incisions are likely to occasion at least as much irritation as amputation itself, without being productive of equal good, the avoidance even of

pain cannot be urged as a reason against the practice. The occasional healing of such wounds only proves, that it is not altogether impossible, in certain instances, to effect a cure without amputation. The surgeon can the more readily make up his mind to amputate, as, in this case, the operation does not occasion the loss of a limb. As for the place of the incision, no one would be justified in amputating above the knee, when the limb is injured at the foot or ankle.

The skin has been violently stretched and lacerated; the muscles have been ruptured and irregularly torn away; the tendons and aponeuroses lacerated; the nerves and vessels divided and forcibly dragged; lastly, the bones broken and smashed to a greater or lesser extent. These first effects are followed by a general, or partial commotion; by a kind of torpor in the injured part, and a good way above the wound; by a painful trembling in the remains of the limb, an event that is singularly afflicting to the patient; and by a local swelling preceeding the erythismus, which quickly shows itself. The hæmorrhage, says Baron Larrey, an accident much more to be apprehended than has been supposed, often comes on a few moments after the injury, and, if prompt succour were not afforded, would put a period to the patient's existence. "I can even declare, that, had it not been for the activity of the train of light surgical carriages (*ambulances volantes*), by means of which the wounded have always been dressed upon the field of battle, many soldiers would have perished from this accident alone."

If the operation is not speedily done, pain commences, fever occurs, and the functions of the system become disordered: the irritation then increases, and convulsive motions take place. If the patient should not be a victim to these first symptoms, gangrene of the stump follows, the fatal consequences of which it is extremely difficult to prevent.

After this short exposition, it is easy to see, that, in this case, amputation ought to be practised immediately, and to delay the operation, and merely apply simple dressings, would be affording time for the bad symptoms to come on.

At Strasburg, during the bombardment of the fort of Kell, in 1792, three volunteers, says Baron Larrey, had limbs shot off by the explosion of shells: one, an arm; another, a fore-arm; and the third, a leg. They were conveyed to the hospital for the wounded in that town, which was superintended by M. Boy. Several days were suffered to elapse before amputation was performed: not one of the patients escaped. At Mentz, after the retreat from Frankfort, several of the wounded, who had had limbs shot off, did not have amputation performed till some time afterwards, and not one of them recovered. At Nice, after the taking of Saorgio, two amputations were practised at the hospital, No. 2, one of the fore-arm, the other of the arm, nine or ten days after the receipt of the injuries: both the patients died. At Perpignan, Baron Larrey visited two soldiers, on whom amputation had been done, seven or eight days after the receipt of gunshot injuries in the action of the 14th of July, 1794. One had had a leg shot off, and the other his right arm. Notwithstanding Larrey's utmost care, he could not save their lives: one died of tetanus; the other of gangrene.

In the month of August, 1805, two cannoniers of the guards, in discharging the artillery, had each a hand shot away, and all the fore part of their bodies burnt. These were the two men, whose office it was to charge the gun. At the moment when they had just rammed down the wad on the cartridge, a spark that had been left unextinguished, from the neglect to keep the touch-hole closed, set fire to the powder: the ramrod was violently repelled by the explosion, together with every thing that was situated in front of the charge. The right hand of one of these soldiers was completely torn off, between the two phalanges of the carpus, and thrown more than two hundred paces. The countershock even threw him down into the ditch of the square of the Hôtel des Invalides. The left hand of the other was torn away, together with the fore-arm at the elbow-joint, and also forced to a considerable distance. The tendons and muscles sustained vast injury, and the worst symptoms would have occurred, if amputation had not been instantly performed. In one case, amputation was done at the wrist; and, in the other, at the lower third of the arm. The two operations were followed by complete success, although the burns upon the face and chest, in both the patients, were serious and extensive.

Second case.—When a body, propelled by gunpowder, strikes a limb, in such a manner as to smash the bones, violently contuse, lacerate, and deeply tear away, the soft parts, amputation ought to be immediately performed. If this measure be neglected, all the injured parts will soon be seized with gangrene: and besides, as Larrey has explained, the accident, which the gravity of the first case produces, will also here be excited. It is only doing justice to the memory of M. Faure to state, that this second case was one, which he also particularly instanced as demanding the immediate performance of amputation. (See *Prix de l'Acad. Royale de Chirurgie*, t. viii. p. 23. éd. 12mo.)

Third case.—If a similar body were to carry away a great mass of the soft parts, and the principal vessels of a limb (of the thigh, for instance), without fracturing the bone, the patient would be in a state demanding immediate amputation; for, independently of the accidents which would originate from a considerable loss of substance, the limb must inevitably mortify. Mr. Guthrie, also says, “A cannon-shot destroying the artery and vein, on the inside (of the thigh), without injuring the bone, requires amputation.” (P. 185.) When, however, the femoral artery, or vein, is injured by a musket-ball, or small canister-shot, this gentleman recommends tying the vessel above and below the wound in it, if the nature of the case be evinced by hæmorrhage. But, he believes, that when both vein and artery are injured, amputation is necessary. (P. 186.) With respect to bleeding from the femoral vein, as it may easily be stopped by moderate pressure, the propriety of using any ligature at all is questionable.

“An injury of the femoral artery (observes Mr. Guthrie), requiring an operation, accompanied with fracture of the bone of the most simple kind, is a proper case for immediate amputation; for, although many patients would recover from either accident alone, none would, I

believe, surmount the two united; and the higher the accident is in the thigh, the more imperious is the necessity for amputation.” (*Guthrie on Gunshot Wounds*, p. 187.)

Fourth case.—A grape-shot strikes the thick part of a member, breaks the bone, divides and tears the muscles, and destroys the large nerves, without, however, touching the main artery. According to Larrey, this is a fourth case, requiring immediate amputation.

Mr. Guthrie seems to coincide on this point with Larrey: “If a cannon-shot strike the back part of the thigh, and carry away the muscular part behind, and with it the great sciatic nerve, amputation is necessary, even if the bone be untouched, &c. In this case, I would not perform the operation by the circular incision, but would preserve a flap from the forepart, or sides, as I could get it, to cover the bone, which should be short.” (*Guthrie on Gunshot Wounds of the Extremities*, p. 184.)

Fifth case.—If a spent cannon-shot, or one that has been reflected, should strike a member obliquely, without producing a solution of continuity in the skin, as often happens, the parts which resist its action, such as the bones, muscles, tendons, fasciæ, and vessels, may be ruptured and crushed. The extent of the internal disorder is to be examined; and if the bones should feel, through the soft parts, as if they were smashed, and if there should be reason to suspect, from the swelling, and a sort of fluctuation, that the vessels are lacerated, amputation ought to be immediately practised. This is also the advice of Baron Percy. Sometimes, however, the vessels and bones escape injury, and the muscles are almost the only parts disordered. In this circumstance, we are enjoined to follow the counsel of De La Martinière, who recommended making an incision through the skin. By this means, a quantity of thick blackish blood will be discharged, and the practitioner must await events. According to Larrey, such incision is equally necessary in the preceding case, previously to amputation, in order to ascertain the extent of mischief.

It is to such injury, done to internal organs, that we must ascribe the death of many individuals, which was for a long while attributed to the commotion produced in the air. (See Ravaton, *Traité des Plaies d'Armes à feu*.)

The incorrectness of this opinion we may easily convince ourselves of, if we carefully consider, 1st, the direction and course of solid hard bodies, and their relation to the air, through which they have to pass; 2dly, the internal disorder observable in the dead bodies of persons, whose death is imputed to the mere impression of the air, agitated by the ball; 3dly, the properties of the elastic substances, such as the integuments, cellular substance, &c. struck by the shot. It is universally agreed amongst philosophers, that a solid body, moving in a fluid, only acts upon a column of this fluid, the base of which column is nearly equal to the surface which the solid body presents. (See *Le Vacher sur quelques Particularités concernant les Plaies faites par Armes à feu*, in *Mém. de l'Acad. de Chirurgie*, t. xi. p. 34. éd. 12mo.)

Thus a cannon-ball, in traversing a space equal to its diameter, can only displace a portion of air, in the relation of 3 to 2, compared with the size of the shot. This fluid, in consequence of its divisibility and homogeneity with the ambient

air, is dispersed in all directions, and confounded with the total mass of the atmosphere. The effects of this aeriform substance amount to nothing, and not a doubt can be entertained, that if there is the slightest solution of continuity of any part of the body, it must depend upon the direct action of the ball itself.

The different movements which the ball describes in its course, and the elasticity of the skin, enable us to explain how internal injuries are produced, without any external solution of continuity, and often even without ecchymosis. The motion communicated to the ball by the power which projects it, is, for a given space, rectilinear. If, at this distance, it strikes against the body, it carries the part away to an extent proportioned to the mass with which it touches the part. But, the ball, after having traversed a certain distance, undergoes, in consequence of the resistance of the air, and the attraction of gravity, a change of motion, and now turns on its own axis, in the diagonal direction.

If the shot should strike any rounded part of the body, towards the end of its course, it will run round a great portion of the circumference of the part, by the effect of its curvilinear movement. It is also in this manner, observes Larrey, that the wheel of a carriage acts, in passing obliquely over the thigh, or leg, of an individual stretched upon the ground. In this case, the results are the same as those of which we have been speaking. The most elastic parts yield to the impulse of the contusing body; while such as offer resistance, as, for instance, the bones, are fractured; and tendons, muscles, and aponeuroses, ruptured or lacerated. Sometimes the viscera are similarly injured.

At first sight, all the parts appear to be entire; but a careful examination will not let us remain long in doubt about the internal mischief. In this case, an ecchymosis cannot manifest itself outwardly, because the extravasation of blood naturally takes place in the deep excavations occasioned by the rupture of the muscles and other parts, and because this fluid cannot make its way through the texture of the skin. Such extravasations can only be detected by the touch.

The foregoing reasoning is supported by experience. How often, says Larrey, have we not seen the ball carry away pieces of helmets, hats, cartridge-boxes, knapsacks, or other parts of the soldier's dress, without doing any other injury? The same ball, perhaps, takes off his arm, often at a time when it is closely applied to the body of his comrade, and yet the latter does not receive the slightest harm. The shot may pass betwixt the thighs, and these members hardly exhibit an ecchymosis at the points, which are gently grazed; the only example in which ecchymosis does occur. In other instances, the ball severs the arm from the trunk, and the functions of the thoracic viscera are not at all injured.

Baron Larrey then relates the following case, which is analogous to one which I saw near Antwerp, and have already mentioned in the foregoing columns. M. Méget, a captain, marching in the front of a square of men, in the heat of the battle of Alzey, 30th March, 1793, had his right leg almost entirely carried away by a large cannon-shot, without the contiguous limb of his lieutenant, who was as close as possible to him, receiving the

least injury. The violent general commotion excited, and the extreme severity of the weather, made this officer's condition imminently perilous. The progress of the symptoms, however, was checked by amputation, which was instantly performed. M. Méget was then conveyed to the hospital at Landau, fifteen leagues from the field of battle, where he got quite well.

Larrey declines relating numerous other analogous amputations, which he has been called upon to practise under the same circumstances. M. Buffy, a captain of the artillery of the army of the Rhine, was struck by a howitzer, his left arm being injured, and his head so nearly grazed, that the corner of his hat, which was placed forwards over his face, was shot away as far as the crown. This officer, the skin of whose nose was even torn off, was not deprived of his senses, and he was actually courageous enough to continue for some minutes commanding his company. At length he was conveyed to Larrey's ambulance, who amputated his arm: in about a month the patient was well.

Larrey expresses his belief, that what have been erroneously termed *wind contusions*, if attended with the mischief above specified, require immediate amputation. The least delay makes the patient's preservation extremely doubtful. The internal injury of the member may be ascertained by the touch, by the loss of motion, by the little sensibility retained by the parts, which have been struck; and, lastly, by practising an incision, as already recommended.

At the siege of Rosas, two cannoniers, having nearly similar wounds, were brought from the trenches to the ambulance, which Baron Larrey had posted at the village of Palau. They had been struck by a large shot, which, towards the termination of its course, had grazed posteriorly both shoulders. In one, Larrey perceived a slight ecchymosis over all the back part of the trunk, without any apparent solution of continuity. Respiration hardly went on, and the man spit up a large quantity of frothy vermilion blood. The pulse was small and intermitting, and the extremities were cold. He died an hour after the accident. Baron Larrey opened the body, in the presence of M. Dubois. The skin was entire; the muscles, aponeuroses, nerves, and vessels of the shoulders were ruptured and lacerated, the scapulae broken in pieces, the spinous processes of the corresponding dorsal vertebrae, and the posterior extremities of the adjacent ribs, fractured. The spinal marrow had suffered injury; the neighbouring part of the lungs was lacerated, and a considerable extravasation had taken place in each cavity of the chest.

The second artilleryman died of similar symptoms, three quarters of an hour after his arrival at the hospital. On opening the body, the same sort of mischief was discovered.

Sixth case.—According to Baron Larrey, when the articular heads of bones are much broken, especially those which form the joints of the foot, or knee, and the ligaments, which strengthen these articulations, are lacerated, by the fire of a howitzer or a grape-shot, or other kind of ball, immediate amputation is indispensable. The same indication would occur, were the ball lodged in the thickness of the articular head of a bone, or were it so engaged in the joint, as not to admit of being extracted.

by simple and ordinary means. (See also Guthrie on *Gunshot Wounds*, p. 197.)

Fractures extending into the joints, and accompanied with great laceration of the ligaments, were cases of gunshot injuries pointed out by M. Faure as indispensably requiring immediate amputation. (See *Prix de l'Acad. de Chir.* t. viii.) Thus we see that this author was not so averse to early amputation as several modern writers have represented. If the voice of experience be not listened to, and amputation be deferred, the parts become disorganised, and the patient's life is put into imminent peril.

It is evident, says Larrey, that in this case, if we wish to prevent the patient from dying of the subsequent symptoms, amputation should be performed before twelve, or at most twenty-four, hours have elapsed. (*Mém. de Chir. Militaire*, t. ii.)

With respect to wounds of the knee, the sentiments of Mr. Guthrie nearly coincide with those of Larrey. "I most solemnly protest (says Mr. G.) I do not remember a case so well, in which I knew the articulating end of the femur, or tibia, to be fractured by a ball that passed through the joint, although I have tried great numbers, even to the last battle of Toulouse. I know that persons, wounded in this way, have lived; for a recovery it cannot be called, where the limb is useless, bent backward, and a constant source of irritation and distress, after several months of acute suffering, to obtain even this partial security from impending death; but, if one case of recovery should take place in fifty, is it any sort of equivalent for the sacrifice of the other forty-nine? Or is the preserving of a limb of this kind an equivalent for the loss of one man?" (*On Gunshot Wounds*, p. 196.)

In the attack of the village of Merksam near Antwerp, early in 1814, a soldier of the 9th regiment was brought to our field-hospital, having received a musket-ball through the knee-joint. The staff-surgeons on duty, and Mr. Curtis, surgeon of the 1st guards, were preparing to amputate the limb, when a surgeon, attached to the 95th, urgently recommended deferring the operation. Superficial dressings were applied, and the patient sent to the rear. He lived several months after the accident, at times affording hopes of a perfect recovery; but, in the end, he fell a victim to hectic symptoms.

Indeed, such is the general unfortunate result of these cases, that Dr. Hennen lays it down as a rule in military surgery, that no lacerated joint, particularly the knee, ankle, or elbow, should ever leave the field unamputated, where the patient is not obviously sinking. (*On Military Surgery*, p. 41. ed. 2.)

According to Mr. Guthrie, fractures of the patella, without injury of the other bones, admit of delay, provided the bone is not much splintered.

Seventh case.—Larrey observes, that if a grape shot, a small cannon-shot, or a piece of a bomb-shell, in passing through the substance of a member, should have extensively denuded the bone, without breaking it, amputation is equally indicated, although the soft parts may not appear to be particularly suffered. Indeed, the violent concussion produced by the accident, has torn away many parts, the medullary substance injured, the vessels are lacerated, the

nerves immoderately stretched, and thrown into a state of stupor; the muscles are deprived of their tone; and the circulation and sensibility in the limb are obstructed. Before we decide, however, Baron Larrey cautions us to observe attentively the symptoms which characterise this kind of disorder. The case can be supposed to happen only in the leg, where the bone is very superficial, and merely covered at its anterior part with the skin.

The following are described as the symptoms: the limb is insensible, the foot cold as ice, the bone partly exposed, and, on careful examination, it will be found, that the integuments, and even the periosteum, are extensively detached from it. The commotion extends to a considerable distance; the functions of the body are disordered; and all the secretions experience a more or less palpable disturbance. The intellectual faculties are suspended, and the circulation is retarded. The pulse is small and concentrated; the countenance pale, and the eyes have a dull moist appearance. The patient feels such anxiety, that he cannot long remain in one posture, and requests that his leg may be quickly taken off, as it incommodes him severely, and he experiences very acute pain in the knee. When all these characteristic symptoms are conjoined, says Larrey, we should not hesitate to amputate immediately; for otherwise, the leg will be attacked with sphacelus, and the patient certainly perish.

Larrey adduces several interesting cases in support of the preceding observations.

Eighth case.—When a large ganglymoid articulation, such as the elbow, or especially the knee, has been extensively opened with a cutting instrument, and blood is extravasated in the joint, Larrey deems immediate amputation necessary. In these cases, the synovial membranes, the ligaments and aponeuroses, inflame, the part swells, cretismus rapidly takes place, and acute pain, abscesses, deep sinuses, caries, febrile symptoms, and death, are the speedy consequences. Larrey has seen numerous subjects die of such injuries, on account of the operation having been postponed through a hope of saving the limb. In his *Mém. de Chir. Militaire*, t. ii. some of these are detailed. Several facts of the same kind are candidly recorded by M. Velpeau. (*See Nouv. Elem. de Méd. Opér.* t. i. p. 284.)

Although a wound may penetrate a joint, yet, if it be small, and unattended with extravasation of blood, M. Larrey informs us, it will generally heal, provided too much compression be not employed. This gentleman believes in the common doctrine of the pernicious effect of the air on the cavities of the body; yet, in this place, it doubt seems to affect him: for, in speaking of the less danger of small wounds of joints, he says, "à quel point cette différence, puisque l'air pénètre dans l'articulation dans l'un comme dans l'autre cas?"

When two limbs have been at the same time so injured, as to require amputation, we should not be afraid of amputating them both immediately, without any interval. We have, says Larrey, several times performed this double amputation with almost as much success as the amputation of a single member. He has recorded an excellent case in confirmation of this statement. (*Mém. de Chir. Militaire*, t. ii. p. 478.)

When a limb is differently injured at the same

GUNSHOT WOUNDS.

time in two places, and one of the wounds requires amputation (suppose a wound of the leg with a splintered fracture of the bone, and a second of the thigh, done with a ball, but without any fracture of the os femoris, or other bad accident.) Larrey recommends us first to dress the simple wound of the thigh, and amputate the leg immediately afterwards, if the knee be free from injury. When it is necessary to amputate above this joint, the less important wound need not be dressed, till after the operation, provided it can be comprehended in the section of the member, or be so near the place of the incision as to alter the indication. When the wound demanding amputation is the upper one, the operation of course is to be done above it, without paying any regard to the injury situated lower down.

Ninth case.—To the foregoing species of gunshot wounds, pointed out by Baron Larrey as urgently requiring immediate amputation, my own experience, and the observations of Dr. Thomson, justify me in adding compound fractures of the thigh from gunshot violence. I am particularly glad that the latter gentleman has devoted a proper degree of attention to these cases; for the opportunities which I had of judging when abroad, incline me to believe, that military surgeons are hardly yet sufficiently impressed with the propriety of immediate amputation in gunshot fractures of the thigh. There were brought into my hospital at Oudenbosch, in 1814, about eight of such cases, all in the worst state for an operation, because several days had elapsed after the receipt of the injuries. All these patients died, excepting one, whose fracture was not far above the condyles, and I do not know, that he ever regained a very useful limb. Another had indeed been rescued by amputation from the dangers of the injury, but was, unfortunately, lost by secondary hemorrhage about three days after the operation. The bleeding was almost instantly suppressed; yet such was the weakness of the patient, that the irritation of securing the vessel, and the loss of blood together, destroyed at once every hope of recovery. Were I to judge then, from my own personal observations in the army, and from some other cases, which I saw under my colleagues, I should, without hesitation, recommend immediate amputation in all cases of compound fractures of the thigh, caused by grape-shot, musket-balls, &c. If there are any exceptions to this advice, they are such as are specified in the article AMPUTATION.

"Gunshot fractures of the thigh (says Dr. J. Thomson) have been universally allowed to be attended with a high degree of danger; indeed, till of late years, very few instances have been recorded of recovery from these injuries. Ravaton acknowledges, that in his long and extensive experience, he had never seen an example of recovery from a gunshot fracture of the thigh; and Bilguer, in his calculations, with regard to those who recover from gunshot fractures, sets aside those of the thigh-bone as being of a nature altogether hopeless. In the present improved state of military surgery, instances sometimes occur of recovery from this fracture; but, of these, the number will be found, I believe, to be exceedingly small, in comparison with those who die, particularly when the fracture has had its seat above the middle of the bone.

According to the observation of Percy, scarcely

two of ten recover, who have suffered gunshot fractures of the thigh-bone. Mr. Guthrie, who seems to have paid great attention to this subject, says, that "upon a review of the many cases which I have seen, I do not believe, that more than one-sixth recovered, so as to have useful limbs; two-thirds of the whole died either with or without amputation; and the limbs of the remaining sixth were not only nearly useless, but a cause of much uneasiness to them for the remainder of their lives." (See *Guthrie on Gunshot Wounds*, p. 191.)

"In fractures by musket-bullets of the lower part of the thigh-bone (says Dr. Thomson) recovery not unfrequently takes place; and both Schmucker and Mr. Guthrie conceive that they are injuries in which amputation may be delayed with safety. It would be very agreeable that this opinion should be confirmed by future experience; but it appears to me, that, before it can be received as a maxim in military surgery, much more extensive and accurate observation than we yet possess, will be required, with regard to the proportion of those who recover without amputation, or after secondary operations, and of those who recover after primary amputation. Of those who had suffered this injury, we saw, comparatively, but a small number recovering in Belgium, and they had been attended with severe local and constitutional symptoms." (See *Obs. made, &c. in Belgium*, p. 247. *et seq.*)

In the article AMPUTATION, I have described the manner in which balls produce fissures of several inches in length in the thigh-bone. This state of the bone, observes Dr. Thomson, must be very unfavourable to recovery, and his conclusion is, that, in general, even in fractures of the lower part of the thigh-bone, a greater number of lives will be preserved in military practice, by immediate amputation, than by attempting the cure, without that operation. "When the bone appears, on a careful examination, to be broken without being much splintered, and when the patient can be removed easily to a place of rest and safety, it may be right to attempt to preserve the limb; but if the bone be much splintered, or if the conveyance is to be long or uncertain, it will, in most instances, I am convinced, be a much safer practice, even in fractures of this part of the thigh-bone, to amputate without delay.

"Musket-bullets, in passing through the femur, near to the knee-joint, produce fissures of the condyles, which generally communicate with the joint. These cases, like those, in which the bullets have passed directly through the joint, require immediate amputation.

"The writings of military surgeons contain but few histories of cases, in which the thigh-bone had been fractured above its middle by the passage of musket-bullets. These are cases, I believe, which have generally had a fatal termination; and the danger attendant upon the amputation which they require, seems long to have deterred surgeons from attempting to ascertain what advantages might be derived from the employment of that operation. Schmucker recommends, and states that he had practised with success, immediate amputation in those cases, in which a sufficient space was left below the groin for the application of the tourniquet. It is curious to remark, in the history of amputation, how long surgeons were in dis-

covering the ease and safety with which the femoral artery might be compressed by the fingers, or pads, in its passage over the brim of the pelvis. M. Boy, from the immediate danger, protracted suffering, and ultimate want of success, which he had observed to follow this kind of injury, urges strenuously the propriety of immediate amputation. Mr. Guthrie's opinion, with regard to the dangerous nature of these injuries, and the advantages to be derived in them from immediate amputation, coincides in every respect with those of Schmucker and Boy. He observes, that those whose thigh-bone has been fractured in its upper part by a musket-bullet, generally die with great suffering, before the end of the sixth or eighth week; and that few even of those escape, in whom that bone has been fractured in its middle part. Of the few whom we saw, who had survived gunshot fractures in the upper part of the thigh-bone in Belgium, scarcely any one could be said to be in a favourable condition. In all, the limbs were much contracted, distorted, and swollen, and abscesses had formed round and in the neighbourhood of the fractured extremities of the bones. In some instances, these abscesses had extended down the thigh; but more frequently they passed upwards, and occupied the region of the hip-joint and buttocks. In several instances, in which incisions had been made for the evacuation of matter, the fractured and exfoliating extremities of the bones, sometimes comminuted, and sometimes forming the whole cylinder, could be felt bare, rough, and extensively separated from the soft parts which surrounded them. In other instances, these extremities were partially enclosed in depositions of new bone, which, from the quantity thrown out, seemed to be present in a morbid degree. It was obvious that, in all of these cases, several months would be required for the reunion of the fractured extremities; that, in some, much pain and misery was still to be endured from the processes of suppuration, ulceration, exfoliation, and ejection of dead bone; that, in some cases, the patients were incurring great danger from hectic fever, and from diarrhoea; that the ultimate recovery in most of them was doubtful, and that of those, in whom this might take place, there was but little probability that any would be able to use their limbs! The sight of these cases (says Dr. Thompson) made a deep impression upon my mind, and has tended to increase my conviction, that this, of all others, the class of injuries in which immediate amputation is most indispensably required." (See *Obs. &c. in Belgium*, p. 254—258.)

Dr. Thompson adds, that what has been said of the danger of fractures, produced by musket-bullets, in the upper part of the femur, is true in a still greater degree of those, which have their seat in the neck or head of that bone. In such instances, Dr. Thompson joins the generality of modern army surgeons in strongly recommending amputation at the hip joint; a subject, of which I have already spoken. (See AMPUTATION.)

Q. GUNSHOT WOUNDS, IN WHICH AMPUTATION MAY BE DEFERRED.

If, says Baron Larrey, it be possible to specify the cases in which amputation ought to be immediately performed, it is impossible to determine *a priori* those, which will require the operation subsequently. One gunshot wound, for example,

will be cured by ordinary treatment, while another, that is at first less severe, will afterwards render amputation indispensable, whether this be owing to the patient's bad constitution, or the febrile disturbance induced. However this may be, the safe rule for fulfilling the indication that presents itself, is to amputate consecutively only in circumstances in which every endeavour to save the limb is manifestly in vain. Upon this point Larrey's doctrine differs from that of Faure.

The latter practitioner admits cases, which he terms cases of the second kind, in which he delays amputation, not with any hope of saving the limb, but in order to let the first symptoms subside. The operation, done between the fifteenth and twentieth day, appears to him less dangerous than when performed immediately after the receipt of the injury. At the above period, according to M. Faure, the commotion, occasioned by the gunshot injury, is dispelled; the patient can reconcile himself to amputation, the mere mention of which fills the pusillanimous with terror in a greater or lesser degree; the debility of the individual is no objection; and it is laid down as an axiom "that the consequences of every amputation, done in the first instance, are in general extremely dangerous." In support of this theory, M. Faure adduces ten cases of gunshot injuries, in which, after the battle of Fontenoy, the operation was delayed, in order that it might afterwards be performed with more success: a plan which, according to the author, proved completely successful. (See *Prix de l'Acad. de Chir.* t. viii. ed. in 12mo.)

This division of cases for amputation into two classes, not consistent with nature, Larrey conceives has been the cause of a great deal of harm. Very often the partisans of M. Faure have not dared to resort in the first instance to amputation, the dangers of which they exaggerate; while on other occasions, they have amputated, consecutively, without any success.

Larrey argues that the effects of commotion, instead of increasing, gradually diminish, and disappear after the operation. He will not even admit that the patient's alarm ought to be a reason for postponing the operation; because the patient, just after the accident, will be much less afraid of the risk which he has to encounter, than at the expiration of the first four-and-twenty hours, when he has had time to reflect upon the consequences of the injury, or of amputation; a remark made by the illustrious Paré.

"Experience agreeing with my theory (says Baron Larrey), has proved both to the army and navy surgeons, that the bad symptoms which soon follow such gunshot injuries, as must occasion the loss of a limb, are much more to be dreaded than those of immediate amputation. Out of a vast number of the wounded, who suffered amputation in the course of the first four-and-twenty hours after the memorable naval battle of the 1st of June, 1794, a very few lost their lives. This fact has been attested by several of our colleagues, and especially by M. Ferroc, surgeon of the ship *Le Jemappe*."

The following is said to be an extract from one of his letters:—

"After the naval engagement of the 1st of June, 1794, a great number of amputations were done immediately after the receipt of the injuries. Sixty of the patients, whose limbs had been thus cut off, were taken to the naval hospital at Brest, and put

under the care of M. Duret. With the exception of two, who died of tetanus, all the rest were cured; and there was one who had had both his arms amputated. The surgeon of the *Téméraire*, which ship was captured by the English, was desirous, in compliance with the advice of their medical men, to defer the operation, which many of the wounded stood in need of, till his arrival in port; but he had the mortification to see them all die during the passage," &c.

Larrey next acquaints us, that, when he was sent to the army of Italy, in 1796, he had also the pain of seeing, in the hospitals, great numbers of the wounded fall victims to the confidence, which many of the surgeons of that army placed in the principles of M. Faure. Buonaparte saw that the *ambulance volante* was the only thing that, in the event of fresh hostilities, could prevent such accidents, and in consequence of his orders, Larrey formed the three divisions *d'ambulance*, which are described in his *Mémoires de Chirurgie Militaire*.

Since this period it has always been customary in the French armies, on the day of battle, to make every preparation for performing amputations as speedily as possible. The mere sight of these *ambulances* (always attached to the advanced guard), says M. Larrey, encourages the soldiers, and inspires them with the greatest courage. On this occasion the following anecdote is cited from Ambrose Paré: this famous surgeon having been urgently sent for by the Duke de Guise, besieged in Metz, to attend the wounded of his army, who were in want of assistance, Ambrose Paré was shown to the frightened soldiers at the breach. Upon this they immediately filled the air with shouts of the most lively joy, and cried out: "*Nous ne pouvons plus mourir, s'il arrive que nous soyons blessés, puisque Paré est parmi nous.*" Their courage revived, and their confidence in this skilful surgeon contributed to the preservation of a place, before which a formidable army was destroyed.

Larrey desires us to interrogate the invalids who have lost one or two of their limbs, and nearly all will tell us, that they suffered amputation a few minutes after the accident, or in the first four-and-twenty hours. "If Faure now retains any partisans," says Larrey, "I recommend them to repair to the field of battle, the day after an action: they would then soon be convinced, that, without the prompt performance of amputation, great numbers of soldiers must inevitably lose their lives. In Egypt this truth was particularly manifested."

The following communication upon this point was made to Baron Larrey by M. Masclet, a French surgeon on duty at Alexandria:—

"In the naval hospital of this port, I have seen eleven soldiers, or sailors, who were wounded in the naval action off Aboukir, and who had suffered amputation in the first four-and-twenty hours. In five of these cases the operation had been done on the arm; in two, on the thigh; and, in three others, on the leg. All these men are recovering. In the army hospital there have been only three thigh amputations, which we performed seven or eight days after the battle, and these three patients died a few days after the operation, although the operation was done methodically, and no grave symptoms prevailed at the time of its performance. You see, sir, experience has, in this instance, quite confirmed your principles."

In 1780, during the American war, as we are informed by Larrey, the surgeons of the French followed the maxim then generally adopted in France, that the operation should not be undertaken till after the subsidence of the first symptoms. Almost all the patients thus treated, died after the operation. On the contrary, the Americans, who had the boldness to amputate immediately (or in the first four and twenty hours) upon many of their wounded countrymen, lost only a very few. Yet M. Dubor, at that time surgeon to the Artois dragoons, and from whom Larrey has collected this fact, states, that the situation of the hospital for the French wounded was, on many accounts, the most advantageous. (*Dubor, Thèse Inaugurale, soutenue 16 Sept., 1803, à l'Ecole de Strasbourg.*)

Admitting that, by a concurrence of fortunate circumstances, which are not always to be calculated upon, some patients escape the danger of the first symptoms, as Larrey remarks, this proves nothing in favour of doing the operation afterwards: it must be seen what nature will do towards the event of the case. If at the end of twenty or thirty days, the prognosis is as bad as it was previously, amputation cannot be avoided. Thus all the sufferings which the patient has endured, have been undergone for nothing, and the operation will now be attended with considerable risk, inasmuch, as the patient is in a dangerously weakened state. If nature revives at all, no doubt the success of the operation becomes more probable; but, in this case, the surgeon, instead of having recourse to amputation, should redouble his efforts to preserve the limb.

CASES DEMANDING AMPUTATION CONSECUTIVELY.

First case. A spreading Mortification.—If the disorder were owing to an internal and general cause, it would be rashness to amputate before nature had put limits to the disease. Larrey describes this species of gangrene, as being distinguished from that kind which is named *traumatic*, by the symptoms which precede and accompany it. These symptoms are similar to those which are observed in nervous and typhoid fevers. Here the operation ought to be deferred, and endeavours made to combat the general causes with regimens and internal medicines.

But when gangrene is *traumatic*, Larrey advises the limb to be immediately cut off above the disorganised part. Several facts in support of this doctrine, are related by this experienced surgeon in his *Mém. sur la Gangrène Traumatique*. (See MORTIFICATION.)

In that part of the Dictionary will be found additional observations, in favour of the practice adopted and recommended by Larrey, which is so opposite to that inculcated by Sharp, Pott, and the generality of writers.

In the article AMPUTATION, I have noticed a particular case of gangrene, which has been pointed out by Mr. Guthrie, as demanding the early performance of amputation, and a deviation from the old rule of waiting till the mortification has ceased to spread. (*On Gunshot Wounds of the Extremities*, p. 63. &c.)

Second case. Violent Spasms and Tetanus.—It is one of Larrey's doctrines, though not a well-founded one, that amputation of the limb, per-

formed immediately the first symptoms of tetanus manifest themselves, interrupts all communication between the source of the disorder and the rest of the body. He states that the operation unloads the vessels, and this puts a stop to the tension of the nerves, and to the contracted state of the muscles. These first effects, he says, are followed by a general collapse, which promotes the excretions, sleep, and the equilibrium of every part of the system. Amputation, however, is entirely renounced in this country, as a remedy for tetanus. In France also Baron Dupuytren condemned the practice. (See *Clin. Chir.* t. ii. p. 599., and t. iv. p. 270.) One of Larrey's patients, with traumatic tetanus, recovered after amputation; and a few cases of success are recorded in periodical works. Yet M. Velpeau, after adverting to them, expresses his little confidence in the practice, and his disinclination to imitate Baron Larrey and M. del Signore. (See *Nouv. Elém. de Méd. Opér.* t. i. p. 279.; and *TETANUS*.)

Third case. Bad State of the Discharge.—It often happens, that, in gunshot wounds complicated with fractures, notwithstanding the most skilful treatment, the discharge becomes of a bad quality; the fragments of bone lie surrounded with the matter, and have not the least tendency to unite; the patient is attacked with hectic fever, and a colliquative diarrhoea. Under these circumstances, life may sometimes be preserved by amputation.

Fourth case. Bad State of the Stump.—In hospitals, the cure of amputations is sometimes prevented by a fever of a bad character. The stump swells, the integuments become at first retracted, and then everted and diseased a good way upward. The wound changes into a fungous ulcer, the cicatrization of which is hindered by the deep disorder of the bone, and the ulceration of the soft parts. The extremity of the bone projects. In order to remedy this last evil, it has been proposed to saw off the projecting part of the bone, and, with this, even to amputate all the flesh beyond the level of the skin. Larrey condemns such practice as unnecessary and dangerous, and he recommends giving nature time to bring about exfoliation. (See *Mém. de Chir. Militaire*, t. ii.) Exceptions to this advice, however, are met with.

GUNSHOT WOUNDS OF THE ABDOMEN,

May be divided into two kinds; some only penetrate the parietes of the belly, without hurting the contained parts; others do mischief also to the viscera: the event is generally very different. In the first, little danger is to be expected, under proper treatment; but, in the second, the success will be extremely uncertain, for in many instances nothing can be done for the patient, and on other occasions a good deal.

It is observed by John Hunter, that such wounds of the abdomen as do not injure parts like the stomach, intestines, bladder, ureters, gall-bladder, large blood-vessels, &c., all which contain particular fluids, will generally end well. But he adds, that there will be a great difference, when the ball has passed with immense velocity, as a slough will be produced; whereas, when the ball has moved with less impetus, there will not be so much sloughing, and the parts will in some degree heal by the first intention. Even when the ball occasions a slough, the wound frequently termi-

nates well, the adhesive inflammation taking place in the peritoneum, all round the wound, so as to exclude the general cavity of the abdomen from taking part in the inflammation. Such is often the favourable event, when the ball, besides entering the abdomen, has wounded parts like the omentum, mesentery, &c., and gone quite through the body. (*Hunter on Inflammation, Gunshot Wounds*, &c. p. 548.)

In gunshot wounds of the belly, an extravasation is apt to take place on the sloughs becoming loose, about eight, ten, twelve, or fourteen days after the accident; but, says Mr. Hunter, although this new symptom is in general very disagreeable, most of the danger is usually over before it can appear.

The stupor, that remarkable consequence of severe injuries, is particularly observed to follow those affecting the cavity of the abdomen. The patient quickly turns yellow, and lies completely motionless, inattentive to every thing around him. (See *Dupuytren, Clin. Chir.* t. ii. p. 543.) This I have often seen exemplified in fatal cases.

When a ball passes through the pelvis, and breaks the bones, this latter circumstance alone constitutes a formidable accident; for, as Dupuytren observes, the bones are deep, covered by a thick mass of soft parts, and surrounded by considerable vessels and nerves. If the organs contained in the pelvis are wounded, the fluids or matters which are within them, are effused, inflammation ensues, and the result is mostly fatal. If large vessels are opened, the hæmorrhage cannot be stopped. If nerves are injured, paralysis of the rectum, bladder, or lower extremities, is the consequence. If the ball lodges in the thick substance of the bones, it is apt to bring on necrosis, periostitis, extensive and deep abscesses, sinuses, and fistulous openings. A wound of the bladder is followed by effusion of urine; one of the rectum, by that of fecal matter; the dangers of which occurrences are great. (See *Dupuytren, in Clin. Chir.* t. u. p. 544.)

In the article *WOUNDS*, I have detailed at large the general principles, which should be observed in the treatment of wounds of the belly; consequently it would be superfluous here to go over the whole of this extensive subject. As an excellent practical writer observes, "In their treatment, the violence of symptoms is to be combated more by general means, than by any of the mechanical aids of surgery. The search for extraneous bodies, unless superficially situated, is altogether out of the question, except they can be felt with the probe, as in Ravaton's case (*Chir. d'Armée*, p. 211.), or in other cases of lodgment in the bladder, where they may become the object of secondary operations. Enlargement or contraction of the original wound, as the case may require, for returning the protruded intestine, securing the intestine itself, and promoting the adhesion of the parts, are all that the surgeon has to do in the way of operation; and, even in this, the less he interferes the better. Nature makes wonderful exertions to relieve every injury inflicted upon her, and they are often surprisingly successful, if not injudiciously interfered with. In a penetrating wound of the abdomen, whether gun-shot, or by a cutting instrument, if no portion of intestine take place (and this, it must be observed, in musket or pistol wounds, is

occurs), the lancet, with its powerful concomitants, abstinence and rest, particularly in the supine posture, are our chief dependence. Great pain and tension, which usually accompany these wounds, must be relieved by leeches to the abdomen (if they can be procured), by topical applications of fomentations, and the warm bath; and, if any internal medicine is given, as a purgative, it must, for obvious reasons, be of the mildest nature. The removal of the ingesta, as a source of irritation, is best effected, by frequently repeated oleaginous clysters" (see *Hennen's Principles of Military Surgery*, p. 431. ed. 2.); and, with respect to dressings, as the same author has observed, concerning cases in which a ball has passed directly through the abdomen, the mildest application should be employed, and no plugging with tents, nor introduction of medicated dressings, thought of. (P. 406.) In this publication may be found cases, in which musket-balls were passed by stool (p. 404.); in which an artificial anus was formed (p. 407, &c.); or the kidneys, liver (p. 430—432.), diaphragm (p. 437.), and other viscera, injured.

The following case, exhibiting the possibility of recovery, though the small intestine be completely severed with a ball, is interesting, particularly as cases of this kind have been regarded as positively fatal. The success was also obtained, notwithstanding the treatment appears to have been rather too officious, especially in regard to four incisions made in the end of the bowel, when one would have removed the constriction spoken of.

At the assault of Cuero, 1799, M. N. was shot in the abdomen with a ball, which divided the muscular parietes of this cavity on the right side, and a portion of the ileum. Larrey being upon the field of battle, gave him the first assistance. The two ends of the intestine protruded in a separated and inflated state. The upper end was everted, in such a way, that its contracted edge, like the prepuce in a case of paraphimosis, strangulated the intestinal tube. The course of the feces was thus obstructed, and the contents of the bowel accumulated above the constriction.

Although the patient's recovery was nearly hopeless, both from the nature of the wound, and from the debility and cholera morbus which had already seized him in the short period that he remained without succour in one of the intrenchments, Larrey was desirous of trying what could be done for so singular a case. He first made four small cuts through the constricted part of the intestine, with a pair of curved scissors, and put the bowel into its ordinary state. He passed a ligature through the piece of the mesentery corresponding to the two extremities of the bowel. These he reduced as far as the margin of the opening, which he had taken care to dilate; and the dressings having been applied, he awaited events. The first days were attended with alarming symptoms, which, however, afterwards subsided. Those which depended upon the loss of the alimentary matter, successively abated; and, after two months, the ends of the ileum were opposite each other, and disposed to become connected together. Larrey seconded the efforts of nature, and dressed the patient with a tampon, or sort of tent, that was occasionally employed for

two months. The patient was then discharged from the hospital quite cured.

In several instances, says Larrey, the sigmoid flexure of the colon was injured, and yet the wounds were cured without any fecal fistulae. At the siege of Acre, three examples occurred; and, at that of Cairo, two. Larrey dilated the entrance and exit of the ball. Clysters of the decoction of linseed, and emollient beverages, were frequently exhibited; and the patients were kept on low diet, and in the most quiet state.

Sword-wounds, and those made with the bayonet, or lance, may injure some part of the bladder, or even pass through both sides of this organ. In the latter case, the injury is usually fatal, as the urine escapes from the inner wound into the abdomen, and immediately excites mortal inflammation. Baron Larrey dressed on the field of battle several soldiers, whose bladders were thus completely transfixed, and who all perished of inflammation and gangrene, within the first forty-eight hours. However, he observes, that if the weapon enter the bladder at that part of its fundus which is not covered by the peritoneum, the case is curable, unless complicated with too much internal hæmorrhage.

The surest criterion of these cases is the escape of the urine from the external wound; and its discharge may either be momentary, occasional, or continual; differences to be accounted for by the situation of the wound, and the changes which happen in the bladder. When the bladder is full, and its upper part is pierced, the urine will issue only just at the moment of the accident, and, as soon as it is discharged, the edges of the wound will come together, and permanently close, especially, if the urine can pass freely through the natural channel. But when this favourable condition is absent, the bladder becomes enormously distended again, the wound is opened anew, and the urine discharged once more from the external opening. The same things might happen, if one were to withdraw too soon the elastic gum catheter, which has been introduced; and by introducing the instrument again, the urine might be diverted from the wound, and its natural course re-established. Lastly, Larrey observes, that, when the wound is situated at one of the lowest points of the bladder, the discharge of urine may be incessant, and be of more or less duration.

When the track of these punctured wounds is extensive, and not direct, abscesses form at different points where the urine passes. These abscesses, Larrey directs to be immediately opened, and their recurrence prevented by the introduction of an elastic gum catheter through the urethra; one of the chief means of relief in all wounds of the bladder. Together with this treatment, he recommends the warm bath, the application of camphorated oily liniments to the belly, antispasmodic cooling medicines, frequent clysters, and sometimes cupping in the vicinity of the wound, or bleeding. (See *Mém. de Chir. Mil.* t. iv. p. 286, 287.) On the two last means of relief, it would have been better if Larrey had laid more stress; for, next to the catheter, they are unquestionably the most essential.

Baron Larrey informs us, that the gunshot wounds of the bladder, which occurred in Egypt, had for the most part a favourable termination. The most remarkable case was that of F. Chau-

mette, a light horseman, who was wounded at the battle of Tabor. The ball passed across the hypogastrium, about one finger-breadth above the pubes, to the point of the left buttock, which corresponds to the ischiatic notch. The direction of the wound, and the issue of feces and urine from the two orifices, left no doubt that the bladder and rectum were injured. M. Milioz, who directed the surgical affairs of the division of the army under Kleber, diligently pursued the same kind of treatment which he had seen Larrey adopt at the siege of Acre. During the suppurative stage, the patient was affected with fever; and, after the sloughs were detached, the discharge was very copious. A catheter that was passed into the bladder, prevented an extravasation of the urine, and, at the same time, promoted the union of the wound of that viscus. This was healed the first, and the patient, upon his return to Cairo, was quite cured.

Larrey has recorded several other interesting cases of wounds, either of the bladder alone, or of it and the rectum together, to which I must content myself with referring. (*See Mém. de Chir. Militaire*, t. ii. p. 160. 165.; t. iii. p. 340. &c.; t. iv. p. 296. &c.)

A ball may go through both sides of the bladder, and then either perforate the neighbouring parts, and escape externally, or bury itself deeply in the flesh. When it has gone quite through the bladder, and afterwards passed out of the body again, urine, blended with blood, immediately issues from one or both apertures, according to their situation. The flow of urine through the urethra is either lessened, or completely suppressed; but, through this passage, the patient generally voids more or less blood. Acute and incessant pain is felt in the course of the wound, together with a frequent painful desire to make water, nausea, sometimes actual vomiting, and extreme anxiety, and restlessness. Either in its passage inwards, or its course outwards, the ball may have injured, or perforated the rectum; in which case, the urine passes into this bowel, and, mixing with the feces, is discharged from the anus.

When a part of the bladder, towards the cavity of the abdomen, is injured, as, for instance, its posterior surface, which is covered by the peritoneum, the urine is generally extravasated within the belly, and inflammation of the preceding membrane is the immediate consequence. This inflammation spreads with rapidity, and attacks all the viscera, producing vast distension of the abdomen, fever, coma, and other bad symptoms, soon terminating in gangrene and death. (*Larrey, Mém. de Chir. Mil.* t. iv. p. 292, 293.)

During the first four-and-twenty hours, very little urine escapes from gunshot wounds of the bladder, in consequence of the swelling, which almost instantly affects the lips of the wound. When the bladder is full, this fluid is discharged, only at the moment of the accident, and mostly only from the wound by which the ball has made its exit. An extravasation is prevented by the thick slough which fills all the track of the injury, and it is not till the deadened parts become loose, that any effusion can happen. Hence, it is of the highest importance to introduce an elastic gum catheter into the bladder, where it should be kept, and the instrument should be large enough to

fill exactly the urethra; for, according to Baron Larrey's observations, if, at the period when the sloughs are detached, the urine has not a ready passage outward, it passes through the wound, and is extravasated the more readily, inasmuch as the separation of the sloughs has occasioned many openings, by which the fluid may insinuate itself into the cellular membrane. Hence, gangrenous mischief and death.

On two points, my own experience would not lead me to join in the sentiments of Larrey: first, in opposition to his statement, I am sure that there is risk of extravasation of urine earlier than the period which he specifies, having known this accident commence as it were within a few hours after the receipt of the wound; and therefore, I should not depend upon the sloughs being always at first a complete barrier to extravasation of urine (indeed, their formation throughout the whole track of a gunshot wound is by no means a regular occurrence), but invariably pass a catheter as soon as possible, for the more certain prevention of this dangerous consequence. Secondly, the period of the separation of sloughs may, indeed, often be contemporary with the first appearance, or symptoms of extravasation, particularly in cases where the employment of the catheter is for some time deferred, as in Baron Larrey's practice, because then a partial extravasation of the urine, soon after the injury, and previous to the introduction of the catheter, will cause rapid sloughing, and actually prevent the adhesive inflammation from closing up the cavities of the cellular membrane in time to prevent a fatal extension of that irritating fluid amongst the surrounding parts. Were it not for the partial early effusion of urine, no doubt, the adhesive inflammation would, in these cases, soon have the same effect, in obviating the danger of urinary extravasation, which it has after lithotomy, or paracentesis of the bladder. (*See BLADDER*.)

It is the practice of Baron Larrey to dilate the wounds, in order to facilitate the escape of the urine, which might otherwise lodge in the track of the ball; and perhaps, here the method may frequently be right, though I should conceive its propriety must usually depend upon whether the urine has a tendency to continue to flow out through the wounds, or not, and upon the presence of obstruction or not. And, in confirmation of this opinion, I may cite Dr. Hennen's declaration, that, in these cases, he has very rarely found it necessary to enlarge the wound, when the catheter and proper dressings have been employed. (*On Military Surgery*, p. 421. ed. 2.) And, as soon as possible, a large elastic gum catheter should be introduced, and left in the urethra taking care to withdraw it, and pass in a clean one every two or three days, so that no incrustations may occur. Sometimes, however, the passage of a catheter is very difficult, as is the case, when there are splinters of bone in the urethra, or the parts about the neck of the bladder are inflamed. (*Mém. de Chir. Militaire*, t. iv. p. 294.) Emollient clysters, and acidulated demulcent drinks, are to be prescribed, and the patient is to be kept upon a very low regimen, and in the most quiet state. The dressings are to be light and simple, and cleanliness observed. (*Op. cit.* t. ii. p. 165—170.) Instead of camphorated embrocations to the abdomen, another means commended by Larrey, it

appears to me, that this author's directions would have been more complete and judicious, had he advised in these cases bleeding, both topical and general.

From the injury of arterial ramifications, or varicose vessels, blood is sometimes extravasated within the wounded bladder, and causes deep-seated irritation. According to Baron Larrey, the case is indicated by the symptoms of retention of urine, and those of inflammation, with a small pulse, pallor of the countenance, and dryness of the wounds. (T. iv. p. 295.) A more decided criterion, I should think, would be the partial escape of urine mixed with blood, a symptom, which could deceive only where the urethra itself had been injured. Larrey states, that blood, extravasated in the bladder, rarely coagulates, because blended with urine, and hence, he advises its discharge to be facilitated by means of a catheter, and tepid, emollient, anodyne injections. (T. iv. p. 295.)

Sometimes, balls carry before them into the bladder, fragments of bone, small coins, pieces of buttons, &c.; or bits of bullets break off, and lodge in that viscus. When these extraneous bodies are not above a certain size, they are frequently voided through the urethra (see *Cases in Hennen's work*, p. 419. 422. 424. &c. ed. 2.), and their evacuation may be materially facilitated by the introduction of an elastic gum catheter, the size of which is to be increased gradually, until the largest can be passed, when the foreign substances will readily enter the tube, or pass out through the dilated urethra. In this way, Baron Larrey has saved gravel patients from a vast deal of suffering. (*Mém. de Chir. Mil.* t. iv. p. 302.) In such cases, the urethral forceps, made by Mr. Weiss, might often be used with advantage. (See *Lithotomy*.) When the ball is too large to be taken out in this manner, the lateral operation is to be performed, and it ought to be done before the bladder falls into an ulcerated, or gangrenous state, from the pressure and irritation of the foreign body. However, as wounds of this organ frequently give rise to dangerous inflammation, Larrey recommends this operation to be done either before its attack, or after its subsidence. (Vol. cit. p. 309.) In fact, almost all the operations of this kind on record have been done some considerable time after the receipt of the wound, and to this practice my own judgment would lead me to give a general preference. In one case, however, Larrey operated on the fourth day after the receipt of the wound, and with success.

After the battle of Waterloo, I was not a little surprised to find, in the hospital established in the St. Elizabeth Barracks, at Brussels, a considerable number of cases, in which either the intestines, the stomach, the omentum, or the bladder protruded. I think, we had in the division under Mr. Collier and myself, not less than three protrusions of the bladder. An order, which I received to join the army in the field on the 27th of June, deprived me of the opportunity of witnessing the progress and termination of these interesting cases. However, many had ended fatally before my departure from Brussels.

Cannon-balls sometimes rupture, or crush the viscera, without occasioning any wound of the skin; such cases I have already noticed in considering the erroneous doctrine of *wind contusions*.

Whoever has served in a campaign must have had opportunities of seeing such accidents. They are recorded by every writer. Dupuytren gives the particulars of one, in which all the soft parts of the lumbar region, together with the left kidney, were crushed to atoms; the lumbar nerves lacerated; the transverse processes of the lumbar vertebrae, and the last ribs comminuted; and the cavity of the abdomen, and injured side of the chest, filled with blood. The skin was the only texture that had resisted the ball. (See *Clin. Chir.* t. ii. p. 241.)

GUNSHOT WOUNDS OF THE THORAX.

Wounds of the lungs, abstracted from other mischief are now well known not to be always fatal. Balls have been found in the substance of the lungs after having lodged there twenty years, during all which time the patients were healthy, and free from symptoms indicative of the case. (Percy, *Manuel*, &c. p. 25.) Mr. Hunter had some reason to believe, that wounds of the lungs made with balls, were generally less dangerous than such as were made with sharp-pointed instruments; for he had seen several patients recover after they had been shot through the lungs, while other persons died of very small wounds of those organs, done with swords and bayonets. Perhaps, one cause of this fact may be owing to the circumstance of gunshot wounds generally bleeding less than other wounds, so that there is not so much danger of blood being effused in the cavity of the chest, or the cells of the lungs. The indisposition of the orifice of a gunshot wound to heal up too soon, is also another circumstance that must lessen the hazard, as whatever matter happens to be extravasated has thereby an opportunity of escaping.

But, from what has been stated, it must not be inferred that gunshot wounds of the lungs are not accompanied with a serious degree of danger. I frequently the patient expires instantly, being suffocated in consequence of profuse hemorrhage from those organs; for, though it be true, that gunshot wounds generally do not bleed much, when the injured vessels are under a certain size, yet, the contrary is the case, when the wounded vessels are like those situated towards the root of the lungs. Gunshot wounds of the chest often prove fatal by the inflammation excited within this cavity; and occasionally when the lung is wounded, they are followed by an extensive and even fatal inflation of the cellular tissue of the whole body. (See EMPHYSEMA.)

Appearances sometimes create a belief, that a ball has passed completely through the chest and lungs, when the fact is otherwise. "Thus (as Dr. Hennen observes), I have traced a ball by dissection, passing into the cavity of the thorax, making the circuit of the lungs, penetrating nearly opposite the point of entrance, and giving the appearance of the man having been shot fairly across, while bloody sputa seemed to prove the fact, and, in reality, rendered the same measures to a certain extent, as necessary as if the case had been what was suspected. The bloody sputa, however, were only secondary, and neither so active and alarming as those which pour out at once from the lungs when wounded." (*Military Surgery*, p. 368. ed. 2.) A second cause of deception is the frequent long course of a ball, round the chest under the

skin and muscles, previously to its exit, whereby an appearance is presented, as if the patient had been shot through the thorax. And, another source of deception, as to the actual penetration of balls, is, "where they strike against a handkerchief, linen, cloth, &c. and are drawn out unperceived in their folds, a peculiarity which has not escaped M. Larrey, who gives an interesting notice of it in the *Bulletins de la Faculté de Méd.* Paris, 1815, No. 2. I have also given an instance in the preceding pages." (*Hennen*, loco cit.) In these cases, the absence of bloody expectoration directly after the injury, the undisturbed state of respiration, and the greater freedom from oppression, anxiety, syncope, and other bad symptoms, than in cases where the lungs are hurt, form grounds for a correct opinion on the true nature of the accident.

It cannot be supposed that adhesions always take place round the opening of a gunshot wound in the chest, because the lung sometimes collapses, and becomes considerably distant from the pleura, especially when the communication established between the atmospheric air and the cavity of the thorax is free and direct. However, as adhesions are extremely common between the outer surface of the lung, and the inner surface of the pleura costalis, they must, in many instances, exist before the receipt of a wound, and, of course, prevent the usual collapse of the lung.

As the general symptoms and treatment of wounds of the chest are detailed in the article WOUNDS, I shall not here detain the reader long upon the subject. When a patient has been shot in the chest, the most important indication is to prevent and subdue inflammation of the lungs and pleura. In few other cases can repeated and large bleedings be so advantageously practised. Here, there will not be so much danger of an extravasation of blood as in stabs; and, even if an effusion of that fluid were to happen within the cavity of the pleura, the opening would generally be sufficient for its escape, and it would not be so frequently found necessary to dilate the wound, or make a new opening, as when the injury has been inflicted with a sharp-pointed weapon.

In this last kind of case, when attended in the beginning with bleeding, Baron Larrey particularly insists upon the advantage of immediately bringing the edges of the wound together with adhesive plaster, instead of leaving it open as advised by the generality of writers; and he endeavours to prove, that this immediate closure of the wound has great effect in stopping the hæmorrhage from the pulmonary vessels. Supposing an extravasation of blood in the chest were to follow, he argues, that it would be better to let it out afterwards by a suitable incision, than to suffer the patient to perish of hæmorrhage at once by not closing the wound. (*Mém. de Chir. Mil.* t. iv. p. 151. &c.) Dr. Hennen is in favour of the same practice. (*On Military Surgery*, p. 373. ed. 2.) In a penetrating gunshot wound of the chest, after taking away from thirty to forty ounces of blood, the surgeon should extract all extraneous substances, and splinters of bone within reach, and even dilate the external wound for this purpose, if necessary. Light unirritating dressings are then to be applied. The patient may now be (comparatively speaking) easy, until the spitting of blood, and danger of suffocation, from inward hæmorrhage, come on again, when the lancet must be again employed;

"and, if by this management, repeated as often as circumstances demand, the patient survives the first twelve hours, hopes may begin to be entertained of his recovering from the immediate effects of hæmorrhage," and until this danger is over, as Dr. Hennen truly observes, the lancet is the only thing which can save life. Afterwards, when the paroxysms of pain, the sense of suffocation, and the return of hæmorrhage, have become more moderate, digitalis may be prescribed with the most beneficial effect; and, if the cough be very troublesome, no medicine is more useful than the spermaceti-mixture with opium. With this treatment must be combined the exhibition of saline purgatives, mild laxative clysters, and a strictly low diet, the patient being allowed only slops. (*See Hennen's Military Surgery*, p. 373. ed. 2.)

When matter forms in the thorax, in consequence of gunshot wounds, the opening will generally suffice for its escape; but, should the collection of pus be confined, and occasion dangerous symptoms, the external wound must either be enlarged, or a new incision practised, as circumstances may indicate. The mode of making an opening in the chest is considered in the article PLEURISIS.

When a ball lodges, without falling into the chest, it may lie either in the substance of the parietes of this cavity between the muscles, or in one of the intercostal spaces, and continue there a very long time without causing much inconvenience, or making its way outward. But, when it is lodged in the thoracic cavity itself, it descends by its weight, and sometimes excites considerable irritation, suppuration, sinuses, and hectic symptoms; in this case, if its situation can be ascertained, Baron Larrey recommends an attempt to extract it. In an early stage of the case, he says, that the intercostal space will often be wide enough to let the ball pass through it; but that, at a later period, this space becomes too narrow, and it will be necessary to cut away a portion of the upper edge of the rib with a lenticular knife, which is to be preferred to a trephine, or saw. This advice is supported by some interesting cases. (*See Mém. de Chir. Mil.* t. iv. p. 263.) Frequently, the ball fractures the rib, and, with the aid of dilatation, sufficient room for its extraction may be made: but the possibility and propriety of removing it through the original opening will, of course, depend upon the situation of the foreign body, and the urgency of the symptoms. A case is recorded, in which a ball weighing three ounces and a half, was thus removed. (*Med. and Surg. Journ.* vol. iii. p. 353.)

Alphons. Ferrarius de Sclopetorum, sive Archibutorum Vulneribus, &c. vvo. Romæ, 1552. *J. F. Botta, de Bellorum Tormentorum Vulneribus et Curatione*, 4to. Bonon. 1555. *Botallus, de Curat. Vuln.* 1565. *Nim. Clarke's Approved Treatise for all young Chirurgians concerning Burnings with Gunpowder, and Wounds made with Gunshot*, &c. 4to. 1591. *J. Quercetanus, Sclopetarius, sive de curandis Vulneribus quæ Sclopetorum et similibus Tormentorum Ictibus acciderunt*, 8vo. 1591, 12mo. Leips. 1614. *Fr. Plazxonius, De Vulneribus Sclopetorum*, &c. 4to. Venet. 1618. *J. Woodal, Vtiacum*, fol. Lond. 1639. *H. F. Le Dran, Traité, ou Réflexions tirées de la Pratique sur les Plaies d'Armes à feu*, 2de édit. 12mo. Paris, 1740. *Desport, Traité des Plaies d'Armes à feu*, 12mo. Paris, 1749. *Randey's Method of treating Gunshot Wounds*, 12mo. Lond. 1781. *Obs. sur les Plaies d'Armes à feu, compliquées de Fracture aux Articulations des Extrémités, ou au Voisinage*

de ces Articulations, par *M. Boucher*, in *Mém. de l'Acad. de Chirurgie*, t. v. p. 279. 6d. in 12mo. Obs. sur des Plaies d'Armes à feu, compliquées sur tout de Fracas des Os, par *M. Boucher*, in *opere cit.* t. vi. p. 109, &c. 6d. in 12mo. Obs. sur les Plaies d'Armes à feu: 1. Sur un Coup de Fusil, avec Fracas des deux Machoires; par *M. Cannac*: 2. Sur une Plaque d'Arme à feu traversant la Poitrine d'un côté à l'autre; par *M. Gerard*: 3. Sur une Plaque d'Arme à feu, pénétrante depuis la Partie antérieure du Pubis jusqu'à l'Os Sacrum; par *M. Andouillé*: 4. Sur une Jambe écorchée par un Obus, ou petite Bombe, par *M. Cannac*: 5. Sur une Plaque à la Partie inférieure et interne de la Jambe, faite par un Eclat de Grenade, sans Fracas d'Os; par *M. Cannac*: 6. Précis de plusieurs Observations sur les Plaies d'Armes à feu en différentes Parties, par *M. Bordenave*:—all these papers are inserted in *Mém. de l'Acad. de Chir.* t. vi. in 12mo.; and in t. xi. of the same edition are inserted *Mém. sur le Traitement des Plaies d'Armes à feu*, par *M. de la Martinière*, et *Mémoires sur quelques Particularités concernant les Plaies faites par Armes à feu*, par *M. Vacher*. *M. Faure's* *Mémoires* relative to Amputation in Cases of Gunshot Wounds, may be seen in t. vii. of the *Recueil des Pièces qui ont concouru pour le Prix de l'Acad. de Chirurgie*, 6d. in 12mo. *John Hunter's* *Treatise on the Blood, Inflammation, and Gunshot Wounds*, 1774. *Richter's*, *Anfangsgründe der Wundarzneikunst*, b. 1. *Schmucker's*, *Vermischte Chir. Schriften*, 3 vols. 8vo. Berlin, 1776, 1782. *Chirurgische Wahrnehmungen*, Berlin, 2 vols. 8vo. 1741, 1789: works of high value. Discourses on the Nature and Cure of Wounds, by *John Bell*, p. 163. 8r. ed. 3. *Richerand*, *Nosographie Chir.* t. i. ed. 1. *Chevalier's* *Treatise on Gunshot Wounds*, ed. 3. *Leveillé*, *Nouvelle Doctr. Chir.* t. i. chap. viii. p. 436, &c. *Larrey*, *Mém. de Chirurgie Militaire*, 4 tomes, 8vo. Paris, 1812, 1817; one of the most instructive books for army surgeons ever published. *Mém. par M. De Coute*, *Prix de l'Acad.* t. viii. Examen des plusieurs Parties de la Chirurgie, par *M. Bignon*, à Paris, 1766. *Bilguer*, *Dissert. de Membrorum Amputatione rarissime administranda*, aut quasi abroganda; Halle, 1761: this work is celebrated as having attracted most deservedly the criticisms of Pott, La Martinière, Merand, &c. *Merand*, *Opusculs de Chirurgie*, 1768. *Von Gessner*, *Abhandlung von der Nothwendigkeit der Amputation*; Freyberg, 1775. *M. G. Daiguan*, *Reflexions Importantes sur le Service des Hôpitaux Militaires*, 8vo. Par. 1745. *Marsana*, *Neue Medicinisch-Chirurgische Beobachtungen*, zweiter theil, s. 138. Berlin 1756. *Hickland's* *Nachrichten über das Französische, Kriesspitalwesen*, &c. &c. Leipzig, 1757. *Baron Percy*, *Manuel des Chirurgiens d'Armée*, 8vo. Paris, 1792. *Pac*, *Opusculs de Chir.* 8vo. Paris, 1806. *Gracfe*, *Nomen in die Abtheilung Grosserer Gliedmassen*, 4to. Berlin, 1812. *Assalini*, *Manuale di Chirurgia*, 8vo. Milano, 1812. *Guthrie*, on Gunshot Wounds of the Extremities, Lond. 1815; or the 2d ed. 8vo. Lond. 1820, a work detailing the practice of our military surgeons during the late war in Spain, and replete with valuable information. *Thomson's* Report of Observations made in the Military Hospitals in Belgium. Edmb. 1816. *A. C. Hutchinson's* *Practical Obs. in Surgery*, 1816; and ed. 2d. 1826. Also, *Further Obs. on the Period for amputation in Gunshot Wounds*, 8vo. Lond. 1817. *Milington's* *Manuel*, 8vo. Lond. 1819. *J. Hennen's* *Principles of Military Surgery*, 2d. edit. 8vo. Edmb. 1820; a publication which I cannot too strongly recommend, not only to army and navy surgeons, but to practitioners in general. *James Mann*, *Medical Sketches of the Campaigns of 1812, 13, 14*, &c. 8vo. Edmb. 1816. *M. L. Baron Dupuytren*, *Leçons Orales de Chir. Chir.* t. ii. art. 7, and t. iv. art. 7, and 14. 8vo. Paris, 1832-34. *Hippolyte Larrey*, *Hist. Chir. du Siège de la Citadelle d'Anvers*, 8vo. Paris, 1833.

GUTTA SERENA. A term said to have been first applied by Aeturius to amaurosis, or the species of blindness arising from a morbid state of the retina, or optic nerve. When the word is now employed, it usually denotes the complete form of amaurosis, or that in which the patient is entirely deprived of the power of discerning objects, or even the difference between light and darkness. (See AMAUROSIS.)

HÆMATOCELE. (From *αἷμα*, blood, and *κύημα*, tumour.) A swelling of the scrotum, proceeding from, or caused by, blood.

The term has sometimes been applied to every kind of extravasation of blood about the scrotum and spermatic chord; but, at the present day, it is usually restricted by British surgeons to a collection of blood in the cavity of the tunica vaginalis. Extravasation of blood in the cellular tissue of

the scrotum and spermatic chord, or within the structure of the testicle itself. Pott, however, arranges with hæmatocele. This last swelling is generally pyriform, like hydrocele; but is distinguishable from it, by its greater weight and firmness, its want of transparency, its obscure fluctuation, and its cause, which is usually a blow upon the scrotum, or an accidental puncture of some vessels of the testicle, or tunica vaginalis, in tapping a hydrocele. When the latter membrane has been long, or much distended by the serous fluid of hydrocele, it becomes thickened, and its vessels, especially those of its inner surface, enlarged, and even varicose. If one of these lies in the way of the instrument, with which the hydrocele is tapped, it is of course wounded, and then the fluid, which is discharged, is deeply tinged with blood. Should the bleeding continue, after the evacuation of the hydrocele, the blood will accumulate in the cavity of the tunica vaginalis, and, in the course of two or three hours, the scrotum will again be considerably swollen. In one or two examples, I have known hæmatocele follow the tapping of a hydrocele with a lancet, or other sharp-edged instrument. Sir Astley Cooper has noticed this risk, as attending the plan of tapping a hydrocele with a lancet. (*On the Structure and Dis. of the Testis*, p. 212.) A gentleman in the Fleet prison, took it into his head to tap his hydrocele with a kind of long spring-lancet of his own invention: the operation was followed by the rapid formation of a very large hæmatocele.

Sometimes one of the enlarged veins of the tunica vaginalis bursts of itself, after the fluid of a hydrocele has been discharged, and hæmatocele then comes on, as it were, spontaneously. According to Sir Benjamin Brodie, hæmatocele may arise from a diseased condition of the arteries. "This is analogous to that which occurs in the brain, under the form of sanguineous apoplexy. There is a natural change, which takes place in the arteries of old persons; they become ossified in patches, and ulcerate; and I have known this to lay the foundation of hæmatocele." (*See Lond. Med. Gaz.* vol. 1831-32, p. 927.)

As Sir Astley Cooper observes, hæmatocele is often connected with hydrocele, and a consequence of it. The latter disease frequently becomes complicated with hydrocele from an accidental blow on the tumour, occasioning a rent in the tunica vaginalis. In one case, operated upon by Sir Astley Cooper, this membrane had been ruptured to the extent of between one and two inches. The same distinguished surgeon records the case of a gentleman, in whom hæmatocele arose, not from a blow, but from excessive bodily exertion. (*On the Structure, &c. of the Testis*, p. 213-215.)

However, of all the causes of hæmatocele, a blow on the scrotum is the most frequent, and especially a blow from the pommel of the saddle in riding. I have known the disease produced, however, by external violence of different kinds; as by a fall against a piece of timber, by which the scrotum was violently struck. After such accidents, the scrotum will suddenly swell to double or treble its natural size. Every swelling, so produced in the scrotum by effused blood, is not invariably a collection of this fluid in the tunica vaginalis; for sometimes the extravasation is in the loose cellular tissue external to this membrane. Hæmatocele is to be distinguished from the latter case, partly by the oblong or pyriform shape of

the tumour, its obscure fluctuation, its freedom from the common appearances of ecchymosis, and its presenting itself more on one side of the scrotum, than the other; while an extravasation of blood in the cellular tissue generally is more diffused, produces a dark blue discolouration of the part, and conceals more or less both testes.

When hæmatocele occurs in combination with hydrocele, the blood is mixed with the serous fluid contained in the tunica vaginalis, and partially dissolved in it: if the quantity of blood be small, the solution is complete; but, in the opposite case, coagula are formed, which remain undissolved. (*Sir B. Brodie, ib.*)

In the dissection of some hæmatoceles, the tunica vaginalis is found excessively thickened; and the blood in it, whether coagulated or fluid, is of the colour of coffee. Sir Asstley Cooper refers to a preparation at St. Thomas's Hospital, exemplifying the serious mistake of removing the testicle, while the true disease was merely hæmatocele. The tunica vaginalis was excessively thickened, and filled with coagulated blood of a brownish red colour. (*Op. cit. p. 215.*)

A negro died in St. George's Hospital, who had an enlargement of one testicle; but as it had occasioned little or no inconvenience, the surgeon had not been consulted. Sir Benjamin Brodie examined the part after the patient's death, and found a very large quantity of grumous blood in the tunica vaginalis, and at the back part a soft pulpy mass was seen, not at all resembling the testicle in structure, and only recognisable as such, by its connexion with the epididymis and vas deferens. Sir Benjamin Brodie conceives, that the changed state of the testicle had been occasioned by the pressure of a large quantity of blood. (*See Lond. Med. Gaz. 1831-1832, p. 927.*)

Hæmatocele is sometimes unaccompanied by pain: this is the case, when the quantity of blood is small, and no inflammation present. Under other circumstances, the disease may be attended with excessive pain, and bring on abscesses, gangrene, and dangerous degrees of constitutional disturbance. This was exemplified in the person, whom I have mentioned as having produced hæmatocele by plunging a large lancet into his own hydrocele, for the purpose of curing it himself. In this instance, which I visited with Mr. Bransby Cooper, if a free and prompt incision had not been made to discharge the matter and putrid blood, the patient would soon have lost his life by the violence of the constitutional disturbance. Sir Benjamin Brodie mentions a painter, who was in the habit of drinking to excess, and who, while climbing a ladder, was seized with pain in the testicle, and an enormous hæmatocele formed. In this patient, the symptoms at first were more nearly allied to mania, then delirium.

If hæmatocele be occasioned by a blow, and not accompanied by hydrocele, and the quantity of blood in the tunica vaginalis be moderate, the treatment should consist in keeping the patient in the recumbent position, applying leeches, administering purgative medicines, and covering the tumour with a cold lotion, which will have the effect of checking any further internal bleeding. These means will prevent inflammation, and, after a time, the blood will probably be absorbed. Were the quantity of blood considerable, its pressure might cause an absorption of the testicle (*Sir B.*

Brodie), or, at all events, it would be likely to excite inflammation, and have little or no chance of being dispersed: in such a case, therefore, the best practitioners agree, respecting the propriety of laying open the tunica vaginalis, and taking out the blood.

If hæmatocele be combined with hydrocele, and free from much inflammation, Sir Asstley Cooper recommends making an incision into the tunica vaginalis, discharging its contents, and, without introducing any lint into the cavity, leaving the cure to be completed by the process of inflammation. (*On the Structure, &c. of the Testis, p. 216.*)

If, on drawing off a hydrocele, the contents are tinged with blood, Sir Benjamin Brodie allows the fluid to collect again, and repeats the tapplings at intervals, until no blood is mixed with it. The injection may then be used with success. Should the quantity of blood be large, he regards the expectation of its being removed by absorption as hopeless, and, therefore, punctures the tunica vaginalis with a lancet, introduces a director into the opening, and then enlarges it with a scalpel. (*Ib.*)

Whoever has read the observations of Pott on this subject will know, that the operation of laying open the tunica vaginalis, for the cure of hæmatocele, is sometimes followed by a severe attack of symptomatic fever, delirium, and even death. In unfavourable constitutions, the symptoms will generally prove serious, whatever be the mode adopted of dressing the wound, or the internal treatment. But now that the plan of introducing lint and other extraneous substances into the exposed cavity is abandoned, bad cases are far less frequent than formerly. The violence of the symptoms will generally depend upon the degree of inflammation in the parts, and the kind of constitution in which it occurs. If hæmatocele excite inflammation, the clots of blood putrefy, and a gangrenous suppuration follows, attended with an accumulation of sulphuretted hydrogen in the part, and most urgent danger. Here a free opening must be made without delay, the scrotum poulticed or covered with cold lotions, and the patient kept under the influence of the muriate or acetate of morphia.

Mr. Pott, in his account of hæmatocele, comprehends one species, which he describes as an extravasation of blood within the tunica albuginea.

I confess that no good reason appears for arranging cases of this kind with hæmatocele; for, what are they but diseased testicles, which have been punctured, either on account of their seeming to contain a fluid, or really having within them cysts filled with a chocolate-coloured or other fluid, as I have seen in hundreds of instances of sarcocele? and, whatever blood is discharged, is not extravasated in the substance of the testis previously to the puncture, but issues as a necessary consequence of that proceeding.

Another species of hæmatocele, noticed by Pott, "arises from a bursting of a branch of the spermatic vein, between the groin and scrotum, within the sheath of the chord. This, which is generally produced by great or sudden exertions of strength, feats of agility, &c., may happen to persons in the best health.

I cannot conceive, that in any case of a mere rupture of one of the spermatic veins, it can ever be justifiable to tie the whole spermatic chord, and

then perform castration, though Pott advises this plan, if the bleeding branch cannot be tied singly. Discutient applications, and an occasional purge, will almost always disperse the swelling; and if not, opening it, and taking out the blood, applying cold, or, if necessary, filling the cavity with lint, and using compression, would be, according to my humble judgment, the most judicious treatment.

With regard to the extravasation of blood in the loose cellular tissue of the scrotum, from blows on the part, and sometimes from lithotomy, castration, &c., I have seen it followed by suppuration and sloughing; but, in general, the effused blood is gradually absorbed, with the aid of discutient applications, leeches, fomentations, poultices, and saline purges. A surgeon should generally be reluctant to lay open the tumour, as, in many instances, sloughing and severe symptoms have been the result.

Celsus and *Paulus Ægineta* are the best of the old writers on hæmatocele. For modern information, consult *Pott's Chir. Works*, vol. ii. *B. Edl.* on Hydrocele. *Flajani*, Collezione d'Oscervazioni, &c. t. ii. *Richter*, Anfangsgr. der Wundarzn. b. vi. *Osiander*, in *Ernenmann's Magazin für die Wundarzn.* b. i. p. 355: the patient died after an opening had been made in the swelling. *Follet*, in *Journ. de Méd. continué*, vol. xiii. p. 422: a case from contusion, cured by an incision. *Harris*, in *Mem. of Lond. Med. Society*, vol. v. *Sir Benjamin Brodie*, in *Lond. Med. Gaz.* for 1831-32, p. 926. *Sir Astley Cooper*, in *Obs.* on the Structure and Dis. of the Testicles, p. 209. 4to. Lond. 1830.

HARE-LIP. (*Labia Leporina.*) A fissure, or perpendicular division, of one or both lips. The term has arisen from the fancied resemblance of the part to the upper lip of a hare. Occasionally the fissure is more or less oblique: it may be directly below the septum of the nose, or correspond to one of the nostrils. The two portions of the lip are generally moveable, and not adherent to the alveolar process; in some cases, they are closely attached to it.

Children are frequently born with this kind of malformation, which is called a *natural* hare-lip, while that which is produced by a wound is named *accidental*. Sometimes the portions of the lip, which ought to be united, have a considerable interspace between them, while in other instances they are not much apart. The cleft is occasionally *double*, a little lobe, or small portion of the lip, being situated between the two fissures; this is termed a *double* hare-lip.

The fissure mostly affects only the lip itself, and usually the upper one. In many cases, however, it extends along the bones and soft parts forming the palate, even as far as the uvula; and sometimes those bones are entirely wanting. In a few instances, the jaw not only is imperfectly ossified in front, so that a cleft presents itself there, but one side of it projects forward, and is at the same time inclined too much outward, drawing with it the corresponding part of the palate, and the septum nasi, so that a very unsightly distortion of the nostril and nose is produced. Such cases are denominated *complicated* hare-lips.

A hare-lip, in its least degree, occasions considerable deformity; and when more marked, it frequently hinders infants from sucking, and makes it indispensable to nourish them by other means. When the lower lip alone is affected, which is rare as a malformation, the child can neither retain its saliva, nor learn to speak, except with the greatest impediment. The constant escape of the saliva,

besides being an annoyance, is found to be detrimental to the health; for its loss impairs the digestive functions, the patient becomes emaciated, and even death would sometimes ensue, if the incessant discharge of so necessary a fluid in the animal economy were not prevented. Thus, a lady, who was in this state, consulted Tronchin, who immediately saw the cause of her indisposition, and recommended the fissure in the lip to be united: the operation was done, and the dyspeptic symptoms then ceased. And when the fissure pervades the palate, the patient not only articulates very imperfectly, but cannot masticate, nor swallow, except with great difficulty, on account of the food readily getting up into the nose.

An early removal of the deformity must obviously be very desirable; but as it cannot be accomplished without an operation, attended with some degree of pain, Dionis, Garengeot, and others, advise waiting till the child is four or five years old, on the supposition that, at an earlier age, the child's agitations and cries would render the operation impracticable, or derange all the proceedings taken to insure its success. It is plain, however, that such reasons are not of great weight. A child, four or five years old, and very often, even one eight or ten years of age, is more difficult to manage than an infant only a few months old. Every child of the above age has a thousand times more dread of the pain than of the deformity, or of the inconveniences of the complaint, to which he is habituated; while an infant of tender years fears nothing, and only feels the pain of the moment.

A more rational objection is the liability of infants to convulsions after operations; and this has induced many surgeons to postpone the cure of the hare-lip till the child is about two years old. This custom is also sanctioned by Sir Astley Cooper, who mentions in his lectures several instances, which have either been communicated to him by others, or have occurred in his own practice, where operations for the cure of hare-lips in very young infants have had a fatal termination, in consequence of an attack of convulsions, or diarrhoea. The period when dentition is completed, or the age of two years, he therefore sets down as the most advantageous for the operation; and if parents urge its being done earlier, he very properly advises the surgeon to let them be duly apprised of the risk, so that, in the event of the child being cut off, he may not incur blame for having operated at a disadvantageous period of life. About the end of 1823, I met Sir Astley Cooper in consultation in a case where this very question occurred. The deformity was particularly unsightly, in consequence of the upper jaw bone being imperfectly ossified in front, and one side of it forming a considerable projection forwards through the fissure which extended into the nostril, at the same time that the nose was seriously distorted to one side of the face. The parents, persons of the first respectability, were therefore uncommonly solicitous for an early operation, some instances of the success of which in very young infants, had already been communicated to them by their friends. The projection of bone, they had also learned, might be cut away so as to permit the soft parts to meet, which they now would not do. The risk of an operation on the infant in question, then scarcely two months old, was fairly explained to the parents; but I doubt whether they could have been prevailed upon to wait three

months longer, had not Sir Astley Cooper represented to them the disadvantages of cutting away the bony projection, and urged the allowance of a little time to reduce the protuberance by means of pressure. As I had not had any previous conference with Sir Astley on the subject, I was particularly gratified in finding his advice agree precisely with what I had already given, when the case was first shown to me. Exactly when the infant was five months old, a period selected on account of its being the latest previously to the usual time of the commencement of the ailments of dentition, I performed the operation in the presence of Mr. Ives, of Chertsey, and Mr. Ives, jun., of Chobham. By this time the bone had been so effectually depressed, by means of a kind of spring-truss, constructed by Messrs. Salmon and Odly for the purpose, and worn several hours daily, that the soft parts admitted of being brought over it with tolerable facility. Union followed very well, and, though it was one of the worst hare-lips ever seen by Mr. Ives, senior, or myself, without an extensive division of the palate, the disfigurement is now very trivial, and the wrong direction of the nose constantly undergoing further diminution, in proportion as the jaw recedes under the pressure of the apparatus, which is still employed. This is the youngest infant on which I have operated; but, in October, 1824, I performed the operation on an infant twelve months old, at Walton-on-Thames, where I was assisted by Mr. Stillwell. Union took place favourably, without any indisposition whatever. Only one pin was used, at the lower part of the lip, as I found that the upper part of the division could be perfectly and readily closed with a strip of adhesive plaster.

Le Dran performed the operation on children of all ages, even on those at the breast. B. Bell operated with success on an infant only three months old. Muys advises it to be undertaken as soon as the child is six months old. Roombuyseu operated on children ten weeks after their birth, and all his contemporaries praised his singular dexterity and success. As an essential step to the success of the operation, he recommended hindering the children from sleeping a certain length of time before it was undertaken, in order that they might fall asleep immediately afterwards; and with the same view opium has been prescribed.

Baron Dupuytren deems it unsafe to operate on newborn children, because their flesh is so soft, that the pins readily cut through it, and because general mortality, independent of every particular cause, being at this age greater than at any other period of life, it would be imprudent to augment the chances of death, which hang over the young being, by an additional one resulting from the operation. On the whole, he infers, that the best period for operating is when the infant is three months old. (See *Clin. Chir.* t. iv. p. 90—92.)

Putting out of consideration the partial success, which has attended the use of blistering plaster, for making the edges of the fissure raw and capable of union, all practitioners entertain the same sentiment, with regard to the object of this operation, which consists in reducing the preternatural solution of continuity to the state of a simple wound, by cutting off the edges of the separated parts throughout their length, and then keeping these parts in contact until they have completely grown together. But, although such principles have

been generally admitted, there was formerly some difference of opinion, with respect to the best method to be followed in practice; some operators having preferred sutures for keeping the edges of the wound in contact, while others disapproved of them, believing that a perfect cure might always be accomplished by means of adhesive plaster and an uniting bandage, so as to save the patient from all the pain and annoyance of sutures.

M. Louis thought that the use of sutures, in the operation for the hare-lip, proceeded from a false idea respecting the nature of the disease; for, the fissure in the lip being wrongly imputed to loss of substance, it was deemed impossible to keep the parts in contact except by a suture.

M. Louis lays it down as a fact, that, the retraction of the muscles being the cause of the separation of the edges of the fissure, it is not to these edges that the force which is to unite them should be applied; but to the very parts, whose action (the cause of the separation) is to be impeded. A great many means for supporting the wound, only irritate the muscles and excite them to action, and it is this action which we should endeavour to overcome. The means for promoting union, he says, can only be methodical, when directly employed to prevent such action, by an immediate application to the point where it is to be resisted. The facility with which the parts may be brought forward, so as to bring the two commissures of the lips into contact, by the mere pressure of the hands, shows what may be expected from a very simple apparatus, which will execute the same office without any effort, in a firm and permanent manner, and which will render sutures unnecessary, the inconveniences of which are too well known.

M. Louis, after having explained the reasons of the theory, on which he founded his method, details the history of twenty cases, in which his plan perfectly succeeded, both in accidental hare-lips, with considerable loss of substance, and in natural ones. In most of these instances, however, it was thought proper to assist the bandage with one stitch at the extremity of the fissure, close to the vermilion border of the lip, for the purpose of keeping the parts securely on a level. This fact seems to me a full admission of the practical advantages of a suture.

Notwithstanding the operation as performed with the twisted suture, is opposed by an authority of such weight as that of M. Louis, still it is the method now universally practised. No modern surgeons doubt that a hare-lip may be cured by means of adhesive plaster, and uniting bandages, quite as perfectly as with a suture; and all readily allow, that the first of these methods, as being more simple and less painful, would be preferable to the latter, if it were equally sure of succeeding. But it is considered far more uncertain in its effect. To accomplish a complete cure, the parts to be united must be maintained in perfect contact, until they have contracted the necessary adhesion; and how can we always depend upon a bandage for keeping them from being displaced? What other means, besides a suture, affords in this respect perfect security?

I shall first describe the operation as usually performed at the present day, with the twisted suture. The first thing is to examine whether there is any adhesion of the lip to the gum; and,

if there be, to divide it with a knife. Some authors (*Sharp*) recommend the frænulum, which attaches the lip to the gum, always to be divided: but when the hare-lip is at some distance from this part, it will not be in the way of the operation, and need not be cut. On the other hand, when the frænulum is situated in the centre of the division, it should be divided beforehand. When one of the incisor teeth, opposite the fissure, projects forward, it must be drawn, lest it irritate the parts, after they have been brought into contact.

Sometimes, but particularly when a cleft exists in the bony part of the palate, a portion of the upper jaw forms such a projection, just in the situation of the fissure in the lip, that it would render the union very difficult, if not impracticable. In this circumstance, the common plan has been to cut off the projecting angles of bone with a strong pair of bone-nippers. The part was then healed, and the operation for the hare-lip performed. Cutting off the projection of bone leads to a diminution in the diameter of the bone, which no longer corresponds to the lower jaw bone, and great disfigurement, and even inconvenience in mastication, are the consequences. Hence, Desault used to employ simple compression, by which means the prominence was usually reduced in a few weeks, and the opportunity afforded of operating for the cure of the hare-lip. (*Euvres Chir.* t. ii. p. 207.) Of course, the actual necessity of using bone-nippers, or even of having recourse to compression, will depend upon circumstances; for if the prominence of bone be sharp and irregular, no surgeon, I conceive, would hesitate about the removal of such inequalities in preference to the trial of pressure. Mr. Dunn, of Scarborough, has expressed to me his doubts whether cutting off the projections of the alveolar process be ever necessary, as the pressure of the entire lip gradually diminishes the deformity. "I had (says he) two very unseemly cases, with an immense division of the palate, together with a projection of the alveolar process, which, with the incisor teeth, resembled the talons of a bird. A tubercular appendage of skin hung from the base of the nose. By drawing the teeth, in the first case, very delicately, I avoided fracturing the bony projection. I then cut off one edge of the nasal appendage, and of the lip on the same side, and attached them together with two needles. The wound was sufficiently united in a week or ten days to allow the same operation on the other side. In less than three weeks, the boy was sent home quite well, to the astonishment of the neighbourhood, where his frightful appearance had made him an object of disgust and ridicule. I succeeded in the other case even without the extraction of the teeth. Both the patients can now articulate labial sounds, retain their saliva, and are gradually losing the inconvenience of the passage of the mucus from the nose into the mouth, as the fissure is more contracted, and the projection by no means so disagreeable." These facts should lessen the haste with which certain operators proceed to cut off every projection of the alveolar process; for a moderate prominence of bone without any sharp, irritating edges, or angles, will not hinder the success of the operation; and even the propriety of removing teeth must entirely depend upon their being likely, by their direction, to irritate the lip, and disturb the union of the fissure.

One serious objection to cutting away the pro-

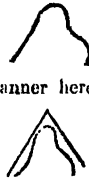
jection of the jaw is the deformity afterwards likely to continue during life from the deficient of the incisors teeth; and another is the subsequent overlapping of the lower jaw, and its projection beyond the upper one; communicating to the mouth an appearance seen in very old subjects. These were the considerations which induced me, in the case above mentioned, to employ pressure, which is much more conveniently applied by means of a kind of spring-truss, adapted to the child's head, than with bandages, which would be seriously annoying, and the right action of which could not be regulated without the utmost difficulty. When also some of the bone must be cut away, on account of its roughness and angular prominences, I advise the practitioner to remove only the irritating points, and afterwards have recourse to pressure.

In a boy, thirteen years old, where the alveolar process jutted forward, M. Gensoul took hold of it with a strong pair of forceps, and brought it into the perpendicular position by main force. This rough method succeeded perfectly. (*See J. F. Malgaigne, in Manuel de Méd. Opér.* p. 444. ed. 2.)

Dupuytren had a particular method of operating in some cases of complicated hare-lip. He observed, that when the labial tubercle was inserted very close to the point of the nose, its union to the lateral parts drew the lip upwards, and exposed the gums and teeth; while the nose itself was pulled down and flattened in a most ugly manner. Hence he conceived, that it would be better to employ the labial tubercle in forming the lower part of the partition of the nose, and to unite at once the lateral portions of the lip. He first divided with a bistoury the fold of mucous membrane uniting the labial tubercle to the osseous one, and then, with a pair of cutting forceps, removed all such portions of the latter as projected beyond the anterior level of the jaws. He next pared off the sides of the cutaneous tubercle, and its lower edge. These things having been done, the vertical margin of the fissure, on each side, was cut off with a pair of scissors. The two lateral portions of the lip were now brought together, and united with two pins; and then the fresh-cut bleeding middle tubercle was laid over the bony partition of the nostrils, of which it was to form the lower portion. A third pin was applied, so as to include at once the upper end of each part of the lip, and the loose extremity of the reflected tubercle. Lastly, two interrupted sutures united the angles of this tubercle to the lateral portions of the lip. The sutures were assisted with strips of adhesive plaster, and a bandage, that made pressure on the apex of the nose, so as to keep the flap from being too much stretched. (*See Clin. Chir.* t. iv. p. 92.)

In the operation for single hare-lip, the grand object is to make as smooth and even a cut as possible, in order that it may more certainly unite by the first intention, and of such a shape, that the cicatrix may form only one narrow line. Hence in this country, the edges of the fissure are cut off with a sharp knife. One plan is to place any flat instrument, such as a piece of horn, wood, or pasteboard, underneath one portion of the lip, and then, holding the part stretched and supported on it, to cut away the whole of the callous edge. Another is to hold the part with a pair of forceps, the under blade of which is much broader than the upper one; the first serves to support the lip, the other

contributes also to this effect, and, at the same time, serves as a sort of ruler for guiding the knife in an accurately straight line. When the forceps are preferred, the surgeon must of course leave out of the upper blade just as much of the edge of the fissure as is to be removed, so that it can be cut off with one sweep of the knife. This is to be done on each side of the cleft, observing the rule, to make the new wound in straight lines, because the sides of it can never be made to correspond without this caution. For instance, if the hare-lip has this shape, the incision of the edges must be continued in straight lines till they meet in the manner here represented. In short, the two incisions are to be perfectly straight, and are to meet at an angle above, in order that the whole track of the wound may be brought together, and united by the first intention.



In University College Hospital, the margins of the fissure are usually removed by transfixing the lip with a long sharp-pointed narrow bistoury just above the upper end of the cleft, and then cutting towards the red portion of the lip, while the part is held and stretched, by the surgeon himself, or his assistant. One side of the cleft is thus pared off, and then the other; particular care being taken to remove a small piece of the red part of the lip on each side, lest an ugly notch should be left in that situation. This is the plan ordinarily followed by Mr. Liston.

In France, the edges of the fissure are always taken off with a pair of strong, sharp, long-handled scissors, invented for the purpose by M. Dubois. (See *Alf. A. L. M. Velpeau in Nouv. Élém. de Méd. Opér.* t. ii. p. 4.; and *J. F. Malgaigne, in Manuel de Méd. Opér.* p. 442, ed. 2.) Scissors had an advocate in Desault, (*Eurr. Chr. t. ii. p. 179*); and B. Bell was also in favour of them.

Two silver pins, made with steel points, which admit of easy removal, are next to be introduced through the edges of the wound, so as to keep them accurately in contact; the lowest pin being introduced first, near the inferior termination of the wound, and the upper pin afterwards, about a quarter of an inch higher up. A piece of thread is then to be repeatedly wound round the ends of the pins, from one side of the division to the other, first transversely, then obliquely, from the right or left end of one pin above, to the opposite end of the lower one, &c. Thus the thread is made to cross as many points of the wound as possible, which greatly contributes to maintaining its edges in even apposition. Lastly, the steel points of the pins are to be taken off, or, if not made to slide off, they are to be supported by small dossils of lint, placed between them and the skin. In University College Hospital, Mr. Liston employs largish common needles, the heads of which are dipped in sealing wax: and after they have transfixed the lip, he then takes off their points with a pair of cutting forceps. This plan removes all chance of the interruption sometimes caused by the steel points of silver pins not readily slipping off, when they have fulfilled their duty. Instead of pins, made with steel points, Dr. Barton, of Philadelphia, prefers using a piece of iron wire, with a point made by simply cutting it with a pair of scissors. Thus he avoids the risk of the steel point slipping off the pin, and remaining within the lip, an accident, which Dr. Reese

states has often happened. "So many failures (says he) have occurred from the pins being torn out by the child, or catching in the nurse's clothes, that if there were no other objection to the use of pins, they ought to be abandoned. Many surgeons in this country (the United States), and among these, Dr. Mott, have adopted the interrupted suture in cases of hare-lip, and with the most satisfactory results." Notice is then taken of Sir Astley Cooper's relinquishment of the twisted suture. (*See Dr. Reese's Amer. ed. of this Dict.*)

It is obvious that a great deal of exactness is requisite in introducing the pins, in order that the edges of the incision may afterwards be precisely applied to each other. For this purpose, some surgeons previously place the sides of the wound in the best position, and mark with a pen the points at which the pins should enter, and come out again. The pins ought never to extend more deeply than about two-thirds through the substance of the lip, and it would be a great improvement always to have them of a flat, instead of a round shape, and a little curved, as this is the course which they naturally ought to take when introduced. The steel points should also admit of being easily taken off, when the pins have been applied; and, perhaps, having them to screw off and on, is the best mode, as removing them in this way is not so likely to be attended with any sudden jerk, which might be injurious to the wound, as if they were made to pull off. In general, the pins may be safely removed in about four days, when the support of sticking plaster will be quite sufficient.

After the operation, compresses and a bandage for keeping forward the cheeks, are sometimes employed; but they may in general be dispensed with, because irksome to children, and the occasion of restlessness.

The process just described is what is well known by the name of the *twisted suture*, which is applicable to other surgical cases, in which the grand object is to heal some fistula, or opening, by the first intention. Thus, as Mr. Sharp observes, it is of great service in fistulas of the urethra, remaining after the operation for the stone, in which case callous edges may be cut off, and the lips of the wound held together by the above method.

Although the generality of surgeons use the twisted suture, I ought to notice, that Sir Astley Cooper gives the preference to the common interrupted suture, on account of the difficulty sometimes experienced in withdrawing the pins, and the liability of the new adhesions to be broken on the occasion; whereas the threads of a common suture may be cut, and taken out with the greatest facility. However, as most children cry on the removal of the suture, whether one kind or the other be employed, the only safe plan is not to withdraw the pins or ligatures till three or four complete days have elapsed from the time of the operation, when the adhesions will be tolerably strong; and the cheeks should always be held forward by an assistant, until the plasters, and, if deemed necessary, compresses and a bandage, have been put on.

These observations particularly refer to the most simple form of the hare-lip, viz. to that which presents only one fissure. When there are two clefts, the cure is accomplished on the same principle; but it is rather more difficult of execution;

so that the old surgeons, until the time of Heister, almost all regarded the operation for the double hare-lip as impracticable: only a few described it, with the direction to operate on each fissure, just as if it were single. M. de la Faye operated in this way with success. (*Mém. de l'Acad. de Chir.* t. iv. 4to.) M. Louis was of opinion, that all difficulties would be obviated by doing the operation at two different times, and awaiting the perfect cure of one of the fissures, before that of the other was undertaken. Experience proves, however, that it is not essential to perform two operations for the cure of the double hare-lip. Desault found, that when the edges of the two fissures were pared off, and care taken to let one of the pins pass across the central piece of the lip, the practice answered extremely well. (See *Œuvres Chir.* t. ii. p. 201.)

In cutting off the edges of the fissure, the incision must be carried to the upper part of the lip; and even when the fissure does not reach wholly up the lip, the same thing should be done; for, in this manner, the sides of the wound will admit of being applied together more uniformly, and the cicatrix will have a better appearance. We should also not be too sparing of the edges which are to be cut off. Practitioners, says M. Louis, persuaded that the hare-lip was a division with loss of substance, have invariably advised the removal of the callous edges. But, in the natural hare-lip there is no callosity; the margins of the fissure are composed, like those of the lip itself, of a pulpy, fresh-coloured, vermilion flesh, covered with an exceedingly delicate cuticle. The whole of the part having this appearance must be taken away, together with a little of the true skin. At the lower part of the fissure, towards the nearest commissure, a rounded red substance is commonly situated, which it is absolutely necessary to include in the incision. Were this neglected, the union below would be unequal, and, through an injudicious economy, a degree of deformity would remain. The grand object, however, is to make the two incisions diverge at an acute angle, so that the edges may be put into reciprocal contact their whole length, without the least inequality.

The pins should be introduced at least two thirds of the way through the substance of the lip, lest a furrow should remain on the inside of the part, which might allow pieces of food to lodge in it. There is, however, a stronger reason for attending to this circumstance, viz. the hemorrhage which may take place when it is neglected. As soon as the edges of the wound have been brought together by means of the suture, and the pins are properly placed, the bleeding ceases; but, when the pins have not been introduced deeply enough, and the posterior surfaces of the incisions are not applied to each other, the blood may continue to run into the mouth, and give the surgeon an immense deal of trouble. In the memoir, written by Louis, there is a case, in which the patient died in consequence of such an accident. Persons who had undergone the operation were formerly advised to swallow their spittle, even though mixed with blood, in order to avoid disturbing the wound, by getting rid of it otherwise. In the case alluded to, the patient, who had been operated upon for a cancerous affection of the lip, swallowed the blood as he had been directed to do, and he bled so profusely that he died. On the examination of the

body, the stomach and small intestines were found full of blood. "This deplorable case," says the illustrious author who relates it, "deserves to be recorded for public instruction, for the purpose of keeping alive the attention of surgeons on all occasions, where, in consequence of any operation whatsoever, there is reason to apprehend bleeding in the cavity of the mouth. Platner is the only writer who, so far as I know, forswears this kind of danger."

What has been said concerning the operation for the hare-lip is equally applicable, not only to the treatment of cancer of the lip, but also to that of accidental cuts or lacerations of this part, from any cause whatsoever.

When there is a fissure in the bones forming the roof of the mouth, it usually diminishes, and gradually closes, after the hare-lip is cured. But this does not always happen; and when the parts remain so considerably separated, as to obstruct speech and deglutition, or cause any other inconvenience, a plate of gold or silver, exactly adapted to the arch of the palate, and steadied by means of a piece of sponge, fixed to its convex side, and introduced into the cleft, may sometimes be usefully employed. When the sponge is of suitable size, and very dry before being used, the moisture of the adjacent parts will make it swell, and in many cases be sufficient to keep it in its situation, so as greatly to facilitate speaking and swallowing. Sometimes, however, the fissure is so slanted, that the sponge cannot be fixed in it; this principally happens when the opening widens very much towards the front of the jaw. In such cases it has been proposed to fix a plate of gold, by means of springs covered with the same metal. Platina, which is cheaper, might be used for the same purpose. The subject, however, of artificial palates, is one on which much mechanical ingenuity may yet be usefully exerted; and it can hardly be expected, that I should here do more than give references to works in which the reader may find information upon it.

See *Fauchard, Le Chirurgien-Dentiste*, 2 tom. 12mo. Paris, 1728. *Camper, Vermischte Schriften*, No. 13. *Loder's Journ.* b. ii. p. 25. p. 155. &c. *Von Strechling* über eine merkwürdige künstliche Ersetzung mehrerer, sowohl zur Sprache, als zum Schlucken nothwendiger, zerstörter Werkzeuge, &c. Heidelberg, 1793. *Schubd, Chir. Taschenb.* No. 20. *J. H. F. Autenrieth, Supplementa ad Hist. Embryonis Humani, quibus accedunt Observata quædam circa Palatum fissum, verosimilissimeque illi medendi Methodum*, 4to. Tübing. 1797. *Callerton*, in *Journ. Gén. &c.* t. xix. *Reauch, Périod.* &c. t. xi. p. 22. *Dict. des Sciences Méd.* t. xxxvii. art. Obturateur. *C. Græfe et Ph. von Walther, Journ. der Chir.* b. i. p. 1. 8vo. Berlin, 1820: in this work, *Græfe* has described a method of curing fissures in the soft palate by means of a particular kind of suture, with the various instruments necessary in the operation. *James Snell, Obs. on Artificial Palates*, 8vo. Lond. 1828.

For information relative to the hare-lip, see *B. Bell's Surgery*, vol. iv. *Heister's Surgery. Le Dran's Operations. Sharp's Operations.* *F. D. Merriault, Mém. de l'Acad. des Sciences*, année 1713. p. 86.: a very curious case, complicated with a fissure in the palate, and two oblong apertures at the sides of this cleft. In play, the child would sometimes fill his mouth with water, and, through those apertures, let it spout out at the nostrils, in imitation of what takes place in whales. *G. de la Faye, Mém. de l'Acad. Royale de Chir.* t. i. p. 605. année 1743. *F. Sandfort, Obs. Anat. Pathol.* 4to. et Museum Anat. p. 110, 164. *Ludg. Bat.* 1777. *Plajani, Collezione d'Osserv.* &c. t. iv. 8vo. Roma. *Latta's Surgery*, vol. II. *Louis*, in *Mém. de l'Acad. de Chir.* t. iv. p. 385. 4to. année 1768. t. v. p. 292. année 1774. *De la Médecine Opératoire*, par Salutar, t. iii. p. 272. 8vo. Paris, 1810. *Œuvres Chir. de Desault*, par *Bichat*, t. ii. p. 173. *Traité des Opérations de Chirurgie*, par *A. Bertrandi*, chap. 19. *P. N. Huguettier, Sur le Bec-de-lièvre naturel*, 4to. Paris, 1804. *J. Kirby, Cases*, &c. 8vo. Lond. 1819: forceps

HEAD, INJURIES OF THE.

recommended for holding the lip in the operation. *Recher.* Anfangsgr. der Wundarzn. b. II. Kap. 7. *Locher*, de Operatione labii leporini. Jenæ, 1795. *Fretur*, de Labio leporino. Halæ. 1798. *Rieg.*, von der Hausscharte. Frankf. 1803. *M. J. Chelius*, Handb. der Chir. b. I. p. 426. Haidelb. 1826. *Sprengel*, Geschichte der Chir. Operationen, b. I. p. 158. *Græge*, Angiectasis, v. Langenbeck Bibl. b. II. p. 389. *Eckoldt*, Ueber eine sehr complicirte Hausscharte. Leipz. 1804. fol. *Sir Astley Cooper's Lectures*, ed. by *Tyrrrell*. *Baron Dupuytren*, in *Leçons Orales de Clin. Chir.* t. IV. p. 89. *R. Liston*, *Éléments de Chirurgie*. *A. J. Velpeau*, *Nouv. Élém. de Méd. Opér.* t. II. art. 1. 8vo. Paris, 1832. *J. F. Malgaigne*, *Manuel de Méd. Opér.* p. 439. ed. 2. 12mo. Paris, 1857.

HEAD, INJURIES OF THE. 1. From the variety of parts of which the scalp is composed, from their structure, connections, and uses, injuries done to it by external violence become of much more consequence, than the same kind of ill can prove, when inflicted on the common integuments of the rest of the body. One principal reason of the danger in these cases depends upon the free communication between the vessels of the pericranium, and those of the dura mater, through the diploe of the skull; for, when inflammation is kindled in the former membrane, it may extend itself to the latter. According to Sir Astley Cooper, there are three modes in which wounds of the scalp may induce fatal consequences:—1st, by exciting erysipelatous inflammation; 2dly, by producing extensive suppuration under the tendon of the occipito-frontalis; 3dly, by rendering a simple fracture compound, so as to cause more extensive inflammation of the dura mater. (*Lectures*, vol. i. p. 350.) The latter observation, so far as my information reaches, is new, and deserves the serious consideration of the practitioner; for, in the great hospital where I was educated, and in all the practice which I have seen in the army and elsewhere, no analogy of this kind was ever suspected between ordinary compound fractures and those of the cranium. If the doctrine be correct, it forms another weighty argument against the method of cutting down to a fracture of the skull, without urgent motives.

Incised wounds of the scalp are, indeed, less liable than contused and lacerated ones, to produce bad consequences; but they are not entirely devoid of danger; in proof of which Sir Astley Cooper mentions the case of a lady of rank in the country, who died from the removal of an encysted tumour of the scalp. (*Lectures*, vol. i. p. 349.) I have seen several unfortunate cases of this kind both in hospitals and out of them. We know, in fact, that the scalp is a part frequently attacked by erysipelas, and this after very slight injuries. Passing over incised wounds, however, which generally heal as well as the generality of cuts of other parts of the skin, and require no particularity of treatment, I will proceed to the consideration of lacerated and punctured wounds. "The former may be reduced to two kinds: viz. those in which the scalp, though torn, or unequally divided, still keeps its natural situation, and is not stripped nor separated from the cranium, to any considerable distance beyond the breadth of the wound; and those in which it is considerably detached from the parts it ought to cover. The first of these, if simple, and not combined with the symptoms, or appearances of any other mischief, does not require any particular or different treatment, from what the same kind of wounds require in all other parts;" but with respect to those in which the scalp is separated and detached from the parts it ought to co-

ver, Mr. Pott makes no scruple of declaring it as his opinion, that its preservation ought always to be attempted, *unless it be so torn as to be absolutely spoiled, or there are manifest present symptoms of other mischief.* In former days, the excision of the lacerated and detached scalp was the general practice; but Mr. Pott had so often made the experiment of endeavouring to preserve the torn piece, and so often succeeded, that he recommended it as a thing always to be attempted, even though a part of the cranium were perfectly bare.

Here I may remark that all practitioners now invariably avoid cutting away the scalp, even in the circumstances in which such practice was allowed by Pott. By *spoiled* this eminent writer must mean so injured as necessarily to slough afterwards. However, as no harm results from taking the chance of its not sloughing, which never can be foretold with certainty; and as the excision of the part is painful, and productive of no benefit, even if sloughing must follow, such operation is in every point of view hurtful and wrong. With respect to other mischief, as a reason, the examination of the cranium, and even the application of the trephine, never require any of the scalp to be cut away. (See TREPHINE.)

Let the surgeon, therefore, free the torn piece from all dirt, or foreign bodies, and restore it as quickly, and as perfectly, as he can to its natural situation, and keep it there with strips of adhesive plaster, and, if necessary, with sutures, which are chiefly useful for maintaining the angles of the flap, in their right position. As few sutures, however, as possible should be employed, because they augment the irritation and the chances of erysipelas.

Sometimes the loosened scalp will unite with the parts from which it is torn and separated, and there will be no other granulating surface, than what arises from the impracticability of bringing the lips of the wound into smooth and immediate contact, the scar of which surface must be small in proportion.

In some cases, the whole separated piece will unite perfectly, and give little or no trouble, especially in young and healthy persons. In some, the union will take place in certain parts and not in others (also Sir B. Brodie, in *Med. Chir. Trans.* vol. xiv. p. 408), and consequently matter will be formed, and require to be discharged, perhaps at several different points; and in some particular cases, circumstances, and habits, there will be no union at all; the torn cellular tissue, or the naked aponeurosis, will inflame and become sloughy, a considerable quantity of matter will be collected, and, perhaps, the cranium will be denuded. But even in this state of things, which, as Pott observes, is almost the worst that can happen in the case of mere simple laceration and detachment, the surgeon will often find the cure much more feasible than he may at first imagine: let him take care to keep the inflammation under by proper means; let him have patience till the matter is fairly and fully formed, and the sloughs perfectly separated; and when this is accomplished, let him make a proper number of dependent openings for the discharge of them; and let him, by bandage, and other proper management, keep the parts in constant contact with each other; and he will often find, that although he was foiled in his first intention of procuring immediate union, yet he will frequently succeed in this his second; he will yet

save the scalp, shorten the cure, and prevent the great deformity arising (particularly to women) not only from the scar, but from the total loss of hair.

This union may often be procured, even though the cranium should have been perfectly denuded by the accident; and it is true, not only though it should have been stripped of its pericranium at first, (see *Abernethy on the Injuries of the Head*, case 6.) but even if that pericranium should have become sloughy and cast off, as Pott and every surgeon of experience have often seen.

"Exfoliation from a cranium laid bare by external violence, and to which no other injury has been done than merely stripping it of its covering, is a circumstance (says Pott) which would not so often happen if it was not taken for granted that it must be, and the bone treated according to such expectation. The soft open texture of the bones of children and young people will frequently furnish an incarnation, which will cover their surface, and render exfoliation quite unnecessary (see Sir B. Brodie, in *Med. Chir. Trans.* vol. xiv. p. 409.); and even in those of mature age, and in whom the bones are still harder, exfoliation is full as often the effect of art as the intention of nature, and produced by a method of dressing calculated to accomplish such end, under a supposition of its being necessary. Sometimes, indeed, it happens that a small scale will necessarily separate, and the sore cannot be perfectly healed till such separation has been made; but this kind of exfoliation will be very small and thin, in proportion to that produced by art, that is, by dressing the surface of the bare bone with spirituous tinctures, &c.

In some of these instances, the exfoliation takes place as it were imperceptibly. In University College Hospital, I have had several cases in which, though a portion of dead bone was plainly felt for a time, it ultimately disappeared, and the wound healed up. M. Velpeau has often observed the same thing in the hospitals of Paris, and this not only with respect to small superficial necroses of the cranium, but those of other bones. (See *Alf. A. M. L. Velpeau, De l'Opération du Trepan*, &c., p. 20.) On this point my experience entirely coincides with that of M. Velpeau. In such cases, is the scale of bone absorbed? or is it dissolved, and does it come away unperceived in minute particles with the discharge? M. Velpeau believes, that there is a dissolution, and not an imperceptible exfoliation. "In certain cases (says he), there does not appear to be any exfoliation, although the denuded surface of the bone has been for a long time in contact with the air, or pus. In other instances a fine scale is separated, which is either insensibly destroyed by the soft parts, or passes out. Lastly, in some persons, the dead layer of bone, though very thick, ceases to excite suppuration, and yields to the molecular action of the textures. These are phenomena (he observes) which deprive the pericranium of a great deal of that influence, which has been assigned to it in the reproduction of bone, and the formation of necroses." (*Op. cit.* p. 21.)

Wounds made by bodies which pierce, or puncture rather than cut, are, in general, more apt to become inflamed, and to give trouble, than those which are larger. In particular, simple and phlegmonous erysipelas of the head are frequent consequences of such injuries, in constitutions predis-

posed to them, either naturally, or from the influence of atmospheric causes, or intemperance. Having already considered this subject (see *ERYSIPELAS*), I need not here expatiate upon it. Let us notice, however, the observation of Pott, that in erysipelas of the head from a wound, he believed bark to be never productive of any decided benefit. He confided entirely in antiphlogistic means. Where also the cellular tissue, under the tendon of the occipito-frontalis, was implicated, as it is in some examples of phlegmonous erysipelas, he found that a simple incision down to the bone would most commonly remove all the bad symptoms; a remark meriting attention, with reference to the modern revival of the practice of incisions in this disorder, which, indeed, are mentioned by Freund.

"When the scalp receives a very smart blow, it often happens that a quantity of extravasated blood immediately forms a tumour, easily distinguishable from all others, and generally very easily cured. But it also sometimes happens, that this kind of tumour produces to the fingers of an unadvised or inattentive examiner, a sensation so like to that of a fracture, with depression of the cranium, as may be easily mistaken." Now, if, upon such supposition, a surgeon immediately makes an incision into the tumid scalp, he may give his patient a great deal of unnecessary pain, and for that reason run some risk of his own character.

"The touch is in this case so liable to deception, that recourse should always be had to other circumstances and symptoms, before an opinion be given.

"If a person, with such tumour occasioned by a blow, and attended with such appearances and feel, has any complaint, which seems to be the effect of pressure made on the brain and nerves, or of any mischief done to the parts within the cranium, the division of the scalp, in order to inquire into the state of the skull, is right and necessary; but if there are no such general symptoms, and the patient is in every respect perfectly well, the mere feel of something like a fracture will not authorise or vindicate such operation, since it will often be found, that such sensation is a deception, and that, when the extravasated fluid is removed, or dissipated, the cranium is perfectly sound and uninjured." (*Pott*.)

When blood is extravasated under the scalp, the surgeon need not be too officious with his knife, merely because there is a tumour containing blood. The facility, with which an effusion of blood under the scalp is dispersed, is well illustrated in a case mentioned by Sir Benjamin Brodie. He was consulted about a young gentleman, under whose scalp an effusion of blood extended from the superiliary ridges to the nape of the neck, and from ear to ear. The blood appeared to be in a fluid state, and was so copious, that no part of the cranium could be felt. In a few weeks, and with the aid of a cold lotion, the whole tumour was dispersed. Sir Benjamin Brodie observes, that whatever might be the vessel ruptured, it must have continued to bleed a considerable time, in order to produce so large an extravasation. I have seen three or four cases, nearly as remarkable as the preceding, and having a similar favourable termination under the use of simple discutient lotions and occasional purgatives. In one instance, attended by Sir B. Brodie, he succeeded in preventing the effusion from attaining

the extent described in his other case, by means of pressure applied to the point where the blow had been received, and a vessel ruptured. (See *Med. Chir. Trans.* vol. xv. p. 406.)

In wounds of the head, Dr. Hennen has very properly advised surgeons not to be content with clipping away a little of the hair around the injury, but always to have the head shaved to a proper extent. This proceeding, which is perfectly harmless in itself, is more generally right, than the custom of cutting the scalp, which has been too frequently employed without any rational aim. The free removal of the hair, directly after the accident, often brings into view marks indicative of other parts of the head having been struck, besides that which is at first noticed; and thus the practitioner will have a more correct notion of the serious nature of the accident, than he might otherwise have conceived, and be more strict in his mode of treatment. Nay, fractures and depression of the skull, sometimes not denoted by any disturbance of the functions of the brain, and liable to escape observation, while concealed under the hair, are frequently detected after its removal; and the surgeon, being now aware of the extent and situation of the mischief, must of course be better qualified to conduct the treatment. In short, as Dr. Hennen has observed, "independent of the more accurate view (thus procured), we facilitate the application of leeches, if they may be found necessary, and of a most excellent adjuvant on all occasions, viz. cold applications."

It affords me particular pleasure to be able to number so good a surgeon as Dr. Hennen amongst the advocates of Schmucker's plan of having the head well shaved and covered with cloths wet with a very cold lotion; a practice which the latter eminent surgeon always adopted, whether a sabre-cut or gunshot injury of this part had the appearance of being serious or not. "As soon as the patient was brought to the hospital with a wound of the head, whether the injury looked important or not (says Schmucker), I directed the hair to be immediately removed, and after the necessary dilatation, applied dressings. Sixteen ounces of blood were next taken away, and the evacuation, in less quantity, repeated, according to circumstances, three or four times, within the space of twenty-four hours. The pulse now generally became softer, and the determination of blood to the head lessened. Over the dressings, and the whole of the head, thick cloths, dipped in the cold mixture hereafter specified, were laid, and renewed every hour. These cloths were kept in their place with the bandage called the *grand couvre-chef*. (See *BANDAGE*.) As internal medicines, the nitrate of potassa, neutral salts, and emollient and stimulating clysters, and gentle aperients were given. These means were employed, both in slight injuries, and in those where the bones were depressed, and fissures and fractures were accompanied with violent convulsive twitches, coma, paralysis, and other bad symptoms; and even in cases where the use of the trephine was indispensable, the practice was continued until the cure was complete." Schmucker assures us, that, under such treatment, fewer patients with wounds of the head were lost than used previously to happen, especially of those whose injuries at first had the appearance of being but slight. (See *Chir. Wahrnehmungen*, b. i. p. 154.)

Schmucker was led to try this practice by the decided benefit which he had seen afforded by the application of cold water to the head in cases of mania, attended with great determination of blood to the brain. And, in order to increase the efficacy of the water, he added to every five gallons of it two quarts of vinegar, sixteen ounces of nitre, and eight of the muriate of ammonia. This mixture was then preserved for use in a cold place. (Vol. cit. p. 153.) Or, in order to avail ourselves fully of the frigorific effects of this mixture, it should be prepared, as Dr. Hennen observes, in small quantities, and used immediately, before its temperature has risen; or, "snow, or pounded ice, or ice-water applied to the parts in a half-filled bladder, or cloths simply dipped in cold water, will often answer every purpose." (*On Military Surgery*, p. 279. ed. 2.) Dr. Hennen mentions one important fact, in recommendation of cold applications, antimonials, and saline purgatives, preceded by the common blue pill, and assisted with quiet and abstinence, viz. by such means "those troublesome puffy enlargements and erysipelatous affections of the scalp, which so often succeed to bruises," are prevented, and where the evacuant plan is duly observed, the extensive and formidable erysipelatous affections, so common formerly, are rare and mild at present in military hospitals." Let this be a lesson to those, who have charge of civil ones.

2. EFFECTS OF CONTUSION ON THE DURA MATER AND PARS WITHIN THE SKULL.

In consequence of blows, falls, and other shocks, either blood may be effused under the cranium, or inflammation and suppuration of the dura mater may arise. The best description of the latter case is that delivered by Mr. Pott.

Smart and severe strokes on the middle part of the bones, at a distance from the sutures, he says, are most frequently followed by this kind of mischief; the coats of the small vessels, which sustain the injury, inflame and become sloughy, and, in consequence of such alteration in them, the pericranium separates from the outside of that part of the bone which received the blow, and the dura mater from the inside, the latter of which membranes, soon after such inflammation, becomes sloughy also, and furnishes matter, which matter being collected between the said membrane and the cranium, and having no natural outlet, whereby to escape or be discharged, brings on a train of very terrible symptoms, and is a frequent cause of destruction. The effect of this kind of violence is frequently confined to the vessels connecting the dura mater to the cranium, in which case the matter is external to the said membrane; but sometimes the matter formed in consequence of such violence is found on the surface of the brain, or between the pia and dura mater, as well as on the surface of the latter; or, perhaps, in all these three situations at the same time.

The difference of this kind of disease from either an extravasation of blood, or a concussion of the brain, is great and obvious. "All the complaints produced by extravasation are such as proceed from pressure made on the brain and nerves, and obstruction to the circulation of the blood through the former; stupidity, loss of sense and voluntary motion, laborious and obstructed pulse and respiration, &c. and (which is of importance to

remark), if the effusion be at all considerable, these symptoms appear immediately, or very soon after the accident.

"The symptoms attending an inflamed or sloughy state of the membranes, in consequence of external violence, are very different; they are all of the febrile kind, and never, at first, imply any unnatural pressure: such are, pain in the head, restlessness, want of sleep, frequent and hard pulse, hot and dry skin, flushed countenance, inflamed eyes, nausea, vomiting, rigor, and toward the end, convulsion and delirium. And none of these appear at first, that is, immediately after the accident; seldom until some days are passed."

This last observation, made by Pott, is one that is well worthy of the practitioner's constant recollection, lest he wrongly fancy his patient secure too soon, and neglect the early use of the only means by which a recovery can be effected. Thus, as Sir Astley Cooper notices, the time when inflammation of the brain (and it may be added of its membranes) follows the violence, is generally about a week; rarely sooner. Frequently, it does not come on till a fortnight or three weeks after the injury; and even more time must elapse before the patient is quite safe, or ought to deviate from a strict and temperate regimen. In confirmation of this remark, a case is mentioned, where the neglect to keep the bowels regular brought on a fatal attack of inflammation of the brain, as late as four months after the receipt of a blow on the head. (*Lectures, &c.*, p. 339.) In University College Hospital, I have had several cases in which the bad symptoms began at very late periods after the accident.

One set or class of symptoms is produced by an extravasated fluid, making pressure on the brain and origin of the nerves, so as to impair or abolish voluntary motion and the senses; the other is caused by the inflamed or putrid state of the membranes covering the brain, and seldom affects the organs of sense until the latter end of the disease, that is, until a considerable quantity of matter is formed, which matter must press like any other fluid.

'If there be neither fissure nor fracture of the skull, nor extravasation, nor commotion underneath it, and the scalp be neither considerably bruised nor wounded, the mischief is seldom discovered or attended to for some few days. The first attack is generally by pain in the part which received the blow. This pain, though beginning in that point, is soon extended all over the head, and is attended with a languor, or dejection of strength and spirits, which are soon followed by a nausea, and inclination to vomit, a vertigo or giddiness, a quick and hard pulse, and an incapacity of sleeping, at least quietly. A day or two after this attack, if no means preventive of inflammation are used, the part stricken generally swells, and becomes puffy and tender, but not painful; neither does the tumour arise to any considerable height, nor spread to any great extent: if this tumid part of the scalp be now divided, the pericranium will be found of a darkish hue, and either quite detached, or very easily separable from the skull, between which and it will be found a small quantity of dark-coloured ichor.

"If the disorder has made such progress that the pericranium is quite separated and detached from the skull, the latter will even now be found

to be somewhat altered in colour from a sound healthy bone.

"From this time the symptoms generally advance more hastily and more apparently; the fever increases, the skin becomes hotter, the pulse quicker and harder, the sleep more disturbed, the anxiety and restlessness more fatiguing; and to these are generally added irregular rigors, which are not followed by any critical sweat, and which instead of relieving the patient, add considerably to his sufferings. If the scalp has not been divided or removed, until the symptoms are thus far advanced, the alteration of the colour of the bone will be found to be more remarkable; it will be found to be whiter and more dry than a healthy one; or, as Fallopius has very justly observed, it will be found to be more like a dead bone: the sanies, or fluid, between it and the pericranium, will also, in this state, be found to be more in quantity, and the said membrane will have a more livid diseased aspect.

"In this state of matters, if the dura mater be denuded, it will be found to be detached from the inside of the cranium, to have lost its bright silver hue, and to be, as it were, smeared over with a kind of mucus, or with matter, but not with blood. Every hour after this period all the symptoms are exasperated, and advance with hasty strides; the headach and thirst become more intense, the strength decreases, the rigors are more frequent, and at last convulsive motions, attended in some with delirium, in others with paralysis, or comatose stupidity, finish the tragedy.

"If the scalp has not been divided till this point of time, and it be done now, a very offensive discoloured kind of fluid will be found lying on the bare cranium, whose appearance will be still more like to the healthy natural one; if the bone be now perforated, matter will be found between it and the dura mater, generally in considerable quantity, but different in different cases and circumstances. Sometimes it will be in great abundance, and diffused over a very large part of the membrane; and sometimes the quantity will be less, and consequently the space which it occupies smaller. Sometimes it lies only on the exterior surface of the dura mater, and sometimes it is between it and the pia mater, or also even on the surface of the brain, or within the substance of it, &c.

"As the inflammation and separation of the dura mater is not an immediate consequence of the violence, so neither are the symptoms immediate, seldom until some days have passed; the fever at first is slight, but increases gradually; as the membrane becomes more and more diseased, all the febrile symptoms are heightened; the formation of matter occasions rigors, frequent and irregular, until such a quantity is collected as brings on delirium, spasm, and death."

When the scalp has been wounded, Mr. Pott observes, [the wound will for some little time have the same appearance as a mere simple wound of this part, unattended with other mischief would have; it will, like that, at first discharge a thin sanies, or gleet, and then begin to suppurate; it will digest, begin to incrust, and look perfectly well; but, after a few days, all these favourable appearances will vanish; the sore will lose its florid complexion and granulated surface; will become pale, glassy, and flabby; instead of good matter, it will discharge only a thin discoloured sanies; the

lint with which it is dressed, instead of coming off easily (as in a kindly suppurating sore), will stick to all parts of it; and the pericranium, instead of adhering firmly to the bone, will separate from it, all round, to some distance from the edges.

"This alteration in the face and circumstances of the sore is produced merely by the diseased state of the parts underneath the skull; which is a circumstance of great importance, in support of the doctrine advanced, and is demonstrably proved, by observing that this diseased aspect of the sore, and this spontaneous separation of the pericranium, are always confined to that part which cover the altered or injured portion of the dura mater, and do not at all affect the rest of the scalp: nay, if it has by accident been wounded in any other part, or a portion has been removed from any part where no injury has been done to the dura mater, no such separation will happen.

"The first appearance of alteration in the wound immediately succeeds the febrile attack; and as the febrile symptoms increase, the wound becomes worse and worse; that is, degenerates more and more from a healthy, kindly aspect." (Pott.)

The same intelligent surgeon further observes "that it is no very uncommon thing for a smart blow on the head to produce some immediate bad symptoms, which after a short space of time disappear, and leave the patient perfectly well. A slight pain in the head, a little acceleration of pulse, a vertigo and sickness, sometimes immediately follow such accident, but do not continue many hours, especially if any evacuation has been used. These are not improbably owing to a light commotion of the brain, which, having suffered no material injury thereby, soon ceases. But if, after an interval of some time, the same symptoms are renewed; if the patient, having been well, becomes again feverish and restless, and that without any new cause; if he complains of being languid and uneasy, sleeps disturbedly, loses his appetite, has a hot skin, a hard quick pulse, and a flushed, heated countenance; and neither irregularity of diet nor accidental cold have been productive of these; mischief is most certainly impending, and that most probably under the skull.

"If the symptoms of pressure, such as stupidity, loss of sense, voluntary motion, &c. appear some few days after the head has suffered injury from external mischief, they do most probably imply an effusion of a fluid somewhere; this effusion may be in the substance of the brain, in its ventricles, between its membranes, or on the surface of the dura mater; and which of these is the real situation of such extravasation is a matter of great uncertainty, none of them being attended with any peculiar mark or sign that can be depended upon, as pointing it out precisely; but the inflammation of the dura mater, and the formation of matter between it and the skull; in consequence of contusion, is generally indicated and preceded by one which Mr. Pott has hardly ever known to fail; a puffy, circumscribed, indolent tumour of the scalp, and a spontaneous separation of the pericranium from the skull under such tumour."

Sometimes the scalp is so wounded at the time of the accident, or so torn away, as to leave the bone perfectly bare; and yet no suppuration on the dura mater may ensue. Hence, if the pericranium be only turned back, along with the detached portion of scalp, there may be probability of its re-union; and

it should be immediately made clean and replaced, for the purpose of such experiment; which, if it succeeds, will save time, and prevent considerable deformity. Should the attempt fail, it can only be in consequence of the detached part sloughing. Hence, removing it with a knife, though allowed by Pott, is now never practised. Frequently, when the scalp does not adhere at once, it becomes attached to the cranium afterwards by a granulating process. When the detached piece sloughs, the worst that can happen is an exfoliation from the bare skull.

Sometimes the force, which detaches or removes the scalp, also occasions the mischief in question; but the integuments being wounded or removed, we cannot have the criterion of the tumour of the scalp for the direction of our judgment. Our whole attention must be directed to the wound and general symptoms. The edges of the former will digest as well, and look as kindly for a few days, as if no mischief was done underneath. But after some little space of time, when the patient begins to be restless, and hot, and to complain of pain in the head, these edges will lose their vermilion hue, and become pale and flabby. Instead of matter, they will discharge a thin gleet, and the pericranium will loosen from the skull to some distance from the said edges. Immediately after this, all the general symptoms are increased and exasperated; and as the inflammation of the membrane is heightened or extended, they become daily worse and worse, until a quantity of matter is formed and collected, and brings on that fatal period, which, though uncertain as to date, very seldom fails to arrive.

"The method of attempting the relief of this kind of injury consists in two points: viz. to endeavour to prevent the inflammation of the dura mater; or, that being neglected or found impracticable, to give discharge to the fluid collected within the cranium, in consequence of such inflammation.

"Of all the remedies in the power of art, for inflammations of membranous parts, there is none equal to phlebotomy. To this truth many diseases bear testimony; pleurisies, ophthalmies, strangulated hernias, &c.; and if any thing can particularly contribute to the prevention of the ills likely to follow severe contusions of the head, it is this kind of evacuation; but then it must be made use of in such a manner as to become truly a preventive; that is, it must be made use of immediately and freely."

Acceleration or hardness of pulse, restlessness, anxiety, and any degree of fever, after a smart blow on the head, are always to be suspected and attended to. Immediate, plentiful, and repeated evacuations by bleeding have, in many instances, removed these, in persons to whom, Mr. Pott firmly believes, terrible mischief would have happened, had not such precaution been used. In this, as well as some other parts of practice, we neither have, nor can have, any other method of judging, than by comparing together cases apparently similar. Mr. Pott had more than once or twice seen that increased velocity and hardness of pulse, and that oppressive languor which most frequently precede mischief under the bone, removed by free and repeated bloodletting; and had often, much too often, seen cases end fatally, whose beginnings were fully as slight, but in which such evacuation had been either neglected, or not complied with. This judicious writer "would by no means be

thought to infer from hence, that early bleeding will always prove a certain preservative; and that they only die to whom it has not been applied: this, like all other human means, is fallible; and, perhaps, there are more cases out of its reach than within it: but where preventive means can take place, this is certainly the best, and the most frequently successful.

"The second intention, viz. the discharge of matter collected under the cranium, can be answered only by the perforation of it.

"When, from the symptoms and appearances already described, there is just reason for supposing matter to be formed under the skull, the operation of perforation cannot be performed too soon; it seldom happens that it is done soon enough."

In short, whenever the dura mater, after the head has received external violence, separates, or is detached spontaneously, from the bone underneath it, and such separation is attended with the collection of a small quantity of thin brown ichor, an alteration of colour in the separated pericranium, unnatural dryness of the bone, chilliness, horripilation, languor, and some degree of fever, Mr. Pott considers the operation indispensably necessary to save the patient's life.

"When the skull has been once perforated, and the dura mater thereby laid bare, the state of the matter must principally determine the surgeon's future conduct. In some cases, one operation will prove sufficient for all necessary purposes; in others, several may be necessary."

Notwithstanding the operation of perforation be absolutely and unavoidably necessary, as Mr. Pott remarks, "the repetition of bloodletting, or cooling laxative medicines, the use of antiphlogistic remedies, and a most strict observance of a low diet and regimen, are as indispensably requisite after such operation as before: the perforation sets the membrane free from pressure, and gives vent to collected matter, but nothing more; the inflamed state of the parts under the skull, and all the necessary consequences of such inflammation, call for all our attention, full as much afterwards as before; and although the patient must have perished without the use of the trephine, yet the merely having used it will not preserve him without every other caution and care." (Pott.)

In relation to this subject, a remark, made by Sir Astley Cooper, merits notice: when pus lies between the dura mater and skull, the application of the trephine, he acknowledges, is a successful practice; but, according to his experience, this situation of the purulent matter is comparatively rare, as it generally collects between the pia mater and surface of the brain, for which case an operation will be useless. (Lectures, &c. vol. i. p. 325.) It is stated by Sir Benjamin Brodie, that in hospital practice, suppuration between the dura mater and the bone, in consequence of fracture, is also less common at the present period, than when Pott wrote; a change which he refers to the stricter antiphlogistic plan adopted by modern surgeons, whether the early symptoms be or be not of a dangerous description. (See *Med. Chir. Trans.* vol. xiv. p. 411.)

My own observations agree with those of Sir Astley Cooper, respecting the greater frequency of purulent matter under, than upon the dura mater. Some months ago, I trephined a patient who had paralysis and other symptoms of pressure, preceded

by those of inflammation within the skull. I was partly induced to do so for the purpose of removing a necrosis, which, I conceived, might extend through both tables, and be a source of irritation. The matter, however, was not under the sequestrum which consisted merely of the outer table, but was diffused both between the arachnoid coat and dura mater, and also more deeply over the pia mater. The operation was therefore useless. In two other cases, which proved fatal, in University College Hospital, there was, indeed, pus on the surface of the dura mater; but there were also abscesses in the substance of the brain. Two fine specimens of this are preserved in the College Museum. Suppuration on the dura mater, though demanding the trephine, will often fail, not merely on account of the circumstances here adverted to, but because the brain and its membranes are actually in a state of inflammation. The matter may be discharged, but its pressure is not the only mischief. La Peyronie relates a case, in which an incision was made in the dura mater, and a basin of pus discharged, leaving a cavity that reached to the corpus callosum. The patient recovered. (*Acad. de Chir.* t. i. p. 250.) Baron Dupuytren ventured in one instance to make a puncture, an inch deep, in the brain, and was fortunate enough to reach the abscess: the case ended well. (*Pathol. Med. Ch.* t. iv. p. 308.)

I think it not improper to recommend again the practice of applying cold wet cloths to the head for the prevention and relief of inflammation of the dura mater; a plan to which, as already explained, Schmucker ascribed a good deal of the success with which he treated injuries of the head. It is favourably mentioned by Dr. Hennen, and has received the recommendation of another modern writer, whose opinion must have great weight: "In the inflammation, which succeeds slowly to injuries of the head, a species of inflammation not more insidious in its approach than dangerous in its consequences, cold is by far the most efficacious remedy that has yet been discovered." (See *Thomson's Lectures on Inflammation*, p. 181.)

Both tables of the skull sometimes exfoliate in consequence of external violence. Here the dead bone must be removed, as soon as loose; and, if necessary, the skull divided for the purpose. M. Velpeau mentions this as a case requiring the trephine, without exfoliation being awaited, and this whether symptoms of pressure exist or not; and he gives three cases in support of this doctrine. (*De l'opération du Trépan*, p. 23.) I have seen cases in which the patients recovered by the exfoliation of both tables; but some of them encountered so much danger, that I suspect their chance of recovery would have been increased by acting on the principle inculcated by M. Velpeau. Yet, where the symptoms are not urgent, I should recommend awaiting exfoliation. M. Velpeau is, perhaps, rather too zealous an advocate for this practice. (*De l'Opér. du Trépan*, p. 79.)

3. FISSURES AND FRACTURES OF THE CRANIUM WITHOUT DEPRESSION.

Fractures of the cranium are divisible into "those in which the broken parts keep their proper level, or equality of surface, with the rest of the skull, and those in which they do not; or, in other words, fractures without depression, and fractures with it;

"These two distinctions are all which are really necessary to be made, and will be found to comprehend every violent division of the parts of the skull (not made by a cutting instrument), from the finest capillary fissure up to the most complicated fracture." (*Pott.*) In most instances, the fracture takes place in the upper part of the cranium; and it is also correctly noticed by Sir Benjamin Brodie, that fractures of its basis are always the consequence of very great violence, and recoveries from them comparatively rare. (*Med. Chir. Trans.* vol. xiv. p. 328.) The inner table of the skull, being more brittle than the outer one, is usually broken to a greater extent than the latter. In the situation of the frontal sinuses and parietal eminences, however, where the diploe is abundant, the outer table may be fractured without the inner one being at all implicated. (See *A. Velpeau, De l'Opér. du Trépan*, p. 27.) Sometimes the fracture does not occur at the point to which the violence has been directly applied, but elsewhere, as the effect of what the French term a *contre-coup*. Various explanations of the fact have been offered. Mr. Earle has never known it happen, except when the occiput seemed to have been forcibly impelled against the atlas. (*Sir B. Brodie, in Med. Chir. Trans.* vol. xiv. p. 329.) An ingenious attempt to account for the circumstance may be found in the writings of Sir C. Bell; though certain cases on record will not conform to any principles yet offered in explanation of them. M. Velpeau sets down counter-fissures as less dangerous than direct fractures, inasmuch as they are not exposed to the air, nor accompanied by any contusion of the pericranium, and the contiguous membranes of the brain suffer less; but he admits that they are usually combined with more violent concussion, a greater tendency to inflammation of the brain, and frequently with extravasation of blood, or, in a subsequent stage, with abscesses. (*De l'Opér. du Trépan*, p. 35.) According to my experience, counter-fissures are mostly fatal cases. The disjunction of the sutures is much more rare than fractures of the cranium, and can only happen in young subjects, in whom the sutures are not yet consolidated. They are accidents, implying the operation of great violence, and, in this point of view, may be viewed as dangerous. (*Sir B. Brodie, Op. cit.* vol. xiv. p. 332.) *

No truth in surgery is now better understood and established, than that the bad symptoms, frequently accompanying a broken skull, are not produced by the breach made in the bone, nor indicate such breach to have been made. As Sir Astley Cooper remarks, the danger of fractures of the skull depends upon their being united with concussion or extravasation; there is also a remote danger from inflammation. (*Lectures, &c.* p. 289.) This was the doctrine so well explained by Pott, who observes: "The sickness, giddiness, vomiting, and loss of sense and motion, can only be the consequence of an affection of the brain, as the common sensorium. They may be produced by its having been violently shaken, by a derangement of its medullary structure, or by unnatural pressure made by a fluid extravasated on its surface, or within its ventricles; but never can be caused by the mere division of the bone (considered abstractedly); which division, in a simple fracture, can neither press on, nor derange, the structure of the parts within the cranium."

"The operation of the trepan is frequently performed in the case of simple fractures, and that very judiciously and properly; but it is not performed because the bone is broken or cracked. A mere fracture, or fissure of the skull can never require perforation, or that the dura mater under it be laid bare; the reason for doing this springs from other causes than the fracture, and those really independent of it: they spring from the nature of the mischief which the parts within the cranium have sustained, and not from the accidental division of the bone. From these arise the threatening symptoms; from these all the hazard; and from these, the necessity and vindication of performing the operation of the trepan."

"If a simple fracture of the cranium was unattended in present with any of the before-mentioned symptoms, and there was no reason for apprehending any other evil in future, that is, if the solution of continuity in the bone was the whole disease, it could not possibly indicate any other curative intention, but the general one in all fractures, viz. the union of the divided parts." (*Pott.*) Even a fracture of the basis of the skull, which is most frequently fatal, proves so, not because this part of the cranium is broken (the fracture itself being here not more dangerous than elsewhere), but "because it is almost invariably complicated with extensive injury of other and more important parts." (*Sir B. Brodie, in Med. Chir. Trans.* vol. xiv. p. 328.) The post mortem examinations, which I have attended, lead me to believe, that most of these cases are complicated with extravasation.

I could relate numerous examples to the point, if it were any longer necessary, in the present state of surgical knowledge, to cite facts, in proof of the important truth, that the mere undepressed fissure, or fracture of the skull itself, cannot be the source of the immediate bad symptoms, but that, in these cases, the whole of the sudden peril arises from the manner in which the brain and its membranes have been hurt by the same violence which caused the injury of the bone. Dr. John Thomson had opportunities of witnessing in the Netherlands several instances, which can leave no doubt upon the subject. "In some of the wounds (says he), in which the head had been struck obliquely by the sabre, portions of the cranium had been removed, without the brain appearing to have sustained much injury. In one case of this kind, where a considerable portion of the upper part of the occipital bone, along with the *dura mater*, had been removed, a tendency to protrusion of the brain took place during an attack of inflammation; a slight degree of stupor with loss of memory occurred; but, on the inflammatory state having been subdued, the brain sunk to its former level, the stupor went off, and the memory returned:"—and in another remarkable sabre-cut, more than an inch in breadth of the left lobe of the cerebellum was exposed, and was seen pulsating for a period of eight weeks, yet the injury was unaccompanied with any particular constitutional symptoms. (See *Obs. made in the Military Hospitals of Belgium*, p. 50, 51.)

In many cases of simple undepressed fractures of the cranium, it is true, that trephining is necessary; but, the reasons for the operation, in these instances, are, first, the immediate relief of present symptoms, arising from the pressure of extravasated fluid; and, secondly, the discharge of matter,

formed between the skull and dura mater, in consequence of inflammation. If the edges of the fissure are widely apart, and blood is freely escaping from it, the application of the trephine should be deferred, provided the symptoms of compression were not very urgent. Such a fissure, be it recollected, however, is generally connected with a very extensive fracture, and, if there is extravasation, it is likely to be over a large surface; so that the trephine will probably be of no service. (See *M. Velpeau, De l'Opér. du Trépan*, p. 32.) The operation of trephining was sometimes recommended by Pott, as a *preventive* of ill consequences; a practice, however, which is now never adopted; and many writers of the highest reputation, especially Desault, Dease, John Bell, and Abernethy, have strongly remonstrated against it.

The latter remarks: "In the accounts which have of the former practice in France, it is related, that surgeons made numerous perforations along the whole track of a fracture of the cranium; and, as far as I am able to judge, without any clear design. Mr. Pott also advises such an operation, with a view to prevent the inflammation and suppuration of the dura mater, which he so much apprehended. But many cases have occurred of late, where, even in fractures with depression, the patients have done well without an operation."

Mr. Abernethy next relates several cases of fracture of the cranium with depression, which terminated favourably, although no operation had been performed, and expresses his belief that these cases, as well as a great many others on record, prove, that at all events a slight degree of pressure may not derange the functions of the brain, for a limited time after its application, and in this circumstance probably never, for all those patients, whom he had an opportunity of knowing for any length of time after the accident, continued as well as if nothing of the kind had happened to them. In *Hill's Cases in Surgery*, two instances of this sort are related, and Mr. Hill knew both the patients for many years afterwards; yet no inconvenience arose. Indeed it is not easy to conceive that the pressure, which caused no ill effects at a time when the contents of the cranium filled its cavity completely, should afterwards prove injurious, when they have adapted themselves to its altered size and shape. Severe illness, it is true, often intervenes between the receipt of the injury and the time of the recovery; and many surgeons might be inclined to attribute this to pressure; but it equally occurs when the depressed portion is elevated. If a surgeon, prepossessed with the opinion, that elevation of the bone is necessary in every instance of depressed cranium, should have acted upon this opinion in several of the cases which Mr. Abernethy has related, and afterwards have employed proper evacuations, his patients would probably have had no bad symptoms, and he would naturally have attributed their well-doing to the mode of treatment which he had pursued; yet, these cases did equally well without an operation. (See *Abernethy's Surgical Works*, vol. ii. p. 4., &c. 8vo. Lond. 1811.)

Depressed fractures of the skull not being the immediate consideration, I need not expatiate upon them; but it seemed right to make the preceding remarks, in order to show how unnecessary it must be to trephine a patient, merely because there is a fracture of the cranium, and with a view of pre-

venting bad consequences. Even when the fracture is depressed, it is not necessary, unless there are evident signs, that the degree of pressure, thus produced on the brain, is the cause of existing bad symptoms.

The inflammation and suppuration of the parts beneath the skull, which Mr. Pott wished so much to prevent by trephining early, do not arise from the occurrence of a breach in the cranium, but are the consequences of the same violence which was the occasion of the fracture. Hence, it is obvious, that removing a portion of the bone cannot in the least prevent the inflammation and suppuration, which must result from the external violence which was first applied to the head; but, on the contrary, such a removal, being an additional violence, must have a tendency to increase the inevitable inflammatory mischief.

From what has been said, it is not to be inferred, however, that trephining is never proper, when there is a simple undepressed fracture of the skull. Such injury may be joined with an extravasation of blood on the dura mater; or, it may be followed by the formation of matter between the membrane and the cranium; in both which circumstances the operation is essential to the preservation of the patient, immediately, but not before, the symptoms indicative of the existence of dangerous pressure on the brain begin to show themselves. (See *TREPHINE*.)

A fracture of the skull, unattended with urgent symptoms, and not brought into the surgeon's view by any accidental wound of the integuments, often remains for ever undiscovered; and as no benefit could arise from laying it bare by an incision, such practice should never be adopted. The surgeon ought only to be officious in this way when he can accomplish by it some better object than the mere gratification of his own curiosity. And as we shall find from the perusal of this article, and the one entitled *Trephine*, that in these cases, the removal of pressure off the surface of the brain is the only possible reason for ever perforating the cranium with this instrument; and, as dividing the scalp is only a useful measure, when it is preparatory to such operation; neither the one, nor the other, should ever be practised, unless there exist unequivocal symptoms, that there is a dangerous degree of pressure operating on the brain, and caused either by matter, extravasated blood, or a depressed portion of the skull. If any exceptions can be made to this observation, these are cases in which it is advisable to remove loose splinters and fragments of bone, or balls, plainly felt under the scalp, or examples of *punctured fracture*, as it is termed, where the inner table is sure to be splintered and more extensively broken than the outer, and inflammation and suppuration beneath the injured part of the bone be certain of ensuing, if this be not removed. (See *Liston's Elements*; and *Velpeau, De l'Opération du Trépan*, p. 42.) In all ordinary cases, the true mode of preventing the bad effects frequently following, but not arising from simple fractures of the skull, is not to trephine, but to put in practice all kinds of antiphlogistic means. For this purpose, let the patient be repeatedly and copiously bled, both from the arm and temporal arteries; apply cold lotions; let him be properly purged; give him antimonials; keep him on the lowest diet; let him remain in the most quiet situation possible; and if, notwithstanding

such steps, the symptoms of inflammation of the brain continue to increase, let a large blister be applied to the scalp. If the scalp be wounded, it is to be healed as speedily as possible. Bloodletting and purgatives (as Sir Astley Cooper remarks) will sometimes remove the symptoms of concussion and extravasation, when they accompany the fracture, and a few hours will often show that the trephine, which was at first thought indispensable, is unnecessary. Irreparable mischief might arise from your making an incision, and converting a simple into a compound fracture. "If you act prudently (he adds), you will try bleeding and purgatives, before you operate; and the depletion will prove of the greatest possible advantage in preventing inflammation." (*Lectures*, vol. i. p. 299.) These are the cases, also, in which the topical application of cold water to the shaved and naked head, by means of cloths kept constantly wet, is an eligible, though, in this country, a much-neglected practice. Numerous instances, however, in favour of the method are recorded by the experienced Schmucker (*Chir. Wahrnehmungen*, b. i. Berlin, 1774); and the trials which I have seen made of it, give me a high opinion of its superior efficacy. When in spite of all these measures, matter forms under the cranium, attended with symptoms of pressure, a puffy tumour of the injured part of the scalp, or those changes of the wound, if there is one, which Mr. Pott has so excellently described; not a moment should be lost in delaying to perforate the bone with the trephine, and giving vent to the confined matter.

Fractures at the basis of the skull are extremely dangerous, because they are generally attended with extravasation, or followed by inflammation of the brain, in consequence of the violence of the injury. According to Sir Astley Cooper, they are produced by falls from a great height on the summit of the head. The whole weight of the body is received on the foramen magnum, and cuneiform process of the os occipitis, and, in many instances, the consequence is a transverse fracture through the foramen magnum, the cuneiform process, and part of the temporal bone. A discharge of blood into each meatus auditorius accompanies the accident. It is supposed also, that the deafness which sometimes remains during life, in rare instances of recovery, is the result of this kind of injury. (*Lectures*, &c. vol. i. p. 289.)

A fracture within the orbit may be occasioned by the forcible introduction of a stick, weapon, or pointed instrument, and is generally fatal, from the pressure and irritation of the depressed splinters of bone, and the simultaneous wound of the brain. The symptoms in the beginning, however, are frequently mild and deceitful, and it is not till inflammation and suppuration ensue, that the patient's condition is always such as to create immediate alarm. A case exemplifying this fact is reported by Sir A. Cooper. (Vol. cit. p. 295.) The same eminent surgeon mentions the occasional production of a circular fracture of the entire cranium, by a blow on the vertex; also the emphysema of the forehead, or the escape of the air, if there be a wound, caused when the nose is blown, in the case of a fracture extending into the frontal sinuses; and the complete detachment, sometimes met with, of the fragments, instead of their depression. His observations confirm the fact, that fractures of the skull, if unaccompanied with concussion or com-

pression, become united like those of other bones; but he adds, that it is more slowly, and that where the interspace is wide, it will not be filled up with bony matter. (P. 297, 298.)

4. FRACTURES OF THE CRANIUM, WITH DEPRESSION,

Are sometimes attended with a moveable state of the fragments, and a crepitus; while, in other instances, the bottom of the depression is as unyielding as its margins. The projection of such a fracture inward, is also exceedingly variable; the bone may be more or less irregular, the dura mater and brain lacerated, or the membranes simply pushed inward. (See *Velpeau, De l'Opér. du Trépan*, p. 37.)

In simple fractures of the skull, or those in which the parts of the broken bone are not depressed from their situation, Mr. Pott remarks, that "the chirurgical intention, and requisite treatment, are the same in each, viz. to procure a discharge for any fluid which may be extravasated in present (provided the pressure of such extravasation produces urgent symptoms, a condition which should here be added), and to guard against the formation or confinement of matter." The prevention of suppuration will, as we have already remarked, be best accomplished, not by perforating the cranium, as Mr. Pott advised, but by copious bleeding, evacuations, cold washes to the head, blisters, and a rigorous antiphlogistic regimen. However, the confinement of matter, producing symptoms of pressure on the brain, certainly indicates the immediate use of the trephine.

"But," says the author, "in fractures attended with depression, there are other intentions. In these, the depressed parts are to be elevated; and such as are so separated as to be incapable of reunion, or of being brought to lie properly, and without pressing on the brain, are to be totally removed. These circumstances are peculiar to a depressed fracture; but, although they are peculiar, they must not be considered as sole, but as additional to those which have been mentioned at large under the head of simple fracture: commotion, extravasation, inflammation, suppuration, and every ill which can attend on or be found in the latter, are to be met with in the former, and will require the same method of treatment." That loose splintered pieces of the cranium, when quite detached, and already in view, in consequence of the scalp being wounded, ought to be taken away, no one will be inclined to question. That they ought also to be exposed by an incision, even when the scalp is unwounded, and then taken away, whenever they cause urgent symptoms of irritation or pressure, I believe will be universally allowed. But the reader will already understand, from what has been said in the preceding section, that several excellent surgeons do not coincide with Pott, in believing that every depressed fracture of the skull necessarily demands the application of the trephine.

"There certainly are," says Mr. Abernethy degrees of this injury, which it would be highly imprudent to treat in this manner. Whenever the patient retains his senses perfectly, I should think it improper to trephine him, unless symptoms arose that indicated the necessity of it." (P. 21.)

It is extraordinary and unaccountable, but it is not less true, that no calculation of the bad

effects can be made by the degree in which a part of the skull is depressed. This is a fact which has been long known. It has also been particularly adverted to by an eminent modern writer. "Various instances also presented themselves, in which, though a considerable degree of compression must have been occasioned, sometimes by the depression of both tables, and at other times by the depression of the inner table only, of the skull, yet neither stupor, paralysis, nor loss of memory was produced. In one of these cases, the middle of the right parietal bone was fractured, and considerably depressed, by a ball, which was extracted on the twentieth day. In this case, neither stupor nor paralysis appeared. In another, a musket-ball had struck the right parietal bone, fractured it, and was flattened, and lodged between the tables of the skull. The inner table was much depressed, yet no bad symptoms supervened." (See *Thomson's Obs. made in the Military Hospitals in Belgium*, p. 59, 60.) The same author also saw a singular case, in which a ball, entering behind the right temple, and passing backwards and downwards, had fractured the bones in its passage, and lodged on the surface of the brain, over the tentorium, from which place it was extracted on the seventeenth day after the injury. No bad symptom had manifested itself previously to the operation; and the man recovered, under the strictest antiphlogistic regimen, with little or no constitutional derangement. Dr. Hennen has recorded two cases, fully proving the correctness of Mr. Abernethy's opinions, about the impropriety of using the trephine in cases of depression unattended with urgent symptoms: in one of these instances, the upper and posterior angle of the parietal, which had been struck by a musket-ball, was depressed exactly an inch and a quarter from the surface of the scalp, yet no bad symptoms followed, and with the aid of bleeding and other antiphlogistic remedies, the soldier recovered perfectly in a few weeks. "In a similar case, where the man survived thirteen years, with no other inconvenience than occasional determination of blood to the head on hard drinking, a funnel-like depression to the depth of an inch and a half was formed in the vertex." (See *Hennen's Military Surgery*, p. 287. ed. 2.)

If then the violence of the symptoms is not always in proportion to the compression, but is sometimes considerable when the pressure is slight, every surgeon cannot be too fully impressed with the following truth, that existing symptoms of dangerous pressure on the brain, which symptoms will be presently related, can alone form a true reason for perforating the cranium.

Although the doctrines of Sir Astley Cooper, generally speaking, coincide very much with the preceding maxim, which I regard as a very important one, there is an exception to it in his advice, in relation to compound fractures of the skull, as will be understood from the following passage. "The old practice used to be, the moment an injury of the brain was suspected, and the least depression of the bone appeared, to make an incision into the scalp. This is putting the patient to considerable hazard; for the simple fracture would, by the incision, be rendered compound. In simple fracture, then, when

it is attended with symptoms of injury of the brain, deplete before you trephine; and when it is unattended with such symptoms, deplete merely, and do not divide the scalp, &c. If the fracture be compound, the treatment must be very different; because a compound fracture is very generally followed by inflammation of the brain; and it will be of little use to trephine, when inflammation is once produced. If the inflammation come on, the patient will generally die, whether you trephine or not;" and, it is added, that the operation will even be likely to increase the inflammation, which has been excited by a depressed portion of the skull. "The rule (says Sir Astley) which I always follow, is this: when I am called to a compound fracture, with depression, which is exposed to view, whether symptoms of injured brain exist or not, I generally use an elevator, and very rarely the trephine. I put the elevator under the bone, raise it, and, if it has been comminuted, remove the small portions of bone." (*Lectures, &c.*, vol. i. p. 304. 308.) Of the propriety of using the elevator in such cases, and also of taking away loose fragments, there cannot be a doubt; but many surgeons object (and I confess myself one of the number) to saw out a portion of the skull while the patient is free from urgent symptoms. I believe, also, that the inflammation, when it does arise, is mostly the effect of the violence itself, not of the depression of the bone, and, therefore, more likely to be increased than prevented by the application of the trephine. I think a better reason for elevating the bone, when it is exposed, and there are no bad symptoms, is the fact, that many patients, after their recovery from the imminent danger of the accident, become subject, whenever the circulation is hurried, to insanity, or epilepsy, or remain in a state of hebetude, with dilated pupils, and more or less impairment of some of the external senses, as the eyesight, &c., (See *Case by H. Larrey, in Hist. Chir. du Siècle de la Cavalerie d'Anvers*, p. 114.) Yet, here it is to be considered, that it may be quite time enough to trephine when such ills follow the continuance of the depression, and that, perhaps, the operation would then be in itself less dangerous, inasmuch as the tendency to inflammation, arising from the first violence, must now have subsided. Much would depend, however, upon the frequency and severity of the fits, and the degree of annoyance and suffering; for as M. H. Larrey well observes, the result of an operation would be doubtful, and it might even prove fatal. (*Op. cit.* p. 116.)

The view of this part of the subject, taken by M. Velpeau, does not exactly coincide with that entertained by Abernethy. "The cases (says he) of recovery, notwithstanding a depression to the depth of an inch, or an inch and a half, as recorded by numerous former observers, by no means prove, that in such examples trepanning is never useful. The same remark applies to the cases brought forward in modern times by Dorsey, Dupuytren, Paillard, Graefe, &c. These instances must all, or nearly all, have been fixed depressions, without any great inequalities internally, or manifest laceration of textures. Most of them had given rise to but slight symptoms of compression; and many of them to none at all. The case of a rich banker mentioned by Dupuytren, and who is still living with the bone depressed, although the injury took place many years ago, forms a kind of exception,

I know (observes M. Velpeau) that it is not the only one; but these are rare cases, on which it would be dangerous to lay a foundation. For one patient thus saved, ten would perish who might be preserved. I saw a woman who had a depression on the frontal bone half an inch deep, and whom I deemed it improper to operate upon, because she had no alarming symptoms. Yet at the end of six weeks, she died of inflammation and suppuration of the anterior part of the brain. Would this have happened had she been trepanned?" (*De l'Opér. du Trépan*, p. 57.)

I believe few surgeons in London would have any difficulty in replying, that if the operation had been performed the result might, or might not, have been the same. It seems to me, also, that when signs of suppuration under the cranium first presented themselves, the operation might have been indicated, though not so in an earlier stage; but, without being in possession of all the particulars of the case, I offer this remark without any intention of being critical.

M. Velpeau is not on the whole an over zealous advocate for the operation; and some of his advice approximates very much to that delivered by Sir Astley Cooper, with a modification, depending upon whether the depression is immovable and fixed. If it be of this kind, without manifest compression, he recommends delay, and antiphlogistic treatment. But when there is a wound, with denudation to the bottom of it the operation seems to him called for, even though urgent or unequivocal symptoms of compression may be absent. He would not trepan, however, if the depression were broad, and of no great depth; if the intellects were uninterrupted; and there were no marks of paralysis. M. Velpeau regards a depression with mobility of the bone as far more dangerous. An effusion of blood, first, and pus afterwards, he sets down as frequent consequences of it; and the case is almost sure to prove fatal, unless the trepan be employed. (*Op. cit.* 58.) A movable depressed fragment, I may observe, may often be removed with the forceps, without any occasion to perforate the cranium with the trephine, or trepan; and if not removable in this simple manner, may frequently be taken away by dividing a small portion of the bone with one of Hey's saws. (See TREPHINE.)

M. Velpeau adverts to one species of depression, in which no good is derived from the trepan, namely, that in which the fracture is usually extensive, and the edges of the fragments overlap one another, in consequence of a violent concussion of the skull. Here, says he, the degree of crushing, contusion, and extravasation at different points, make the patient's recovery almost impossible.

In another place, M. Velpeau points out the practical importance of studying the differences in the symptoms of compression according as they depend upon a depression of bone, either simple or comminuted, a foreign body, an extravasation of blood, or an effusion of pus. A simple depressed fracture he sets down as the most favourable of these cases; for if the operation is not done, the brain in the end frequently becomes habituated to the pressure, and resumes its functions. If no extravasation take place, the pressure arising from a depressed fracture is really less than might at first be imagined. If the operation be decided upon, it presents the greatest chance of success, provided the compressing cause has not seriously wounded the brain.

The rule which M. Velpeau here lays down, is, that in cases of depression, if the symptoms are not urgent, or begin to abate after 24 hours, the trepan may be dispensed with; but if they are at all intense, or make progress, the operation is strictly required. (*De l'Opér. du Trépan*, p. 120.)

In children, a portion of the skull is sometimes depressed, or indented by a blow, but in a few days regains its natural level, without the aid of the surgeon. In such examples, it is conceived by Sir Benjamin Brodie, that the carthy part of the bone gives way, while the animal part remains entire, so that there is not an actual solution of continuity; and he supposes that the restoration of the bone to its proper level is brought about by the constant pulsations of the brain against its inner surface. (*Sec Med. Chir. Trans.* vol. xiv. p. 332.)

M. Velpeau denies the possibility of indentations without fracture. (*Op. cit.* p. 36.)

Sometimes a considerable depression of the bone arises from the external table being driven into the diploe, while the inner table is entire. To trephine, therefore, merely because there is a depression of the bone, would be completely erroneous, and the only safe principle is that which I have just now specified. The depression of the outer table in the foregoing manner I have never seen myself, except over the frontal sinus. Sir Astley Cooper, however, mentions it as a frequent occurrence; but that it is confined to persons of middle age, as in very young and very old persons the skull is thin and without diploe. (*Lectures*, vol. i. p. 302.) Another sort of depression, I believe, is more frequent; at least, I have seen several examples of the case: it consists in a fracture and depression of the internal table, while the external one continues unbroken. A case of this kind, attended with urgent symptoms of compression, I trephined at Brüssels, the battle of Waterloo, a large splinter of the inner table was driven more than an inch to the brain, and, on its extraction, the patient's senses and power of voluntary motion instantly returned. Part of the skull to which the trephine was applied, of course, did not indicate externally any depression, and it was selected because the appearance of the scalp showed that there the external violence had operated. I rather expected to find extravasated blood, than a depression of the inner table of the skull. (See also *Sauvageot*, in *Mém. pour le Prix de l'Acad. de Chir.* t. iv. ed. 1819, p. 322. *Bilguer*, two examples as quoted by M. Velpeau, *De l'Opér. du Trépan*, p. 29. *Hennen's Military Surg.* vol. p. 323. ed. 2; and Sir B. C. Brodie, in *Med. Chir. Trans.* vol. xvi. p. 331.)

In military surgery, particular cases present themselves, which scarcely admit of being comprehended within the tenor of any general rules and principles. Thus it sometimes happens, that a ball breaks the os frontis, and the whole or a part of it lodges in the frontal sinus, with or without fracture of the inner boundary of this cavity. In cases of this description, Baron Larrey recommends exposing the course of the fracture by a free incision, and the use of the trephine for the removal of the extraneous body. When the inner side of the sinus was found broken and depressed, he next perforated that part of the cavity with a small conical trephine, took away such pieces of bone as required removal, and let out any extravasated blood. Sometimes, however, the front of the sinus

is so splintered, that the fragments, when taken away with the forceps, leave the cavity sufficiently opened, not only for the extraction of the ball, but for the application of the trephine to the inside of the sinus, as we find exemplified in one of the two cases of this nature, which Larrey met with in the Egyptian campaign. (*Mém. de Chir. Militaire*, t. ii. p. 138.) After the battle of Witepsk, in 1812, he was called to two Russian soldiers, whose cases were remarkable; one of them had been struck above the right eyebrow, with a grape-shot, which after breaking and penetrating the frontal bone, entered the cavity of the cranium, so as to lodge upon the anterior right lobe of the brain, and the orbital process and internal crista of the os frontis. Notwithstanding the large size of the ball, little of it could be seen externally, and the aperture through which it had passed was not more than three or four lines broad; every attempt to extract it, therefore, was in vain. The patient experienced a painful sense of oppression and weight in the head, and, whenever he inclined it backward, was seized with syncope. He kept himself constantly in a sitting posture, with his head on his knees. Larrey adds, that every symptom of compression of the brain also prevailed, though this account is rather difficult to comprehend, considering that the patient could sit up, and choose his posture. As for any description given by himself of his sufferings, that is another circumstance, on which I should not be inclined to dwell, because in all probability the baron was not able to converse in the Russian language, and the inferences respecting the man's feelings were made in some other way. But whatever might be the real state of the symptoms (and in a case of this kind a correct account of them would have been interesting), the ball was plainly ascertained, by means of a probe, to be of iron, and of much larger diameter than the opening through which it had entered; and that, for the purpose of extracting it, the application of the trepan was urgently necessary. The fracture was fairly brought into view by suitable incisions; three perforations, were made with a small trephine at its upper part, and, after the removal of the angles of the bone between these perforations the ball, which weighed seven French ounces, was readily extracted with the aid of a strong pair of forceps, and an elevator. A considerable quantity of coagulated blood was also removed, under which the brain was found with a depression three or four lines deep. As soon as some splinters of the bone had been taken away the part was dressed with a bit of fine linen dipped in warm wine, over which were placed charpie, several compresses, and a bandage. With respect to the application of warm wine, and other stimulants, to the surface of the brain, in wounds exposing or interesting that organ, it seems to be an invariable practice with Larrey, as well as Schmucker and the older surgeons. On what principle the custom is still kept up, and whether it is truly right and useful, are questions which may be rationally put. In whatever way experience may hereafter decide these matters, suffice it to add, that the patient was relieved by the treatment, and fell into a quiet sleep for two hours; but in the evening he became feverish, and the wound acutely painful. A copious quantity of blood was then taken from the vena saphena (and why bleeding was not practised at first, seems extraordinary). The dressings, which, according

to my ideas, were highly objectionable, were removed, and a large emollient poultice applied. Cooling beverages, containing a small quantity of tartarised antimony, and antispasmodic anodyne medicines, were prescribed. The following day, the patient's state appeared satisfactory, without the slightest disturbance of the senses, and, in due time, he perfectly recovered.

The other soldier had been wounded in the left temple, with a leaden ball, five days before Larrey saw him. One half of the ball had gone into the cranium, through a very narrow breach; the other had burrowed under the temporal muscle, and lodged near the mastoid process. The right side of the body was paralytic, the senses were annihilated, and the man was in a state of incessant agitation. After dilating the wound in the temple, and exposing the fracture, Larrey discovered the track of the piece of lead, which had gone towards the mastoid process, and which he immediately extracted by a counter opening. At the lower part of the temporal wound, he applied a trepan, very near the spot where the other portion of the ball was lodged. This, with some fragments of the bone, and a quantity of extravasated blood, was easily extracted. The patient, however, was not saved; the operation having been done too late.

In another case, one of the Imperial Guards, wounded at the battle of the Moskowa, died with symptoms of compression, and, after death, a quarter of a bullet and a fragment of bone were found under the skull, attended with an ulcerated or wounded state of the adjacent portion of the brain. Larrey expresses his opinion, that this soldier would have had a chance of being saved, had the trepan been used. (*See Mém. de Chir. Mil. t. iv. p. 183, &c.*) The practice of trephining for the removal of balls, situated near a fracture of the skull, within this bony cavity, or lodged amongst the fragments, or between the two tables forced asunder (*see Enet's case, in Vermischte Chir. Schriften von J. L. Schmucker, b. i. p. 242.*), is not peculiar to Larrey, for it has been done by many other surgeons (*see Schmucker's Wahrnehmungen, b. i. p. 298.*), but I do not know that he has been anticipated in his bold practice of making a counter-opening in the skull, when the ball is lodged at such a distance from the fracture, that it cannot be extracted through any perforation made in the vicinity of the original injury; for it is a principle which he ventures to lay down, that when a ball has entered the cranium, without quitting the roof of this cavity, the case is one requiring the application of the trepan. (*Mém. de Chir. Mil. t. iv. p. 180.*) In the 2d vol. of this work (p. 139.), the reader will find the account of a soldier, who was struck on the middle of the forehead with a ball which penetrated the os frontis, and then passed obliquely backwards, between the skull and the dura mater, in the course of the longitudinal sinus, as far as the lambdoidal suture, where it stopped. Larrey traced the situation of the ball, by the introduction of an elastic gum catheter into the opening; and measuring the distance between the fracture and the place where he felt the ball, he cut down upon that part of the skull, beneath which he concluded that the ball was lodged. The bone was then perforated with a large trepan; a good deal of pus was discharged: the ball was extracted, and the patient recovered. One thing here merits the attention of surgeons: Larrey tells us that a good deal of pus issued

as soon as an opening had been made in the skull: there must then have been suppuration under the bone, and inflammation and detachment of the mater; circumstances always indicated, according to Pott, by a corresponding separation of the cranium, and a puffy tumour of the scalp.

— These symptoms take place in the foregoing case, so as to be of any assistance to Larrey, in judging of the place where the ball was lodged! and, has the mention of them been omitted only by accident? or, are we to infer, that suppuration may happen between the cranium and dura mater, without any detachment of the pericranium and puffy tumour of the scalp; a thing which Richat asserts is proved by daily experience in the Hôtel-Dieu, at Paris? (See *Œuvres Chir. de Desault*, t. ii. p. 29.) Larrey, in his 3d vol. (p. 82.), gives us another case, in which a ball pierced the left parietal bone, and lodged near the lambdoidal suture. Its situation was detected with the aid of an elastic gum catheter, and partly in consequence of there being a slight ecchymosis over the part. Here a crucial incision was made through the scalp, and a small fissure discovered. As the symptoms of compression increased, the trepan was applied, so as to include the fissure. A half of the ball, flattened, was found directly under the perforation, and a good deal of blood was voided from the two openings in the cranium. For a fortnight, the case went on favourably; but the patient was then attacked with what Larrey terms hospital fever, but which, in all probability, was inflammation and suppuration of the membranes of the brain, and died.

The records of surgery furnish numerous instances, in which the patients lived a considerable time with balls lodged in the cavity of the cranium. Thus, one is related by Parioisse, where the patient soon recovered his senses after the injury, and, at the end of six months, felt no inconvenience, except a difficulty of opening the mouth. (*Opuscules de Chir.* Obs. i. 8vo. Paris, 1806.) Ramdohr published another case, where a soldier was shot through the frontal sinus, and the ball was found after death in the medullary substance of the left hemisphere of the brain, half an inch above the ventricle; yet this patient lived four months after the injury, and soon recovered his senses after its occurrence. For a considerable part of this time, he was also free from any bad symptoms. At last, he was affected with a kind of stupor, and an inability to open his left eye, and fell into a lethargic and convulsed state. (*Schmucker, Vermischte Chir. Schriften*, b. i. p. 277.) A French soldier, at the battle of Waterloo, was wounded with a musket-ball, which entered at the anterior portion of the squamous suture, lodged in the substance of the brain, and on the fifth day, after an enlargement of the wound, and the removal of several fragments of bone, was extracted from the posterior lobe of the right hemisphere of the brain, where it was found resting on the tentorium. Yet, during the several previous days, the man, with the exception of a slight headach, and partial deafness of the right ear, seemed to enjoy perfect health. The case ended well. (See *Hennen's Mil. Surg.* p. 269. ed. 2.) M. Velpeau cites a case, where several small shots lodged for many years on the dura mater, and were the cause of epileptic attacks. (*De l'Opér. du Trépan*, p. 44.) He saw a soldier at the Invalides, with a ball, that had remained

fixed for many years in the opening, which it had produced in the skull, the man having refused to permit its extraction to be attempted: from the account, however, I infer, that it lay partly in the frontal sinus, and that the inner table was not injured. The same surgeon also quotes a case from Schmucker (*Bibl. du Nord*, t. i.), where a wounded person remained senseless for six days, with a piece of the barrel of a gun within the skull: four perforations were made with the trepan, and a recovery took place. In the *Méd. Chir. Trans.* are the particulars of a case, in which the linch-pin of a gun was driven into the os frontis, and penetrated the brain, so as to be concealed, and its presence not suspected, till the twenty-seventh day after the accident, when it was detected and taken out. The boy walked some distance directly after the accident, and then fell down senseless and convulsed. By means of antiphlogistic treatment, he regained his mental faculties the next day, and finally recovered, with the exception of amaurosis of one eye. Notwithstanding the instances on record of balls and other foreign bodies having lodged in the brain without proving fatal (see *Ramdohr*, *Op. cit.* p. 81., and *La Martinière*, as referred to by Velpeau), the rule in surgery is always to extract them when practicable. In a case, mentioned by Quesnay (p. 23.), the patient, who was supposed to be entirely out of danger, died a year afterwards, and the ball was found in the brain at the depth of two inches. The example, published by Anel (*Acad. de Chir.* t. i. p. 236.), terminated in the patient's sudden death, and the ball was found on the pineal gland. Many other interesting observations on this subject have been collected by M. Velpeau. (*De l'Opér. du Trépan*, p. 48.) All foreign bodies, occasioning irritation or laceration of the brain, seem to M. Velpeau formally to require the perforation of the cranium; but the chances of a favourable result are less than in a simple depression of the bone, on account of the risk of inflammation of the brain being greater. (*Op. cit.* p. 122.)

Remarkable instances of the duration of life, and even of the absence of very serious symptoms, after great and serious wounds of the brain, and the lodgment of balls, are recorded in the Essay of M. Que-nay (*Mém. de l'Acad. de Chir.* vol. i. 4to.) Professor Sewall, of Washington, has reported two cases of fracture of the cranium, with loss of a portion of the substance of the brain. In one of them, the injury was inflicted with a spade, which penetrated through the dura mater and into the medullary substance of the brain. The antiphlogistic treatment was relied upon from the commencement, and during the suppuration which followed; some of the brain itself protruded and sloughed away, and subsequently portions of it were removed with a spatula. Nevertheless, in six weeks, the patient completely recovered. (See *Amer. Journ. of the Med. and Phys. Sciences*, No. iii.; and *Reese's Amer. ed. of this Dict.*) Twenty-two French soldiers, whose vertices, with more or less of the brain, had been cut off by sabre-strokes, had, at first, not a single bad symptom, and all performed a journey of thirty leagues after being wounded, and one half of this distance on foot. Ten of them died. (See *Parioisse, Opuscules de Chir.* p. 41. &c.) Several cases, exemplifying the absence of bad symptoms in the first stage of a wound of the brain, and yet ter-

minating fatally, I have seen in the army, as well as at St. Bartholomew's and University College Hospitals. A case is recorded by Fardeau (*Soc. d'Emul.* t. viii. p. 399.), of a bayonet penetrating one temple and coming out below the cheek of the opposite side: the efforts of a strong man were required to get it out again: the patient recovered. Whether the brain was pierced in this example may, I think, admit of doubt.

5. EXTRAVASATION UNDER THE CRANIUM, SYMPTOMS OF PRESSURE ON THE BRAIN, ETC.

Mr. Pott remarks, "the shock, which the head sometimes receives by falls from on high, or by strokes from ponderous bodies, does not unfrequently cause a breach in some of the vessels, either of the brain or its meninges; and thereby occasions extravasation of the fluid which should circulate through them. This extravasation may be the only complaint produced by the accident; or it may be joined with, or added to, a fracture of the skull. But, this is not all; for it may be produced not only when the cranium is unhurt by the blow, but even when no violence of any kind has been offered to, or received by, the head."

The effused blood may lie between the cranium and dura mater; between the latter membrane and the arachnoides; on the surface of the pia mater; or under this membrane, on the surface, in the substance, or cavities of the brain. The first species of extravasation, which is observed to be always more or less circumscribed, may occur at any part of the skull, but, when situated at its base, is generally fatal. In the second, which is the most common species of extravasation within the dura mater (see Brodie, in *Med. Chir. Trans.* vol. xiv. p. 333.), the blood is widely scattered about between the dura mater and arachnoides, and on this account, unless its quantity be very considerable, it does not cause any great degree of pressure. In the third example, if the blood be situated in the convolutions, it is also widely diffused; but if it be within the substance or ventricles of the brain, which is rare (Brodie, vol. cit.), it is circumscribed. (*Œuvres Chir. de Desault*, t. ii. p. 23.) Sometimes, in cases of great violence, the blood is found at the same time in all these different parts.

According to Sir Benjamin Brodie's experience, which confirms the observations of Mr. Abernethy, there is never such hæmorrhage from a rupture of the blood-vessels, by which the dura mater is connected to the bone, as will produce dangerous pressure on the brain, except when the middle meningeal artery has been lacerated, from which vessel the bleeding is sometimes very copious. Sir Benjamin Brodie has never seen this artery lacerated, except in the combination with a fracture running across the bony canal in which it is situated; but he adverts to other cases, recorded by Latta and Abernethy, in which no such fracture accompanied the rupture of the vessel. (See *Med. Chir. Trans.* vol. xiv. p. 333.)

Another observation, made by Sir Benjamin Brodie, is, that large extravasations are sometimes found upon the upper surface of the brain, but more frequently at its basis, where they are usually the consequence of a rupture of the substance of the brain. The same surgeon has never seen an instance, in which the blood from a wounded

sinus, collected between the dura mater and the skull, or between that membrane and the brain, was in sufficient quantity to interfere with the functions of the latter organ.

When blood is extravasated beneath the skull, the violence, which produces the rupture of the vessel, usually stuns the patient, from which state, provided the quantity and pressure of the blood, and the force of the concussion be not too great, he gradually recovers, and regains his senses. If the first extravasation be trivial, the patient, after regaining his senses, may only feel a little drowsiness, and go to bed. The bleeding from the ruptured vessel continuing, and the pressure on the brain increasing, he becomes more and more insensible, and begins to breathe in a slow, interrupted, stertorous manner. In cases of compression, whether from blood or a depressed portion of the skull, there is a general insensibility; the eyes are half open; the pupils dilated, and motionless, even before the vivid light of a candle; the retina is insensible; the limbs relaxed; the breathing stertorous; the pulse slow, and, according to Mr. Abernethy, less subject to intermission than in cases of concussion. The absence of stertor, however, as this gentleman admits, must not be relied upon as a proof of there being no compression; for, Morgagni relates dissections of apoplectic persons, in whom the effusion was considerable, yet no stertor had occurred.

In a case of wound of the posterior part of the skull, with depression, seen by Dr. J. Thomson, the pulse at one time sunk as low as 36 strokes in a minute. However, he is at variance with Mr. Abernethy upon one point, by stating, that irregularity of the pulse is a frequent attendant upon compressed brain. (*Report of Obs. &c.* p. 54, 55.)

Sir Benjamin Brodie does not give any positive opinion on the statement made by Mr. Abernethy, that intermission of the pulse is less frequent in compression than concussion; but he expresses his belief, that pressure on the brain for the most part affects the action of the heart; *not by producing actual interruption, but by causing its contractions to be either less frequent, or less forcible, than natural.* (*Med. Chir. Trans.* vol. xiv. p. 355.) In the cases referred to in Dr. Thomson's report, convulsions sometimes arose from the pressure of portions of the skull, forced inwards upon the brain. This is a very dangerous symptom; but Dr. Thomson saw it cease in a few examples, after the depressed piece of bone had been elevated, and the antiphlogistic regimen adopted. (p. 60.)

Convulsions, I am disposed to regard, with Lisch, rather as a symptom of injury of the brain, than of compression. (*Œuvres Chir. de Desault*, t. ii. p. 27.) Sir Benjamin Brodie, seemingly unaware of the corresponding remark published in the foregoing work, considers it questionable, whether convulsive twitches of the muscles ought to be regarded as the consequence of simple pressure on the brain. We find them occur, says he, in cases of punctured and wounded brain, where there is no pressure; and whenever he has noticed them, as attendant on depression of the skull, or extravasated blood, and has afterwards had the opportunity of ascertaining the exact nature of the injury, the pressure has always been found to be complicated with wound, or laceration, of the substance of the brain. The convulsive twitches to which Sir Benjamin Brodie alludes, he particularly describes as slight and

partial, and different from the more violent and general convulsions. (See *Med. Chir. Trans.* vol. xiv. p. 352.)

Indeed, the difficulty of the diagnosis of many cases may be well conceived by what Dr. Hennen remarked, in his practice; viz. that, in some instances, the pupils were contracted, in others dilated, where the injury was nearly of a similar nature and degree; while, sometimes, in the same patient, one pupil was dilated, and the other much contracted. He saw, also, paralysis occur on one side, and convulsions on the other, when the blow had been on the forehead, and the same when it had been on the occiput. (*Op. cit.* p. 300, 301.)

Sir Benjamin Brodie has seen the pupils dilate with the absence, and contract with the presence, of light, although the patient lay in a state of complete insensibility, and did not seem to be at all conscious of the impressions made on the retina. He admits, however, that this is a rare occurrence, and that, when the other symptoms of pressure are present, the pupils are generally insensible and motionless, and mostly dilated, though sometimes contracted. Every surgeon of experience must be aware of another circumstance mentioned by the same surgeon; namely, that it is not uncommon for the pupils to remain for a time in a state of dilatation, then to become suddenly contracted, and, after remaining so for a longer or shorter time, to become again dilated; these changes taking place independently of light and darkness. When the pupils have been dilated, Sir Benjamin Brodie has frequently known them to become contracted after the abstraction of blood; the dilatation returning as soon as the immediate effect of the bloodletting had ceased. He adverts to a curious case, reported by Dr. Hennen, in which blood was extravasated between the membranes of the brain, and the pupils sometimes dilated in an increased light, and contracted in a diminution of it. (See *Med. Chir. Trans.* vol. xiv. p. 352.) Another observation, made by Sir Benjamin Brodie, is an occasional insensibility of one iris, dilatation of the pupil, and a ptosis, continuing after the subsidence of the general insensibility of the body, and even unattended with loss of vision. (*Vol. cit.* p. 354.)

The patient is hardly ever sick, when the pressure on the brain, and the general insensibility, are considerable; for the very action of vomiting betrays sensibility in the stomach and oesophagus. The truth of this statement, which agrees with Mr. Abernethy's experience, is strikingly confirmed by an observation made by Sir Benjamin Brodie; namely, that when he has had occasion to apply the trephine on account of a fracture and depression, and no sickness existed previously, he has sometimes known the patient become sick, and vomit immediately the depressed bone had been elevated. (See *Med. Chir. Trans.* vol. xiv. p. 356.) These symptoms are not peculiar to pressure from blood, but arise also from that of many depressed fractures of the skull, and of supuration under this part. They are all attributable to the unnatural pressure made on the brain and nerves, and have too often been mistaken as indications of an injury, which, considered abstractedly, can never cause them.—I allude to a simple undepressed fracture of the cranium, which may be accompanied with them, but cannot cause them.—They differ in degree, according to the quantity, kind, and situation of the pressing fluid. The hemor-

rhage from the nose and ears, which often follows violence applied to the head, is generally conceived to lead to no particular or useful inference; we cannot even calculate, by this sign, that the force has exceeded a certain degree; for such bleedings take place from much slighter causes in some persons than others.

Sir Benjamin Brodie's observations on this point merit attention:—"There is often a considerable effusion of blood from the ear, especially in cases of fracture of the basis of the cranium. This may, as far as I know, sometimes arise from other sources; but it seems probable, that it must in most instances arise from the laceration of the lateral sinus, where it extends downwards behind the petrous process of the temporal bone, and the external meatus; and, in one instance, I ascertained it to have been so by the examination of the body after death. In another case, which fell under my observation, there was hemorrhage both from the ear and the nostrils. The patient, a boy, died shortly after the accident; and it was found, on dissection, that there was a fracture of the base of the cranium, with laceration of the cavernous sinus, and that the hemorrhage had taken place from this sinus." (See *Med. Chir. Trans.* vol. xiv. p. 334.) According to my experience, bleedings from the ear and nose, from injuries of the head, are particularly frequent in children, and often manifestly consist of arterial blood.

Paralysis is a symptom which generally attends hurtful pressure on the brain. The particular circumstances, however, which determine its degree, extent, and situation, are not well understood. "In some instances of paralysis from sabre-wounds, as well as in those made by gunshot (says Dr. J. Thomson), paralysis was confined to the upper, and in others to the lower, extremity. In every instance, in which it distinctly appeared, that the injury existed on one side of the head, the paralysis uniformly manifested itself upon the other; but we were unable to perceive any other fixed relation between the part of the brain, which had been injured, and the part of the body affected with palsy. A wound of the right parietal bone by a musket-ball was followed by palsy of the left arm and leg. In another case, a wound, penetrating the upper part of the right parietal bone, was accompanied with a slight paralytic affection of the left side of the mouth, and complete palsy of the left leg. In a third case, a sabre-wound of the same bone, followed by extensive exfoliations, gave rise to a complete palsy of the left side." (*Obs. in the Military Hospitals of Belgium*, p. 52, 53.)

When the destruction of sensibility is complete, the voluntary muscles are entirely paralysed. The patient lies motionless in any position in which he happens to be placed. The bladder, incapable of contraction, becomes preternaturally distended with urine; and the relaxation of the sphincter allows the involuntary discharge of feces from the rectum. Afterwards the muscles of respiration become affected also; the patient breathes with stertor, as in a most profound sleep; and the diaphragm contracts at longer and longer intervals, until respiration altogether ceases. It is this paralysis of the muscles of respiration, which, in ordinary cases of pressure on the brain, is the immediate cause of death. When the loss of sense is imperfect, there are often no marks of paralysis

whatever. At other times, there is a hemiplegia, which, however, is much more rarely the consequence of accidental violence, than of apoplexy. Sir Benjamin Brodie conceives that this difference is referrible to the different situation of the pressure. In apoplexy, the extravasation is mostly situated in one of the ventricles, or in the substance of the brain; but, after a blow on the head, the cause of pressure commonly operates upon the surface. (*Med. Chir. Trans.* vol. xiv. p. 349, 350.)

With respect to paralysis, it is unquestionably one of the common symptoms of pressure on the brain; but, according to Bichat, it may also be caused by concussion; and we know, that it may arise in cases of inflammation and suppuration within the skull. The above statement, respecting the paralysis being always on the side of the body opposite that on which the brain is compressed, agrees with what is generally remarked by other surgical writers. (See *Larrey's Mém. de Chir. Mil.* t. iv. p. 180.; *Hennen's Principles*, p. 301. ed. 2. &c.) Yet, at the Hôtel-Dieu, at Paris, extravasation has very often been noticed both on the side affected with paralysis, and on the opposite one; or else the blood was generally diffused, while the paralysis was local. (*Œuvres Chir. de Desault*, t. ii. p. 27.)

The preceding symptoms only inform us, that the brain is suffering compression; and leave us quite in the dark, respecting several other very important circumstances. "We not only have no certain infallible rule, whereby to distinguish what the pressing fluid is, or where it is situated, but we are, in many instances, absolutely incapable of knowing whether the symptoms be occasioned by any fluid at all; for a fragment of bone broken off from the internal table of the cranium, and making an equal degree of pressure, will produce exactly the same complaints. (Pott.) In detailing the symptoms of pressure from blood, I took particular notice of the patient being at first generally stunned by the blow, of his gradually regaining his senses, and of his afterwards relapsing into a state of insensibility again. The interval of sense, which thus occurs, was pointed out by Petit and Le Dran as a circumstance of the greatest consequence in elucidation of the nature of the case. It is still considered so by every surgeon of judgment and experience.

"The loss of sense, which immediately follows the violence, say they, is most probably owing to a commotion; but that which comes on after an interval of time has passed, is most probably caused by extravasation.

"This distinction is certainly just and good, as far as it will go. That degree of abolition or diminution of sense, which immediately attends or follows the blow or fall, and goes off again without the assistance of art, is in all probability occasioned by the sudden shake or temporary derangement of the contents of the head: and the same kind of symptoms recurring again some time after they had ceased, or not coming on until some time has passed from the receipt of the violence, do most probably proceed from the breach of a vessel within or upon the brain. But, unluckily, we have it not very often in our power to make this exact distinction. An extravasation is often made so immediately, and so largely, at the instant of the accident, that all sense and motion are instantaneously lost, and never again return. And it also sometimes

happens, that although an extravasation may possibly not have been made at the moment of the accident, and the first complaints may have been owing to commotion merely, yet a quantity of fluid having been shed from its proper vessels very soon after the accident, and producing its proper symptoms, before those caused by the commotion have had time to go off, the similarity of the effects of each of these different causes is such, as to deprive us of all power of distinguishing between the one and the other, or of determining, with any tolerable precision, to which of them such symptoms as remain are really owing." (Pott.)

A man meets with a fall; a slight concussion of the brain is the consequence, and the patient is instantly stunned. The effects of concussion gradually subside, but an extravasation takes place, and the loss of the senses continues, though from a different cause. Here, according to the principles of Petit, the case would be set down as concussion; yet, things are quite the contrary, the extravasation now keeping up the symptom, which was only temporarily produced by concussion. In many instances, also, the effects of concussion and extravasation exist together; and then how is a surgeon to judge of the nature of the case? (See *Œuvres Chir. de Desault*, t. ii. p. 25.)

"When an extravasation of any kind is made, either upon or within the brain, if it be in such quantity, or so situated, as to disorder the economy of the animal, it always produces such disorder, by making an unnatural pressure on the parts where it lies. The nature and degree of the symptoms, hereby produced, are various, and different in different persons, according to the kind, quantity, and situation of the pressing fluid. Sometimes it is merely fluid blood, sometimes blood in a state of coagulation; sometimes it is a clear lymph, and at others blood and water are found mixed together: each of these is found either simple or mixed in different situations, that is, between the skull and dura mater, between the dura and pia mater, or in the natural cavities of the brain called its ventricles; and sometimes, in cases of great violence, they are found at the same time in all these different parts. Sometimes a considerable quantity is shed instantly, at the time of the accident; and sometimes the breach by which the effusion is made is so circumstanced, both as to nature and situation, that it is at first very small, and increases by faster or slower degrees. In the former, the symptoms are generally immediate and urgent, and the extravasation is of the bloody kind; in the latter, they are frequently slight at first, appear after some little interval of time, increase gradually till they become urgent or fatal, and are in such case generally occasioned by extravasated lymph. So that although the immediate appearance of bad symptoms does most certainly imply mischief of some kind or other, yet, on the other hand, no man ought to suppose his patient free from hazard, either because such symptoms do not show themselves at first, or because they appear to be but slight; those which come on late, or, appearing slight at first, increase gradually, being full as much to be dreaded as to consequence, as the more immediately alarming ones; with this material difference between them, that the one may be the consequence of a mere concussion of the brain, and may by means of quietude and evacuation go quite off; whereas, the other being most frequently

owing to an extravasation of lymph (though sometimes of blood also) within the substance of the brain, are very seldom removed by art." (Pott.) No experienced surgeon, I think, can doubt the fact; that many cases, supposed to have been examples of compression from extravasation, and cured by the absorption of the effused blood, were in reality instances, in which the effects of a severe concussion had gradually subsided. (See Dupuytren, *Clin. Chir.* t. ii. p. 493.)

The case of extravasation, between the cranium and dura mater, is almost the only one, which admits of relief from trephining. Mr. Abernethy informs us, that in the cases which he met with, of blood extravasated between the dura and pia mater, on a division of the former membrane being made for its discharge, only the serous part of it could be evacuated; for, the coagulum was spread over the hemisphere of the brain, and had descended, as low as possible, towards its inferior part, so that very little relief was obtained by the operation. (*Surgical Works*, vol. ii. p. 46.) This statement is confirmed by that of Bichat; and the practice inculcated agrees with what Sir Astley Cooper also directs, as will be presently noticed.

Fractures of the cranium, which take place across the lower and front angle of the parietal bone, and the rest of the track of the trunk, and large branches of the spinous artery of the dura mater, are very likely to be attended with a copious extravasation. This vessel, and others more deeply seated, however, may be ruptured, pour out a considerable quantity of blood, and induce urgent symptoms of pressure on the brain, not only without the co-existence of a fracture, but even of any external mark of violence on the scalp.

The effused blood is frequently situated below the part on which the violence has operated; and hence, when such part is pointed out by a wound or discoloration of the scalp, or a fracture, and the symptoms of pressure are considerable, with paralysis on the opposite side of the body, I should have no hesitation about immediately trephining in the situation of the external injury. I have seen many cases in which such practice was justified by the result; and even when no extravasation exists, this plan will sometimes detect a depression of the inner table of the skull, and be the means of saving life, as happened in one very remarkable case, which I trephined at Brussels after the battle of Waterloo. At the same time, it would be wrong to hold out the expectation, that, by acting on this principle, the surgeon will always find blood immediately under the part of the cranium which he perforates. With respect to a fracture also, as a guide to the place for the application of the trephine in cases of extravasation, Desault regards it as fallacious; dissections proving that numerous fractures of the skull are unattended with any effusion of blood immediately under them; and his experience taught him, that the most frequent cases were those, in which there was either extravasation without fracture, or a fracture with blood effused in a part of the head remote from the injury of the bone. (*Œuvres Chir.* t. ii. p. 130.) Even when blood is seen issuing from the fissure, he regards it as no proof of the dura mater being detached, as such blood may proceed from the vessels of the scalp. (p. 31.) But what is to be done, when dangerous symptoms of pressure prevail, without any external mark, to denote what part of the head

has received the blow, or whether any at all? for, a general concussion of the head may produce an effusion of blood within the cranium. Under these circumstances, Pott was against the operation; and says, that "the only chance of relief is from phlebotomy, and an open belly; by which we may hope so to lessen the quantity of the circulating fluids as to assist nature in the dissipation or absorption of what has been extravasated. This is an effect, which, although not highly improbable in itself, yet is not to be expected from a slight or trifling application of the means proposed. The use of them must be proportioned to the hazard of the case. Blood must be drawn off freely and repeatedly, and from different veins; the belly must be kept constantly open, the body quiet, and the strictest regularity of general regimen must be rigidly observed." By these means, very alarming symptoms have now and then been removed, and people in seemingly very hazardous circumstances have been recovered." Desault also promulgated the same advice, and blamed the doctrine formerly in vogue, that it was better to apply the trephine many times uselessly, than to let a single extravasation remain undetected; for he was firmly convinced, that the trephine, when used on this principle, was a source of greater mischief than the effused blood itself. (*Œuvres Chir.* t. ii. p. 34.) The same doctrine is espoused by Sir Astley Cooper (*Lectures*, &c. vol. i. p. 288.), and, I believe, by all the best modern surgeons.

But should the mode of judging, whether blood lies immediately under the skull, suggested by Mr. Abernethy, prove invariably correct, the question, whether the trephine should be applied or not, may in future be more easily determined. Even when the injured scalp shows where the violence has operated, the criterion about to be noticed may inform us whether we should perforate the bone or not; for though the extravasation is sometimes found immediately under the external mark, yet it often is not so, but is in a part distant from that mark, to which situation we have nothing to lead us, and to which indeed, if we knew it, we could not reach. Mr. Abernethy has observed, "that unless one of the large arteries of the dura mater be wounded, the quantity of blood poured out will probably be inconsiderable, and the slight compression of the brain which this occasions, may not be attended with any peculiar symptoms, or perhaps it may occasion some stupor, or excite an irritation, disposing the subjacent parts to become inflamed. It is indeed highly probable, that, in many cases, which have done well without an operation, such an extravasation has existed. But if there be so much blood on the dura mater as materially to derange the functions of the brain, the bone, to a certain extent, will no longer receive blood from within, and by the operation, performed for its exposure, the pericranium must have been separated from its outside. I believe that a circumstance will not be found to bleed; and I am at least certain it cannot with the same freedom and celerity, as it does when the dura mater remains connected with it internally." (See *Abernethy's Surgical Works*, vol. ii. p. 47.) In some cases, related by this gentleman, there was no hemorrhage; twice he was able, by attending to this circumstance, to tell how far the detachment of the dura mater extended; and often, when symptoms seemed to demand a perforation of the skull, he has seen the

operation contra-indicated by the hemorrhage from the bone, and, as the event shewed, with accuracy. Mr. Abernethy admits, however, that in aged persons, and in those in whom the circulation has been rendered languid by the accident, the mode of distinction, which he has pointed out, will be less conclusive.

Pott remarks, that, "if the extravasation be of blood, and that blood be in a fluid state, small in quantity, and lying between the skull and dura mater, immediately under or near to the place perforated, it may happily be all discharged by such perforation, and the patient's life may thereby be saved; of which many instances are producible. But if the event does not prove so fortunate, if the extravasation be so large or so situated that the operation proves insufficient, yet the symptoms having been urgent, general evacuation having been used ineffectually, and a wound or bruise of the scalp having pointed out the part which most probably received the blow, although the removal of that part of the scalp (a simple incision ought to have been said) should not detect any injury done to the bone, yet the symptoms still subsisting, I cannot help thinking that perforation of the cranium is in these circumstances so fully warranted, that the omission of it may truly be called a neglect of having done that which might have proved serviceable; and, *rebus sic stantibus*, can do no harm. It is very true, that no man can beforehand tell whether such operation will prove beneficial or not, because he cannot know the precise nature, degree, or situation of the mischief; but, this uncertainty, properly considered, is so far from being a dissuasive from the attempt, that it is really a strong incitement to make it; it being fully as impossible to know, that the extravasated fluid does not lie between the skull and dura mater, and that under the part stricken, as that it does; and if the latter should be the case, and the operation be not performed, one, and most probably the only means of relief will have been omitted."

On some of the foregoing points Sir Benjamin Brodie's advice coincides very much with the precepts of Mr. Abernethy, and with the doctrines which have been for many years inculcated in this work. Blood, he observes, is seldom poured out in any considerable quantity between the dura mater and the bone, except in consequence of a laceration of the middle meningeal artery, or one of its principal branches. If, therefore, we find the patient lying in a state of stupor, and discover a fracture with or without depression, extending in the direction of the middle meningeal artery, Sir Benjamin Brodie is an advocate for the trephine. When no fracture is discoverable, but there is other evidence of the injury having fallen on that part of the cranium, under which the middle meningeal artery is situated, the trephine, he says, may be employed on speculation, rather than that the patient should be left to die without any attempt being made for his preservation. (See *Med. Chir. Trans.* vol. xiv. p. 385.)

When there is no interval of sense, between the blow and the coming on of perilous symptoms, it is frequently impossible to determine, whether the mischief be owing to the largeness and suddenness of the extravasation, to the violence of the shock which the brain has received, or to both these causes at once, which unfortunately is too often the case. In this latter complication, indeed, trephining

will frequently be of no avail, even though it serve for the entire removal of all pressure off the brain; for the patient may not recover from the violence of the concussion, and never regain his senses. This is no reason, however, why the chance of the operation doing good should not be taken, when there are evident symptoms of pressure. Let us, in these darkened cases, call to mind the sentiments of Pott, who says, "No man, who is at all acquainted with this subject, will ever venture to pronounce or promise success from the use of the trephine, even in the most apparently slight cases: he knows that honestly he cannot; it is enough that it has often been successful where and when every other means has failed. The true and just consideration is this: does the operation of perforating the cranium in such case add at all to that degree of hazard which the patient is in before it is performed; or can he in many instances do well without it? If it does add to the patient's hazard, that is certainly a very good reason for laying it aside, or for using it very cautiously; but, if it does not,—and the only objection made to it is, that it frequently fails of being successful,—surely it cannot be right to disuse that which has often been, not only salutary, but the *causa sine qua non* of preservation, merely because it is also often unsuccessful, that is, because it is not infallible."

Giving vent to the confined blood "may produce a cure, or it may prove only a temporary relief, according to the different circumstances of different cases. The disappearance, and even the alleviation of the most pressing symptoms is undoubtedly a favourable circumstance, but is not to be depended upon as absolutely portending a good event. Either a bloody, or limpid extravasation may be formed, or forming between the meninges, or upon, or within the brain, and may prove as certainly pernicious in future, as the more external effusion would have done, had it not been discharged; or the dura mater may have been so damaged by the violence of the blow as to inflame and suppurate, and thereby destroy the patient.

"If the disease lies between the dura and pia mater, mere perforation of the skull can do nothing; and, therefore, if the symptoms are pressing, there is no remedy but division of the outer of these membranes. The division of the dura mater is an operation which I have several times seen done by others, and have often done myself. I have seen it, and found it now and then successful; and from those instances of success, am satisfied of the propriety and necessity of its being sometimes done." He next states, however, that wounding the dura mater is itself attended with dangerous consequences. Mr. Abernethy's opinion of such operation has already been given. It is also disapproved of by Sir Astley Cooper, who says, that if blood be not found between the dura mater and skull, do not puncture the dura mater to seek for it, which would be of no use, as the blood is coagulated, and could not escape, being seated under the pia mater, or in the brain itself. (*Lectures, &c.* p. 289.)

If, after the removal of a portion of bone, the dura mater should present itself of a blue colour, be lifted up by blood underneath it, and bulge, as it were, into the aperture, Sir Benjamin Brodie approves of a puncture being made in that membrane; and though he joins Pott in regarding a wound of the dura mater as dangerous, he considers it here

justified by circumstances, and supports his advice by a reference to a case, in which Mr. Chevalier thus discharged a considerable quantity of blood, and the patient recovered. (See *Med. and Physical Journ.* vol. viii. p. 505.) He has also adduced another instance of the success of the practice, in the hands of my friend and late neighbour, Mr. Ogle. Neither does M. Velpeau join in the absolute condemnation of it, which, as he conceives, may sometimes be useful. (*De l'Opér. du Trépan*, p. 58.)

"Upon the removal of a piece of bone by means of the trephine, if the operation has been performed over the part where the disease is situated, and the extravasation be of the fluid kind, and between the cranium and dura mater; such fluid, whether it be blood, water, or both, is immediately seen, and is partly discharged by such opening: if, on the other hand, the extravasation be of blood in a coagulated or grumous state, it is either loose or in some degree adherent to the dura mater; if the former of these be the case, it is either totally or partially discharged at the time of, or soon after, the operation, according to the quantity or extent of the mischief; if the latter, the perforation discovers, but does not immediately discharge it." Mr. Pott then lays it down as a rule, that a large extravasation must necessarily require a more free removal of bone than a small one; and a grumous or coagulated extravasation, a still more free use of the instrument.

In applying the trephine, on account of a fracture with depression, Sir Benjamin Brodie deems the removal of a small portion of bone generally sufficient; but, when blood is extravasated the surface of the dura mater, he recommends the bone to be more freely taken away. He founds this advice on the circumstances of a case, which he has recorded, where a more limited opening did not give a sufficiently ready outlet to the suppuration that ensued, and the patient died. (See *Med. Chir. Trans.* vol. xi. p. 386.)

The application of the trephine would be unnecessary, if the cranium were broken, and fragments of a certain diameter could be extracted with forceps, so as to leave a free opening for the discharge of the extravasated blood. (See *Velpeau, de l'Opér. du Trépan*, p. 55.)

In the treatment of pressure from extravasation, Sir Astley Cooper joins the generality of surgeons in recommending free depletion, in order to prevent inflammation; the bowels, he says, are to be opened, and the patient kept very quiet. "If there be a bruise indicating the spot at which the injury has been sustained, you may trephine, after every other means has been tried ineffectually. If a fracture exists, and the symptoms do not yield to depletion, you will trephine to seek the extravasation." (*Lectures*, p. 288.)

All cases of pressure on the brain are attended with hazard of inflammation of this organ, and its membranes. The danger must be averted as much as possible, by applying cold washes to the head, and employing free and repeated bleeding, leeches, antimonials, saline purgatives, and other antiphlogistic means. After the depleting method has been continued some time, blisters may be applied to the head, and the cold wash omitted.

For an account of the various theories entertained, respecting the manner in which pressure operates upon the brain, I must refer to the writings of Sir Charles Bell, M. Serres (*Ann. des Ho-*

pitaur, t. i.), M. Flourens (*Considérations sur l'Opér. du Trépan*, 1830), Sir B. Brodie (*Med. Chir. Trans.* vol. xiv.), and particularly M. Velpeau (*De l'Opér. du Trépan*, p. 89.)

6. CONCUSSION OR COMMOTION OF THE BRAIN.

It is observed by Mr. Pott, that "very alarming symptoms, followed sometimes by the most fatal consequences, are found to attend great violence offered to the head; and, upon the strictest examination both of the living and the dead, neither fissure, fracture, nor extravasation of any kind can be discovered. The same symptoms, and the same event are met with, when the head has received no injury at all *ab externo*, but has only been violently shaken; nay, when only the body, or general frame, has seemed to sustain the whole violence." And he afterwards remarks, that "the symptoms attending a concussion are generally in proportion to the degree of violence which the brain itself has sustained, and which, indeed, is cognisable only by the symptoms. If the concussion be very great, all sense and power of motion are immediately abolished, and death follows soon; but, between this degree, and that slight confusion (or stunning, as it is called) which attends most violences done to the head, there are many stages." But besides the foregoing description of concussion, which seems rather to consist in a lesion of function, than in any visible disorganisation, Sir Astley Cooper has found the more violent degrees of it attended with laceration of the brain, and slight extravasation. (*Lectures*, &c. p. 262.) The latter, however, are rather to be considered as compound cases, than as instances of pure concussion. Sir Benjamin Brodie has observed, that the symptoms of concussion do not depend upon any such derangement of the organisation of the brain as admits of being disclosed to us by dissection; yet he thinks the inference not justified, that there is really no organic change. It is difficult, he says, to conceive in what other manner concussion of the brain can operate so as to produce the effects which it is known to produce; and if we consider, that the ultimate structure of the brain is on so minute a scale, that our senses are incapable of detecting it, it is evident that there may be changes and alterations of structure, which our senses are also incapable of detecting. (*Med. Chir. Trans.* vol. xiv. p. 337.)

With respect to the symptoms of concussion, if the blow is slight, the patient is confused, or partially stunned, and at the moment of the injury, has a sensation of flushes of light, or of stars, before his eyes, *tinnitus aurium*, and remains for some moments in a state of hebetude, or as if he were intoxicated. When the blow is more violent, he falls down senseless, and is unable to get up again for several minutes, or even hours, and sometimes he never rises again. Then the skin is pale, the pulse slow, small, and feeble. Respiration seems nearly annihilated, and the patient lies as if in a lethargy. Such condition may quickly terminate in death; but if this does not happen, it is soon remarked, that there is no paralysis; for, on pinching the skin, the patient is made to move; and, afterwards, when the stupor has partially or temporarily subsided, he is continually turning and throwing himself about in bed. At length, if he be spoken to loudly, he endeavours to answer, and opens his eyes. Next come on symptoms of irritation; but

nothing that characterises compression, except as a complication in a more advanced stage. (See *A. Velpeau, De l'Opér. du Trépan*, p. 123.)

Mr. Abernethy, I think, has removed a good deal of the perplexity of this subject by dividing concussion into three stages. In fact, without such discrimination, the various descriptions of the symptoms, as given by different writers, cannot be at all reconciled.

"The first is, that state of insensibility and derangement of the bodily powers, which immediately succeeds the accident. While it lasts, the patient scarcely feels any injury that may be inflicted on him. His breathing is difficult, but in general without stertor; his pulse intermits, and his extremities are cold. But such a state cannot last long; it goes off gradually, and is succeeded by another, which I consider as the second stage of concussion. In this, the pulse and respiration become better, and, though not regularly performed, are sufficient to maintain life, and to diffuse warmth over the extreme parts of the body. The feeling of the patient is now so far restored, that he is sensible if his skin be pinched; but he lies stupid and inattentive to slight external impressions. As the effects of concussion diminish, he becomes capable of replying to questions put to him in a loud tone of voice, especially when they refer to his chief suffering at the time, as pain in the head, &c.; otherwise, he answers incoherently, and as if his attention was occupied by something else. As long as the stupor remains, the inflammation of the brain seems to be moderate; but as the former abates, the latter seldom fails to increase; and this constitutes the third stage, which is the most important of the series of effects proceeding from concussion.

"These several stages vary considerably in their degree and duration; but more or less of each will be found to take place in every instance where the brain has been violently shaken. Whether they bear any certain proportion to each other or not, I do not know. Indeed, this will depend upon such a variety of circumstances in the constitution, the injury, and the after-treatment, that it must be difficult to determine.

"With regard to the treatment of concussion, it would appear that in the first stage very little can be done; and, perhaps, what little is done had better be omitted, as the brain and nerves are probably insensible to any stimulants that can be employed. From a loose, and, I think, fallacious analogy between the insensibility in fainting, and that which occurs in concussion, the more powerful stimulants, such as wine, brandy, and volatile alkali, are commonly had recourse to, as soon as the patient can be got to swallow. The same reasoning which led to the employment of these remedies in the first stage, in order to recall sensibility, has given a kind of sanction to their repetition in the second, with a view to continue and increase it.

"But here the practice becomes more pernicious and less defensible. The circumstance of the brain having so far recovered its powers, as to carry on the animal functions in a degree sufficient to maintain life, is surely a strong argument, that it will continue to do so without the aid of means, which probably tend to exhaust parts already weakened, by the violent action they induce.

"And it seems probable, that these stimulating liquors will aggravate that inflammation which

must sooner or later ensue." (*Essay on Injuries of the Head*, p. 59.)

In the first stage of severe examples, the voluntary muscles have lost their power of action. However, respiration and the circulation continue; and hence, the patient is not immediately destroyed, the principal organic nerves, connected with these functions, being derived from the medulla oblongata. (*Dupuytren, Clin. Chir. t. ii. p. 491.*)

In most cases of concussion, the patient vomits after the accident. Sickness and vomiting are generally early symptoms, and seldom continue after the patient has recovered from the first shock of the accident. In the beginning, a torpor exists in the intestinal canal, and there is considerable difficulty in procuring an evacuation; yet afterwards, the feces are sometimes involuntarily discharged; and the bladder becomes distended, so as to require the catheter; but after a time, the urine also comes away involuntarily. There is sometimes bleeding at the nose, and a part of the blood which drops into the throat, is vomited up. The pupils of the eyes are generally natural; but, if changed, both are a little dilated, or sometimes only one. The state of the pupils, however, is differently represented by different writers, and my experience has taught me that it is subject to much variety. In that stage, in which the sensibility of the patient is impaired, but not annihilated, "the pupils contract on exposure to light, and are sometimes more contracted than under ordinary circumstances." (*Sir R. Brodie, vol. cit. p. 388, 339.*) Immediately after the concussion, palpitations are experienced; and respiration, which is then disturbed and irregular, soon becomes quiet again, and goes on so gently, and with so little noise, or motion of the chest, that one might say, the patient does not breathe. This is a characteristic sign. The eyelids are almost always closed, the levatores palpebrarum having lost their power. (See *Dupuytren in Clin. Chir. t. ii. p. 492.*) According to Sir Astley Cooper, the pulse, although natural when the patient is undisturbed, scarcely ever fails to be quickened by any exertion made by the patient; and the carotids sometimes pulsate with great force, but the latter symptom is generally not noticed till after a few hours. The state of the pulse is very different, according to the stage of the disorder. In severe cases, the pulse is at first intermitting, irregular, feeble, perhaps scarcely perceptible, and the patient in a condition approaching that of syncope. Such may be his situation for several hours after the accident. When concussion proves fatal, the cause of death is imputed by Sir Benjamin Brodie to this disturbance of the action of the heart. "In general, when the patient has lain for some time in the state which has been described, a reaction of the circulating system takes place, and the pulse beats with greater strength in proportion as the failure of it was greater in the first instance. But where the shock has been unusually severe, there is no such reaction. The pulse becomes more and more feeble, more irregular and intermittent; the extremities grow cold, and at last, the action of the heart being altogether suspended, the patient expires. In some cases, even after reaction has begun to take place, it seems as if the constitution were unequal to the effort: there is another failure of the circulation, the result of which is the same as if the patient had never rallied from the beginning." (*Med. Chir. Trans. vol. xiv. p. 341.*) In the earlier stages, patients swallow, but only when

liquids are introduced far back into the pharynx. Digestion is suspended. (*Dupuytren, Clin. Chir. t. ii. p. 493.*)

After concussion, the mind is variously affected, according to the degree of injury which the patient has sustained. In some cases, there is a total loss of mental power; in others, the patient is capable, though with difficulty, of being roused to make a rational answer, but immediately sinks again into coma. Sometimes the memory is lost, while, in other instances, it is only partially impaired. A total forgetfulness of any foreign language is a common effect of concussion. It frequently happens that the patient, when roused, will be perfectly sensible, and answer questions rationally; but, if left undisturbed, the mind appears to be occupied by some particular circumstance (often an incoherent one), of which he is constantly talking. Patients recollect nothing about the mode in which their accidents took place. If the injury has been occasioned by a fall from a horse, they can only remember mounting and riding to some distance, but not that the animal ran away, or threw them; nor, however perfectly they may recover in other respects, do they ever have any recollection of the kind of accident. I attended a lady in Regent's Park, who had suffered a concussion of the brain, from her horses having ran away, and brought her carriage violently against the iron gates of the park. Two or three days previously, she had set fire to her dress, and slightly burnt her neck. After the return of her senses, she remembered nothing about the accident in the park. The change, produced by injuries of the brain, is remarked to be somewhat similar to the effects of age: the patient loses impressions of a recent date, and is sensible of those which he received in his earlier years. But, as Sir Astley Cooper correctly explains, the degree of injury sustained by the brain varies considerably in different cases. Some patients are only stunned, or deprived of sense for a moment; others recover in a few hours; some remain in a great degree insensible for fifteen or twenty days. Some recover entirely; others have afterwards an imperfect memory. A partial loss of sense will be produced in the function of one eye, for deafness in one ear; and the squinting, caused by an injury of the brain, is sometimes permanent. In some cases, a degree of fatuity; in some, great irritability; in others, vertigo, and tendency to severe headache from the slightest excitement, will remain. In one example, seen by Sir Astley Cooper, a remarkable irritability of the stomach, and disposition to vomit, were the permanent consequences of a concussion of the brain. In particular instances, the faculty of readily uttering the proper words for expressing ideas is lost, and never regained, and wrong terms are used. Often the judgment remains enfeebled. (*Lectures, vol. i. p. 254, &c.*) Many of the observations in the foregoing statement coincide with the accounts given of the subject in the writings of Bichat, Desault, and Dupuytren. The latter, after noticing the symptoms of the first stage, and their abatement, describes the pulse as now becoming stronger and more frequent; the eyes intolerant of light, even through the eyelids; the restlessness, and the return of speech, and recollection. The patient now perhaps asks for food, and falls asleep again for hours. After one or two such periods, his intellectual faculties are restored;

but he is incapable of long-continued attention, or of constant motion. He begins a sentence, but does not finish it. Perhaps, in four or five days, he recovers; but the effects continue a long while; as, for instance, an indisposition, or inability to read, or to enter into long conversation, or mental exertion. He commences a letter, but does not finish it. He experiences a difficulty of digestion, and weakness in walking. A debilitated condition of the genital organs will sometimes continue for several months. (*See Dupuytren, in Clin. Chir. t. ii. p. 494.*)

The following passage, extracted from a writer who has already been of material assistance in this article, cannot be too deeply impressed on the memory of every surgical practitioner:—

"To distinguish between an extravasation and commotion, by the symptoms only, is frequently a very difficult matter, sometimes an impossible one. The similarity of the effects in some cases, and the very small space of time which may intervene between the going off of the one and accession of the other, render this a very nice exercise of the judgment. The first stunning or deprivation of sense, whether total or partial, may be from either, and no man can tell from which; but when these first symptoms have been removed, or have spontaneously disappeared, if such patient is again oppressed with drowsiness, or stupidity, or total or partial loss of sense, it then becomes most probable that the first complaints were from commotion, and that the latter are from extravasation; and the greater the distance of time between the two, the greater is the probability not only that an extravasation is the cause, but that the extravasation is of the limpid kind, made gradatim, and within the brain.

"When there is no reason to apprehend any other injury, and commotion seems to be the sole disease, plentiful evacuation by phlebotomy and lenient cathartics, a dark room, the most perfect quietude, and a very low regimen, are the only means in our power; and are sometimes successful." (*Pott.*) When the patient is at all sensible, every thing likely to irritate the mind is to be avoided. (*Sir A. Cooper, Lectures, &c. p. 279. vol. i.*)

With these means should also be associated the constant application to the head of cloths dipped in very cold water, or Schmucker's Frigorific Lotion. When the effects of the violence are not necessarily fatal in a very short time after the accident, the great danger, which is to be guarded against, is certainly inflammation of the brain. Hence the necessity of freely employing the lancet, and anti-phlogistic means. The discrimination which Mr. Abernethy introduced into the views of the present subject, by his division of concussion into three stages, has led also to more rational and successful practice. For, though bleeding is now generally allowed to be the great means of relief in concussion, it is not rashly practised at the beginning of many cases, while the pulse can hardly be felt, and the circulation scarcely goes on, and every action in the system is nearly annihilated. But the state of the pulse and circulation is closely watched, and the surgeon bleeds in sufficient time and quantity, to prevent in many instances that immoderate frequency and hardness, which the pulse always has a tendency in these cases to assume immediately the first shock of the accident begins to abate. "Bleeding, (as Sir Astley Cooper correctly notices), may be carried to excess. You must,

in the repetition of bleeding, regulate your conduct by the symptoms; observe whether there be any hardness in your patient's pulse, and whether he complains of pain in the head, if he have still the power of complaining. Watch your patient with the greatest possible anxiety; visit him at least three times a day; and if you find any hardness of the pulse supervening, after the first copious bleeding, take away a tea-cup full of blood; but do not go on bleeding him largely; for you would, by this means, reduce the strength too much, and prevent the reparative process of nature." Sir Astley admits, however, that it is frequently necessary to take away blood after the first bleeding; but he directs this to be generally done in small quantities. He acknowledges, also, that it is sometimes necessary to take away large quantities by repeated bleedings. (P. 271.) The recovery of many cases which have fallen under my own observation, I have imputed to the frequent and even copious abstraction of blood, by means of the lancet, leeches, and cupping; at the same time I know, that this practice is often carried beyond all moderation, without due attention to those circumstances which I have mentioned as the proper guide.

I believe, with Mr. Abernethy and Sir Benjamin Brodie, that, in the very first stage of concussion, when all the powers of life are depressed, cordials and stimulants can rarely be employed with advantage. The latter gentleman has lately offered some considerations against this practice which merit attention. There are, he observes, sufficient reasons why we should regard that condition of the system, which approaches to syncope, as being mostly conducive to the patient's welfare, and why we should wish to prolong, rather than abridge, the period of its duration. The same blow, which gives rise to symptoms of concussion, he remarks, frequently occasions the rupture of some small vessels within the cranium. The same state of the system, which produces an enfeebled action of the heart, is calculated to prevent the ruptured vessels from pouring out their contents; and the longer it continues, the less is the danger of internal hemorrhage. If we excite the action of the heart with wine and ammonia, we may bring on symptoms of pressure on the brain. If, on the contrary, we watch the gradual restoration of the pulse, and bleed at the proper moment in quantity sufficient to keep down the action of the heart, we may often check extravasation. Sir Benjamin Brodie also argues, that as the state of depression is followed by one of excitement, it is another strong consideration in favour of avoiding stimuli, and having recourse to bleeding in time to prevent the action of the heart from becoming too vehement. (See *Med. Chir. Trans.* vol. xiv. p. 377.)

With respect to emetics, I have no confidence in their usefulness in cases of concussion, and doubt even their safety, especially when the disorder is complicated with extravasation (Sir A. Cooper, *Lectures*, &c. vol. i. p. 276.), a point, often incapable of positive decision.

Purgative and antimonial medicines should be prescribed, and a low regimen enjoined. After bleeding has been freely practised, and the bowels emptied, blisters on the scalp and nape of the neck are frequently very useful in preventing or lessening the tendency to inflammation of the brain and its membranes.

As bleeding from the arm cannot be employed in young children, Sir A. Cooper recommends the exhibition of colomel, with aceseant drinks so as to purge them; and leeches, or opening the jugular vein.

For the relief of certain symptoms, frequently remaining after concussion, as pain in the head, giddiness, diminution of sight, and deafness, Sir A. Cooper directs the head to be washed with spirit of wine and water, or the use of the shower-bath. Sometimes he orders the ung. canthar. to be rubbed on the head, and pil. hydrarg. and extr. colocynth. to be given. In cases of nervous debility of an organ, electricity is sometimes useful; and occasionally, in long-continued pains of the head, he forms an issue in the scalp, benefit sometimes resulting even from slight exfoliations. (*Lectures*, vol. i. p. 280.) When any of these complaints seem likely to depend upon effusion of fluid, a thickening of the membranes, or deposits of new matter within the head, from previous inflammation, a course of mercury, and blistering the scalp, or rubbing it with iodine liniments, may be advisable. These measures are infinitely more prudent, than the old custom of trephining.

I cannot conclude this article without adverting to the great propensity to relapse, after patients have long appeared out of every danger from wounds of the head, the bad symptoms sometimes coming on again, and proving fatal, many years after the original injury, as is strongly exemplified in a case related in a work of high character. (See *Schnucker's Vermischte Schriften*, b. i. p. 247.)

Hippocrates, De Capitis Vulneribus, 12mo. Lutetiae, 1578. *Jac. Berengarius*, De Fractura Cranii; Bologna, 1513. *James Yonge*, Wounds of the Brain proved curable, not only by the Opinion and Experience of many of the best Authors, but the remarkable History of a Child cured of two very large Depressions, with the Loss of a great Part of the skull; a Portion of the Brain also issuing through a penetrating Wound of the Dura and Pia Mater, 12mo. Lond. 1682. *J. J. Wepfer*, Observationes Medicæ practicae de Affectibus Capitis internis et externis; Scapudis, 1727. *Murray*, An post gravem ab actu vel casu capitis percussione, non juvante etiam iterata trepanatione dura menis incisioe aperienda? Tutet. Paris. 1736. (*Haller*, Disp. Chir. vol. i. p. 97.) *R. C. Wagner*, De Contrahenda Cere, 1708. (*Haller*, Disp. Chir. vol. i. p. 15.) *J. C. Teubner*, De Vulneribus Cerebri non semper lethalius, Halae, 1760. *J. Chr. Camerarius*, Diss. Inaug. exhibens rarissimam Sanationem Cerebri quassati cum notabili Substantia Deperditione, Tubing. 1719. *Alx. Camerarius*, et *Th. Fr. Fabr.*, De Apostemate Piae Matris, Tubing. 1722. *J. A. Conradi*, De Vulnere Fronti Indiciæ, Lugd. 1722. *M. E. Borelins*, et *J. G. Arnoldi*, De Ipilepsia ex Depresso Cranio, Regionout. 1724. *G. A. Langguth*, Programma de Sinu Frontalis Vulnere sine Trepanatione curando, Wittemb. 1748. *Chopard*, Mémoire sur les Lésions de la Tête par Contrecoup, 8vo. Paris, 1771. *J. La Fosse*, De Cerebri Affectibus a Causis externis evidentiibus, Monsp. 1763. *A. J. Van Huelst*, De Cerebri ejusque Membrarum Inflammatione et Suppuratione oculis, Ghillepo, 1784. *P. J. Pigeonius*, De Utilitate Incisionis Integumentorum Capitis in Læstionibus Capitis; &c. Aethre, 1788. *Bordenave*, in Mém. de l'Acad. de Chirurgie, t. ii. *Le Drun*, Traité des Opérations de Chirurgie. *J. L. Petit*, Traité des Mal. Chir. t. i. *Drass*, Obs. on Wounds of the Head, 8vo. Lond. 1776. *Pott* on Injuries of the Head from External Violence. *Hill's Cases in Surgery*. *O'Halloran* On the different Disorders arising from External Injuries of the Head, 8vo. Dublin, 1793. (Some cases in *Desault's* of the Parisian Chirurgurgical Journal. Mémoire sur les Plaies de la Tête, in Œuvres Chir. de Desault, par *Richat*, t. ii. *Tassus*, Pathologie Chirurgicale, t. ii. p. 252, &c. édit. 1809. *Schnucker's Wahrnehmungen*, b. i. et *Vermischte Chir. Schriften*, b. i. et iii. 8vo. Berlin, 1785. *Richerand*, Nosographie Chir. t. ii. p. 230, et seq. édit. 4. *Abernethy* on Injuries of the Head, in his *Surgical Works*, vol. ii. ed. 1811. *Larrey*, in Mém. de Chir. Militaire, t. ii. li. et. 8vo. Paris, 1812-1817. *Dr. Hennen*, Principles of Military Surgery, ed. 2. 8vo. Edin. 1820. *Dr. J. Thomson's Report of Observations made in the Military Hospitals in Belgium*, Edin. 1816. — *Sir Astley*

Cooper, *Lectures on the Principles, &c. of Surgery*, vol. 1. 1824. Sir B. C. Brodie, in *Med. Chir. Trans.* vol. xlv. 1828. Hippolyte Larrey, *Hist. Chir. du Siège de la Citadelle d'Anvers*, p. 80. 8vo. Paris, 1838. A. A. M. Velpeau, *De l'Opération du Trépan*, 8vo. Paris, 1834. M. le Baron Dupuytren, in *Leçons Orales de Clin. Chir.* t. iii. p. 490. 8vo. Paris, 1832. Dudley, in *Transylvania Journ. of Medicine*, No. 1, as quoted by Dr. Reese in *Amer. ed. of this Dictionary*. See TAPHEINE.

HEMERALOPIA. According to M. Durjardin, this term is derived from *hēmera*, the day, *ālōs*, blind, and *ōph*, the eye, and its right signification is therefore inferred to be *diurna cecitudo*, or *day-blindness*. (See *Journal de Méd.* t. xix. p. 348.) In the same sense, Dr. Hillary (*Obs. on the Diseases of Barbadoes*, p. 298. edit. 2.), and Heberden (*Med. Trans.* vol. i. art. 5.), have employed the term.

Hemeralopia, then, which is of very rare occurrence, stands in opposition to the *nyctalopia* of the ancients, or *night-blindness*. Dr. Hillary never met with but two examples. He mentions a report, however, that there are a people in Siam, in the East Indies, and also in Africa, who are subject to the disease of being blind in the day-time, and seeing well by night. (*Mod. Univ. Hist.* vol. vii.)

Scarpa, with the generality of modern writers, considers *hemeralopia* as an affection, in which the patient sees very well in the day, but not after sunset.

According to Sauvages, *hemeralopia* (in his nomenclature called *amblyopia crepuscularis*) was in some degree epidemic in the neighbourhood of Montpellier, in villages in damp situations, adjoining rivers, and it particularly affected the soldiers who slept in the open damp air. They were cured, he says, by blistering, together with emetics and cathartics, and other evacuations. (*Nosol. Method.* class vi. gen. 3. spec. 1.)

The abolition of eyesight by night (observes Mr. Bampffield) has occurred in all ages, and is a common disease of seamen in the East and West Indies, Mediterranean, and in all hot and tropical countries and latitudes, and affects more or less the natives likewise of those regions of the globe. It also occurs frequently among soldiers in the East and West Indies; but, he has been informed, that it is by no means so prevalent amongst them as sailors. It is not an uncommon complaint of the Lascars, employed in the East India Company's ships, trading between India and Europe. It has very rarely indeed affected the officers of his Majesty's, or of the East India Company's ships. Celsus has remarked, that women and virgins, whose menstrual returns are regular, are exempt from this disease (lib. vi. cap. 6.); and it may be observed, that the inhabitants of cold latitudes are less subject to *hemeralopia* in their own climate, than the natives of tropical countries are in theirs; but, more so, when they visit the tropics. (*Med. Chir. Trans.* vol. v. p. 38.)

"*Hemeralopia*, or *nocturnal blindness* (says Scarpa), is properly nothing but a kind of imperfect periodical amaurosis, most commonly sympathetic with the stomach. Its paroxysms come on towards the evening, and disappear in the morning. The disease is endemic in some countries, and epidemic, at certain seasons of the year, in others.

"At sunset, objects appear to persons affected with the complaint, as if covered with an ash-coloured veil, which gradually changes into a

dense cloud, which intervenes between the eyes and surrounding objects. Patients with *hemeralopia* have the pupil, both in the day and night-time, more dilated, and less moveable, than it usually is in healthy eyes. The majority of them, however, have the pupil more or less moveable in the day time, and always expanded and motionless at night. When brought into a room faintly lighted by a candle, where all the bystanders can see tolerably well, they cannot discern at all, or in a very feeble manner, scarcely any one object: or they only find themselves able to distinguish light from darkness: and at moonlight their sight is still worse. At daybreak they recover their sight, which continues perfect all the rest of the day, till sunset." (Cap. xix. p. 322. ed. 8vo.)

Mr. Bampffield represents the disease as always affecting both eyes. "In general (says this gentleman) the nocturnal blindness is at first partial, the patient is enabled to see objects a short time after sunset, and perhaps will be able to see a little by clear moonlight. At this period of the complaint, he is capable of seeing distinctly by bright candlelight. The nocturnal sight, however, becomes daily more impaired and imperfect, and, after a few days, the patient is unable to discriminate the largest objects after sunset, or by moonlight, &c.; and, finally, after a longer lapse of time, he cannot perceive any object distinctly by the brightest candlelight. If the patient is permitted to remain in this state of disease, the sight will become weak by daylight, the rays of the sun will be too powerful to be endured, whether they be direct or reflected; Ippitude is sometimes induced; myopia, or shortness of sight, succeeds; and, in progress of time, vision becomes so impaired and imperfect, that apprehensions of a total loss of sight are entertained; and this dreadful consequence has been known to ensue, where the complaint has been totally neglected, or left to nature, or where ineffectual remedies have been employed." (*Bontius*, p. 73.)

"It has been remarked by some, that the patients are capable of seeing distinctly, at all periods of the complaint, with the aid of a strong artificial light; but, in bad cases of *hemeralopia*, in my practice, the patients positively denied the existence of the sense of distinct sight by very clear candlelight." (*Bampffield in Medico-Chir. Trans.* vol. v. p. 39, 40.)

The duration of the disease, when left to itself, is generally from two weeks to three or six months. Experience has not proved that the disposition to the complaint depends upon any particular colour of the iris, as several writers have conjectured; nor upon the largeness of the eyes, as alleged by Hippocrates. (Lib. vi. sec. 7.)

In idiopathic cases, the health does not in general suffer, and, except in the worst stage, the eye is not altered in appearance. But, in cases of long duration, the pupil, according to Mr. Bampffield, "is often contracted, and the eyes and actions of the patient evince marks of painful irritation, if the eyes are exposed to a vivid light; or if he looks upward. But, if they meet the direct rays of the sun, which in the tropics are always powerful, or a strong glaring reflection of them, pain and temporary blindness are induced, from which the patient recovers, by closing his eyelids for a time to exclude the rays of light, and retiring to the shade. The pupil of the eye is

considerably dilated, both by day and night, in the proportion of about one case in twelve, and at night the pupil is often dilated, and does not perform its expansions and contractions, when exposed to the moon, or artificial light. The cases, attended with dilated pupil, were generally those of long duration, &c.

"Europeans, who have been once affected with hemeralopia, in tropical climates, are particularly liable to a recurrence of this disease, as long as they remain in them." (*Bampfild, Op. cit. p. 42, 43.*)

In two examples, described by Dr. Andrew Smith, the pupils were observed to contract and dilate regularly in the day time, according to the quantity of light; but, after sunset, they seemed a little more dilated than natural, and contracted but sluggishly upon exposure to light, while the eyes themselves seemed devoid of their usual energy and vivacity. (*See Edin. Med. and Surgical Journ. No. 74. p. 22.*)

The proximate causes of hemeralopia are not well ascertained. Sleeping with the face exposed to the brilliancy of daylight, the vivid reflection of the sun's rays from the sandy shores of hot countries, and bright moonlight, have been enumerated as exciting causes. Dr. Pye regards the disorder as intermittent. (*Med. Obs. and Inquiries, vol. i. art. 13.*) But, as Mr. Bampfild properly observes, though the complaint is certainly periodical, there is nothing in its character tending to prove, that it is influenced by the same causes as intermittent fever. The latter gentleman conjectures, "that too much light suddenly transmitted to the retina, or for a long period acting on it, may afterwards render it unsusceptible of being stimulated to action, by the weaker or smaller quantities of light transmitted to it by night." (*P. 44.*) The same sentiment is adopted by Dr. Smith. (*Edin. Med. Journ. No. 74. p. 23.*) Amongst other objections to this explanation, however, it might be remarked, that the patients do not always see, though the light be good; and Mr. Bampfild's own "patients positively denied the existence of distinct sight by very clear candlelight." Besides, if the disease were entirely caused by the sudden or long operation of vivid light, one would conclude, that all persons subjected to that cause ought to have the effect produced, which is far from being the case.

When the tongue is white, and the patient has headach and bilious complaints, M. Lassus thinks the cause of the disease is in the stomach and primæ viæ. The same author likewise states, that hemeralopia attacks debilitated persons, subject to catarrhal affections, residing in damp situations, and living on indigestible food. From the combination of such causes (says he) the disorder was epidemic in the vicinity of Montpellier. (*Sauvage, Nosolog. Méthod. t. ii. p. 732.*); at Belle-Isle sur Mer. (*Recueil d'Observ. de Médecine des Hôpitaux Militaires, par Richard, t. ii. p. 573.*); and hence, it is endemic in watery situations, where the nights are cold and damp. They who expose themselves to this humidity (says M. Lassus), or who navigate along the eastern coasts of Africa, who traverse the Mozambique channel, or sail along the coasts of Malabar and Coromandel, are sometimes attacked by it. (*See Pathologie Chir. t. ii. p. 542, 543.*) Hemeralopia sometimes occurs as a symptom of the scurvy. This fact

was noticed by Mr. Telford, in Sir G. Blane's Treatise on Diseases of Seamen, and it is likewise confirmed by Mr. Bampfild, who remarks, that hemeralopia should be referred to the same causes as scurvy, "when the subject of it has for a long period subsisted on a salted diet at sea, &c., and if any other scorbutic symptom be present, such as spongy gums, ecchymoses, saline smell of the secretions, ulcers, with liver-like fungus, &c." (*Medico-Chir. Trans. vol. v. p. 45.*)

In July and August, 1834, hemeralopia was epidemic in two battalions of the 19th Prussian regiment of the line, 138 soldiers having been attacked by it, while quartered at Ehrenbreitstein and Pfaffendorf. Those who suffered were unable to find their muskets, if they put them out of their hands at night, and they experienced such difficulty in discerning at that time, even near objects, that they were afraid of quitting the sentry-box, lest they should not find it again. Surgeon-general Hubner attributed the origin of the disorder to the following causes: — 1. The great heat of the summer. 2. The fatigue of the men in the frequent ascent of the steep heights of Ehrenbreitstein and Pfaffendorf. 3. The frequency of their exercise and parade, on an unshaded and dazzling sandy soil, where also they were exposed to the reflection of the sun from the Rhine. 4. The extreme darkness of their rooms, which rendered their eyes too sensible to bear the open daylight without ill consequences. (*See Med. Zeitung, and Dubl. Journ. of Med. Science, vol. viii. p. 123.*)

This disease (according to Scarpa) may commonly be completely cured, and oftentimes in a very short time, by employing emetics, aperient powders, and pills, and a blister on the nape of the neck; and topically, the vapours of ammonia; followed, towards the end of the treatment, by bark, conjoined with valerian. In cases in which the disease has been preceded by plethora, and suppressed perspiration, bleeding and sudorifics are also indicated. (*Cap. xiv. p. 322, 333.*)

One hundred cases, of idiopathic, and two hundred of symptomatic or scorbutic hemeralopia, occurred in the practice of Mr. Bampfild, in different parts of the globe, but chiefly in the East Indies. All these cases perfectly recovered: and hence we may infer, that, under proper treatment, a favourable prognosis may always be given.

In a few instances, however, night-blindness is congenital and constitutional, and altogether beyond the reach of any curative measure. It is said sometimes to be hereditary; and the writer of the article *Nyctalopia*, in Dr. Rees's Cyclopædia, was acquainted with an instance, in which it occurred to two children of the same family. A congenital case, which had continued many years without change, and independently of any disease, is related by Dr. Parham. (*See Med. Obs. and Inquiries, vol. i. p. 122. note.*)

The treatment, which Mr. Bampfild adopted, was simple. "A succession of blisters to the temples (says he), of the size of a crown, or half-crown piece, applied tolerably close to the external canthus of the eye, has succeeded in every case of idiopathic hemeralopia which I have seen, &c. The first application of blisters commonly enables the patient to see dimly by candlelight, or perceive objects without the power of discriminating what they are. In some slight cases, which admitted of easy cure, the first application suc-

ceeded perfectly. The second application of blisters commonly enables the patient to see by candlelight distinctly, perhaps by bright moonlight, and even half an hour after sunset, or the sight is restored for short periods during the night, and is again abolished. The second application very often effects a perfect recovery. The third, fourth, or fifth applications in succession, generally produce a complete recovery, where the first or second have failed; but some rare instances of very obstinate hemeralopia have required even ten successive blisters to each temple; or, instead of using them in succession, a perpetual vesicatory has been formed on each temple, and maintained until a cure has been accomplished; an event, which has generally followed in a fortnight." (*Bampfied in Medico-Chir. Trans.* vol. v. p. 47, 48.) In some cases, shades over the eyes were worn during the treatment, and a certain time after the cure. The patients were also often directed to bathe their eyes with cold water, two or three times a day.

The epidemic hemeralopia amongst the Prussian soldiers at Ehrenbreitstein, was cured by change of quarters, removing the exciting causes, already specified, and having recourse to cold lotions.

Mr. Bampfied knew of some instances, in which electricity was successfully employed, as a topical stimulus to the eye. He also informs us, that a spontaneous cure sometimes followed the eruption of boils on the head or face, or the formation of abscesses on those parts, or in the ears.

Although blisters will generally effect a cure, there were particular cases in which Mr. Bampfied administered cathartics, such as calomel and the neutral salts. In these examples, the patient had bilious complaints, indicated by a yellow state of the tongue and skin, headach, and pain about the præcordia; or symptoms of indigestion; white tongue, loss of appetite, pain and flatulence of the stomach, &c. With blisters and aperient medicines, Mr. Lawrence sometimes combines cupping on the temples, or nape of the neck. (*On Dis. of the Eye*, p. 570.)

The patients, treated by Dr. Smith, were put into a ward moderately lighted, and their bowels emptied by a gentle cathartic. A blister was then applied to each temple, and kept open with savin cerate. A little of a solution of the oxymercurate of mercury, in the proportion of two grains to an ounce of water was dropped into the eyes twice a day. The purgatives were repeated on the third day, and the quantity of light to which the patients were exposed, was afterwards gradually increased. (*See Edin. Med. Journ.* No. 74. p. 24.)

In scorbutic hemeralopia, blisters are to be deferred until the state of the constitution has been amended, by giving lemon and lime juice, and fresh animal and vegetable food; because hemeralopia often gradually ceases as the scurvy is cured; and before this last event, the blister might produce a scorbutic ulcer. Mr. Bampfied estimates, that about one-third of the cases of scorbutic hemeralopia resist the efficacy of the antiscorbutic regimen and medicines; and consequently must ultimately be treated as idiopathic cases.

The frequent recurrence of this disease, during the patient's continuance in a tropical or hot climate, naturally suggests the propriety of recommending him to return to his native climate, by which change the tendency to a relapse is in ge-

neral completely removed. (*Bampfied, in Medico-Chir. Trans.* vol. v. p. 53.)

Consult Celsus de Re Médica, cap. 6. lib. 6. Galen Op. Lib. de Oculis, pars iv. cap. 11. 22. *Ætli Sermo Septimus*, cap. 48. &c. Paul. *Æginæ*, lib. iii. cap. 48. *Actuarius*, De Method. Med. lib. iv. cap. 11. *Rhasar*, De *Ægritud.* ocul. cap. 4. *Avicenna*, lib. iii. fen. 3. tractat. 4. *Fabricei* *Hildani* *centur.* i. obs. 24.; *centur.* v. obs. 13. *Platner*, *Praxis Med.* C. A. *Bergm.*, et J. C. *Wegel*, De Nyctalopia seu *Cæcitate Nocturna*; *Haller*, *Diap.* ad Morb. &c. 350. *Journal de Médecine et de Chirurgie*, an 1756, t. iv. *Medical Observations and Inquiries*, vol. i. *Recueil d'Observations de Médecine des Hôpitaux Militaires*, par *Richard*, t. ii. *Deport*, *Mémoire sur la Goutte Sereine Nocturne Épidémique, ou Nyctalopie*. *Observations on Tropical Nyctalopia*, by *Mr. J. Forbes*, in *Edinb. Medical and Surgical Journal*, No. xxviii. p. 417, et seq. *Richter's Anfangsgründe der Wundarzneikunst*, b. iii. p. 483, et seq. *Schmucker's* *Chirurgische Schriften*, band. 2. "Saggio di Osservazioni e d'Esperienze sulle Principali Malattie degli Occhi di *Antonio Scapa*", p. 322, et seq. edit. 8vo. *Venezia*, 1802. *Iassus*, *Pathologia Chirurgicale*, t. ii. p. 539, edit. 2. *Rees's Cyclopaedia*, art. *Nyctalopia*. A Practical Essay on Hemeralopia, or Night-blindness, commonly called Nyctalopia, by *R. W. Bampfied*, in *Medico-Chirurgial Trans.* vol. v. p. 32, et seq. *A. Simpson* on Hemeralopia, 8vo. Glasgow, 1819. C. H. *Weller*, *Manual of the Dis. of the Eye*, transl. by *D. Montearth*, vol. ii. p. 142. 8vo. Glasgow, 1821. *Good's Study of Medicine*, vol. iv. p. 203, edit. 3. 1829. *W. Lawrence* on Dis. of the Eye, p. 568, 8vo. Lond. 1833. Dr. J. *Smith*, in *Edinb. Med. and Surgical Journ.* No. 18xv. *W. Muckenre* on Dis. of the Eye, p. 880, ed. 2. 8vo. Lond. 1835. *Robert Maitland*, on Dis. of the Eye, vol. ii. p. 225, 8vo. Lond. 1836. H. E. C. *Fischer*, *Scriptores Ophthalmologici Minores*, vol. iii. *Dublin Journ. of Med. Science*, vol. viii. p. 123, 8vo. 1835

HEMIOPIA. (from *ἥμιος*, half, and *ὄψ*, the eye.) A certain disorder of the eye, in which the patient cannot see the whole of any object which he is looking at, but only a part of it. Sometimes he sees the middle, but not the circumference; sometimes the circumference, but not the centre; while, on other occasions, it is only the upper or lower half which is discerned. Sometimes objects are seen thus imperfectly, whether distant or near; sometimes only when they are near, and not at a great distance.

The causes of hemiopia are divided by Richter into four kinds.

To the first belong opacities of the cornea and crystalline lens, especially such as destroy the transparency of only a certain portion of these parts. The cure of this species of hemiopia depends upon the removal of the partial opacity from which it originates. (See CATARACT, and CORNEA, *Opacities of*.)

Under certain circumstances, persons, whose upper eyelids cannot be properly raised, are affected with hemiopia. They can only discern the lower half of an object, which is near and of large size, unless they go further from it, draw their heads backward, or turn their eyes downward.

The pupil, in particular instances, becomes drawn away from the middle of the iris, or there may be a separation of the iris from the margin of the cornea by external violence, or other causes.

Each of these occurrences may cause hemiopia of an incurable kind.

The foregoing species of hemiopia are merely effects of other diseases. The fourth and last kind is the most important, being generally regarded as an independent disorder. Sometimes it appears to be the effect of a sudden and transient irritation, producing a morbid sensibility in the optic nerve.

The causes of this sort of case, if we can credit Richter, are mostly seated in the abdominal viscera. When the affection is more durable, forming what has been termed *amaurosis dimidiata*,

the same treatment is indicated as in *amaurosis*; in which, indeed, it often terminates. (*Richter, Anfangsgr. der Wundarzn.* b. iii. kap. 17.)

Dr. Wollaston, who experienced two attacks of hemiopia, and wrote a paper on the semidecussation of the optic nerves, concluded that the disorder might depend upon injury of one of the thalami, occasioning insensibility of the right or left halves of the retinae, according to the nervous filaments implicated. (See *Phil. Trans.* for 1824, p. 224.) For reasons against this hypothesis, consult *MacKenzie on Dis. of the Eye*, ed. 2. p. 892.)

HEMORRHAGE. (from *αἷμα*, blood, and *ῥήγνμι*, to break out.) Bleeding. Effusion, or loss of blood.

This is doubtless one of the most important subjects in surgery. The fear of hemorrhage retarded the improvement of our profession for ages; the ancients, ignorant how to stop bleeding, were afraid to cut out the most trivial tumour, or they did so with terror. They generally performed slowly and imperfectly, by means of burning irons or ligatures, the same operations which the moderns execute quickly and safely with a knife. If the old surgeons ventured to amputate a limb, they only did so, after it had mortified, by dividing the dead parts; and so great was their apprehension of hemorrhage, that they only dared to cut parts which could no longer bleed. (*John Bell's Principles of Surgery*, vol. i. p. 142.) But not only as a consequence of surgery, is hemorrhage to be feared; it is also one of the most alarming accidents which surgery is called upon to relieve. "*Un sentiment naturel attache à l'idée de perdre son sang; un terreur machinale, dont l'enfant qui commence à parler, et l'homme le plus décidé, sont également susceptibles. On ne peut point dire, que cette peur soit chimérique. Si l'on comptoit ceux, qui perdent la vie dans une bataille, on verroit, que les trois quarts ont péri par quelque hemorrhagie; et dans les grandes opérations de chirurgie cet accident est presque toujours le plus formidable.*" (*Morand, Mém. de l'Acad. de Chir.* vol. v. 8vo.)

As the blood circulates in the arteries with much greater impetus and rapidity than in the veins, it necessarily follows, that their wounds are generally attended with more profuse hemorrhage, than those of the latter vessels, and that such hemorrhage is more difficult to suppress. However, as the blood also flows through veins of great magnitude with much velocity, bleeding from them, if they lie deeply, is frequently highly dangerous, and sometimes unavoidably fatal. When a large artery is wounded, the blood is of a bright scarlet colour, and gushes from the vessel *per saltum*; but, if the artery be of inferior size, the blood, which first spouts from it, does not issue *per saltum*, and it is not until the first gush has subsided, that the stream takes place in jets. (See *J. W. Earle, in Lond. Med. Gaz.* vol. xvi. p. 9.) The blood issues from a vein in an even unbroken stream, and is of a dark purple red colour. It is of great practical use to remember these distinguishing differences, between arterial and venous hemorrhage, because, though in both cases the oozing of blood may be equal in quantity, yet, in the latter instance, the surgeon is often justified in bringing the sides of a wound together, without taking further means to suppress the bleeding, while it might not be proper to adopt the same conduct, were there an equal discharge of arterial blood.

Dr. Jones has favoured the world with a matchless work on the present subject; and as one grand object of this Dictionary is to present a careful account of the principal improvements in surgical science, I shall first endeavour to make the reader acquainted with the more accurate doctrines first promulgated by this gentleman relative to the subject of hemorrhage. Afterwards, the surgical means, to be practised in different cases, will be considered.

The sides of the arteries are divisible into three coats. The internal one is extremely thin, and transparent and smooth, with an appearance somewhat like that of a serous membrane. It is elastic and firm (considering its delicate structure) in the longitudinal direction, but so weak in the circular as to be very easily torn by the slightest force applied in that direction. Its diseases prove, that it is vascular, and probably it is sensible. The experiments of M. Manec prove, that it secretes an unctuous matter, which facilitates the course of the blood; another fact, in confirmation of its vascularity. (See *Manec, Traité de la Ligature des Artères*; Paris, 1832, in fol.)

The middle coat is the thickest, and is composed of fibres, all arranged in a circular, or, as is sometimes alleged, in a spiral manner; they differ, however, from common muscular fibres in being more elastic, by which they tend to keep a dead artery open, and of a cylindrical form. They differ also from common muscular fibres in the facility with which they are divided by any trivial pressure, whether made with the ligature, forceps, or the nail. (See *J. Lisfranc, De l'Oblutération des Artères*, p. 9.) Another difference is, the absence of fibrine from the fibrous coat of an artery. As this middle coat has no longitudinal fibres, the circular fibres are held together by a slender connection, which yields readily to any force, applied in the circumference of the artery. It easily gives way, whether the force is exerted in the direction of the diameter, or in that of the course of the vessel. (See *J. L. Sanson, Des Hemorrhagies Traumatiques*, p. 33.)

The external coat is remarkable for its whiteness, density, and great elasticity. It adheres to the middle coat by means of very fine reddish filaments, analogous to those which unite the middle to the internal coat, and it manifestly receives the *vas vasorum*. (See *J. L. Sanson, Op. cit.*) When an artery is surrounded with a tight ligature, its middle and internal coats are as completely divided by it as they could be by a knife, while the external coat remains entire. (Jones.)

If an artery be extended longitudinally, the internal tunic is first ruptured, and then the middle one; but, the external coat will admit of being elongated to a great extent, before it will be torn. If an artery is twisted, rents are formed in the internal coat, and next in the middle one; but it is difficult to produce a complete rupture of the external tunic. If an artery is struck and forcibly contused; or if it is surrounded with a tight ligature; its internal and middle coats are readily divided, but the external one still makes resistance. (See *J. L. Sanson, Des Hemorrhagies Traumatiques*, p. 33.)

In addition to these three coats, it would appear from the researches of M. Malgaigne, that, in the aorta, and the large trunks derived from it, there is interposed between the internal and fibrous coats, one, which he has named *sclerous*, which renders

the aorta stronger and more rigid than the pulmonary artery; and is the seat of various earthy, stentatomatous, and cartilaginous formations, met with in the former vessel. It is certainly remarkable, that no good specimen of an ossification of the pulmonary artery, has ever been noticed. (See J. Lisfranc, *De l'Oblitération des Artères*, p. 10.)

Besides these proper coats, all the arteries, in their natural situations, are connected, by means of fine cellular tissue, with surrounding membranous sheaths. *If an artery be divided, the divided parts, owing to their elasticity, recede from each other, and the length of the cellular tissue, connecting the artery with the sheath, admits of its retracting a certain way within the sheath.*

Another important fact is, *that when an artery is divided, its truncated extremities contract in a greater or less degree, and the contraction is generally, if not always, permanent.*

Arteries are furnished with arteries, veins, absorbents, and nerves; a structure, which makes them susceptible of every change to which living parts are subjected in common; enables them to inflame, when injured, and to pour out coagulating lymph, by which the injury is repaired, or the tube permanently closed. (See Jones on Hemorrhage.)

Petit, the surgeon, in 1731, first endeavoured to explain the means, which nature employs for the suppression of hemorrhage. He thought that bleeding from a divided artery is stopped by the formation of a coagulum of blood, which is situated partly within, and partly without the vessel. The clot, he says, afterwards adheres to the inside of the artery, to its orifice, and to the surrounding parts; and he adds, that when hemorrhage is stopped by a ligature, a coagulum is formed above the ligature, which only differs in shape from the one which takes place when no ligature is employed. His theory leads him to recommend compression for the support of the coagulum.

In 1736, Morand published additional interesting remarks. He allowed, that a coagulum had some effect in stopping hemorrhage; but contended, that a corrugation, or plating, of the circular fibres of the artery which diminish its canal, and a shortening and consequent thickening of its longitudinal ones, which nearly rendered it impervious, had some share in the process. He thought that the cavity of an artery might be obliterated, by the puckering, or corrugation, when circular pressure, like that of a ligature, was made.

Morand erred chiefly in his mode of explanation, and in his belief in the existence of longitudinal fibres, which no modern anatomists admit; for the contraction and retraction of divided arteries are indisputable facts, and, as Dr. Jones remarks, this does not affect the truth of his general conclusion, *that the change, produced on a divided artery, contributes with the coagulum to stop the flow of blood.*

Mr. S. Sharp (2d edit. of *Operations of Surgery*, 1739) supported the same doctrine. "The blood-vessels, immediately upon their division, bleed freely, and continue bleeding, till they are either stopped by art, or at length contracting, and withdrawing themselves into the wound, their extremities are shut up by coagulated blood."

Pouteau (*Mélanges de Chirurgie*, 1760), denied, that a coagulum is always found after an artery is divided; and when it is, he thought it only a feeble subsidiary means towards the sup-

pression of hemorrhage. He contended, that the retraction of the artery had not been demonstrated, and could not be more effectual than a coagulum. His theory was, that the swelling of the cellular membrane, at the circumference of the cut extremity of the artery, forms the principal impediment to the flow of blood; and that a ligature is useful in promoting a more immediate and extensive induration of the cellular substance.

Gooch, White, Aikin, and Kirkland, all oppose Petit's doctrine of coagulum. The first blends some of Pouteau's theory with his own, by observing, that "when a small artery is totally divided, its retraction may bring it under the surrounding parts, and with the natural contraction of the diameter of its mouth, assisted by the compressive power of those parts, increased by their growing tumid, the efflux of blood may be stopped."

White was convinced, from what Gooch had suggested, and Kirkland confirmed, that the arteries, by their natural contraction, coalesce as far as their first ramification.

Dr. Jones admits, that an artery contracts after it has been divided, and his experiments authorise him to say, that the contraction of an artery is an important means, but certainly not the only, nor even the chief means, by which hemorrhage is stopped. When the artery is above a certain size, the impetuous flow of blood through the wound of the artery would resist the contraction of the vessel in such a degree, that the consequences would be fatal in almost every instance, were it not for the formation of coagulum.

Mr. J. Bell supposed, that when hemorrhage stops of its own accord, it is neither from the retraction of an artery, nor the constriction of its fibres, nor the formation of clots, but by the cellular tissue which surrounds the artery being injected with blood. I must refer the reader to Dr. Jones's work for a complete exposure of the inconsistencies and absurdities in Mr. Bell's account of his own theory. (See p. 25, &c.) Dr. Jones concludes his criticisms on Mr. Bell with observing, that if this gentleman really mean to confine his doctrine of the natural means of suppressing hemorrhage to the injection of the cellular tissue round the artery with blood, he dwells improperly on one of the attendant circumstances, to the exclusion of the retraction and contraction of an artery, and the formation of a distinct clot, all primary parts of the process.

The blood, besides filling the cellular tissue round the artery, also fills that which is at the mouth of the artery in a particular manner; for the divided vessel, by its retraction within its cellular sheath, leaves a space of a determinate form, which, when all the circumstances necessary for the suppression of hemorrhage operate, is gradually filled up by a distinct clot. (Jones.)

Arteries of the fourth or fifth order, like those of the forearm and leg, have not any well-defined sheath; and hence the constantly greater difficulty of insulating small vessels than large. (See P. P. Maucé, *de la Ligature des Artères*, p. 3.)

MEANS OF NATURE IN STOPPING BLEEDING FROM DIVIDED ARTERIES.

Dr. Jones has given a faithful and accurate detail of a series of experiments on animals, which demonstrate, "that the blood, the action, and even

the structure of the arteries, their sheath, and the cellular substance connecting them with it," are concerned in stopping bleeding from a divided artery of moderate size, in the following manner:—"An impetuous flow of blood, a sudden and forcible retraction of the artery within its sheath, and a slight contraction of its extremity, are the immediate, and almost simultaneous, effects of its division. The natural impulse, however, with which the blood is driven on, in some measure counteracts the retraction, and resists the contraction of the artery. The blood is effused into the cellular tissue, between the artery and its sheath, and passing through that canal of the sheath, which had been formed by the retraction of the artery, flows freely externally, or is extravasated into the surrounding cellular tissue, in proportion to the open or confined state of the wound. The retracting artery leaves the internal surface of the sheath uneven, by lacerating or stretching the cellular fibres that connected them. These fibres entangle the blood as it flows, and thus the foundation is laid for the formation of a coagulum at the mouth of the artery, and which appears to be completed by the blood, as it passes through this canal of the sheath, gradually adhering and coagulating around its internal surface, till it completely fills it up from the circumference to the centre." (Jones, p. 53.)

The effusion of blood into the surrounding cellular tissue, and between the artery and its sheath; but, in particular, the diminished force of the circulation from loss of blood, and the speedy coagulation of this fluid under these circumstances, most essentially contribute, says Dr. Jones, to the desirable effect.

It appears then, that a coagulum, which Dr. Jones calls the *external* one, situated at the mouth of the artery, and within its sheath, forms the first complete obstacle to the continuance of bleeding; and though it seems externally like a continuation of the artery, yet, on slitting open this vessel, its termination can be plainly observed, with the coagulum shutting up its mouth, and contained in its sheath.

No collateral branch being very near the impervious mouth of the artery, the blood just within it is at rest, and usually forms a slender conical coagulum, which neither fills up the canal of the artery, nor adheres to its sides, except by a small portion of the circumference of its base, near the extremity of the vessel. This coagulum is distinct from the former, and what Dr. Jones calls the *internal* one.

The description given by Mr. Guthrie of this subject, differs in some respects from that of Dr. Jones. The contraction of the divided end of the artery is alleged by Mr. Guthrie "to be confined, in the first instance, to its very extremity, so that the barrier, opposing the flow of blood, is formed by this part alone. This contraction goes on, however, increasing for the space of an inch, and the inside of this contracted inch of the vessel is filled up with an internal coagulum, which takes the shape of, and adheres to, the inside of the artery, rarely extending any far as a collateral branch, or under almost any circumstances, beyond a couple of inches. (On Dis. and Injuries of Arteries, p. 247.)

The cut end of the artery next inflames, and the vasa vasorum pour out lymph or fibrine, which fills up the extremity of the artery, is situated be-

tween the internal and external coagula, and is somewhat intermingled with them, or adheres to them, and is firmly united all round to the internal coat of the vessel. Dr. Jones further states, that the permanent suppression of hemorrhage chiefly depends on this coagulum of fibrine; but, that the end of the artery is also secured by a gradual contraction, which it undergoes, and by an effusion of fibrine between its tunics, and into the surrounding cellular tissue; whereby these parts become thickened, and so incorporated with each other, that one cannot be discerned from the other. Should the wound in the integuments not heal by the first intention, the coagulating lymph, soon effused, attaches the artery firmly to the subjacent and lateral parts, gives it a new covering, and entirely excludes it from the outward wound.

The same circumstances are also remarkable in the portion of the vessel, most remote from the heart. Its orifice, however, is usually more contracted, and its external coagulum smaller, than the one which attaches itself to the other cut end of the artery. (Jones on Hemorrhage, p. 56.)

According to Mr. Guthrie's observations, the lower end of a divided artery is more prone to secondary hemorrhage, than the upper; and thus he believes to be so much the fact, that, when hemorrhage returns, after having been arrested for a period of four hours, it is in all probability from the lower end. This, he further observes, may always be known by the "darker colour of the blood, ~~and~~ by its flowing out in a continuous stream, in the same manner as water rises from a spring, and without an arterial impulse. The surgeon has no right to believe, that the blood comes from the upper extremity of the artery, unless it is of a florid, scarlet, arterial colour, when it will usually rush out with force, if not with undisguised arterial impetus." The greater disposition to secondary hemorrhage in the lower, than the upper end of the artery, is thought by Mr. Guthrie to depend upon the retraction and contraction of the former, being neither so perfect, nor so permanent as in the latter; a statement at variance with that of Jones. He suspects, also, that the internal coagulum is in many instances altogether wanting, or very defective in its formation. (See G. J. Guthrie, on the Dis. and Injuries of Arteries, p. 248.) We have seen, that Dr. Jones found the external coagulum smaller here, than that which is formed over the mouth of the end of the artery nearest the heart. The darker colour of the blood from the distal end of the artery, is ascribed by Mr. Sanson to its previous passage through the capillary vessels; and the fact, he says, was observed by John Hunter. (Des Hemorrhages Traumatiques, p. 45.)

The impervious extremity of the artery no longer allowing blood to circulate through it, the portion, which lies between it and the first lateral branch, gradually contracts, till its cavity is completely obliterated, and its tunics assume a ligamentous appearance. In a few days, the external coagulum, which in the first instance stopped the hemorrhage, is absorbed, and the coagulating lymph, effused around it, and by which the parts were thickened, is gradually removed, so that they resume again their cellular texture.

At a still later period, the ligamentous portion is reduced to a filamentous state, so that the artery

is, as it were, completely annihilated, with its cut end to the first lateral branch; but, long before this final change is accomplished, the inoculating branches have become considerably enlarged, so as to establish a free communication between the disunited parts of the main artery.

As Mr. Guthrie observes, out of four or five inches of the artery, two or three will be imperious, and the remaining part very much contracted, although, perhaps, still permeable by a probe. The accompanying nerve, where there is one, has undergone a change, the very reverse of that of the artery, its cut extremity having become enlarged, or bulbous, the nerve gradually diminishing upwards until it resumes its proper size. (*On Dis. and Inj. of Arteries*, p. 248.)

When an artery has been divided at some distance from a lateral branch, three coagula are formed: one of blood, externally, which shuts up its mouth; one of lymph, just within the extremity of its canal; and one of blood, within its cavity, and contiguous to that of lymph. But, when the artery has been divided near a lateral branch, no internal coagulum of blood is formed. (*Jones*, p. 63.)

The external coagulum is always formed, when the divided artery is left to nature: not so, however, if art interfere, for, under the application of the ligature, it can never form. If arapic, lycoperdon, or sponge, be used, its formation is doubtful, depending entirely upon the degree of pressure that is used; but the internal coagulum of blood will be equally formed, whatever treatment be left to art or nature. If a lateral branch be near the transverse division of the artery; and, lastly, effused fibrine, which, when in sufficient quantity, forms a distinct coagulum, just at the mouth of the artery, will be always found, if the hemorrhage be permanently suppressed. (*Jones*, p. 74.)

MEANS WHICH NATURE EMPLOYS FOR SUPPRESSING THE HEMORRHAGE FROM PUNCTURED OR PARTIALLY DIVIDED ARTERIES.

The suppression of hemorrhage by the natural means is sometimes more easily accomplished, when an artery is completely divided, than when merely punctured, or partially divided. Completely dividing a wounded artery was one means practised by the ancients for the stoppage of hemorrhage: the moderns frequently do the same thing, when bleeding from the temporal artery proves troublesome.

Dr. Jones has related many experiments, highly worthy of perusal, and which were undertaken to investigate the present part of the subject of hemorrhage. He candidly acknowledges, however, that, in regard to the temporary means by which the bleeding from a punctured artery is stopped, he has but little to add to what Petit has explained, in his third publication on hemorrhage. (*Mém. de l'Acad. des Sciences*, 1735.) The blood is effused into the cellular substance, between the artery and its sheath, for some distance, both above and below the wounded part; and when the parts are examined, a short time after the hemorrhage has completely stopped, we find a stratum of coagulated blood between the artery and its sheath, extending from a few inches below the wounded part to two or three inches above it,

and somewhat thicker, or more prominent over the wounded part, than elsewhere.

Hence, rather than say that the hemorrhage is stopped by a coagulum, it is more correct to say, that it is stopped by a thick lamina of coagulated blood, which, though somewhat thicker at the wounded part, is perfectly continuous with the coagulated blood lying between the artery and its sheath. (*Jones*, p. 113.)

When an artery is punctured, the immediate hemorrhage, by filling up the space, between the artery and its sheath with blood, and consequently, distending the sheath, alters the relative situation of the puncture in the sheath to that in the artery, so that they are not exactly opposite to each other; and, by this means, a layer of blood is confined by the sheath over the puncture in the artery, and, by coagulating there, prevents any further effusion of blood.

But this coagulated blood, like the external coagulum of a divided artery, affords only a temporary barrier to the hemorrhage; its permanent suppression is effected by a process of reparation, or of obliteration.

Dr. Jones's experiments prove, that an artery, if wounded only to a moderate extent, is capable of reuniting and healing so completely, that, after a certain time, the cicatrization cannot be discovered, either on its internal or external surface; and that even oblique and transverse wounds, (which gape most), when they do not open the artery to a greater extent than one fourth of the circumference, are also filled up and healed by an effusion of coagulating lymph from their inflamed lips, so as to occasion but little or no obstruction to the canal of the artery. The utmost magnitude of a wound, which will still allow the continuity of the canal to be preserved, is difficult to be learned; for, when the wound is large, but yet capable of being united, such a quantity of coagulating lymph is poured out, that the canal of the vessel, at the wounded part, is more or less filled up by it. And, when the wound is still larger, the vessel soon becomes either torn, or ulcerated completely across, by which its complete division is accomplished.

Béclard made a series of experiments upon dogs, whose arteries are said not to differ much from those of man, though the impulse of the heart is not so strong, and the blood is more coagulable; two circumstances, which should be duly considered in applying any of the inferences drawn from such experiments to the human subject. "In his first experiment, he pricked the femoral artery with a needle; the blood flowed, but soon stopped. On removing the coagulum it again flowed, but in a smaller stream; it gradually ceased to bleed, and finally stopped, though the coagulum was again scraped off. On examination of the artery, no trace of the cicatrix was found. Several similar experiments had the same result. In experiment 4, he denuded the femoral artery, and made a longitudinal cut in it, from two to three lines. The lips of the wound were seen in contact during the diastole of the ventricle, and to be separated by a jet of blood during the systole. The blood was stopped by a coagulum; this was removed twice, and each time the blood flowed in a diminished stream, but the animal died. In experiment 6 he made the same incision, but did not detach the sheath from the artery, and the

wound was left to nature. The hemorrhage was not great; there was an infiltration of blood into the sheath, the size of an almond, which at the end of some days began to diminish, and disappeared in two or three weeks. On the limb being examined, fifteen days afterwards, a little white ridge was found adhering firmly to the artery, and to the sheath, and completely closing the wound. In the interior, there was a depressed longitudinal cicatrix of the breadth of the fifth of a line. The canal was regular and pervious through its whole extent.

"In experiments 7, 8, 9, he made transverse incisions of $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ of the circumference of the femoral artery, separated from its sheath: all the animals died. In experiment 10, he made a transverse incision through $\frac{1}{4}$ of the circumference, without disturbing the sheath. The bleeding was stopped by a coagulum, but, on the animal moving, it again flowed, and the dog died. But, in the next experiment of the same kind, the blood was stopped by a coagulum, and the artery was closed by nearly the same process as in the 6th experiment. So complete was the cure, at the end of six weeks, that the external part of the artery did not show any mark of a wound, and the cicatrix was scarcely observable on the interior surface. In his 12th experiment, he cut one-half of the circumference; the animal died; and so did it in several similar experiments. In experiment 13, he cut $\frac{3}{4}$ of the circumference: after the animal was much reduced, the bleeding ceased, and the artery was closed in the same manner that it is when the section is complete.

"From these experiments, he concludes, that wounds of the arteries of dogs are cured by nature, when they are only occasioned by a puncture, or a longitudinal incision, whether the artery be denuded or not; but, when arising from transverse incisions, they are always mortal if the artery be laid bare. If the artery retain its sheath, and the wound be $\frac{1}{4}$, or $\frac{1}{2}$ of the circumference, it may be cured by the efforts of nature; but, it is always fatal, if one-half of it be cut through." (See *Mém. de la Soc. Méd. d'Emulation*, t. 8. p. 569.) The inferences respecting the curability of a wound, extending through $\frac{3}{4}$ of the circumference, and the incurability of one that affects only one half of the circumference of the vessel, I should presume, must require further examination, notwithstanding an accidental faintness, produced by the sudden loss of blood in the first instance, may have been the means of saving one or two of the animals on which Beclard made his experiments.

This author thinks it probable, that a puncture, or longitudinal incision, in the artery of a man, may be cured by nature; but that a transverse wound never cicatrises properly, as the clot becomes displaced, or, if a cicatrix be formed, it will be distended and torn.

One fact, made out by the same professor, is, that when an artery is deprived of its sheath for an extent greater than its distance of retraction, the hemorrhage is mortal. I have not looked over the original paper; but it appears to me, that it would be desirable to know precisely the size of the arteries which the author is referring to, when he is making some of the above inferences. The size and condition of each animal, the subject of experiment, should also be particularly specified; as experiments made on the femoral artery of a lady's

lap-dog, would surely not have the same results as those performed on the same artery of a large terrier or Newfoundland dog.

According to Dr. Jones, the lymph which fills up the wound of an artery, is poured out very freely both from the vessel and surrounding parts, and it accumulates around the artery, particularly over the wound, where it forms a more distinct tumour. The exposed surrounding parts at the same time inflame, and pour out coagulating lymph, with which the whole surface of the wound becomes covered, and which completely excludes the artery from the external wound. This lymph granulates, and the wound is filled up and healed in the usual manner. (See *Jones on Hemorrhage*, p. 113, &c.)

SURGICAL MEANS OF SUPPRESSING HEMORRHAGE.

It must be plain to every one who understands the course of the circulation, that pressure, made on that portion of a wounded artery which adjoins the wound towards the heart, must check the effusion of blood. The current of blood in the veins, running in the opposite direction, requires the pressure to be applied to that side of the wound, which is most remote from the heart. However, on account of the freedom and facility with which the blood is transmitted through the anastomoses, from the portion of the artery above the point of pressure into the lower continuation of the artery, such pressure will often only check, and not effectually stop, the bleeding, unless the part of the vessel directly below the wound be also compressed or secured. This pressure, is the most rational means of stopping hemorrhage, so it is the most effectual; and almost all the plans employed for this purpose, are only modifications of it. The tourniquet, the ligature, the application of a roller and compresses, even agaric itself, only become useful in the suppression of hemorrhage, on the principle of pressure: the cautery, caustics, and styptics, however, have a different mode of operation.

In order to prevent a wounded person from dying of hemorrhage, Celsus advised the wound to be filled with dry lint, over which was laid a sponge dipped in cold water, and pressed on the part with the hand. If, notwithstanding these means, the hemorrhage should continue, he recommends repeatedly applying fresh lint, wet with vinegar; but he is against the use of corroding escharotic applications, on account of the inflammation which they produce, or only sanctions the employment of the mildest ones. When the hemorrhage resists these methods, he advises two ligatures to be applied to the wounded part of the vessel, and then dividing the portion situated between them:—"Quod si illa quoque profluvio vincuntur, vena, quæ sanguinem fundunt, apprehendenda, circaque id, quod ictum est, duobus locis deliganda, intercidendæque sunt, ut et in se ipsa coeant, et nihilominus ora præclusa habeant." (Lib. 5. cap. 26.) When the ligature was impracticable, the wound bled dangerously, and no large nerves, nor muscles, were situated in the bleeding part, Celsus proposed the actual cautery.

Galen also mentions tying the vessels for the purpose of stopping hemorrhage; and there are some traces of the same information in other authors, who lived before him, as Archigenes and Rufus. Probably, however, the ligature was

little used at these early periods, as may be inferred from the multitude of astringents, caustics, and other applications, which were advised for stopping bleeding, and in which less confidence would have been put, had the use of the ligature been familiarly known. No one can doubt that, if the old surgeons had had many opportunities of seeing the advantages of the ligature, they would soon have used it after amputations; but so far were they from adopting such practice, that Albucasis, a long while afterwards, refused to amputate at the wrist, lest he should see his patient bleed to death.

Paré is considered as the first, who regularly employed the ligature after amputation. His method having been attacked, he modestly defends it in the part of his works entitled, *Apologie*, where he takes great care to impute the origin of it to the ancients; and cites many of them, who had made mention of it. However, he thinks its utility in amputations of such consequence, that he ascribes his first adoption of this practice to inspiration of the Deity.

The method, in which the ancients placed most confidence, for stopping hemorrhage after the amputation of a limb, was the cauterisation of the cut vessel, and surrounding flesh. The parts, thus affected by the heat, formed an eschar, of greater or less thickness, which blocked up the opening of the vessel, and hindered the blood from escaping. The separation of the eschar, however, which frequently took place too soon, occasioned a return of hemorrhage, and rendered it the more dangerous, as its suppression was now more difficult than before the cautery had been applied. Sometimes, the instrument, being too much heated, immediately brought away with it the eschar. At the present time, the cautery is never employed, as a means of suppressing hemorrhage, or, at most, only in a few very unusual cases, in which neither compression nor the ligature can be made use of. In Great Britain, the cautery is never employed, except in circumstances of this description; but, in France, the best hospital surgeons now and then employ it to stop bleedings from the anus, antrum, and mouth.

The old surgeons very commonly applied to bleeding parts pledgets, dipped in boiling turpentine,—a practice that has long been most justly abandoned.

ASTRINGENTS, STYPTICS, &c.

Le Dran says, that a button of vitriol, or alun, applied and properly confined on the extremity of the vessel, is sufficient to stop the hemorrhage in amputations. Heister recommends the application of vitriol, in preference to the ligature, in the amputation of the fore-arm. Great praises have also been conferred on agaric, and sponge, for their styptic properties. Solutions of iron, and all the mineral acids in various forms, have been recommended to the public, as remedies of the same kind, and possessing great efficacy. The ancients, centuries ago, left no application of this nature untried, and the pretended discoveries of new and more effectual styptics in later times, may almost all be met with in their writings. This fact merits particular notice, because the little success attending their practice, especially when bleeding from a considerable artery was to be suppressed, clearly proves what little reliance ought to be placed on means of this description. (*Encyclopédie Méthodique, Partie Chir.*) The most which

styptics can do, is to stop hemorrhages from small arteries; but, they ought never to be trusted, when large vessels are concerned.

There is no doubt that cold air has a styptic property; by which expression, I mean, that it promotes the contraction of the vessels; for no styptics can contribute to make the blood coagulate, though such an erroneous idea is not uncommon. We frequently tie, on the surface of a wound, every artery, that betrays the least disposition to bleed, so long as the wound continues exposed to the air. We bring the opposite sides of this wound into contact, and put the patient to bed. Not an hour elapses, before the renewal of hemorrhage compels us to remove the dressings. The wound is again exposed to the air, and again the bleeding ceases. This often happens in the scrotum, after the removal of a testicle, and on the chest, after the removal of a breast. The proper conduct, in such cases, is not to open the wound unnecessarily, but to apply pressure, or else wet linen, to the part, so as to produce such an evaporation from its surface, as shall create a sufficient degree of cold to stop the bleeding. As all styptics are more or less irritating, no judicious practitioners apply them to recent wounds. However, for the suppression of hemorrhage from diseased surfaces, where the vessels seem to have lost their natural disposition to contract, these applications are sometimes indicated.

COMPRESSION.

We have already remarked, that all the best means of checking hemorrhage operate on the principle of pressure; the actual and potential cautery, and some styptics excepted: the two first of which act by forming a slough, which stops up the mouths of the vessels; while the latter operate by promoting their contraction. Let us next consider the various modifications of pressure.

In a dissertation on the manner of stopping hemorrhage, printed in the *Mém. de l'Acad. de Sciences, année 1731*, Petit endeavoured to prove, that different articles, praised as infallible specifics, would seldom, or never, have succeeded without compression. Even when caustics were employed, it was usual to bind compresses tightly on the part, so as to resist the impulse of the blood in the artery, and the premature separation of the eschar. Had this precaution not been taken, Petit believes, that hemorrhage would almost invariably have followed; and, indeed, notwithstanding the pains taken to avert it by suitable compression, it did too frequently take place on the detachment of the eschar. Petit has noticed, that the end of a finger, gently compressing the mouth of a vessel, is a sufficient means of stopping hemorrhage from it, and that nothing else would be necessary, if the finger and stump could always be kept in this posture. Hence he endeavoured to obviate these difficulties by inventing a machine which securely and incessantly executed the office of the finger. The instrument was a double tourniquet, which, when applied, compressed, at once, both the extremity of the divided artery and its trunk above the wound. The compression on the end of the vessel was permanent; that on the trunk was made only at the time of dressing the wound, or when it was necessary to relax the other. An engraving and particular description of the instrument are to be found in Petit's memoir.

HEMORRHAGE.

Surgeons formerly filled the cavities of wounds with lint, or charpie, and then made pressure on the bleeding vessels, by applying compresses and a tight roller over the part. The practitioners of the present day are too well acquainted with the advantages of not allowing any extraneous substance to intervene between the opposite surfaces of a recent wound to persist in the above plan. They know, that the sides of the wound may be brought into contact, and that compression may yet be adopted, so as both to restrain particular hemorrhages, and rather promote, than retard, the union of the wound.

When the blood does not issue from any particular vessel, but from numerous small ones, compression is preferable to the ligature. In the employment of the latter, it would be necessary to tie the whole surface of the wound. The sides of the wound are to be brought accurately together, and compresses are then to be placed over the part, and a roller to be applied with sufficient tightness to make effectual pressure, but not so forcibly as to produce any chance of the circulation in the limb being completely stopped.

If, in bleeding from large arteries, compression can ever be prudently tried, it is when these vessels lie immediately over a bone. Bleedings from the radial and temporal arteries are generally cited as cases of this kind, though, from the many instances of failure, which I have seen happen where the first of these vessels is concerned, I should be reluctant either to advise or make such an attempt. Compression is sometimes tried, when the brachial artery has been wounded in phlebotomy. Here it is occasionally tried, in preference to the ligature, because the latter cannot be employed without an operation to expose the artery.

"When the brachial artery has been wounded, in bleeding at the bend of the arm (says Mr. Crosse), I find so many instances narrated of successful management by pressure, that it seems imperative on us to regard this as the general rule of treatment. Sometimes the artery has been extensively obliterated by the pressure employed; at others, the same change has taken place in the vein; and one example is afforded of the aperture between the artery and the vein closing, each vessel remaining pervious after the cure. Pressure is, however, applicable only where a competent surgeon has the opportunity of employing it soon after the injury" (*J. G. Crosse, in Prov. Med. and Surgical Trans.*, vol. v.); and, I would add, while the quantity of blood, effused in the cellular tissue, is not such as to interfere with its operation, or to render the trial of it likely to bring on mortification.

When there is a small wound in a large artery, the following plan may be tried: a tourniquet is to be applied, so as to command the flow of blood into the vessel; the edges of the external wound are next to be brought into contact: then, a compress, shaped like a blunt cone, and which is best formed of a series of compresses, gradually increasing in size, is to be placed with its apex exactly on the situation of the wound in the artery. This *graduated compress*, as it is termed, is then to be bound on the part with a roller.

In this manner, I once healed a wound of the superficial palmar arch, in a young lady in Great Pulteney-street. The outward wound was very small; and though the hemorrhage was profuse, I

conceived, that it might be permanently stopped, if compression could be so made as to keep the external wound incessantly and firmly covered for the space of a day or two. At first I tried a compress of lint, bound on the part with a roller; but this proving ineffectual, I took some pieces of money, from the size of a farthing to that of a half-crown, and, wrapping them up in linen, put the smallest one accurately over the wound, so as completely to cover it. Then the others were arranged, and all of them were firmly confined with a roller, and the arm kept as quiet as possible in a sling. They were taken off after three days, and no hemorrhage ensued.

When the palmar fascia is not freely cut, it is conceivable, that it might prevent compression from operating on the vessel; but the foregoing case shows, that a wound of the superficial palmar arch is capable of healing, if the blood be completely prevented from getting out of the external wound by the proper application of compression. Were the outer wound free and open, it would be the safest practice to take up the ends of the vessel. Mr. Crosse, of Norwich, in more than one or two instances, has succeeded in tying the palmar arch when wounded, and would always first attempt it, going to another resource only when that had failed, or swelling and inflammation prevented it. He thinks it would be going a great length, to put a ligature on the brachial artery for a wounded palmar arch. (*Op. et vol. cit.*) Sometimes tying the ulnar artery has failed; but, under these circumstances, instead of tying the brachial artery, if the state of the wound would not bear pressure, I should prefer the trial of moderate compression of the radial artery, by means of a graduated compress, or the steel semicircle and screw, occasionally resorted to by Dupuytren, when he wished to check the flow of blood through any particular artery, without stopping the circulation in the limb. I feel confident that this plan would answer, when the ligature of the ulnar artery had not sufficiently commanded the bleeding.

Besides compressing the wounded part of the artery, some surgeons also apply a longitudinal compress over the track of the vessel above the wound, with the view of weakening the flow of blood into it. Whatever good effect it may have in this way, is more than counterbalanced by the difficulty which it must create to the circulation in the arm. If the graduated compress be properly arranged, an effusion of blood cannot possibly happen, and pressure along the course of the artery must, at all events, be unnecessary. After relaxing the tourniquet, if no blood escape from the artery, the surgeon (supposing it to be the brachial artery wounded) should feel the pulse at the wrist, in order to ascertain, that the compression employed is not so powerful as entirely to impede the circulation in the fore-arm and hand. The arm is to be kept quietly in a sling, and in forty-eight hours, if no bleeding take place, there will be great reason to expect that the case will do well. In another work, I have given an engraving and description of an instrument, invented by Plenck, for making pressure on the wounded brachial artery, at the bend of the arm, without pressing upon the whole circumference of the limb, and, consequently, without stopping the circulation. No one, however, would prefer compression when

large arteries are injured, except in the kind of cases, to which we have just now adverted, or in those in which the wounded vessel can be firmly compressed against a subjacent bone. Sometimes the compresses slip off, or the bandages become slack, and a fatal hemorrhage may arise; and a still greater risk is that of mortification from the constricted state of the limb. When the method is tried, the tourniquet should always be left loosely round the limb, ready to be tightened in an instant. Sometimes the external wound heals, while the opening in the artery remains unclosed, and a false aneurism is the consequence.

TOURNIQUET.

At the present day, the means for the temporary stoppage of the flow of blood through the arteries in operations, are reducible to two, viz., pressure, and, in a few instances, the preliminary application of a ligature on the trunk of the vessels expected to bleed in a dangerous degree. Pressure is made either with mechanical instruments or the hand. In amputations, M. Dupuytren rarely employed any other means but the hand of an intelligent assistant; and it was only in special cases that he had recourse to the ligature or mechanical pressure. The same rule is adopted by Mr. Liston in University College Hospital; and I sometimes dispense with the tourniquet myself. Two conditions are necessary to render pressure effectual, whether made with an instrument, or the hand; the superficial situation of the artery, and its position upon a bone, or some other part sufficiently yielding to admit of the vessel being pressed against it. (See *Dupuytren, Clin. Chir. t. iv. p. 377.*)

M. Dupuytren confirms, what every experienced operator is well aware of, namely, the fact of the flow of blood through the larger arteries admitting of being commanded by means of moderate pressure. But, this must be made with precision, and perpendicularly to the surface, which serves as a point of resistance. The inclination of the surfaces of the bones on which the vessels lie, should therefore be recollected. For example, that of the upper surface of the horizontal branch of the os pubis faces upwards and forwards, and that of the first rib upwards and slightly outwards. Consequently, in the groin, the pressure should be directed from above downwards, and from before backwards; and in the hollow, above the clavicle, from above downwards, and from without inwards. If the operation about to be performed is likely to be long, or the artery is large or rather deep, M. Dupuytren recommends the assistant to place the fingers of his unemployed hand over those which compress the vessel, in order to second their action, and hinder them from being fatigued. But, before beginning the operation, the surgeon is always to assure himself of the exactness of the pressure. In some regions of the body, and in thin persons, the diastole and systole of the vessel are perfectly visible, and then the stoppage of them denotes, that the pressure is well made. The total interruption of the pulsations, as ascertained by the touch, will leave no doubt on this point. There are some amputations, in which every modification of pressure may be dispensed with, even though arteries of great size are concerned: such are cases, in which the principal artery will be cut only in the final division of the parts, and in which an assistant, who can be relied upon, will let his fingers follow

closely the knife, and seize hold of the flap containing the artery, and compress this vessel just before the section of the flap is completed. This method is practicable in amputations at the shoulder, and even in those of the hip. M. Dupuytren knew of only one case, in which the preliminary ligature of the artery was absolutely necessary in amputation, viz., that in which the disorganisation of parts, and of the artery in particular, is such, that a definitive ligature on the surface of the stump would in all probability fail. In this circumstance he sanctions tying the arterial trunk above the point at which the amputation is to be performed. (See *Clin. Chir. t. iv. p. 382. 385.*) I would ask, however, should this measure be preliminary, or ought it not rather to be deferred till the failure of the ligature on the face of the stump has been proved? The performance of two severe operations, instead of one, must never be undertaken without a positive necessity. Most of the preliminary operations on the trunks of arteries, hitherto performed for the prevention of hemorrhage during amputations, and in the removal of the upper or lower jaw, are now considered to have been unnecessary. In England, we should never amputate in parts known beforehand to be so disorganised, that ligatures would have no chance of securing the vessels on the face of the stump.

When hemorrhage takes place from a large artery in one of the limbs, where the vessel can be conveniently compressed above the wound, a tourniquet, judiciously applied, never fails to put an immediate stop to the bleeding. Until the invention of this instrument, which did not take place till the latter part of the 17th century, and until it was known that a very moderate degree of well-directed pressure on an artery would stop profuse bleeding, surgery was really a very defective art. No important operation could be undertaken on the extremities, without placing the patient in the most imminent peril; and many wounds were mortal, which, with the aid of these simple expedients, would not have been attended with the least danger.

The first invention of the tourniquet has been claimed by different surgeons, and even different nations. But, whoever was the inventor, it was first presented to the public in a form so exceedingly simple, that it seems extraordinary its invention did not happen sooner. A small pad being placed on the principal artery of a limb, a band was applied over it, so as to encircle the limb twice. Then a stick was introduced between the two circles of the band, which was twisted; thus the pad was made to stop the flow of blood into the lower part of the vessel.

Although in the *Armamentarium Chirurgicum* of Scultetus, there is a plate of a machine invented by this author for compressing the radial artery by means of a screw, J. L. Petit is universally allowed to be the first who brought the tourniquet to perfection, by combining the circular band with a screw, so that the greatest pressure may operate on the principal artery.

The advantages of the modern tourniquet are, that its pressure can be regulated with the utmost exactness; that it operates chiefly on the point where the pad is placed, and where the main artery lies; that it does not require the aid of an assistant to keep it tense; that it completely commands the flow of blood into a limb; that it

can be relaxed or tightened in a moment; and that, when there is reason to fear a sudden renewal of hemorrhage, it can be left slacker round the limb, and, in case of need, be tightened in an instant. Its utility, however, is confined to the limbs; and, as the pressure, necessary to stop the flow of blood through the principal artery, completely prevents the return of blood through the veins, its application cannot be made very long without inducing mortification. It is only of use, also, in putting a sudden stop to profuse hemorrhages for a time, that is, until the surgeon has put in practice some other means, the effect of which is more permanent.

In the article AMPUTATION, many observations will be found on the advantages and disadvantages of tourniquets in that operation. M. Dupuytren sometimes employed, instead of a common tourniquet, what he terms a *compressor*, which makes pressure only on two opposite points of the limb; but, as he acknowledges, it would not be sufficient, if it were necessary, as in a case of extreme debility, to arrest the blood in all the arteries of the limb. (See *Clin. Chir.* t. iv. p. 386.) The compressor is an old instrument, consisting of a segment of a circle of steel, and the pressure of which is regulated by a screw. It has often been tried in England for the cure of popliteal aneurism. It is an instrument, which, I think, ought always to be kept ready in hospitals, where many cases present themselves, especially of secondary hemorrhage from stumps, the palmar arches, &c., where its application might be of important use. Professor Regnoli, of Pisa, in a case of aneurism, where secondary hemorrhage took place from the femoral artery, high up the limb, and where, in consequence of disense, another ligature would probably have failed, applied Dupuytren's compressor, and thus made moderate pressure on the bleeding point, with complete success.

LIGATURE.

The ancients were quite unacquainted with the use of the tourniquet, and though some of their writers have made mention of the ligature, they do not seem to have known how to make proper use of it, nor to have possessed any other certain means of suppressing hemorrhage from wounds. In modern times, it is easily comprehensible, that when any great operation was undertaken, while surgery was so imperfect, there was more likelihood of the patient's life being shortened, than lengthened by what was attempted. Under these circumstances, it is not surprising, that the old practitioners should have taken immense pains to invent a great many topical astringents. But now that the ligature is known to be a means which is safer, and less painful, than former methods, no longer search need be made for specifics against hemorrhage.

It may, indeed, be set down as a rule in surgery, that whenever large arteries are wounded no styptic application should ever be employed; but immediate recourse had to the ligature, as being, when properly applied, the most simple and safe of all methods.

In order to qualify the reader to judge of the best mode of applying ligatures to arteries, I shall first explain to him their effects on these vessels, as related by Dr. Jones.

This gentleman learned, from Dr. J. Them-

son, of Edinburgh, that, in every instance in which a ligature is applied around an artery, without including the surrounding parts, the internal coat of the vessel is torn through by it; and that this fact had been originally noticed by Desault. Dr. Thomson even demonstrated to Dr. Jones, on a portion of artery taken from the human subject, that the internal and middle coats are divided by the ligature. (Jones, p. 126.)

This led Dr. Jones to make some experiments on the arteries of dogs and horses, tending to the conclusion, that *when several ligatures are applied round an artery*, with sufficient tightness to cut through its internal and middle coats, although the cords be immediately afterwards removed the vessel will always become impervious at the part which was tied, as far as the first collateral branches, above and below the obstructed part. Dr. Jones thinks it reasonable to expect, that the obstruction produced in the arteries of dogs and horses, in the manner he has related, "might be effected by the same treatment in the arteries of the human subject; and, if it should prove successful, it might be employed in some of the most important cases in surgery. The success of the late important improvements, which have been introduced in the operation for aneurism, may perhaps appear to most surgeons to have rendered that operation sufficiently simple and safe; but, if it be possible to produce obstruction in the canal of an artery of the human subject in the above-mentioned manner, may it not be advantageously employed in the cure of aneurism, inasmuch as nothing need be done to prevent the immediate union of the external wound?" Dr. Jones next questions, whether this mode of obstructing the passage of blood through the arteries may not also be advantageously practised in cases of bronchocele? (P. 136.)

Subsequent experimenters have not been equally successful with Dr. Jones in obtaining the obliteration of the cavity of the vessel after this operation. Did this difference depend upon their having tied the vessel only in one place? Mr. Hodgson tried the experiment in two instances upon the carotid arteries of dogs, and in neither of them was the cavity of the vessel obliterated. The same experiment has been repeated by several surgeons upon the arteries of dogs and horses; but in no example, as far as Mr. Hodgson knows, has the complete obliteration of the cavity of the vessel been accomplished. However, as an effusion of lymph is an invariable consequence of the operation, the want of union is owing to the opposite sides of the vessel not being retained in a state of contact, so as to allow of their adhesion. (See *Obs. on the Application of the Ligature to Arteries, &c.*, by B. Travers, vol. iv. *Med. Chir. Trans.*) The presence of the ligature, in the common mode of its application, effects this object; and, for the success of Dr. Jones's experiment, it appeared only necessary, that the opposite sides of the wounded vessel should be retained in contact, until their adhesion had been sufficiently accomplished to resist the passage of the blood through the tube. This object might probably be effected by compression; but, the inconveniences attending such a degree of pressure, as would retain the opposite sides of an artery in contact at the bottom of a recent wound, are too

great to permit its employment. It occurred to Mr. Travers, that, if a ligature were applied to an artery, and suffered to remain only a few hours, the adhesion of the wounded surfaces would be sufficiently accomplished to ensure the obliteration of the canal; and by the removal of the ligature at this period, the inconveniences attending its stay would be obviated. The danger, produced by the continuance of a ligature upon an artery, arise from the irritation, which, as a foreign body, it produces in its coats. Ulceration has never been observed to commence in less than twenty-four hours after the application of a ligature; whilst it is an ascertained fact, that lymph is in a favourable state for organisation in less than six hours, in a wound the sides of which are preserved in contact. (*Jones*, chap. 4. exp. 1.) If it be sufficient, therefore, to ensure their adhesion, that the wounded coats of an artery be kept in contact by a ligature only three or four hours, ulceration and sloughing may, in a great degree, be obviated by promoting the immediate adhesion of the wound. Justified by this reasoning, Mr. Travers performed several experiments, by which he ascertained, that if a ligature be kept six, two hours, or even one hour, upon the carotid artery of a horse, and then removed, the adhesion is sufficiently advanced to secure the permanent obliteration of the canal. It appeared probable, that the same result would be obtained upon the healthy artery of a human subject. (*Hodgson on the Dis. of Arteries*, &c. p. 228. et seq.) Mr. A. C. Hutchison, in the year 1800, tied the brachial arteries of two dogs, and removed the ligatures immediately after their application. In both instances, the complete obliteration of the canal of the artery was the consequence of the operation. (See *Practical Obs. in Surgery*, p. 103.) He has also tried this method, as modified by Mr. Travers, in an operation, which he performed for a popliteal aneurism in a sailor, in Nov. 1813. A double ligature was passed under the femoral artery. The ligatures were tied with loops, or slip-knots, about a quarter of an inch of the vessel being left undivided between them. All that now remained of the pulsation in the tumour, was a slight undulatory motion. Nearly six hours having elapsed from the application of the ligatures, the wound was carefully opened, and the ligatures untied and removed, without the slightest disturbance of the vessel. In less than half a minute afterwards, the artery became distended with blood, and the pulsations in the tumour were as strong as they had been before the operation. Mr. Hutchison then applied two fresh ligatures: hemorrhage afterwards came on, amputation was performed, and the patient died. (See *Pract. Obs. in Surgery*, p. 102, &c.) Now, as Mr. Hutchison chose to apply other ligatures, on finding that the pulsation returned, the above case only proves, that the artery was not obliterated in about six hours; and we are left in the dark respecting the grand question, namely, whether the vessel would have become obliterated by the effusion of coagulating lymph and the adhesive inflammation, notwithstanding the return of circulation through it. As for the hemorrhage which occurred, I think it might have been expected, considering the disturbance and irritation which the artery must have sustained, in the proceedings absolutely necessary for the application of not less than four ligatures,

and the removal of two of them. According to my ideas, only one ligature ought to have been used, and none of the artery detached. We also have no description of the sort of ligatures which were employed; an essential piece of information in forming a judgment of the merits of the preceding method. The application, removal, and re-application of ligatures are not consistent with the wise principles inculcated by the late Dr. Jones, and have, in more instances than that recorded by my friend, Mr. Hutchison, brought on ulceration of the artery and hemorrhage. The researches of M. Manec lead him to conclude, with all the best practical surgeons of the present time, that the removal of the ligature at an earlier period, than that of its spontaneous detachment, is not likely to answer. He observes, that "the continuance of the ligature on the artery, for some hours after the division of the internal and middle coats, is not sufficient in man to produce its closure. The plan succeeds, but seldom in animals, dogs, for instance, whose blood is more plastic. On one hand, the adhesion of the parietes of the artery together is so feeble, for the first five or six hours after the operation; and, on the other, the clot is so small, that the impulse of the blood, and the disturbance of extracting the thread, will destroy one, and displace the other." (See *P. J. Manec, de la Ligature*, &c. p. 30.) If ever the practice, however, should merit revival, I invite the attention of the profession to the simple invention proposed by Mr. John Barker, of Ipswich, for loosening and removing the ligature. See ANEURISM.

It appears, then, that the first effects of a ligature upon an artery are, a complete division of its internal and middle coats, the bringing of its wounded surfaces into contact with each other, and an obstruction to the circulation of the blood through its canal. There must be a small quantity of stagnant blood, just within the extremity of the artery; but this does not, in every instance, immediately form a coagulum, capable of filling up the canal of the artery. In most cases, only a slender coagulum is formed at first, which gradually becomes larger by successive coagulations of the blood; and hence the coagulum is always at first of a tapering form, with its base at the extremity of the artery. But, as Dr. Jones remarks, the formation of this coagulum is not material; for, soon after the ligature has been applied, the end of the artery inflames, and the wounded internal surface of its canal, being kept in close contact by the ligature, adheres, and converts this portion of the artery into an impervious, and, at first, slightly conical sac. It is to the effused lymph that the base of the coagulum adheres, when found to be adherent. Lymph is also effused between the coats of the artery, and among the parts surrounding its extremity. In a little time, the ligature makes the part, on which it is directly applied, ulcerate; and, acting as a tent, a small aperture is formed in the layer of lymph effused over the artery. Through this aperture a small quantity of pus is discharged, as long as the ligature remains; and, finally, the ligature itself also escapes, and the little cavity which it has occasioned granulates and fills up, and the external wound heals, leaving the cellular substance, a little beyond the end of the artery, much thickened and indurated. (*Jones*, p. 159. 161.)

In short, when an artery is properly tied, the following are the effects.

1. The first action of the ligature is to pucker up, and press towards one another the parietes of the artery, and, after they touch, if the ligature is further tightened, the internal and middle coats of the vessel are cleanly and regularly cut through; while the external coat, which, by being forcibly constricted by the ligature, has been the direct means of producing this division, resists the action of the ligature, and becomes interposed between the upper and lower margins of the wound in the other coats of the artery. Thus the ligature now only embraces the external coat, the two divided ones being retracted, one towards the heart, the other towards the capillaries. Hence, the cavity of the artery has a conical shape, above and below the ligature, and the points of these cones, formed by the edges of the division in the internal and middle coats, which are in opposition, hinder the blood from passing further, and striking against the external coat. As M. Manec observes, the whole operation of the ligature must be concentrated on this point; and the margins of the wound, in the middle and internal coats, are only held in contact, inasmuch as the external tunic presses upon them, and inclines them towards the centre of the artery. This pressure, which is sufficient to close the calibre of the vessel, does not interrupt the vital properties of these two coats; but, the external coat, on which the ligature exclusively acts, is killed at the constricted point, and a suppurative, or, rather, an ulcerative, process must occur in this situation, in order to detach the dead circle of this external coat from the living parts, together with the ligature itself. Thus all the artery becomes severed; the internal and middle coats first; the external at a later period. (See *Manec, de la Ligature des Artères*, p. 14).

2. Another effect is to occasion a determination of blood to the collateral branches.

3. To allow the formation of a conglum of blood just within the artery, provided a collateral branch be not very near the ligature. It merits particular notice, however, that, though the nearness of a collateral branch always prevents the formation of the conglum, it cannot always prevent the completion of the adhesive process. In the experiments, made on the arteries of horses and dogs by Mr. Travers, the ligature was purposely applied close to large collateral branches, yet the vessels were safely obliterated. (See *Med. Chir. Trans.* vol. vi. pp. 658. 660.)

4. To excite inflammation in the internal and middle coats of the artery, by having cut them through, and, consequently, to give rise to an effusion of lymph, by which the wounded surfaces are united, and the canal is rendered impervious; to produce a simultaneous inflammation on the corresponding external surface of the artery, by which it becomes very much thickened with effused lymph; and, at the same time, from the exposure and inevitable wounding of the surrounding parts, to occasion inflammation in them, and an effusion of lymph, which covers the artery, and forms the surface of the wound.

5. To produce ulceration in the part of the artery, around which the ligature is immediately applied, viz., its external coat.

6. To produce indirectly a complete obliteration, not only of the canal of the artery, but even

of the artery itself, to the collateral branches on both sides of the part which has been tied.

7. To give rise to an enlargement of the collateral branches. (*Jones*, p. 163, 164.)

Every part of an artery is organised in a similar manner to the other soft parts, and its coats are susceptible of the same processes of adhesion, ulceration, &c., as the latter parts are. Hence, the precautions, taken to secure the adhesion of other parts, should be observed for the same purpose, with regard to an artery. The vessel is put in a state to admit of adhesion by the ligature, which, when properly applied, cuts through its internal and middle coats, keeps their cut surfaces in contact, and affords them an opportunity of uniting by the adhesive inflammation, as other cut surfaces do. The immediate stoppage of the bleeding is merely the incipient and temporary part of what the ligature has to accomplish: it has also to effect the adhesion of the internal and middle coats of the artery, which, being the thing on which the permanent suppression of hemorrhage depends, is the most important. The size and form of the ligature, whether completely flat, or irregular, have not been, as Dr. Jones remarks, sufficiently attended to; nor is the degree of force employed in tying the artery often considered. Some surgeons, wishing to guard against the ligature slipping off, tie it with very considerable force; while others, apprehensive of cutting through the artery, or of occasioning too early a separation of the ligature, draw it only sufficiently tight just to prevent the escape of blood. A broad flat ligature is not likely to make such a wound in the internal and middle coats of the artery as is most favourable to adhesion, because it is scarcely possible to tie it smoothly round the vessel, which is very likely to be thrown into folds, or puckered by it, and, consequently, to have an irregular bruised wound made in its middle and internal coats. By covering, also, a considerable space of the external coat, it may destroy the very vessels which pass on it in their way to the cut surfaces of the inner coats, and thus render them incapable of inflaming. Even supposing the wound to unite, still such a ligature may cover that part of the external coat which is directly over the newly united part, and, consequently, as soon as it has produced ulceration through the external coat, it will cause the same effect on the newly united part, and, of course, secondary hemorrhage. (*Jones*, p. 168.)

When a ligature is of an irregular form, it is apt to cut through the internal and middle coats of an artery more completely at some parts than at others; but these coats ought to be perfectly cut through, in order to produce an effusion of fibrine from the inside of the vessel, which seems to adhere most securely at its cut surfaces.

Also, when the ligature is not applied with sufficient tightness, the inner coats of the artery will not be properly cut through. Dr. Jones thinks, that the ligature being sometimes put on so as to deviate from a circle, has a tendency to produce secondary hemorrhage.

Dr. Jones conceives that ligatures are best when they are round and very firm; and he adds, that, though only a slight force is necessary to cut through the internal and middle coats of an artery, it is better to tie the vessel more tightly than is necessary merely to cut through its inner coats, because the cut surfaces will thus be more

certainly kept in contact, the separation of the ligature expedited, and the danger of ulceration spreading to the newly cicatrised part diminished. The external coat will never ulcerate through before the inner ones have adhered. The limb, however, should be kept in a perfectly quiet state.

I am sincerely glad to find, that so accurate an observer as Dr. Jones has refuted the idea, that ligatures occasionally slip off the vessels, in consequence of the violent impulse of the blood. In fact, the blood does not continue to be impelled against the extremity of the artery with the same impetuosity with which it circulated through the vessel before it was tied. The blood is immediately determined into the collateral branches, nor is there any pulsation for some way above the ligature. Dr. Jones, more rationally, imputes this accident, either to the clumsiness of the ligature, which prevents its lying compactly and securely round the artery; or to its not having been applied with sufficient tightness; or to its having that very insecure hold of the vessel which the deviation from the circular application must occasion. (P. 173.)

Another circumstance, adverted to by Dupuytren, may cause the accident:—"The surgeon," says he, "should avoid taking hold of only one side of the artery by placing one blade of the forceps into its canal; for, it has sometimes happened that, when only a part of the circumference of the artery has thus been included in the noose, hemorrhage has come on directly the wound has been dressed." (See *Clin. Chir.* t. iv. p. 399.)

Dr. Jones is of opinion, that in cases of aneurism, in which the artery has only been tied with one ligature, and left undivided, and in which secondary hemorrhage has arisen, that this has most probably been owing, either to a diseased state of the artery; to various contrivances for compressing a large portion of the vessel; to having a loose ligature above the one which is tied; or, lastly, to not tying the artery sufficiently tight to cut through the internal and middle coats, so as to fit them for adhesion. The latter fault can hardly fail to produce a gradual ulceration of those coats, and, of course, to bring on hemorrhage, which returns with greater violence, as the ulceration advances. (P. 176.)

These reflections must also obviously explain why Scarpa's practice of using a largish ligature, with the intervention of a piece of cloth between the cord and the vessel, for the express purpose of hindering the inner coats of the vessel from being divided, must be objectionable, because it may be set down as an axiom, in all operations where large arteries are to be tied, that the quantity of extraneous substances in the wound, and particularly of such as are in contact with the artery, should be diminished as much as possible. And, though I may be disposed to go so far with Scarpa as to believe, that the interposition of a piece of cork or wood is worse than that of a cylinder of linen, I cannot accede to the proposition, that the latter is free from objection, because it rather acts as a cushion than as a body likely to bruise. (See *Mem. on the Ligature of Arteries*, p. 44.)

With the differences in the constitutions of man and animals, I know that the results of experiments can never be looked upon as a positive

proof of what would happen from the same experiments performed on the human subject. The stronger or weaker impulse of the heart, the more or less coagulable nature of the blood, the greater or less degree of general and local irritability, the more or less quick tendency to adhesive inflammation and ulceration, are circumstances, which must make in different animals the same experiments lead to opposite results. The question, whether a small round ligature or a larger flat one, with a piece of linen between it and the vessel, be best, must therefore, after all, be decided, not by Dr. Jones's experiments, nor those of Scarpa or Mislci, but by the practice of surgery on the human body; and that the principles defended in this Dictionary are, on the whole, to be preferred, can hardly be questioned by any man who knows how much less frequent secondary hemorrhage now is in this metropolis than it was formerly, when those principles were neither observed nor comprehended. (See AMPUTATION, ANEURISM, ARTERIES, and LIGATURE.)

We may next inquire, are small round ligatures most advantageous when arteries are ossified? M. Manec states, that, under these circumstances, such a ligature will break the calcareous and cartilaginous deposits into irregular fragments, so that the external coat, instead of making moderate and uniform pressure on the section of the middle and internal tunics, is distended and violently pushed up by the irregular edges of each fragment. At one of these points, the external coat is likely to give way between the second and fourth day. M. Manec further notices the greater difficulty and slowness with which the exudation of a plastic lymph, the exhalation of an unctuous matter, and the formation of a clot, in an artery thus diseased and tied, occur, than in a healthy artery similarly treated. These considerations lead him to join Boyer, (*Mal. Chir.* t. ii. pp. 139. 155.) in deeming small, round, firm ligatures, or even those which are composed of three or four threads, as improper for ossified arteries; he states, that they ought to be rejected, because they too quickly cut through the external coat. In these particular examples, he expresses a preference to arterial compressors (*presse-artères*), or to Scarpa's method, care being taken not to let the pressure, or constriction, be too considerable. In amputations, cases in which ossified arteries are frequently met with, M. Manec admits the unfitness of any arterial compressors, on account of their irritation and interference with the dressing of the stump. In these instances, therefore, he says, that either Scarpa's method, or, what is better, the introduction of a piece of bougie into the ossified artery, as practised by MM. Dupuytren and Roux, is the only resource. (See *P. J. Manec, de la Ligature*, &c. p. 25.) One inference made by him is, that when an artery is ossified or cartilaginous, the formation of a clot is the only thing which can be confided in as a means of closing the vessel. (P. 30.)

Dr. Jones seems to consider, that the advantage of the retraction of the divided artery within the cellular tissue is compensated, in the case of the undivided artery, by the speedy and profuse effusion of lymph which takes place over and round the vessel at the tied part, and even covers the ligature itself. Another cause of secondary hemorrhage is the including of other parts in the ligature, together with the artery, by doing which the

division of the inner coats of the vessel may be prevented.

In the valuable publication of Dr. Jones, to which I have so freely adverted, some secondary hemorrhages are also imputed to the hidden separation, or laceration, of the recently united parts of an artery by premature and extraordinary exertions of the patient. Hence the necessity for keeping a limb, in which a large artery has been tied, perfectly at rest.

I shall conclude these remarks on the ligature with a few practical rules.

1. Always tie a large artery as separately as possible, but still let the ligature be applied to a part of the vessel which is close to its natural connections.

Besides the reasons for this practice already specified, I may observe, that including many other living textures in the ligature causes immense pain, and a larger part of a wound to remain disunited. The ligature is also apt to become loose as soon as the substance between it and the artery sloughs or ulcerates. Sometimes the ligature, thus applied, forms a circular furrow in the flesh, and remains a tedious time incapable of separation. In particular, the surgeon should take great care not to include in the ligature considerable nerves or veins: "intolerable pain, and, frequently, very serious effects, would immediately follow the constriction of a nervous trunk. Tying large veins does not produce any instantaneous bad symptoms; but it has often led consecutively to phlebitis, and been followed by symptoms which have too often proved fatal." (*Dupuytren, Clin. Chir. t. iv. p. 399.*)

The blood-vessels being organised like other living parts, the healing of a wounded artery can only take place favourably, when that part of the vessel, which is immediately contiguous to the ligature, continues to receive a due supply of blood through its vasa vasorum, which are ramifications of the collateral arteries. Hence, the disadvantage of putting a ligature round the middle of a portion of an artery, which has been separated from its surrounding connections; and hence, the utility of making the knot as closely as possible to that part of the vessel which lies undisturbed among the surrounding flesh.

Small arteries neither allow, nor require, these minute attentions to the mode of tying them.

2. When a divided artery is large, open-mouthed, and quite visible, it is best to take hold of it, and raise its extremity a little way above the surface of the wound, with a pair of forceps, or *Asolini's* double tenaculum. When the vessel is smaller, the common tenaculum is the most convenient instrument.

3. While the surgeon holds the vessel in this way, the assistant is to place the noose of the ligature round it, and tie it according to the above directions. In order that the noose may not rise too high, and even above the mouth of the artery, when it is tightened, the ends of the ligature must be drawn as horizontally as possible, which is best done with the thumbs. A knot is next to be made.

4. As ligatures always operate in wounds as extraneous bodies, and one half of each is sufficient for the removal of the noose when detached, the other should be cut off close to the knot and taken away.

As I have explained in the articles *AMPUTATION*

and the *LIGATURE*, trials have been made of the practice of cutting off both ends of the ligature close to the knot, with the view of diminishing, as far as possible, the quantity of extraneous substances in the wound.

Upon the whole, the plan is not, however, considered to be advantageous, because the portion of the ligature, left in the wound, whatever be the materials of which it is composed, is never absorbed, but gives rise to small abscesses, or even causes a fistulous opening in a stump, of which I lately saw an instance in University College Hospital. In this case, as the two ends of the ligature had been accidentally, and not intentionally, snipped off, the cause of the fistula was, for nearly a fortnight, unsuspected.

5. When a large artery is completely divided, two ligatures, — one to the upper, the other to the lower part of the vessel, — are commonly necessary, in consequence of the anastomosing branches conveying the blood very readily into the part of the artery most remote from the heart, as soon as the first ligature has been applied.

6. When a large artery is only punctured, and compression cannot be judiciously tried, the vessel must be first exposed by an incision, only a small opening being made in the sheath, and then a double ligature introduced under it, with the aid of an eye probe. One ligature is to be tied above, the other below the bleeding orifice, with due attention to the principles explained in this article and that on *ANÆSTHESIA*.

7. Ligatures usually come away from the largest artery ever tied in about a fortnight, and from those of moderate size in six or seven days. When they continue attached much beyond the usual period, it is proper to draw them very gently every time the wound is dressed, for the purpose of accelerating their detachment. Great care, however, is requisite in doing this; for, as Dr. Jones remarks, as long as the ligature seems firmly attached, pulling it rather strongly must act, more or less, on the recently cicatrised extremity of the artery, which is not only contiguous to it, but is still united to that portion of the artery (the external coat) which detains the ligature. (*Jones, p. 162.*)

In particular individuals, there appears to be an extraordinary tendency to profuse hemorrhage from very slight injuries. An instance of this kind has been recorded by Mr. Blagden, where a fatal hemorrhage arose from the extraction of a tooth. The patient, who was twenty-seven years of age, had had a tooth extracted when a boy, in consequence of which operation the bleeding continued for twenty-one days, from the socket, before it ceased. A very slight cut on the head was also followed by an alarming bleeding, which could not be stopped by pressure, styptics, or the ligature, so that it became necessary to apply the *kali purum*, which succeeded. On his having another carious tooth taken out, a profuse bleeding followed, which resisted the effect of styptics, caustic, and every means adopted to stop up the socket. The actual cautery was tried in vain. The dangerous condition of the patient seemed to leave no other resource but that of tying the carotid artery, which was done by Sir Benjamin Brodie. But even this proceeding failed to suppress the hemorrhage, which proved fatal. (*See Med. Chir. Trans., vol. viii. p. 224. Lond. 1817.*) Several instances are recorded, in which all the males of particular fami-

lies had this hemorrhagic tendency, so that, whether the bleeding arose spontaneously, or from a wound, it could not be suppressed, and their lives were lost. (See *Dict. des Sciences Med.*, art. *Cas Rares*; *London Med. Repository*, vol. iii. p. 60.; *Krimer, Versuche einer Physiologie des Bluts*, p. 318. *Leipzig*, 1823. *Journal des Progrès, pour 1828*, vol. ii. *Revue Med.*, Oct. 1835. *Sanson, des Hemorrhagies Traumat.*, p. 16, &c.) Sometimes this extraordinary disposition to hemorrhage is owing to an accidental cause, that is little suspected. Thus, in an example which happened in the practice of M. Dupuytren, a tumour was found in the right auricle, completely blocking up, and greatly dilating the superior vena cava, and extending into the jugular vein up the lower third of the neck: it also filled up the right subclavian vein. The patient, a young woman, lost fatal quantities of blood from the wound of the skin in venesection, and the socket of a tooth. The actual cautery, and all other means were tried in vain. (See *Sanson des Hemorrhagies Traumatiques*, p. 21.) A mechanical obstacle to the circulation, either situated in the heart, or blood-vessels, is noticed by Dr. Carswell, as one of the causes of hemorrhage; and besides solutions of continuity, he likewise enumerates as causes, a modification of the functions of the capillaries, as evinced in vicarious hemorrhage, and that from erectile tissue. Nor does he omit diseased state of the blood, as exemplified in scurvy, and some forms of purpura, and typhus fever. (See *Carswell's Illustrations of the Elementary Forms of Disease*, Fasc. 6.) On the mode of stopping hemorrhage from the sockets of the teeth, the reader will find some remarks in the *Edin. Med. and Surg. Journ.* No. 58. p. 157.

TORSION.

As even the most considerable arteries, in cases of lacerated wounds, frequently do not bleed, in consequence of the violent extension of these vessels, and the change produced in the disposition of their tunics, the idea of stopping hemorrhage, by methodically twisting the end of the wounded arteries, led to trials of what is called *torsion*. The practice was first hinted at by Galen, and proposed in modern days by M. Amussat, in 1829, and, about the same period also, by MM. Velpeau and Thierry. (See *Sanson des Hemorrhagies*, p. 157.) After having ascertained, by experiments on animals, that torsion was capable of arresting hemorrhage from the femoral, brachial, and carotid, and other arteries of magnitude, M. Amussat tried the method on the human subject in amputation, castration, and the removal of the breast. In one case he adopted it after amputation at the shoulder joint. In none of these instances did any secondary hemorrhage arise; but union by the first intention was followed only in one of the cases referred to, viz., that of a child. In 1829, M. Lieber, surgeon to the new hospital at Berlin, tried the plan with equal success; and, about the same period, it was had recourse to with success by Dr. Fricke, of Hamburg, by MM. Rust and Dieffenbach, of Berlin, and by M. Schröder, of Dresden. On the other hand, in France, the practice of torsion proved unsuccessful after two amputations performed by Professor Delpech. As the patients did not die of secondary hemorrhage, perhaps these cases have nothing to do with the advantages or disadvantages of torsion. In the hos-

pital of St. Louis, at Paris, however, torsion failed in five out of six cases of amputation. Baron Dupuytren, having been requested by the Institute to make a report of the merits of the plan, tried it in the Hôtel Dieu, and came to the conclusion, that torsion may be safely applied to arteries of small calibre, but that it is imprudent to trust to it when they are of large size. (See *Clin. Chir.* t. iv. p. 410.) In a certain number of instances, torsion of the arteries has been followed by extensive inflammation and abscesses in the sheath of the artery.

With regard to its increasing the chance of union by the first, inasmuch as no extraneous substance is left in the wound, experience has not proved, that it has any advantage over the ligature, (*Dupuytren*, vol. cit. p. 411.); and, as M. Manec's researches show, the process of torsion kills a small portion of the artery, and the little slough is, in point of fact, quite as much an extraneous substance as the ligature itself. (See *Traité Théorique et Pratique de la Ligature*, &c.; also *Sanson, Op. cit.* p. 161.) Torsion is practised in two modes; in one, which is termed by the French *torsion libre*, the end of the artery is taken hold of with a pair of forceps, gently drawn out, and twisted round from four to six or eight times according to its size. This is the plan adopted by M. Thierry, (*De la Torsion des Artères*, Paris, 1829,) and by Dr. Fricke; but as it has been found sometimes to produce inflammation, extending along the coats of the vessel, and even to rupture a collateral branch, the plan, recommended by M. Velpeau, is mostly preferred in France. This gentleman takes hold of the end of the artery with a pair of forceps, having a groove or not, draws it out of the wound, and separates it from the surrounding tissues: then he takes hold of it near its base with a second pair of forceps, with which he fixes it, while with the first pair of forceps he performs the torsion, three or four times for small arteries, and eight for large ones. (*Sur la Cessation Spontanée des Hemorrhagies*, &c., Paris, 1830.) Some improvements were made in the practice of torsion by M. Amussat. He prefers forceps with longish flat blades, and which admit of being kept firmly shut with a screw. He aims particularly at dividing the inner coats, at the base of the end of the artery, with his finger nail, or the second pair of forceps, and then pushes them away from the surface of the wound, as it were, into the vessel. The torsion then only affects the external coat. The artery is thus closed by a kind of double valve, or, rather, barrier; viz. that formed of the internal coats; and another by the twisted external one.

In practising torsion, great care should be taken not to introduce one of the blades of the forceps into the mouth of the artery, for then all the three coats might be torn, and the bleeding not be stopped. (See *Dupuytren, Clin. Chir.* t. iv. p. 405.)

We find, then, that torsion does not consist in merely twisting the end of the artery, but that the two internal coats are also to be separated from, and pushed back from, the external one by the manœuvres adopted. Then the torsion is of the external tunic.

As the twisted end of the artery sloughs, and necessarily excites some degree of suppuration, this fact seems to explain why torsion is not less objectionable than the ligature, as preventing

union by the first intention. On the whole, I believe, that M. Dupuytren's report of it, above referred to, is as correct as it is concise. The ligature only interferes with union by the first intention in the part of a wound where it lies: the rest may still heal in this desirable manner.

The hemorrhage from the bites of leeches sometimes proves exceedingly obstinate, and instances of death from this cause have occasionally happened, particularly in children. When common methods fail, the plan has been recently tried of passing a fine sewing needle through the skin on one side of the wound, and then another through the skin on the opposite side, and next twisting some thread round the needles, so as to draw them together and close the bite. The experiment fully answered. (See *Lond. Med. Repository*, Jan. 1819, pp. 23—26.)

Though arterial hemorrhage in operations has received full attention, it must be acknowledged, with M. Dupuytren, that venous bleeding has not attracted due consideration. At the instant of the soft parts being divided, where the course of the blood has been suspended by compression, a profuse quantity of this fluid sometimes gushes from the wound. Inexperienced surgeons, alarmed by the circumstance, stop the operation, and, by deranging the compression already made, rather increase than lessen the bleeding. Here, according to Dupuytren, *the colour of the blood should guide the operator. If dark-coloured, it comes from the limb below the incisions, and, as it will soon cease, is of no importance.* But, in operating on parts abounding in veins, and in which the circulation has not been interrupted, the dark-coloured bleeding will sometimes go on, fill the wound, and hinder the operator's proceedings. This is often illustrated in laryngotomy and tracheotomy. In other instances, the blood flows out profusely from the large veins, which are divided, the patient turns pale, and seems as if he would perish on the operating table. Dupuytren observes, that the continuance of such hemorrhage depends more upon the patient suspending respiration than on the size of the veins, and the blood not being then able to pass through the lungs, makes its escape from the veins divided in the operation. Here it is inexpedient to apply ligatures; because if one set of veins were tied, another set would begin to bleed. But directly the patient has filled his lungs two or three times completely with air, by making full inspiration, the hemorrhage ceases. These precepts were never forgotten by Dupuytren, whenever he divided considerable veins, either in the trunk, face, neck, or upper part of the limbs. (See *Leçons Orales de Clinique Chir.* t. iv. p. 392.) It would appear, from the researches of M. Poiseuille, that the interruption of respiration only has influence on the portion of the venous system above the diaphragm. (See *Journ. Univ. Hebdom. de Médecine*, t. i. p. 289. et t. iii. p. 97. 8vo. Paris, 1830.) However this may be, the practical observations of M. Dupuytren are highly important with reference to venous hemorrhage in the extraction of fibrous tumours from the nose, or antrum tracheotomy, and all other operations in the anterior region of the neck, a region so abundantly provided with veins of all sizes. The long and deep inspirations, however, recommended for the suppression of venous bleedings, are suspected by M. Sanson to have had, in some instances, a share in promoting the en-

trance of air into the veins, particularly when one of those in the upper part of the body has been wounded, and, in consequence of its parietes being indurated, it gapes, as was once exemplified to M. Delpech, in the axillary vein. (*Clin. Chir. de Montpellier*.) The passage of air into the wounded veins, observed by Beauchêne, Dupuytren, Grafe, Mott, and Clemot, usually destroys the patient almost instantly, unless care be taken to place a finger over the wound in the vein, as was done by M. Clemot. (See *Sanson des Hémorrhagies Traumatiques*, p. 91.)

For additional information respecting hemorrhage, see AMPUTATION, ANEURISM, ARTERIES, LIGATURE, and WOUNDS.

Consult also *Petit's Mémoires*, among those of l'Acad. des Sciences for the years 1731, 1732—1735. *Morand, Sur le Changement qui arrive aux Artères coupées*, 1736. *Pontcau, Mélanges de Chirurgie*. *Good's* *Chirurgical Works*, vol. i. *Kirkland's Essay on the Method of suppressing Hemorrhages from divided Arteries*, 8vo. Lond. 1763. *White's Cases in Surgery*. *J. Bell's Principles of Surgery*, vol. i. *Larrey, Mém. de Chir. Militaire*, tom. ii. p. 379. *Pelletan, Clinique Chir.* t. ii. p. 240, &c. *Richerand, Nosographie Chir.* t. iv. sect. sur les Maladies des Artères, p. 23. &c. edit. 4. *Jones, On the Process employed by Nature in suppressing the Hemorrhage from Divided and Punctured Arteries*, 1805. *Hodgson, On the Diseases of Arteries and Veins*. *Benj. Francis, Observations upon the Ligature of Arteries, and the Causes of Secondary Hemorrhage, &c.* in *Med. Chir. Trans.* vol. iv. p. 435. et seq. Likewise Further Obs. on the Ligature of Arteries, by the same, in *Med. Chir. Trans.* vol. vi. p. 632. et seq. *W. Laurence, On a New Method of Tying the Arteries in Aneurism, Amputation, &c.* in vol. vi. of the *Med. Chir. Trans.* p. 156, &c.; and *Crampton*, in vol. vii. of the same work. *Laugabeck, Bibl. b. l. Dr. J. Thomson's Lectures on Inflammation*, p. 240, &c.; and *Obs.* made in the Military Hospitals in Belgium, p. 42—44. *Scarpa, On Aneurism, and particularly his Memoir on the Ligature of Arteries: this is contained in the second edit. of the Traité, by Wislart, Richard, Expériences sur les Blessures des Artères, Mém. de la Soc. Méd. d'Emulation*, t. viii. *Robt. Harrison, Surgical Anatomy of the Arteries*, 2 vols. Dublin, 1824—25. *T. Farnor, On the Arterial System, &c.* and the Surgical Treatment of Hemorrhage, 8vo. Lond. 1825. *John Green Grosse, A Case of Amputation, with some Experiments and Observations on the securing of Arteries with nitrate Silk Ligatures*, in *Lond. Med. Repository*, vol. vii. p. 333. *P. J. Man-c, Traité Théorique et Pratique de la Ligature des Artères*, fol. Paris, 1832. *M. le Baron Dupuytren, Leçons Orales de Clinique Chir.* t. iv. art. 13, 8vo. Paris, 1834. *G. J. Galtier, On the Diseases and Injuries of Arteries*, 8vo. Lond. 1830. *J. Lisfranc, Des Diverses Methodes pour l'obliteration des Artères*, 8vo. Paris, 1834. *J. J. Sanson, Des Hémorrhagies Traumatiques*, 8vo. Paris, 1836. *Robert Carswell, Illustrations of the Elementary Forms of Disease; Fasciculus 6.* 4to. Lond. 1834.

HEMORRHOIDS. (from αἷμα, blood, and ῥέω, to flow.) See PILES.

HERNIA. (from ἑρως, a branch, from its protruding forward.) A protrusion of any viscus from its proper cavity is called a hernia; and the term, of course, comprises that very frequent case in which a tumour is formed by the protrusion of some of the viscera of the abdomen, out of that cavity into a kind of sac, composed of the portion of peritoneum, which is pushed before them. With respect to abdominal hernia, however, some cases will not be embraced by this definition; either because the parts are not protruded at all, or have no hernial sac. Yet it is only in rare cases, that the sac is wanting; as, for example, when the hernia has been produced by the operation of great violence, or has been preceded by a wound of the abdominal parietes, or an attempt at a radical cure has been made with caustic. The sac is also sometimes rendered imperfect by laceration or ulceration. A hernial sac is sometimes burst by a

blow. "When this happens (as Sir Astley Cooper has observed) its contents escape out of the sac, and become placed under the contiguous skin, so that the viscera require to be returned into the sac, before they can pass into the abdomen." He attended a case of inguinal hernia, in which these circumstances were exemplified. (*On Abdominal Hernia*, ed. 2., by C. Aston Key, part i.) Some viscera, which occasionally protrude, are not included in the peritoneum, as the bladder and cœcum; and, when they are considerably displaced, they draw after them the portion of peritoneum connected with them, which forms a sac into which other bowels may fall. There may be no sac, when a hernia arises from malformation of the muscles, attended with abdominal openings in them; for these are not always closed by peritoneum. (*Sir Astley Cooper*, *Op. cit.*)

"The brilliant progress, which surgery has made in modern times (says Scarpa) is, properly speaking, only the result of pathological anatomy; that is to say, of exact comparisons of the natural state of our organs with their different diseases, which may depend upon an alteration of texture, a derangement of functions, a solution of continuity, or a change of situation. It is from morbid anatomy that the most rational curative methods, with which modern surgery is enriched, are deduced as so many corollaries; methods to which we are also indebted for the perfection of operations.

"There are, indeed, a certain number of surgical operations, for the prompt and safe execution of which mere anatomical knowledge will suffice; but, in many others, the surgeon cannot promise himself success, even though he be well acquainted with anatomy, unless he has particularly studied the numerous changes of position, and alterations of texture, of which the parts upon which he is about to operate are susceptible. If he has not the requisite information upon all these points false appearances may deceive his judgment, and make him commit mistakes, sometimes of a very serious and irreparable kind.

"In order to have a convincing proof of this truth, it will be sufficient to take a view of the different species of herniæ, and their numerous complications. Assuredly, no anatomist would believe, that the intestine cœcum, naturally fixed in the right iliac fossa, and the urinary bladder, situated at the bottom of the pelvis, could undergo, without being torn, so considerable a displacement as to protrude through the abdominal ring, and descend even into the scrotum; that the same intestine, the cœcum, could pass from the right iliac region to the umbilicus, protrude at this opening, and form an umbilical hernia; that the right colon could have been found protruded from the abdomen at the left abdominal ring, and the left colon through the right one; that the liver, spleen, and ovary could sometimes form the contents of umbilical, inguinal, and femoral herniæ; that the cœcum could engage itself within the colon, and even protrude at the anus; that the stomach could be forced through the diaphragm, and form a hernia within the chest; that the omentum, or intestine, or both these parts together, could sometimes escape from the belly through the foramen ovale, or sacro-ischiatic notch of the pelvis." (*See Scarpa, Traité des Hernies, Pref.*)

The of the body, where herniæ most fre-

quently make their appearance, are the groin, the navel, the labia pudendi, and the upper and fore part of the thigh: they may occur at any point of the anterior part of the abdomen; and, in less common instances, at the foramen ovale, in the perineum; in the vagina; at the ischiatic notch, &c.

The parts which, by being thrust forth from the cavity, in which they ought naturally to remain, mostly produce herniæ, are either a portion of the omentum, or a part of the intestinal canal, or both together. But the stomach, the liver, spleen, uterus, ovaries, bladder, &c., have been known to form the contents of some hernial tumours. Indeed, as Sir Astley Cooper remarks, there is no part of the abdomen at which a hernia may not occur, excepting where it is bounded by bone; and, if the muscles be imperfectly formed, even the kidney may protrude in the loins. The small intestine is more frequently protruded than the large, and the ileum more frequently than the jejunum, in consequence of its greater proximity to the ring and crural arch. A part only of the diameter of the tube is sometimes included in a hernia: any larger quantity may descend, from a single fold to the whole moveable portion of the canal. (*See Lawrence on Ruptures*, p. 5. ed. 4.) The viscera more frequently met with than any others, in a hernia, are the omentum and the ileum; the next in frequency is the colon; then the cœcum; and, lastly, the jejunum. Sometimes the appendix cœci is the only part found in the hernial sac. (*Sir Astley Cooper on Abdominal Hernia*, ed. 2.) A hernia is referred to by Mr. Crosse, which consisted solely of the appendix vermiformis; this was enlarged to four times its natural size, and produced most of the usual symptoms of strangulation, so that the operation was required. (*See Trans. of Provincial Assoc.*, vol. v.)

From these two circumstances of situation and contents are derived all the different appellations by which herniæ are distinguished. If a portion of intestine alone form the contents of the tumour the case is called *enterocœle*; if a piece of omentum only, *epiplocele*; and if both intestine and omentum contribute to the formation of the tumour, it is called an *entero-epiplocele*. When the contents of a hernia protrude at the abdominal ring, but only pass as low as the groin, or labium pudendi, the case receives the name of *humbocœle*, or *inguinal hernia*; but, if the parts descend into the scrotum, it is called an *osheocœle* or *scrotal hernia*. The *crural* or *femoral hernia* is the name given to that which takes place below Poupert's ligament. When the bowels protrude at the navel, the case is named an *exomphalos* or *umbilical hernia*; and *ventral* is the epithet given to the swelling, when it occurs at any other promiscuous part of the front of the abdomen. The *congenital rupture* is a particular case, in which the protruded viscera are not covered by a common hernial sac of peritoneum, but are lodged in the cavity of the tunica vaginalis, in contact with the testicle; and, as must be obvious, it is not named, like herniæ in general, from its situation or contents, but from the circumstance of its existing from the time of birth.

When the protruded bowels lie quietly in the sac, and admit of being readily put back into the abdomen, the case is termed a *reducible hernia*;

and when they suffer no constriction, yet cannot be put back, owing to adhesions, or their large size in relation to the aperture through which they have to pass, the hernia is termed *irreducible*. An *incarcerated* or a *strangulated hernia* signifies one, which not only cannot be easily reduced, or cannot be reduced without an operation, but suffers constriction; so that if a piece of intestine be protruded, the pressure, to which it is subjected, stops the passage of its contents towards the anus, excites inflammation of the bowel, and brings on a train of alarming, and often fatal, consequences.

The causes of herniæ are either *predisposing* or *exciting*. Amongst the former, writers mention a preternaturally large size of the openings, at which the bowels are liable to protrude; a weakness and relaxation of the margins of these apertures; extraordinary laxity of the peritoneum; an unusually long mesentery, or omentum, &c. With regard to the abdominal ring, the transverse tendinous fibres, which naturally cross and strengthen its upper and outer part, are much weaker in some subjects than others. No idea seems more prevalent in books, than, that taking a good deal of oil with our food is conducive to the formation of hernial diseases. Some of the alleged predisposing causes may justly excite scepticism; but several circumstances prove, that a natural deficiency of resistance, in any part of the parietes of the abdomen, promotes the occurrence of hernia. Hence, persons who have had the peritoneum wounded, are very liable to the present disease. (*Richerand, Nosogr. Chir. t. iii. p. 317.*; *Schmucker, Vermischte Chir. Schriften, b. i. p. 197.*) Men are much more liable than women to inguinal hernia, evidently from the larger size of the inguinal canal; while, in women, as there is a larger space for the protrusion of the viscera, below Poupert's ligament, they are more exposed than men to femoral herniæ. The distention of the abdomen in pregnancy, also gives a disposition to crural and umbilical hernia.

With regard to the *exciting* causes, our knowledge is involved in less doubt. The grand cause of this kind is the powerful action of the abdominal muscles and diaphragm on the viscera. In feats of agility, such as jumping, &c. the pressure which the contents of the abdomen must often encounter, sufficiently accounts for their protruding at any part where the abdominal parietes do not make adequate resistance. The same consideration explains why herniæ very often take place in lifting and carrying heavy weights, running, vomiting, straining at stool, parturition, &c. and in people who inhabit mountainous countries. In individuals who have long laboured under bad strictures, the habitual efforts of the abdominal muscles to make the urine pass, often bring on the formation of hernia. In Sir Astley Cooper's splendid work is the representation of a case of this kind, in which several herniæ were produced.

The diminution of the capacity of the abdomen, by the action of the abdominal muscles and diaphragm, in many occasional exertions, must take place in every body, by reason of the common habits and necessities of life. But, as only a certain number of persons meet with the disease, it is fair to infer, that either the exciting causes must operate with greater force in them, than in the generality of people, or else that their abdo-

minal parietes have not been capable of the ordinary degree of resistance. Many patients, who meet with herniæ in making violent efforts and exertions, may be in the former circumstance; while others, whose viscera protrude from such trivial things as coughing, sneezing, crying, &c., must be considered as being under the influence of some predisposing cause. "Herniæ, which originate in predisposition, generally come on gradually, and almost imperceptibly; while those which are produced by bodily exertions, are formed suddenly, and by the immediate action of the exciting cause. The occurrence of the complaint is often indicated, in the first instance, by a fullness, combined with a sense of weakness, about the abdominal ring. The swelling is increased by any action of the respiratory muscles, and disappears on pressure, and in the recumbent position of the body. It gradually finds its way through the tendon of the external oblique muscle into the groin, and afterwards into the scrotum. When a hernia takes place suddenly, it is generally attended with a sensation of something giving way at the part, and with pain." (*Law Ruptures, p. 42. ed. 4.*)

Upon the subject of the immediate cause of herniæ, it is observed by Scarpa, that several distinguished modern surgeons, as, for instance, Warton (*Adenograph. cap. 11.*), Benevoli (*Dissertationi Chir. 1.*), Rossius (*Acta Nat. Cur. t. ii. obs. 178.*), Brendel (*De Herniarum natalibus*), and Morgagni (*De Sed. et Caus. Morb. epist. 43. art. 13.*), consider a relaxation and elongation of the mesentery as the principal cause of herniæ in general, and of the bubonocoele in particular. Hence, say they, the whole mass of intestines, or only a portion of an intestine, descends against the inner orifice of the inguinal ring, presses against this opening, and gradually makes its way out of the abdomen. In examining this pathological point without prejudice, it is incontestable, says Scarpa, that an intestine cannot be moved beyond its natural limits, unless that part of the mesentery, which retains and fixes the bowel in its proper place, be at the same time elongated. But, it does not follow from this, that a relaxation of the mesentery must precede the displacement of the intestine. It appears to Scarpa much more probable, that these two events are simultaneous, and depend upon one and the same cause.

"In the healthy state, the abdomen, considered altogether, is submitted to two opposite forces, which reciprocally balance each other. One is the pressure of the viscera against the abdominal parietes, the other is the reaction of these same parietes upon the viscera which they contain. If these two forces were in perfect equilibrium in all individuals, and under all the circumstances of life, we should not be in the least subject to herniæ. If, when the equilibrium has been broken, every point of the parietes of the belly were to yield equally to the impulse of the viscera, an increase of the volume of the whole abdomen would be the consequence, but a true hernia would never happen. The cavity of the abdomen is always completely full. The containing and contained parts react upon, and reciprocally compress, one another. It is by the effect of this moderate, but equal and unremitting pressure, that all the viscera mutually support each other. Without it, the ligaments of the liver, those of the spleen, and the various mem-

branous bands of the intestines in general, would only be feeble means for fixing such parts in their respective situations. But, there are certain points of the abdominal parietes which naturally present much less resistance than others, and which react with much less power against the pressure made from within outwards by the abdominal viscera. Such is, particularly, the part which extends from the pubes to the anterior superior spinous process of the ilium. This relative weakness of some points of the abdominal parietes is very marked in certain individuals, in consequence of a defect of organisation. It may also be increased by internal or external causes, which are as various as they are numerous. When, in one of these cases, the pressure made by the viscera is unusually increased, as happens in a violent effort, a defect in the equilibrium between the two forces above mentioned is occasioned; that is to say, the reaction of the abdominal parietes is no longer proportioned, at least at certain points, to the force of the impulse of the viscera. The conjoined powers of the abdominal muscles, diaphragm, and levator ani, are then directed and concentrated against the most feeble point of the abdomen, towards which they propel the nearest viscus, or that which, from its moveableness, is the most liable to displacement. If such viscus should happen to be the noose of an intestine, it is evident that the power, which tends to make it protrude from the belly, must at the same time act upon the corresponding portion of the mesentery; and the intestine, in passing through the parietes of the abdomen, drags the mesentery after it, and makes this membrane yield and become elongated. When the displaced viscera meet with little resistance on the part of the parietes of the abdomen, the hernia is quickly formed, and the elongation of the mesentery occurs with equal celerity. We have an example of this in inguinal congenital hernia: in this case the intestine is, in some measure, precipitated into a sac previously prepared for its reception. On the contrary, in the ordinary inguinal hernia, a totally different disposition of the parts renders the progress of the disease much slower. In most instances, the hernia is not formed immediately the equilibrium between the impulse of the viscera and the reaction of the abdominal parietes is broken; but in the groin a slight elevation is first observed in the direction from the anterior superior spinous process of the ilium towards the inguinal ring. Some time afterwards, when the intestine has made its appearance on the outside of the ring, the enlargement of the hernia, and the elongation of the mesentery, make much more rapid, though always simultaneous progress.

"Numerous practical observations (says Scarpa) concur in proving, that we must not search for the immediate cause of hernia in the relaxation of the mesentery, but rather in a want of equilibrium between the pressure of the viscera and the resistance of one or several points of the abdominal parietes. Indeed, herniae are seen occurring from the slightest causes in infants, in whom the neck of the tunica vaginalis is not speedily obliterated, and in individuals who, from being fat, have, all on a sudden, become extremely thin. Such women as have had children, are more subject to the disease than others. Persons also of both sexes, who carry considerable burdens or who play upon wind instruments, or who have suffered a forcible

contusion of the abdomen, are particularly exposed to the disorder, even though there be not the least reason for suspecting in them a relaxation of the mesentery. Vaginal hernia which arise after difficult labours, afford another proof of the same truth: their cause is owing to a laxity and weakness of the parietes of the vagina, which, not being capable of making any further resistance to the pressure of the viscera, situated in the cavity of the pelvis, at length suffer these parts to protrude.

"With respect to the second proposition, that during the formation of a hernia, the combined force of all the abdominal muscles is, as it were, directed and concentrated against the most feeble point of the parietes, we see a proof of it in a fact that occurs to our observation every day. In order to convince ourselves of this, we need only notice what happens in individuals afflicted with hernia: if they cough, or sneeze, or make the slightest effort, they instantly find the size of the swelling increased, and hasten to support the part with their hand. During the slightest efforts, which render the hernia larger, it is also indisputable, that the mesentery is elongated in the same proportion as the intestine protrudes. All the viscera have such a tendency to be displaced, and carried towards the weakest point of the parietes of the abdomen, that even those which are naturally the most distant from it, and are the most firmly fixed by the folds of the mesentery, may, in their turn, descend into the hernia. Anatomical knowledge alone would never have led us to entertain a suspicion of the possibility of these occurrences. Sandifort and Paletta have found, in an umbilical hernia, the cœcum, with a portion of the ileum and colon. (*Obs. Pathol. cap. iv., and Nora Gubernaculi Testis Descriptio.*) Mauchart, Camper, and Bosc, have met with the cœcum in an inguinal hernia of the left side, (*De Hern. Incurc. in Halleri Disput. Chirurg. t. iii.; Demonstrat. Anat. Patholog. lib. ii. p. 18.; et Animadvers. de Hern. Inguin. p. 5.*) Lassus has seen the left colon protrude at the right inguinal ring. (*Méd. Opérateur, t. i. p. 173.*) If it be proved by all these facts, that such viscera, as are the most closely united to the great sac of the peritoneum and neighbouring parts, are nevertheless liable to form hernia; and if such displacements cannot happen without a considerable elongation of the membranous bands fixing these bowels in their natural situation, how can we refuse to admit, that a noose of intestine, pushed by degrees through the inguinal ring, drags along with it the corresponding portion of the mesentery? In order to explain this event, there is no necessity for supposing a partial relaxation of the mesentery." (*Traité Pratique des Hernies, par A. Scarpa, trad. p. 37—43.*)

The same causes which first produced the complaint, or others of an analogous nature, are constantly tending to promote its increase. The tumour becomes larger, in proportion as the pressure against the hernial sac is stronger and more frequent. Hence, the great size, which it often attains in persons constantly pursuing laborious occupations. Its increase will also be in proportion to the less considerable resistance of the parts in which it is situated. Hence, the magnitude of scrotal ruptures, and the generally small size of a femoral hernia. The size of a hernia is

likewise in part dependent upon the largeness and weakness of the opening, through which the protrusion happens. Hence, inguinal ruptures are usually much larger than those called femoral or crural. The looseness of the cellular connection of the peritoneum, is another cause of the disposition of a hernia to attain a considerable magnitude; while the shortness and closeness of the same uniting medium, operate, in particular cases, as a check to the enlargement of the tumour, as is exemplified in herniæ of the linea alba, which are generally small. When the sac, after it has passed the parietes of the abdomen, is situated among cellular, or adipous substance, it expands equally in all directions, and forms a nearly spherical tumour, being, however, generally rather flattened, as in umbilical and crural herniæ. If it protrude through a canal, it is nearly cylindrical, as in incipient inguinal herniæ; and even in those which have passed the ring, and are still confined by the sheath of the spermatic cord. The fundus of the sac enlarges as it descends into the scrotum, and thus, in almost all scrotal cases, the swelling becomes pyriform. Irregularities of shape often take place from the extension of the membrane in directions presenting the least resistance. At the first moment of the occurrence of a hernia of sudden formation, the protruded peritoneum is unconnected to the parts amongst which it lies; but adhesions take place so quickly, that the sac is found universally connected to the contiguous parts, even in a rupture of two or three days' standing. These adhesions prevent the return of the sac into the abdomen, when the contents of the swelling are replaced. The peritoneum, which immediately surrounds the protruded viscera, generally retains the same thin and delicate structure which characterises that membrane in its natural situation. It is covered by other investments, varying in thickness and structure, according to the part in which the swelling is formed, and the size and duration of the tumour, &c. (See *Lawrence on Ruptures*, p. 18, &c. ed. 4.)

Many interesting circumstances, in relation to hernial sacs, have been satisfactorily explained by Sir Astley Cooper and M. Cloquet; and some of them are noticed in Mr. Lawrence's work. "If the causes which have produced the hernia continue to operate, and further descent of the peritoneum be prevented by its strong adhesion to the tendinous opening, the sac becomes thin by distention. It may give way partially by a kind of laceration, and thus become irregular in figure, presenting an appearance of small cysts, or secondary cavities. On the contrary, when the neck does not adhere so strongly, and the mouth of the sac forms a thickened ring, the renewed action of pressure may make the ring descend, and a fresh one will form at the new mouth of the sac. This process may be again repeated; and thus the sac presents one or more constrictions, by which the protruded parts may be compressed, and even strangulated. Inguinal and scrotal ruptures are almost the only cases in which this occurrence can take place. When a hernia passes through a canal, a thickened ring may be formed at both orifices of the canal. If a hernial sac has been formed, and its mouth become thickened, a new protrusion may take place by the side of it: this may occur again; and thus we may have sacs composed of two lateral cavities, or consisting of two or more secondary

openings into one principal protrusion; or the original serous cavity may be contracted, and form a small appendix to the subsequent protrusion." (See *Lawrence on Ruptures*, p. 26; and *J. Cloquet, Recherches sur les Causes, &c. des Hernies*.)

According to Sir Astley Cooper, however, the peritoneum, in forming a common hernial sac, "is not dragged from its natural situation, but becomes elongated by gradual distention; and it is usually not only lengthened, but slightly thickened; for a long-continued pressure of moderate force will produce an elongation and thickening of fibre, though a greater degree will bring about an entire absorption of parts." So far, however, as this distinguished surgeon has been able to ascertain by dissection, the seemingly great thickness of the hernial sac, and its apparent divisibility into several layers in old herniæ, are owing to the state of the coverings of the sac, the latter being generally but little thicker than the peritoneum.

Several hernial sacs are sometimes found in the same patient; and Sir Astley Cooper has recorded an instance in which this occasioned a difficulty in determining which protrusion was to be the subject of operation.

Herniæ are more frequent on the right, than on the left side of the body. This fact, as Mr. Lawrence has remarked, does not depend on any disparity in size between the apertures of the two sides, but must be referred to the employment of the right side in those offices of life which require the most powerful exertion. (On *Ruptures*, p. 33. ed. 4.) This subject has been particularly considered by Cloquet. (See *Recherches sur les Causes et l'Anatomie des Hernies Abdominales*, p. 10. &c. 4to. Paris, 1819.)

The general symptoms of a hernia, which is reducible, and free from stangulation, are, an indolent tumour at some point of the abdomen, most frequently descending out of the abdominal ring, or from just below Poupart's ligament, or else out of the navel; but, occasionally from various other situations, as will be presently explained. The swelling often originates suddenly, except in the circumstances above related, and it is subject to a change of size, being smaller when the patient lies down on his back, and larger when he stands up or holds his breath. It frequently diminishes when pressed, and grows large again when the pressure is removed. Its size and tension often increase after a meal, or when the patient is flatulent. In consequence of the unnatural situation of the bowels, many patients with hernia are occasionally troubled with colic, constipation, and vomiting. Sometimes, however, the functions of the viscera seem to suffer little or no interruption.

Sometimes the contained parts may be known by the symptoms. But, as Mr. Lawrence justly remarks, this discrimination is often difficult, and even impossible, when the hernia is old, large, and very tense: for, in cases of this description, the viscera experience considerable changes in their figure and state, while the thickened hernial sac prevents an accurate examination by the hand. (On *Ruptures*, p. 46. ed. 4.)

If the case be an *enterocæle*, and the portion of intestine be small, the tumour is small in proportion; but, though small, if the bowel be distended with wind, inflamed, or have any degree of stricture

made on it, it will be tense, resist the impression of the finger, and give pain upon being handled. On the contrary, if there be no stricture, and the intestine suffer no degree of inflammation, let the prolapsed piece be of what length it may, and the tumour of whatever size, the tension will be little, and no pain will attend the handling of it; upon the patient's coughing, it will feel as if it were blown into; and, in general, it will be found very easily returnable. (Pott.) A gurgling noise is often made when the bowel is ascending. An enterocoele is also generally characterised by the uniformity of its surface, and its elasticity.

If the hernia be an *epiplocele*, or one of the omental kind, the tumour has a more flabby, and a more unequal feel; it is in general perfectly indolent, is more compressible, and (if in the scrotum) is more oblong, and less round, than the swelling occasioned in the same situation by an intestinal hernia; and, if the quantity be large, and the patient adult, it is in some measure distinguishable by its greater weight. In very young subjects, the contents of a hernia are generally intestine, and but seldom omentum. (Sir A. Cooper, *Lectures*, vol. iii. p. 8.)

If the case be an *entero-epiplocele*, that is, one consisting of both intestine and omentum, the characteristic marks will be less clear than in either of the simple cases; but as the smooth slippery surface of the intestine generally makes its reduction easier than that of the omentum, we may infer, with Mr. Lawrence, "that if a portion of the contents slip up quickly and with noise, leaving behind something which is less easily reduced, the case is probably an *entero-epiplocele*." (Op. cit. ed. 4. p. 47.)

On the subject of prognosis, the age and constitution of the subject, the date of the disease, its being free, or not free from stricture, or inflammation, the symptoms which attend it, and the probability or improbability of its being returnable, necessarily produce much variety. If the subject be an infant, the case is not often attended with much difficulty or hazard, the reduction being easy as well as the descent; and though from neglect, or inattention, the bowel may fall down again, yet it is easily replaced, and mischief seldom produced: Mr. Pott says seldom, because he has seen an infant, one year old, die of a strangulated hernia, which had not been down two days, with all the symptoms of mortified intestine. For other examples of strangulated hernia in very young infants, refer to *Gooch's Chir. Works*, vol. ii. p. 33.; *Lawrence on Ruptures*, p. 77. edit. 4.; *Edinb. Med. and Surgical Journal*, vol. iii. p. 470, &c. "If the patient be adult, and in the vigour of life, the consequences of neglect, or of maltreatment, are more to be feared than at any other time, for reasons too obvious to need relating. The great and principal mischief to be apprehended, in an intestinal hernia, is an inflammation of the gut, and an obstruction to the passage of the aliment and feces through it; which inflammation and obstruction are generally produced by a stricture made on the intestine. In very old people, the symptoms do not usually make such rapid progress, both on account of the laxity of their frame, and their more languid circulation; and also because their ruptures are most frequently of ancient date, and the passage a good deal dilated: but then, on the other hand, it should also be remembered, that they are by no means exempt from

inflammatory symptoms; and that if such should come on, the infirmity of old age is no favourable circumstance in the treatment, which may become necessary." (Pott.)

If the disease be recent, and the patient young, immediate reduction and constant care to prevent another protrusion, are the only means whereby it is possible to obtain a perfect cure.

If the case be an *epiplocele*, that has formed gradually, it seldom occasions any bad symptoms, though its weight will sometimes render it very troublesome. But if it be produced suddenly, by effort or violence, that is, if a considerable piece of the omentum slip down at once, it will sometimes prove painful and cause very disagreeable complaints; the connection between the omentum, stomach, duodenum, &c. being such as to render the sudden descent of a large piece of the first sometimes productive of nausea, vomiting, and colic. When the piece of omentum is engaged in such a degree of stricture as to prevent the circulation of blood through it, it will sometimes, by becoming gangrenous, be the occasion of very bad symptoms, and even of death, as Mr. Pott, and all surgeons of experience have seen. But even though the portion of the omentum should remain uninjured in the scrotum, "yet, as Pott correctly relates, it renders the patient constantly liable to hazard from another quarter; it makes it every moment possible for a piece of intestine to slip into the same sac, and thereby add to the case all the trouble and all the danger arising from an intestinal rupture. It is by no means an uncommon thing for a piece of gut to be added to a rupture, which had for many years been merely omental, and for that piece to be strangulated, and require immediate help.

"An old omental hernia is often rendered not reducible, more by an alteration made in the state of the prolapsed piece of caul, than by its quantity. It is very common for that part of the omentum, which passes through the neck of the sac, to be compressed into a hard, smooth, body, and lose all appearance of caul, while what is below in the scrotum is loose and expanded, and enjoys its natural texture; in this case, reduction is often impossible, from the mere figure of the part; and I have so often seen this, both in the living and the dead, that I am satisfied, that for one omental rupture, rendered irreducible by adhesions, many more become so from the cause above mentioned." (Pott.)

Upon the whole, this author infers, that an intestinal rupture is subject to worse symptoms, and a greater degree of hazard, than an omental one, though the latter is, by no means, so void of either as it was formerly supposed to be; that bad symptoms are more likely to attend a recent rupture, than one of ancient date; that the descent of a very small piece of intestine is more hazardous than that of a larger; and that the hernia, which consists of gut only, is in general attended with worse circumstances, than that which is made up of both gut and caul. (See also *Lawrence on Ruptures*, p. 75, 76. ed. 4.)

Mr. Ilcy coincides with Pott, in thinking the prognosis more unfavourable when the tumour is small. "I think it is not a bad general rule, that the smaller the hernia, the less hope there is of reducing it by the taxis. Long-continued efforts to reduce a prolapsed intestine, are most likely to

succeed in old and large herniæ, when no adhesions have taken place." (*Pract. Observ. in Surgery*, p. 203.)

It is correctly remarked by Mr. Lawrence, that "the danger is greatest, when a rupture is incarcerated (strangulated) at the moment of its formation. Herniæ, which arise spontaneously, and merely from predisposing weakness, seldom become strangulated; the stricture, in such cases, is never close, nor are the symptoms violent, because the parts concerned are weak and relaxed. The opening, through which the parts protrude, is narrower in some situations than in others; the progress of the case will therefore be more rapid, and the danger of the patient more urgent. The aperture is generally very small in femoral hernia; this kind of rupture in men, and the bubonocoele in women, have a particularly narrow entrance. On the same grounds, femoral, inguinal, and umbilical, ruptures, are more dangerous, than the ventral, perineal, or vaginal kinds." (*On Ruptures*, p. 75. ed. 4.)

TREATMENT OF A HERNIA CAPABLE OF EASY AND IMMEDIATE REDUCTION, AND NOT ATTENDED WITH ANY TROUBLESOME OR BAD SYMPTOMS.

Here the first indication is to reduce the protruded viscera, without delay, and to prevent them from descending again, by the application of a suitable truss. As soon as the parts are returned, the truss should be immediately put on, and worn without remission; care being taken, especially if the patient be an infant, to keep the parts upon which it presses regularly washed, to prevent galling. It ought to fit properly; for, one "which does not press enough, is worse than none at all, as it occasions loss of time, and deceives the patient, or his friends; and one which presses too much, or on an improper part, gives pain and trouble, by producing an inflammation and swelling of the spermatic cord, and sometimes of the testicle.

"In adults, whose ruptures are of long standing, and accustomed to frequent descent, the hernial sac is generally firm and thick, and the aperture in the tendon of the abdominal muscle large; the freedom and ease with which the parts return into the belly when the patient is in a supine posture, and the little pain which attends a rupture of this kind, often render the persons who labour under it careless: but all such should be informed, that they are in constant danger of such alteration in their complaint, as may put them into great hazard, and perhaps destroy them. The passage from the belly being open, the quantity of intestine in the hernial sac is always liable to be increased, and, when down, to be bound by a stricture. An inflammation of that portion of the gut which is down, or such obstruction in it as may distend and enlarge it, may at all times produce such complaints as may put the life of the patient in imminent danger; and therefore, notwithstanding this kind of hernia may have been borne for a great length of time, without having proved either troublesome or hazardous, yet as it is always possible to become so, and that very suddenly, it can never be prudent or safe to neglect it.

"Even though the rupture should be of the omental kind (which, considered abstractedly, is not subject to that degree or kind of danger to

which the intestinal is liable), yet it may be secondarily, or by accident, the cause of all the same mischief; for while it keeps the mouth of the hernial sac open, it renders the descent of a piece of intestine always possible, and consequently always likely to produce the mischief which may proceed from thence."

Mr. Pott comments upon the importance of having the parts completely reduced before the truss is applied, and upon the danger that may be incurred by laying such instrument aside after it has been worn some time; since the partial closure of the passage, whereby the descent of the bowel is rendered less easy, will also make the reduction more difficult, if a piece should happen to slip down: and hence he insists, that a truss "should be long and unremittingly worn by all those, whose time of life makes the expectations of a perfect cure reasonable, many of the ruptures of adults being owing to the negligent manner, in which children at school are suffered to wear their trusses." (See Truss.)

Besides the danger of strangulation, and the loss of all chances of a radical cure, when a reducible hernia is neglected, and allowed to remain down, there are other motives for keeping up the tumour with a truss, and preventing its increase of size. The vast size, to which neglected herniæ sometimes increase, not only prohibits all active exertion, but, by involving, in the male, the integuments of the penis, incapacitates the patient from the act of copulation, and gives rise to excoriation from the discharge of the urine over the swelling. Probably, too, the testis may be affected by the pressure of a very large scrotal hernia. (*Morgagni, de Caus. et Sed. ep. xxxiii. art. 12.; Schmucker, Vermischte Chir. Schriften, b. iii. p. 195.*) Disorders of the intestinal functions, invariably attend these large ruptures, and increase in frequency and violence in proportion to the size of the swelling, and age of the patient. All the moveable viscera of the abdomen gradually find their way into the hernial sac, if a rupture be entirely neglected. (*Lawrence on Ruptures*, p. 80. edit. 4.)

TREATMENT OF IRREDUCIBLE HERNIÆ, FREE FROM INFLAMMATION, AND UNATTENDED WITH TROUBLESOME OR DANGEROUS SYMPTOMS.

Mr. Pott, and all the best writers on ruptures, ascribe the incapacity of reduction, in most cases, either to the largeness of the quantity of the contents, an alteration made in their form and texture, or to adhesions, which they have contracted with each other or their containing bag. The reduction is also sometimes prevented by transverse membranous bands within the sac. Mr. Pott was also aware, that ruptures are sometimes rendered difficult to be reduced, by the cæcum being contained in the hernial sac. Of this fact, he was as much convinced, as the nature of such kind of things would permit; that is, by observations made both on the living and the dead. This statement, made many years back, deserves particular notice, because its truth is confirmed by the modern observations of Scarpa.

Mr. Pott has adverted to the kind of impediment to reduction produced by the thickening of the neck of the sac, when the hernia is long neglected, and suffered to remain in the scrotum, without any bandage to support its weight.

The same author reckons an alteration produced by time, and constant, though gentle, pressure, in the form and consistence, or texture of the omentum, as no infrequent cause why neglected omental ruptures become irreducible.

When a portion of omentum "has been suffered to remain for a great length of time in the scrotum, without having ever been returned into the belly, it often happens, that although that part of it which is in the lower part of the hernial sac preserves its natural soft, adipose, expansile state, yet all that part, which passes through what is called the neck of the sac, is, by constant pressure, formed into a hard, firm, incompressible, carnosus kind of body, incapable of being expanded, and taking the form of the passage in which it is confined, exactly filling that passage, and rendering it impossible to push up the loose part which fills the scrotum.

"The same reason for incapacity of reduction is also sometimes met with in ruptures of the intestinal kind, from an alteration produced on that part of the mesentery which has been suffered to lie quiet for a great length of time in the neck of an old hernial sac.

The other impediment to the return of old ruptures, is the connection and adhesion of the parts, either with each other, or with the sac containing them. This is common to both the intestinal and omental hernia, and is produced by slight inflammations of the parts, which have been permitted to lie long in contact with each other. These adhesions are more or less firm, and more or less extensive, in different cases; but even the slightest will almost always be found an invincible objection to the reduction of the adherent parts, by the hand only. They are most frequently situated at the lower part of the sac, but sometimes at its mouth. (Sir A. Cooper, *Op. cit.* p. 27.)

Irreducible hernia, from any of the foregoing circumstances, are capable of no relief from surgery, but the application of a suspensory bandage for the purposes of lessening the inconvenience of the weight of the tumour, and of checking, by means of pressure, the increase of the swelling. But (according to Sir Astley Cooper), if the hernia be omental only, its increase, and the subsequent descent of the intestine, may safely be prevented by a spring truss. Yet, he acknowledges, that there is so much difficulty in determining the precise nature of the hernia, and whether some small convulsion of intestine may not have descended, that the truss should not be applied, without a most careful examination; and he recommends the spring to be weak. If the instrument should produce pain, or interrupt the functions of the bowels, it ought to be immediately discontinued.

Persons having irreducible hernia, "should be particularly careful not to make any attempts beyond their strength, nor aim at feats of agility; they should take care to suspend the loaded scrotum, and to keep it out of the way of all harm from pressure, bruise, &c. When the tumour is very large, a soft quilted bolster should be worn at the bottom of the suspensory to prevent excoriation, and the scrotum should be frequently washed for the same reason; a loss of skin in this part, and in such circumstances, being sometimes of the utmost importance. They ought also to be particularly attentive to the office of the intestinal

canal, to see that they do not, by any irregularity of diet, disorder it, and keep themselves from being costive." Mr. Pott observes, however, that the quiet, inoffensive state of this kind of hernia is by no means to be depended upon: many things may happen to it, by which it may be so altered, as to become hazardous, and even fatal: an inflammation of that part of the gut which is down, any obstruction to the passage of the aliment or feces through it, a stricture made either on what has been long down, or on a new portion which may at any time be added to it, are always capable of so altering the state of the case, as to put the life of the patient into danger.

"Indeed, the hazard, arising from a stricture, made on a piece of intestine contained in the sac of an old irreducible hernia, is in one respect greater than that attending one that has been found at times reducible; since from the nature of the case it will hardly admit of any attempt toward relief, but the operation, which, in these circumstances, must necessarily be accompanied with additional difficulty."

Patients with irreducible hernia, are exposed indeed, to various dangers and inconveniences; as for instance, to laceration of the intestine by accidental blows; to ulceration of it when any pointed or hard body has been swallowed; to dropsy of the hernial sac; and to a fistulous abscess of the scrotum, which can hardly ever be healed, except by confining the patient in bed. (See Sir A. Cooper on *Abdominal Hernia*; chap. vi. ed. 2. *Travers, on Wounds of the Intestines*, p. 37.) Scarpa has recorded an instance, where a violent exertion caused the return of a hernia, which had long been regarded as cured. The viscera lay in the tunica vaginalis, which was torn to the extent of an inch.

Fabricius Hildanus gives an account of a man who was radically cured of a rupture, of twenty years' date, by six months' confinement to bed. (*Cent. v. obs. 54.*) Le Dran and Arnaud relate instances of monstrous bubonocoeles, which disappeared entirely, after the patients had been long confined to bed, and rendered much emaciated by tedious illnesses. Some of the moderns have imitated this operation of nature, and by frequent bleedings and repeated purges, have sometimes so far reduced the size of the hernia, that it has been returned into the abdomen. Mr. Hey has several times succeeded in this way. (P. 219.) But the practice cannot prove successful, when the viscera adhere to the sac, or to the peritoneum, just within the abdomen. The greatest objection to this method of cure, is the want of an absolute criterion for distinguishing, when the parts do, or do not adhere to the hernial sac; and, in advanced years, though one were sure that the viscera were free from the sac, the possibility of hurting the constitution, by the necessary evacuations, is also another objection. (*Sharp's Critical Inquiry*, p. 15.)

Were the plan to be thought worthy of trial, keeping up a constant pressure on the tumour, by means of a suspensory bandage, made to lace in front, would be proper for promoting the absorption of the thickened parts in the hernial sac. Sir A. Cooper has reduced such hernia after applying ice to them; the good effects of which he imputes to its producing a contraction of the scrotum, and by this means a strong and permanent compression of the tumour. Mr. Earle once mentioned to me the

suggestion of keeping up a general pressure on the swelling, by means of a bladder containing quicksilver, the quantity of which can be regulated according to circumstances.

Whenever any attempt of this kind succeeds a truss should be immediately put on, and worn without remission.

However, there are instances on record, where the capacity of the abdomen had become so adapted to the diminished quantity of the viscera, that when the contents of the hernia had been reduced, serious complaints arose from their introduction into the belly. Schmucker met with several such cases, in which he was obliged to take off the truss again. Petit has known the reduction of a hernia of this kind prove fatal, the parts not descending again, when the truss was removed, the nausea and vomiting continuing, and peritonitis taking place. (*Chirurgische Wahrnehmungen*, vol. ii. p. 243. *Maladies Chir.* t. ii. p. 392.)

Mr. Pott remarks, "that an omental rupture, which has been so long in the scrotum as to have become irreducible, is very seldom attended with any bad symptoms, considered abstractedly; but, it is constantly capable of being the occasion of an intestinal hernia, and all its consequences: neither is that all; for the omentum, either so altered in form and texture, or so connected as to be incapable of reduction, may by accident inflame, and either become gangrenous, or suppurate, and the occasion of a great deal of trouble." In a few instances, epiploceles produce very bad symptoms indeed; cases of which are to be found in Garengot, Dionis, &c.

SYMPTOMS AND TREATMENT OF A STRANGULATED, OR AN INCARCERATED HERNIA.— MEANS TO BE TRIED BEFORE AN OPERATION.

If the prolapsed parts cannot be immediately replaced, and the patient suffers pain, or is prevented thereby from going to stool, the case is called an *incarcerated hernia*, a *strangulated hernia*, or a *hernia with stricture*.

A patient, thus circumstanced, is in some danger, and demands immediate assistance. A stricture made on the prolapsed part of the gut, by the aperture, or canal, through which it passes, is the immediate cause of all the bad symptoms, and of course, the removal of such stricture is the only thing which can bring relief. This object can only be accomplished by returning the bowel back into the abdomen, or dividing the parts, which form the stricture. The former plan is always the most desirable when practicable.

I next proceed to notice the various measures to be adopted for the relief of a strangulated hernia, so as to obtain the best chance of obviating the necessity of an operation. After treating of the merits of each plan, a few remarks will be offered on the order in which these means should be put in practice.

Taxis.—This is the term applied to the operation of reducing a hernia with the hand. It is to be promoted by the position of the body, which Winslow thought should be placed on an inclined plane, with the thighs bent towards the trunk. Sir A. Cooper advises the same practice, observing, that this posture, by relaxing the fascia of the thigh, relaxes also the aperture, through which the hernia passes. Every degree of tension, and relaxation of the femoral fascia, must undoubtedly

be attended with a corresponding change in the abdominal ring. But, flexion of the thigh, besides relaxing this fascia, also relaxes the abdominal, internal iliac, and psoas muscles. In common inguinal hernia, the pressure made on the tumour by the hands of the surgeon should always be directed upwards and outwards, along the course of the spermatic chord; and Sir A. Cooper advises it to be continued from a quarter to half an hour.

As the femoral hernia passes downwards, and then forwards, the pressure must be directed first backwards, and then upwards. In umbilical and ventral hernia, it is to be made straight backwards. No violence should ever be used; for, besides being unavailing, it greatly aggravates the inflamed state of the contents of the hernial sac, and has been known even to burst the intestine. (See Sir A. Cooper on *Inguinal Hernia*, &c., p. 23.)

Besides bending the thigh, care should also be taken to rotate it inward, which will have great effect in relaxing the femoral fascia, and tendon of the external oblique muscle. Suspension of the patient over the shoulders of an assistant has been thought to facilitate reduction: "I have tried it often (says Mr. Hey), but have not found it to be of such superior efficacy, as some authors have represented." (P. 144.)

The manoeuvre of gently pulling the intestine downwards, or a little way further out of the ring, previously to the attempt to reduce the hernia, has been suggested. (See *Hall's New Mode of the Taxis*, in *Med. and Phys. Journ.* Nov. 1824.) The plan, I believe, is not entirely new: Mr. Lawrence says, that it will sometimes succeed, when the difficulty of reduction is owing to an accumulation of fecal matter.

The application of cupping glasses, or dry cupping, to facilitate the taxis, has been recommended: how this application acts has not been ascertained. Does it operate by drawing the intestine a little further out in the first instance? It is said to be most serviceable when the hernia is small, and the cupping glass covers the whole tumour; but the plan has been tried with good effect even in large hernia. (See *Erfahrungen über den Gebrauch des Saugpumpe bei eingeklemmten Brüchen* von Dr. L. Köhler (Warsaw) in *Hecker's Neue Wissenschaftliche Annalen der gesammten Heilkunde*, vol. i. p. 382. 1835. Also J. G. Crosse in *Provincial Med. Trans.* vol. v., and *Encyclographie des Sciences Méd.* Mars, 1836.) I know nothing about the merits of this plan from my own experience.

The return of a piece of intestine is generally preceded by a peculiar noise, caused by the passage of air through the stricture. It recedes at first gradually, and then slips up suddenly. The omentum goes up slowly to the very last portion, which must be actually pushed through the opening. If the taxis should not succeed at first, it will often do so after the warm bath, bleeding, or cold applications. Small hernia, being attended with the closest stricture, are the most difficult to reduce; and, for the same reason, crural ruptures do not so often yield to the taxis, as inguinal hernia in the male subject. The taxis becomes less likely to succeed, the longer the inflamed viscera have been down, because adhesions are liable to form. Mr. Lawrence observes (p. 63.), "When the rupture becomes painful, we are no longer justified in persevering in attempts at reduction by the hand. A

sufficient pressure cannot now be endured; and the force, which is employed, only tends to increase the inflammation, and accelerate the approach of gangrene. *At this period the operation is required, and should be performed without delay.*" Desault even proscribed the taxis altogether in the inflammatory strangulation, until the previous use of other means had produced a change in the state of the swelling.

That the taxis is frequently abused, and the cause of serious mischief, is a truth which cannot be doubted. "Strangulated hernia" (says Scarpa) very frequently mortify from the negligence of the patients, and their repugnance to submit to an operation; and, perhaps, still more frequently from the effect of the taxis, unskillfully exercised by uninformed surgeons, who are determined, at any price whatsoever, to accomplish the speedy reduction of the viscera. The majority of them make no distinction between the *acute* and the *chronic* strangulation. In both cases, no sooner are the symptoms of strangulation evinced, than they begin to handle the swelling roughly, and to push the viscera with all their force, in order to make them return into the abdomen; whilst, when the strangulation is *acute*, and the patient young and strong, the taxis ought never to be practised, before all the means proper for diminishing the strength, calming spasm, and relaxing the parts, which are to be reduced, have been employed for a certain time. These means, we know, are bleeding, fomentations, emollient clysters, and especially the warm bath, which, next to bleeding, holds the first rank. At this school of surgery, I have frequently had opportunities of observing the salutary effect of this treatment. My pupils have, more than once, seen hernia, which had been painfully handled without any good, reduced, as it were, spontaneously, after a bleeding, or whilst the patient was in the bath. If what I have said upon the subject of the *acute* strangulation, and the treatment that it requires, were generally known by surgeons, I think that operations for strangulated hernia would be less frequent. Things are different, with regard to the *chronic* strangulation of old large hernia, in feeble or aged persons; for, in these cases, it is of great importance to support the patient's strength. Bleeding, the warm bath, and other weakening means, should also be avoided; which, by producing a general atony, might bring on gangrene of the intestine, either during the strangulation, or after the reduction of the viscera. It is ascertained, that these kinds of strangulation are almost always occasioned by an accumulation of fecal matter, or an extraordinary quantity of air in the hernia. Nothing is more efficacious than cold applications, for promoting the action of the bowel on the matter, which distends it, or for lessening the volume of the air. They produce a corrugation of all the scrotum, and contractions of the cremaster, which alone sometimes suffice for reducing the viscera in a much better manner, than could be done by the hands of the most experienced surgeon." (*Scarpa, Traité des Hernies*, p. 244—247.) The advice of Mr. Guthrie respecting the taxis, is in exact accordance with that of Scarpa. (*On Inguinal and Femoral Hernia*, p. 23.)

Bleeding. The inflammation, which attacks the protruded viscera, and spreads thence over the whole abdomen, and the temporary weakness and

often fainting, which the sudden loss of blood induces, and which is a peculiarly favourable opportunity for reducing the hernia by the hand, are the reasons in favour of bleeding. Sharp, Pott, B. Bell, Sabatier, Richter, Callisen, Sir Astley Cooper, and Scarpa, names which can never be surpassed in respectability, are all in favour of bleeding. Wilmer and Alanson have published against the practice. By some mistake in the last edition, Sir Astley Cooper was enumerated amongst the opponents of bleeding: I feel it to be my duty, therefore, to correct this error by now inserting his valuable opinions on this point. If the taxis fail, other means must be tried. "One of them (says this distinguished surgeon) is venesection, the object of which is, first, by the general languor which it occasions, to produce a relaxation of the stricture part, and next, to prevent the local inflammation from running so high as to occasion mortification, which would render the case fatal, though the protruded parts were returned. The quantity of blood to be drawn should be from fourteen to twenty ounces, according to the strength of the patient's constitution. So much should be taken away as to bring on a degree of faintness, in which state of general relaxation, the attempts at reduction should be repeated. A surgeon, unaccustomed to the small thready pulse of a person suffering under strangulated hernia, feels apprehensive of taking away blood, conceiving the patient's strength to be fast sinking; but, this fear is groundless, as the pulse becomes larger and fuller after this evacuation." (*Sir Astley Cooper on Abdominal Hernia*, p. 32. ed. 2.)

Mr. Hey has related two cases, which strongly evince the manner in which bleeding facilitates the return of a hernia: the protruded viscera, in one instance, went up spontaneously, or blood being taken away; in the other, the taxis succeeded immediately afterwards, though the previous attempt had been made in vain. (P. 125, 126.) Mr. Hey's experience, however, leads him to concur so far with Wilmer and Alanson, as to declare, that bleeding has generally failed to procure a reduction of the strangulated intestine, though he is persuaded that, in many cases, it may be used with advantage. But he cannot agree with Wilmer, that it generally renders the subsequent operation more dangerous. (P. 126.) The majority of candid practitioners, I believe, will allow, that bleeding is always proper, when the hernia is small and recent; the abdomen tense and painful; and the patient young, strong, and plethoric.

In some old hernia, where the symptoms depend upon mere detention of the intestinal matter, without any serious degree of compression of the bowel, and very little pain in the tumour itself, bleeding is not indicated. In these old and well-marked cases of the passive state of the abdominal opening, as Mr. Guthrie calls them, "Bleeding to syncope will only weaken the patient, and do little good. The warm bath will not be very effective, and tobacco enemata in elderly persons, are sometimes dangerous. The three principal remedies in recent hernia, which have become strangulated, are here of little use, save as they act generally in reducing inflammation, because there is no muscular contraction to subdue; whilst, on the other hand, cold steadily applied may be of great service, when combined with such mechanical pressure as may be found advisable. In these cases, stimulating in-

jections are of great use; and, if they be applied, as Mr. O'Beirne of Dublin advises, by means of a tube ten inches long, with a hole at the end of it, and introduced into the sigmoid flexure of the colon, the happiest results will follow, &c. It draws off the flatus, as well as the watery contents of the bowels, whilst the cold, acting on the tumour condenses the air in the incarcerated intestine, and tends to cause it to pass more readily into the abdomen." (*Op. cit.* p. 27.)

Purgative Medicines.—Mr. Hey's experience leads him to condemn almost universally the use of purgatives, while an intestine remains firmly strangulated. In the enteroepiplocele, when the intestine has retired, and the omentum remains strangulated; or in a simple strangulation of the omentum, where the intestine has not been prolapsed; he deems purgatives of great utility. So likewise in very large and old hernias, where there is reason to doubt, whether the disease is not to be considered as a morbid affection of the intestinal canal rather than the effect of strangulation, purgatives, he believes, may be as useful as in the simple ileus without hernia. While the intestine remains firmly strangulated, they usually increase the vomiting, and add to the distress of the patient. If they are to be tried at any time with hope of success, the trial would appear to have the greatest advantage when the vomiting has been removed by means of an opiate; yet Mr. Hey had repeatedly given them in vain during such an interval of relief. (*Practical Obs. in Surgery*, p. 128.)

Purgatives are supposed to operate by exciting the peristaltic action of the intestine, and thereby extricating it from the stricture. Not only Hey, but Pott and Richter have joined in their general condemnation. Sir Astley Cooper also disapproves of cathartics, except when the symptoms are very slight, and there is either no vomiting, or only at distant intervals. (*On Abdominal Hernia*, part i. p. 34. ed. 2.) Under these circumstances, he has known opium, joined with calomel and cathartic extract, produce stools, and relieve the patient.

Purgative clysters certainly have not the objection of increasing the irritation; but their efficacy is not deserving of much confidence. Mr. Hey never saw one case, in which either purgative or emollient clysters produced a return of a strangulated hernia. Such injections will empty the large intestines; but they do no more. It is common also for a natural evacuation to be the immediate consequence of strangulation. (P. 131.) Mr. Guthrie's opinions, with regard to cases likely to be served by stimulating clysters, have already been noticed.

Warm Bath.—Many instances (says Hey) are upon record of the good effect of warm bathing in procuring the reduction of a strangulated hernia. I have often seen it useful; but I have often seen it fail. Whenever it is used in this disease, the patient should be placed, if possible, in a horizontal position. Gentle efforts with the hand to reduce the prolapsed part are perhaps attended with less danger, and with greater prospect of success, while the patient lies in the bath, than in any other position. The free use of opiates coincides with that of warm bathing, and, under some circumstances, these means deserve to be tried in conjunction." (P. 132.)

Cold Bath, and Cold Applications.—The cold bath, and dashing of cold water on the patient, are

little to be depended on, though success has sometimes been obtained in this manner. (*Petit Mal. Chir.* t. ii. p. 325.; *Hey*, p. 126.)

Wilmer strongly recommended the application of cold to the tumour itself; and this plan has acquired the approbation of the most celebrated modern surgeons. It is sometimes tried in conjunction with the effect of tobacco clysters. Cold applications, in the form of ice, were indeed particularly recommended by B. Bell. The best way is to pound the ice, tie it up in a bladder, and place it on the rupture. Its effect is to lessen the pain, to make the skin over the tumour contract, and thus promote the return of the parts. When ice cannot be procured, Sir Astley Cooper employs a mixture of equal parts of nitre and muriate of ammonia. To one pint of water, in a bladder, ten ounces of the mixed salts are to be added. "If, after four hours, (says this distinguished surgeon), the symptoms become mitigated, and the tumour lessens, this remedy may be persevered in for some time longer; but, if they continue with unabated violence, and the tumour resist every attempt at reduction, no farther trial should be made of the application." (*On Inguinal and Congenital Hernia*.) When ice is not at hand, ether sometimes proves a good substitute, when allowed to evaporate from the surface of the swelling.

Care must be taken that the cold be not so applied as to freeze the scrotum, and bring on sloughing. (Sir A. Cooper, p. 15.) In large old hernia, the application of ice is often attended with remarkable efficacy; and in other cases, as Sir Astley Cooper has explained, if it does not completely succeed, it arrests the progress of the symptoms. (*On Abdominal Hernia*, part i. p. 34. ed. 2.)

Opiates.—Mr. Hey met with several cases, in which opiates, given freely (in athletic persons after bleeding), procured a reduction of strangulated hernia. He could not say, however, that this remedy was generally successful; but, it appeared to him to have the advantage of removing, for a time, the pain and vomiting usually attendant on strangulation, even though it proved ultimately inefficacious. Opiates should be given in large doses, when it is wished to try their effect in procuring reduction; and whenever the symptoms of strangulation return, after having been removed by opiates, the operation should be performed without delay. (P. 134, 135.)

Sir Astley Cooper states, that opium allays the vomiting, and, after venesection, promotes the reduction. (*On Abdominal Hernia*, part i. p. 34.)

Tobacco Clysters.—For this purpose, some surgeons prefer a decoction of tobacco, made by infusing, or boiling, one drachm of the plant, for ten minutes, in a pint of water; others employ the smoke, which is prepared, and introduced into the rectum, by means of an apparatus sold at almost every surgical-instrument-maker's. Perhaps both methods are equally efficacious; but as one requires an apparatus, while the other does not, and is equally proper, the decoction may be most entitled to recommendation. The machine for the smoke is also frequently out of order. Next to the operation, tobacco clysters are the most certain means of bringing about the reduction of the strangulated parts. Besides exciting the action of the intestines, they exert a peculiarly depressing influence on the whole system, reducing the pulse, and causing nausea and sickness, cold sweats, and

fainting, under which circumstances, the parts often recede spontaneously, or may be easily reduced. Sir A. Cooper prudently advises injecting half the above quantity at first; for, he has seen two drachms, and even one, when used as an infusion, and introduced at once, prove fatal. (P. 24.) The rest should be injected presently, when it appears that the tobacco does not operate with the extraordinary violence with which it does in a few particular constitutions.

A case published by Sir C. Bell, looks to me very much like an example of the occasional poisonous effects of the tobacco. At least, no particulars of any fatal mischief, either in the tumour or abdomen, are detailed; and it is remarked of the patient, "His strength held up until the tobacco clyster was administered to him, after which he very suddenly fell low and sunk." (*Surgical Obs.* part ii. p. 189.) The smoke proved fatal in an instance witnessed by Desault (*Œuvres de Chir.* t. ii. p. 344.); and an infusion of $\text{Sij. to } \frac{3}{4}$ viij. of water seemed to produce suddenly mortal effects in another example on record. (*Edinb. Med. and Surgical Journ.* vol. ix. p. 159.)

When the patient is old or considerably debilitated, the tobacco clyster should not be employed; for, if it fail, the constitution will not afterwards be in a state to bear the operation. I have known it succeed, however, in an aged person. A woman, above sixty years old, was brought to University College Hospital with a strangulated femoral hernia. The taxis and other means not having answered, I recommended the operation; but she obstinately refused to submit to it. As a last expedient, I directed the tobacco clyster to be employed, and, in half an hour, the hernia returned almost of itself. In another case, admitted into the same hospital, encouraged by the foregoing one. I tried the tobacco clyster for the relief of a strangulated femoral hernia in an aged female; but as the parts could not be reduced, I performed the operation; the sickness ceased; stools soon followed; and the pain and fever entirely subsided. But the weakness was such, that nature made little or no effort to heal the wound; the hernial sac sloughed, and the case ended fatally on the 6th or 7th day. This example, I should say, was against the employment of tobacco clysters in old persons.

Poultices and Fomentations have not the confidence of any experienced or intelligent surgeon. Whoever, in these urgent cases, wastes time in trying the effects of such applications, merits censure for his credulity, ignorance, and unfitness to undertake the treatment of a rapid disease, in which, as Pott remarks, if we do not get forward, we generally go backward; and whatever does no good, if it be at all depended upon, certainly does harm, by occasioning an irretrievable loss of time.

OF THE ORDER, IN WHICH THE PRECEDING METHODS SHOULD BE TRIED, AND OF THE TIME WHEN THE OPERATION SHOULD NOT BE DELAYED.

In the treatment of a strangulated hernia, a surgeon cannot be too deeply impressed with the danger of spending time in the trial of methods of inferior efficacy, of such as are evinced to be ineffectual in the cases before them. The rapidity with which gangrenous mischief sometimes arises, and the patient loses his life, has been

proved in a multitude of unfortunate examples, and should operate as a warning to all practitioners against the danger of deferring the operation too long. In the course of my reading, however, I have not met with so remarkable an instance of the sudden mortification, and rapidly fatal termination of a hernia, as the following case, recorded by Baron Larrey, in speaking of the fatiguing and forced marches performed by the French soldiers in Egypt. These marches, he says, brought on, in one case, "a hernia which formed suddenly, and became at the same time strangulated. The man was immediately brought to my ambulance; but, a spontaneous gangrene, which had all on a sudden attacked the intestine, and extended to the other abdominal viscera, caused the patient's death in the space of two hours, and made it impossible for me to do the operation for him. This is the second example, that I have been acquainted with, in which the effects were thus rapid." (*Mém. de Chir. Militaire*, t. i. p. 196.)

The taxis is generally among the first things to be tried; and Sir A. Cooper recommends the attempts to be continued for a quarter, or half an hour. When these have been ineffectual, the patient, if the circumstances do not forbid, should be immediately bled, and have a large opening made in the vein, so that the suddenness of the evacuation may be most likely to bring on fainting. The taxis should then be tried again.

When the strangulation is very acute, and the patient young and strong, perhaps, it may be most advisable to follow the advice delivered by Scarpa and Desault, which is, to bleed the patient, and put him in the warm bath, before the taxis is attempted at all.

If bleeding alone has been practised, and the manual efforts at reduction should not now succeed, the warm bath may be employed, *provided it can be got ready in a very short time*, but none should ever be lost in waiting for it to be prepared. When the bath is used, the taxis may be attempted, as the patient lies in the water; a situation, in which I have succeeded in reducing several herniæ.

Certainly not more than one hour should ever be allotted for putting in practice the first attempts at reduction, bleeding, and the warm bath.

The plan should be, while the trial of one thing is going on, another should be preparing; so when the preceding measures have been tried in vain, the application of a bladder filled with ice, or the solution of nitre and muriate of ammonia, and, if the patient be not aged, nor of too debilitated a constitution, the injection of tobacco, in the form of smoke or decoction, should never be delayed for want of due previous preparation of all the requisites. Both these measures should be practised at the same time, immediately after the failure of the taxis, bleeding, and the warm bath. Sir Astley Cooper computes, that four hours are enough for the trial of the tobacco clyster, together with cold applications.

In omental herniæ, the necessity for operating may frequently be obviated, by the good effects of bleeding, purgative medicines, and clysters, and leeches applied to the tumour. Mr. Lawrence has justly observed, that "when, as it very frequently happens, the aid of the surgeon is not required, until the complaint has lasted for some time, a trial of the tobacco, together with the topical

use of cold, should be immediately resorted to, as circumstances will not admit of delay in the previous use of less powerful remedies." (P. 148. ed. 3.)

Every man who has seen much of herniæ, will immediately recognise the propriety of the following sentiments of the experienced Hey:—"I can scarcely press in too strong terms the necessity of an early recourse to the operation, as the most effectual method of preserving life in this dangerous disease. If Mr. Pott's opinion be true, that the operation, when performed in a proper manner, and in due time, does not prove the cause of death oftener than perhaps once in fifty times; it would undoubtedly preserve the lives of many, to perform it almost as soon as the disease commenced, without increasing the danger by spending much time in the use of means which cannot be depended upon for a cure. I have twice seen this disease prove fatal in about twenty-four hours. In such cases, it is evident there is little time for delay. A surgeon, who is competent to perform the operation, is not perhaps consulted till the intestine is on the point of being mortified, or is actually in a state of mortification. The dilemma into which he is then cast is painful indeed. But, when the fullest opportunity is afforded him of using the best mode of treatment, I am satisfied, that his success will be the greatest when the operation is not long delayed. This, at least, has been my own experience. When I first entered upon the profession of surgery, in the year 1759, the operation for strangulated hernia had not been performed by any of the surgeons in Leeds. My seniors in the profession were very kind in affording me their assistance, or calling me into consultation when such cases occurred; but we considered the operation as the last resource, and as improper until the danger appeared imminent. By this dilatory mode of practice, I lost three patients in five, upon whom the operation was performed. Having more experience of the urgency of the disease, I made it my custom, when called to a patient who had laboured two or three days under the disease, to wait only about two hours, that I might try the effect of bleeding (if this evacuation was not forbidden by some peculiar circumstances of the case) and the tobacco clyster. In this mode of practice, I lost about two patients in nine, upon whom I operated. This comparison is drawn from cases nearly similar, leaving out of the account those cases, in which a gangrene of the intestine had taken place.

"I have now, at the time of writing this, performed the operation thirty-five times; and have often had occasion to lament, that I had performed it too late, but never, that I had performed it too soon. There are some cases so urgent, that it is not advisable to lose any time in the trial of means to produce a reduction. The delay of a few hours may cut off all hope of success, when a speedy operation might have saved the life of the patient." (P. 141, &c.)

To determine the exact moment when to give up the trial of the preceding measures, and to have immediate recourse to the operation, is certainly difficult; but no one can doubt, that it is generally better to operate too early than too late.

All directions must be general ones, liable to many exceptions: in rapid cases, little or no time should be allotted to the trial of any plan; and the

operation should be done without the least delay. In other instances, we have full time to try the effects of every thing at all likely to succeed. The symptoms, which ought to guide us, in having recourse to the operation, arise from an attack of inflammation in that part of the intestine contained in the hernial sac, and from its spreading into the abdominal cavity. It is in proportion to their violence, that we ought to urge the performance of the operation. Sir A. Cooper considers pain on pressing the belly, and tension, as the symptoms, which point out its immediate necessity. He adds, "indeed, there is scarcely any period of the symptoms which should forbid the operation; for, even if mortification has actually begun, the operation may be the means of saving life, by promoting the ready separation of gangrenous parts." (*On Inguinal and Congenital Hernia*, p. 27.)

According to Mr. Guthrie, if a patient is presented with a strangulated hernia, even one of recent formation, in whom the general symptoms are very severe, and evidently from that cause, the operation should not be delayed, although the tumour itself may be comparatively but little painful. "These general symptoms are, the pain at the umbilicus, the irritability of the stomach, the anxiety of countenance, and the failing state of the pulse. If in a young healthy man, strangulation had existed only four or six hours; the swelling were tense and painful, when touched; the nausea and sickness frequent; the pain at the umbilicus severe and increased on pressure; the pulse small and hard; the countenance distressed; Mr. Guthrie would be for the immediate performance of the operation. If the part were but little painful, and the umbilicus not acutely sensible, he would defer the operation until the effect of bleeding unto syncope, in combination with the hot bath, had been ascertained. Mr. Guthrie remarks, that a hernia of recent formation cannot remain in a state of incarceration ending in strangulation, for a longer period than ten hours, without placing the patient's life in great jeopardy." (*On Inguinal and Femoral Hernia*, p. 24.) I have sometimes operated directly, without expending time in the trial of any measure, but the taxis; of course, these were urgent and advanced cases.

Whenever the surgeon has succeeded in reducing the parts, without having recourse to the knife, if the symptoms of pain, inflammation, &c. run high before such reduction, they will not always cease immediately afterwards. As they probably depend on the reduced bowel having been inflamed by the stricture, the body should be kept open, and the diet and regimen should be low and sparing, whilst the least degree of pain and tension remain; in short, till all complaint is absolutely removed from the abdomen, and the intestines do their office freely, and without trouble. (Pott.)

SYMPTOMS OF A STRANGULATED HERNIA.

According to Sir Astley Cooper, one of the earliest symptoms of a strangulated hernia, is pain about the diaphragm, followed by continual eructation. The patient is next troubled with vomiting and costiveness. He feels a great inclination to have stools, but cannot succeed in his attempts to expel the feces. There is some pain in the swelling, and a great deal at the part where the stricture is situated. Afterwards the abdomen becomes

considerably distended with air, such distension not arising from inflammation, but from the cause here mentioned, as is proved by pressure on the abdomen not giving at first any pain. The vomiting becomes more frequent, and feculent matter is ejected from the stomach; into which it is brought by what is called the antiperistaltic action of the bowels. A clyster will sometimes bring away a portion of feculent matter, but the quantity will be extremely small. While the abdomen is in this tense state, but unaccompanied with pain, and while there is frequent vomiting of the feces, the pulse is hard, frequent, and very distinct; but, in the next stage of the symptoms, when the abdomen is not only tense, but painful on being touched, the pulse is extremely small and frequent. The vomiting and eructations continue, and the patient is pale, and covered with a cold perspiration. The tumour becomes very tense, hard, and in general a little inflamed on the surface of the skin. With respect to the hicough which now succeeds, and which has usually been considered as a sign of the presence of gangrene, Sir Astley Cooper declares, that it is now known not to be so, patients having had it for many hours, and yet recovered after the operation. The truth of this observation was exemplified in two instances, in which I have had occasion to operate. Hicough sometimes continues several days after the operation. If the protruded parts be not now returned by means of the operation, or otherwise, "the tension of the belly, the restlessness, and fever having been considerably increased for a few hours, the patient suddenly becomes perfectly easy, the belly subsides, the pulse, from having been hard, full, and frequent, becomes low, languid, and generally interrupted, and the skin, especially that of the limbs, cold and moist; the eyes have now a languor and a glassiness, a lack-lustre not easily to be described; the tumour of the part disappears, and the skin covering it sometimes changes its natural colour for a livid hue; but whether it keeps or loses its colour, it has an emphysematous feel, a crepitus to the touch, which will easily be conceived by all who have attended to it, but is not so easy to convey an idea of by words; this crepitus is the too sure indicator of gangrenous mischief within. In this state, the gut either goes up spontaneously, or is returned with the smallest degree of pressure: a discharge is made by stool, and the patient is generally much pleased at the ease he finds; but this pleasure is of short duration, for the hicough and the cold sweats continuing and increasing, with the addition of spasmodic rigors and subsultus tendinum, the tragedy soon finishes."

ANATOMY OF INGUINAL HERNIA.

This subject must necessarily precede the account of the operation, which would otherwise be unintelligible. It is chiefly in the anatomical information relative to hernia, and in the mode of operating, that modern surgeons have a decided superiority over their predecessors; for, before Gimbernat, Camper, Sir Astley Cooper, Hey, Scarpa, Hesselbach, Langenbeck, and others, published their several works on hernia, the knowledge of the anatomy of hernia was but imperfectly known. Of all the eminent men, who have written on this subject, there has equalled Sir Astley Cooper

in the number and importance of original observations. His description of the inguinal canal, the first accurate one ever given; his account of the fascia transversalis, (a texture which had not been contemplated, with reference either to anatomy, or disease, previous to his researches); his interesting observations on the muscularity of the internal ring; his description of the fascia propria of crural hernia; and an infinite number of pathological and practical facts; make Sir Astley Cooper the individual, whose labours, more than those of any other surgeon, have contributed to the advancement of this most important and difficult subject.

The tendinous fibres of the aponeurosis of the external oblique muscle, as they run downwards and forwards towards the pubes, separate from each other so as to leave a triangular opening, called the abdominal ring, which is usually more capacious in the male than the female subject. The upper and inner pillar (as it is termed) of this aperture is inserted into the symphysis of the pubes, and is the weakest of the two; the lower and outer one, which is the strongest, is chiefly a continuation of Poupart's ligament (*Hesselbach, über den Ursprung, &c. der Leisten-und-Schenkelbrüche*, p. 4.), and is fixed into the angle and crista of the same bone. Some tendinous fibres cross the upper and outer angle of the ring, so as to diminish the triangular appearance of the whole aperture: these are particularly strong in old herniæ. The anterior and thicker layer of the aponeurosis of the internal oblique muscle joins the tendon of the external oblique; the posterior and thinner one joins that of the transversalis; but the lower portion of this tendon, together with the corresponding part of the transversalis, goes wholly in front of the rectus muscle. Thus, the inferior border of the obliquus internus and transversalis, which originates from the upper part of Poupart's ligament, lies behind the outer pillar of the abdominal ring. Sir A. Cooper first noticed that a thin fascia proceeds from the inner edge of Poupart's ligament, and spreads over the posterior surface of the transversalis. This fascia forms a partition between the peritoneum and the outer opening of the abdominal ring; and were it not for its existence, inguinal herniæ would probably be much more frequent. In front of it are the aponeuroses of the internal oblique and transverse muscles. Hesselbach, who has named the small smooth point, situated directly behind the outer opening of the abdominal ring, its *crural surface*, distinctly states, that it is formed by delicate fleshy and tendinous fibres of the internal oblique muscle (*Ueber den Ursprung, &c. der Leisten-und-Schenkelbrüche*, p. 4.); and, that behind them is the weakest part of what he names the *internal inguinal ligament*, in the rear of which is the peritoneum, with the intervention of a very loose cellular substance. (*Op. cit.* p. 26.) The *internal inguinal ligament* of Hesselbach, is therefore clearly the same thing as the above fascia, first described by Sir A. Cooper. This point of the abdomen is one of the three weak places on the inside of the inguinal region, where herniæ are liable to occur; yet, weak as it appears to be, it is not the most common situation of such tumours. A computation has been made that, in a hundred cases of inguinal hernia, not ten occur at the point here specified. (*H. J. Brüninghausen, Unterricht*

über die Brüche, &c. Wurz. 1811.) Mr. Lawrence observes, that, if we trace the fascia transversalis from the crural arch upwards, we shall find it divided immediately into two portions, an internal and external, which leave between them a considerable interval just in the middle of the crural arch. The former of these, which is the strongest, and most decidedly fibrous, is connected by its inner edge to the outer margin of the rectus, and to the inferior margin of the tendon of the obliquus internus and transversus; and both are gradually lost above, between the peritonæum and transversus. (*On Ruptures*, ed. 4. p. 179.)

The spermatic vessels, joined by the vas deferens, run in front of the epigastric artery, very near the place of its origin. They then pass through the above fascia, go under the edge of the internal oblique and transverse muscles, and next obliquely downwards, and forwards, between the above fascia, and aponeurosis of the external oblique muscle, to the opening of the ring. When arrived on the smooth surface, immediately behind the ring, they describe an obtuse angle, and pass forwards and downwards into the scrotum. (*Hesselbach*, *Op. cit.* p. 5.)

Thus, the spermatic cord, before it actually emerges at what is named the abdominal ring, runs through a kind of canal, to which the epithet *inguinal* is often applied. This oblique passage of the cord, through the abdominal parietes, was well known to, and elegantly delineated by Albinus. Gimbernat makes distinct mention of it in his *Account of a New Method of Operating for Femoral Hernia*, p. 19. 32. But Sir A. Cooper has the merit of having given the earliest correct account of it, in reference to hernia; a subject rendered complete by the more recent elucidations of Hesselbach, Scarpa, Langenbeck, and Cloquet.

The abdominal ring is then only the outer opening of the canal or passage, through which the spermatic cord passes before it emerges. The inner one, at which the viscera first protrude, in the most common cases of inguinal hernia, is situated about an inch and a half from the abdominal ring, in the direction towards the anterior superior spinous process of the ilium; or, according to Sir Astley Cooper and Hesselbach, the inguinal canal is almost an inch and a half in length, the average distance of the outer pillar of the abdominal ring, from the inner pillar of what the latter terms the posterior ring, being about sixteen lines. (*Op. cit.* p. 14.) This inner opening is rather nearer the pubes than the ilium, and its upper border is formed by the lower edge of the internal oblique and transverse muscles, which can be plainly felt with the finger, introduced upward and outward into the abdominal ring. Mr. Guthrie, who is a believer in the muscular structure of the inner opening of the inguinal canal, as the general disposition, refers the difference of the symptoms of recent and old hernia, when strangulated, to considerations founded upon this view. In the recent hernia, that is strangulated, the parts through which the protrusion happens seem to him to be comparatively but little altered, and the muscular structure of the internal ring capable of exercising great compression on the contents of the hernia, and often in a complete circle. Unless the pressure be removed, he observes, inflammation will soon follow, in consequence of the sharpness of the edges of the compressing parts, and the force with

which they contract. 'In recent hernia which have become strangulated, in young and healthy persons, inflammation soon commences in the protruded intestine, and in the part which is above the stricture; and, if relief is not obtained, the intestine below mortifies, or ulceration takes place, or would take place, if time were given, immediately, or directly, above the part pressed on by the edge of the transversalis, or stricture. The patient, therefore, in a recent hernia dies of acute inflammation, followed by mortification, rather than of congestion, followed by low inflammation, and perhaps, although not always, mortification; which is the state of parts to be found usually in old hernia, which have become strangulated. The symptoms correspond with the appearances found after death. In recent hernia, when strangulated, there is pain in two distinct places; at the umbilicus, and extending from it to the pit of the stomach; and in the hernial tumor. In old hernia, the pain is felt at first, and often for a long time at the umbilicus alone; the swelling shows little sign of derangement, and admits of considerable pressure being made upon it for several hours and even days after the incarceration and supposed strangulation are complete. (See *G. J. Guthrie*, on *Inguinal and Femoral Hernia*, p. 20.)

"The precise point, at which the hernia most commonly begins (says Scarpa), is that which corresponds, in the fœtus, to the communication of the tunica vaginalis with the peritonæum, and, in the adult, to the passage of the spermatic cord under the transverse muscle. In the sound state, the peritonæum presents at this part a small funnel-like depression, the depth of which increases in proportion as the spermatic cord is pulled from above downwards. It is this small pouch, this sort of digital appendage, whose progressive augmentation constitutes the hernial sac. Resting upon the anterior surface of the spermatic cord, it first makes its appearance under the inferior edge of the transverse muscle; thence it extends itself in the separation of the inferior fleshy fibres of the internal oblique muscle, always following the spermatic cord, in front of which it is situated; and, after having in this manner passed through the whole of the canal, which extends from the iliac region to the pubes, it lastly protrudes at its external orifice, which is the inguinal (or abdominal) ring, properly so called. In all this track the hernial sac, as well as the spermatic cord, is situated above the femoral arch, the direction of which it follows. The canal which it traverses is of a conical shape, the apex of which is towards the ilium, and the base at the external orifice of the ring." (*Scarpa*, *Traité des Hernies*, p. 44. 45.)

As M. Jules Cloquet observes, the inguinal canal is wider, and its apertures are much more distinct in the male, than the female subject.

The epigastric artery runs behind the spermatic chord, along the inner margin of the internal opening of the above canal, then upwards and inwards, so as to pass at the distance of half an inch, or an inch, from the upper extremity of the outer opening, or abdominal ring.

In common cases of inguinal hernia, the viscera protruded at the inner opening of the inguinal canal, lie over the spermatic cord, and form a tumor on the outside of the abdominal ring.

When the viscera have entered the above described digital pouch of the peritonæum, and the inguinal canal, but do not protrude through

the abdominal ring, the case is sometimes termed, an *incomplete inguinal hernia*; and *complete* when they pass out of that opening. The viscera may continue for a long while quite within the inguinal canal, and even become strangulated there: sometimes, also, they are prevented from passing further towards the ring by some kind of impediment; and, in this circumstance, if the hernial sac have any addition made to its contents, it may expand between the external and internal oblique muscles, as Hesselbach had an opportunity of seeing in the body of a female. (*Ueber den Ursprung, &c. der Leisten-und-Schenkelbrüche*, p. 26.) The stricture may take place either at the internal or external opening of the inguinal canal. In recent and small herniæ, according to Sir A. Cooper, the strangulation is most frequently situated at the inner opening; in large old ruptures at the abdominal ring. Even when the parts completely protrude out of the latter opening, the strangulation may exist at the inner one; but, there may occasionally be two strictures, viz., one at each opening. (See *Lawrence on Ruptures*, p. 183. edit. 3.)

In the foregoing part of this article, I have briefly adverted to the doctrine, that the internal ring is endowed with muscularity. "The lower edge of the transversalis muscle (observes Sir Astley Cooper) has a very peculiar insertion, which I have hinted at in my work on hernia. It begins to be fixed into Poupart's ligament, almost immediately below the commencement of the internal ring, and it continues to be inserted behind the spermatic chord into Poupart's ligament, as far as the attachment of the rectus. Thus, the inguinal canal is endowed with muscular contraction, which under the action of the abdominal muscles, serves to close it, and lessen the propensity to hernia. Sometimes a portion of muscle descends from the tendon of the transversalis, in the course of the linea semilunaris, to be inserted into the fascia transversalis behind the chord, and into Poupart's ligament. It is this circular insertion of the transversalis, which is the cause of stricture in inguinal hernia, in the course of the canal, and nearly at the upper ring.

"Behind this insertion of the transversalis, the internal portion of the fascia transversalis appears, adhering strongly to the tendon of that muscle at the back of the inguinal canal.

"Thus, the inguinal canal is, at its anterior part, formed by the tendon of the external oblique; at its posterior, by the tendon of the transversalis, and by its folded muscular fibres; behind which is the fascia transversalis, into which those fibres are also inserted." (See *Obs. on the Stricture and Diseases of the Testis*, p. 35. 4to. Lond. 1830.

Mr. Guthrie also describes the internal ring, or superior opening of the inguinal canal, as muscular; and he even supposed, that "the opinion, that this opening is in many instances a muscular one," was first advanced by himself in 1816. This claim cannot, however, be maintained against that of Sir Astley Cooper, who, in 1804, made the following observations with regard to the arrangement of the muscles at the internal ring:—"Hereby (says he) may be explained the opinion, which some surgeons have entertained of the spasmodic nature of the stricture,—a state which it was difficult to account for, when the seat of strangulation was supposed to be confined to the external ring,

as this tendinous aperture possesses no muscular action, and cannot assume the state of spasm." (P. 28. part 1.) In another place, in noticing the means for reducing strangulated femoral hernia (Sir Astley Cooper remarks), "These means (tobacco and opium, &c.), are less frequently effectual here, than in the inguinal hernia, which is probably owing to two causes, namely, to the nature of the parts through which the hernia descends, and the smallness of the aperture forming the mouth of the sac. In the inguinal hernia, the parts are so connected with muscles, that any relaxation brought on in these, affects the aperture, through which the hernia descends; but, in crural hernia, the seat of the stricture is in parts less connected with the action of the muscles, and general relaxation has little effect on them." (Part ii. p. 9.) Mr. Swan, who attended Sir Astley Cooper's lectures in the winters of 1810-11 and 1812-13, heard him then explain, that the lower part of the transversalis muscle was the cause of stricture in inguinal hernia (See *Mr. Aston Key's Remarks in Lond. Med. Gaz.* 1833-34, p. 283.) As this gentleman observes, "if recent evidence be required, it may be found in Sir Astley Cooper's description of the cremaster "in his work on the *Testis*. In plate 5, fig. 1. is a view of the muscular structure in the inguinal canal; and the explanation of the plate says, 'C. C. transversalis muscle, arising from Poupart's ligament, and passing around the spermatic chord at the internal ring, so that the fibres of this muscle appear behind, as well as before the spermatic chord: and thus the inguinal canal is rendered a muscular canal.'" In explanation of plate 6. fig. 1. there is also the following note:—"Muscular fibres are always found proceeding from the transversalis, muscle upon that part of the fascia transversalis, which forms the posterior surface of the inguinal canal." The love of truth, then, obliges me to assign to Sir Astley Cooper the merit of this, as well as of numerous other original observations on hernia.

One question yet remains to be settled. Is the encircling of the spermatic chord by the fibres of the transversalis, only an occasional variety; or is it the ordinary condition of it? I know, that several lecturers on anatomy take the former view. (See *Lond. Med. Gaz.* 1833-34, p. 399.) M. Cloquet had seen the lower margin of the transversalis at a very considerable distance above the ring. He had also seen the spermatic chord enter the inguinal canal, passing between the fibres of the same muscle, which were only separated, without accompanying the chord, as those from the internal oblique do. These facts M. Cloquet manifestly speaks of, as deviations from what is most usual. M. Cloquet likewise notices another variety in the anatomy of the parts. "In the majority of subjects, (he observes) the spermatic chord passes underneath the lower border of the internal oblique, which it draws with it, to form the cremaster. In these cases, the anterior arches only exist, but in some individuals, it evidently traverses the fibres of this muscle; and these arches exist then not only in front, but also behind the testis and tunica vaginalis, which thus become everywhere surrounded by them." (See *Jules Cloquet's Description of the Parts concerned in Inguinal and Femoral Herniæ*: translated by A. M. M'Whinnie, p. 13.) On the same subject, Scarpa says, "The lower muscular fibres of the internal

oblique, separate from each other to allow the spermatic chord to pass between them." (*On Inguinal and Scrotal Hernia*, p. 25., English ed.)

The hernial sac descends through the abdominal ring over the spermatic chord, and is covered by a fascia, sent off from the tendon of the external oblique muscle. Beneath this fascia, the cremaster muscle is also situated over the sac, which, after it has descended a certain way, lies on the tunica vaginalis, as well as the spermatic chord.

As the epigastric artery naturally runs first behind the spermatic chord, and then along the inner margin of the internal ring, and as the viscera are protruded over the chord, they must be situated on the outer side of the artery, which runs first behind the neck of the sac, and then on its inner side. Hence, the inner margin of the sac, when inspected on the side towards the abdomen, seems to be formed, as it were, by the track of the vessel. (See *Lawrence*, p. 179.) That this is the ordinary situation of the epigastric artery, in relation to the inguinal hernia, is confirmed by the concurrent testimonies of Camper, Chopart, Des-sault, Sabatier, Sir A. Cooper, Hesselbach, Scarpa, &c., and by preparations to be seen in almost every museum.

In recent inguinal herniæ, the internal and external rings are at some distance from each other, the first being situated obliquely upwards and outwards in relation to the former; but, the pressure of the protruded viscera gradually forces the internal opening more towards the pubes, and nearer to the abdominal ring, so as to render the posterior side of the neck of the hernial sac, and of the inguinal canal, very short. (*Hesselbach*, p. 29.) Thus, in large herniæ of long standing, the opening into the abdomen is almost direct, and the epigastric artery becomes situated nearer the pubes than in the natural state.

Though such is the ordinary direction, in which a bubonocoele protrudes, there are occasional varieties. In one of these, the viscera, instead of descending through the inguinal canal, are at once thrust through the abdominal ring itself, and the opening into the belly is then direct; the hernial sac, instead of passing on the external side of the spermatic vessels, as is usual, now lies on their inner or pubic side; and the epigastric artery, which is commonly situated behind, now pursues its course, in front of the sac, at its usual distance from the upper and outer angle of the abdominal

The following is Scarpa's description of the displacement of the epigastric artery in the greater number of cases of inguinal hernia:—"This artery, which, in the natural state, runs about ten lines from the abdominal ring, has its situation and direction so changed, in subjects affected with hernia, that it crosses the posterior part of the neck of the hernial sac, and is pushed from the outer to the inner side of the abdominal ring. In order to comprehend the reason of this displacement, it is necessary to recollect what I have elsewhere said of the formation of inguinal hernia, and of the manner, in which the spermatic chord crosses the epigastric artery. The hernia begins to form at the very place, where the spermatic chord passes under the inferior margin of the transverse muscle; and this place is rather nearer the ilium, than that where the epigastric artery passes towards the rectus muscle. In its progressive extension, the

hernial sac constantly follows the same track as the spermatic chord, since it is situated upon its anterior surface. As has been already explained, this chord crosses the epigastric artery; consequently, the hernial sac must necessarily pass with the chord above this artery; before protruding from the canal of the abdominal ring. At the same time, the internal orifice of the hernia becoming larger, and the inguinal canal shortened by the approximation of its two orifices to each other, it follows, that, at the period when the hernia begins to make its appearance in the groin, the epigastric artery is unavoidably situated behind the neck of the hernial sac, and is pushed from the outer to the inner side of the ring. Let us suppose a piece of string to be passed from the inside of the abdomen into the scrotum, all through the inguinal canal, and the middle of the hernia; and that this string is pulled so as to bring out the internal orifice of the hernia, which is situated beyond the point where the spermatic chord crosses the epigastric artery; this artery will immediately be found to be carried from the outer to the inner side of the neck of the hernial sac. The same thing happens from the effect of the enlargement of the hernia. The removal of the epigastric artery, from one side of the ring to the other (says Scarpa), is a phenomenon, which may be regarded as almost constant in the inguinal hernia. I have examined the bodies of a great number of subjects, affected with this species of hernia; and it has been only in a very few, that I met with the epigastric artery retaining its natural situation on the outer side of the abdominal ring. In investigating the reason of this exception, I have observed, in all the individuals who presented it, a very remarkable weakness and flaccidity of that part of the abdominal parietes, which extend from the ilium to the pubes. In all, the displaced viscera had passed through the aponeurosis of the transverse and internal oblique muscles; not in the vicinity of the ilium, as is commonly the case, but at a little distance from the pubes, giving to the upper pillar of the ring a curvature that is extraordinary, and disproportioned to the smallness of the hernia. I observed, also, that the neck of the hernial sac did not pass in an oblique direction, from the ilium to the pubes, but, that it protruded from the abdomen almost in a direct line from behind forwards. In short, in these individuals, the small cul-de-sac of the peritoneum, which constitutes the origin of the hernial sac, had not begun to be formed under the edge of the transverse muscle, at the point where the spermatic chord runs outward; but it had passed through the aponeurosis of the internal oblique and transverse muscles, at a little distance from the pubes, and within the point at which the spermatic chord crosses the epigastric artery. The small hernial sac, having at this part come into contact with and united to the spermatic chord, protruded at the external orifice of the inguinal canal, without displacing the epigastric artery from its natural situation.

"This species of hernia, properly speaking, is a mixture of the ventral and inguinal. It resembles the former, inasmuch as the hernial sac pierces the aponeurosis of the transverse and internal oblique muscles; the latter, inasmuch as it passes out at the abdominal ring, conjointly with the spermatic chord." (*Scarpa, Traité des Hernies*, p. 68, &c.)

Hesselbach particularly adverts to a triangular

space to be seen on the inside of the inguinal region: the inner boundary of it is formed by the outer edge of the rectus muscle; the lower by the horizontal branch of the os pubis; and the external shortest boundary by the epigastric artery. Now, says he, when it is considered, that this artery ascends obliquely inwards, between the inner opening of the inguinal canal, and the above triangular space, one cannot fail to know on which side of the neck of the sac the artery must lie in the two species of inguinal, as well as the femoral, hernia; for, in those hernie which originate in the above triangular space, this artery lies at the outer side of the neck of the hernial sac; while in every hernia that takes place through the inner opening of the inguinal canal, the same vessel is situated at the inner side of the neck of the sac. To one species of bubonocoele, Hesselbach applies the epithet *external*; and to the other, *internal*; according to the situation of the point at which they first protrude. By Sir A. Cooper, they are named *oblique* and *direct*, which are also very proper terms. The external inguinal hernia is much more frequent than the internal, and is said to occur oftener on the right than the left side of the body; a circumstance coinciding with another observation, viz. that, in children, the tunica vaginalis remains longer open on the right than the left side.

The circumstance of there being two forms of inguinal hernia formerly caused considerable perplexity: surgeons knew, that the epigastric artery lay sometimes at the inner, sometimes at the outer, side of the neck of the hernial sac, but knew not how to account for this variation. Hence arose the very different opinions about the proper method of dividing the ring when the hernia was strangulated; some authors directing the incision to be made obliquely inwards and upwards, and others, upwards and outwards. But, as a modern writer has judiciously remarked, had they paid greater attention to the direction of the swelling, formed by the neck and body of the hernial sac in the groin, and to the position of the spermatic chord, which is as inconstant as that of the epigastric artery; and had they dissected the parts in the diseased, as well as healthy state, they could not have failed soon to have suspected, that every inguinal hernia does not originate exactly at one and the same point. Though the internal bubonocoele had been occasionally noticed by surgeons many years ago, and Mr. Cline, in particular, saw an example of it in the year 1777, and always mentioned it in his subsequent lectures, yet the earliest satisfactory history of the differences of the two forms of inguinal hernia was given by Sir A. Cooper, in his great work on hernia; and the tract, in which Hesselbach pointed out the nature of the internal bubonocoele in a very particular manner, I believe is the next publication in which the subject is explained. (*Anat. Chir. Abhandlung über den Ursprung der Leistenbrüche*, Wurz. 1806; and *Neueste Anat. Pathol. Untersuchungen über den Ursprung, &c. der Leisten- und Schenkelbrüche*, 4to. Wurz. 1814. p. 18. 26. 28., &c.) According to the latter author, since each form of inguinal hernia, also, presents characteristic appearances externally, the surgeon can have no difficulty in determining the species of hernia; which discrimination must be highly important in the taxis, the application of a truss, and especially the operation. The sac of the external scrotal hernia can

only pass down within the expansion of the cremaster as far as this part is separate from the chord and tunica vaginalis. Hence, the testis, covered by its tunica vaginalis, lies under the lowest part of the hernial sac, while the vessels of the spermatic chord, in a more or less separated form, are situated behind the posterior part of the sac; viz. the spermatic veins externally, and the vas deferens internally, and the artery in the middle. Should the hernia descend still farther, the testis being included as well as the sac within the tendinous expansion of the cremaster, it cannot glide out of the way, but must be pressed still further downwards by the sac, so as to continue invariably under its fundus, but sometimes inclined a little behind it. (*Hesselbach*, p. 34.) And, as the same author justly observes, the position of the spermatic chord and testis, and the oblique direction of the swelling in the external species, are the two strongest characters, by which every case of inguinal hernia may be discriminated. I know of only one direct case, in which the chord was behind the sac, as in the common external bubonocoele: it was seen by Mr. Lawrence. (*On Ruptures*, p. 210. ed. 4.)

Although the spermatic chord, in the external bubonocoele, commonly lies behind, or under, the hernial sac, there are cases in which the vas deferens is found on the outer side of it, while the rest of the spermatic chord lies, as it usually does, on the inner side, or rather under it. (*Sir A. Cooper*.) Le Dran, Schmorck, and Blizard, found the whole chord situated in front of the sac. Sometimes the vas deferens runs on the front and inner part, and the rest of the chord on the back and external part of the swelling. (*Camper, Hey.*) The chord has been known to be before, and the vas deferens behind, the sac. (*Camper, Sir A. Cooper.*)

Upon this part of the subject, the reader may deem the following passage interesting:—"While the hernia is of moderate size (says Scarpa), the surrounding cellular substance is not very greatly compressed, and no change is observed in the situation of the spermatic vessels. The artery and veins of this name always form, with the vas deferens, one single chord, which is intimately adherent to the posterior surface of the hernial sac. But, in proportion as the tumour increases in size, the cellular substance, which immediately surrounds it and unites it to the spermatic chord, is more and more distended and compressed. At length, at a certain period, the distention is carried to such a pitch, that the spermatic vessels are separated from one another, and change their position with respect to the hernial sac. This kind of gradual unravelling of the spermatic chord is quite similar to that, which would be produced by pulling the surrounding cellular substance in two opposite directions. Such is the reason, why, in scrotal hernia of large size, the spermatic artery, the vas deferens, and the spermatic veins, are found separated upon the posterior surface of the sac. All these vessels, instead of being conjoined in one chord, are divided by interspaces, which are sometimes very considerable. Ordinarily, the vas deferens is less separated from the spermatic artery, than from the vein of this name. In some subjects, Camper has seen it situated on one side of the sac, and the artery and veins on the other" (*Icones Herniarum*, tab. v. L. O. tab. viii. 1. 2.) The displacement and splitting of the spermatic

chord take place equally in adults and in children affected with large scrotal hernia. (*Camper, loco cit.*) In general, towards the upper part and neck of the hernia, the vessels are not much separated; but, as they proceed downwards, they diverge more and more. Sometimes, when the hernia is very old and bulky, they are no longer found at the posterior part, but rather at the sides, and even on the front surface of the sac; they show themselves through the cremaster muscle, which covers them, and form a kind of vascular train, which arrests the hand of the operator at the moment when he is about to open the hernial sac. Le Dran relates, that, in operating upon a large scrotal hernia, he found the spermatic chord on the anterior surface of the hernial sac. (*Opérations de Chir. p. 127.*) This fact has been the cause of numerous conjectures, and has appeared altogether inconceivable to such surgeons, as have not been acquainted with the changes, to which the spermatic chord is exposed, in cases of large scrotal herniæ. Lassus could not (*Méd. Opérat. t. i. p. 152.*) conceive the possibility of the occurrence. The observation of Le Dran is not the less true and exact: it exemplifies a very important fact, of which it is easy to give a true explanation, when the state of the spermatic chord, in ordinary inguinal herniæ, and in those which have obtained a considerable size, has been comparatively examined. In the first, the spermatic chord, quite entire, is always situated on the posterior surface of the hernial sac; but, in the second, the spermatic vessels are so separated from one another, that they sometimes extend the sides the fore part of it. (*Scarpa, Traité des Hernies, p. 61., &c.*)

When an oblique inguinal hernia is dissected, a fascia, of greater or less thickness, is found immediately under the skin and superficial fascia: it is often termed the *intercolumnar fascia*. Under this is the covering produced by the cremaster. When the integuments, superficial and intercolumnar fascia, and the cremasteric covering, have been removed, another investment is exposed, derived from the fascia transversalis, where it forms the internal ring, and called by M. Jules Cloquet, the *funnel-shaped sheath*. Within this is the hernial sac itself, composed of peritoneum.

It is observed by Professor Scarpa, that "the cremaster muscle, in cases of old large scrotal herniæ, acquires a thickness, which is really surprising. Its fibres, which are naturally very thin, become from four to six times more considerable. Being spread over the neck and body of the hernial sac, they sometimes present a remarkable consistence, and a yellowish colour. Such alteration, however, does not prevent the muscular texture from being discovered; and Haller was not mistaken about it." (*Opusc. Patholog. p. 317.*) Pathology furnishes us with several examples of similar changes of organisation. In certain cases, the muscular coat of the bladder, that of the stomach and intestines, and even the exceedingly delicate fleshy fibres of the ligaments of the colon, are found to have become yellow, and much thickened.

In old scrotal herniæ (says Scarpa) it is not unusual to find an intimate adhesion of the fibres of the cremaster muscle to the edges of the abdominal ring. This may depend on the pressure,

which the contents of the hernia make on those edges, and perhaps it may also depend on the union of the cremaster muscle with the prolongation of the aponeurosis of the fascia lata, which is continued from the margins of the ring to the groin and scrotum. Howsoever it may be, certain it is, that in old large scrotal herniæ, there is much difficulty in introducing a probe between the fleshy fibres of the cremaster and the margin of the abdominal ring; and that, on the contrary, in recent herniæ, a probe passes as easily between the edges of the ring and the cremaster, as between this muscle and the hernial sac.

With regard to the sheath, formed by the cremaster muscle, in which are inclosed the hernial sac, the spermatic chord, and the tunica vaginalis of the testicle, Sharp (*in Critical Inquiry*) and Mouro, the father, (*Anat. and Chirurg. Works, p. 558.*) were the first to dwell upon this important pathological point. Monro had seen the cremaster muscle covering the hernial sac; but, he did not believe, that the same thing occurred in all individuals affected with inguinal hernia. In this respect he was mistaken; for this disposition of the cremaster muscle is one of the essential characters of the disease. Petit has not omitted to describe the relations, which exist between the cremaster and the hernial sac. (*Euvres Posthum. t. i. p. 288.*) On this subject, he even relates an interesting fact, from which it results, that, in certain cases, this muscle may, by its contractions alone, cause a reduction of the hernia; a fact also noticed by M. Jules Cloquet. (*On Inguinal and Femoral Hernia, tr. by M. Whinnie, p. 10.*) Gunz explains, with tolerable perspicuity, how the cremaster and its aponeurosis form one of the coverings of the inguinal and scrotal hernia. (*Libellus de Hernis, p. 50.*) Morgagni once saw its fleshy fibres extended over the hernial sac. (*De Sed. et Caus. Morb. epist. xxxiv. art. 9.; epist. xxxi. art. 15.* See Scarpa, *Traité des Hernies, p. 48, 50.*)

Scarpa concurs with Sir Astley Cooper, respecting the fact of the peritoneal hernial sac not being in general perceptibly thickened. In a very enormous hernia, the pressure of the contents is so great, that instead of thickening the sac, it renders it thinner, and even makes it ulcerate. The protruded viscera have been met with immediately beneath the integuments, when the sac has been burst by a blow. (*Cooper, J. L. Petit.*)

The outer surface of the peritoneal part of the hernial sac, is always most closely adherent to the other more external covering, by means of cellular tissue. This connection is formed so soon, after the first occurrence of a hernia, that any chance of returning a hernial sac into the abdomen has generally been considered as chimerical. There must, however, be a certain space of time before adhesions form, though it must be exceedingly short. Upon this point Scarpa observes, that in recent and small inguinal herniæ, the intestine, strungulated by the neck of the hernial sac, has been known, in more instances than one, to have been reduced by the taxis, and carried with it the whole of the sac into the abdomen. Observations, not less authentic, inform us, that, after the operation for hernia, when the viscera could not be reduced on account of their adhesions to the sac, they have been seen, notwithstanding such adhesions, to get nearer to the ring daily, and, at

length, spontaneously to return into the belly together with the hernial sac. M. Louis, he thinks, was wrong in denying the possibility of these facts. (*Acad. Royale de Chir. t. xi. p. 486.*)

Scarpa argues, that, "under certain circumstances, the cellular tissue will bear, without laceration, a considerable elongation, and afterwards shrink again. Thus, we often see a viscus, which has suffered a considerable displacement, return spontaneously into its natural situation. In inguinal hernia, the spermatic chord is elongated, and descends farther than in the natural state. No laceration of the cellular tissue, however, is then occasioned; for, if the hernia be kept reduced, the spermatic chord becomes shorter, daily retracts, and at last, has only the same length, which it had previously to the disease. When a sarcocele becomes large and heavy, the portion of the spermatic chord naturally situated within the belly, is by degrees drawn out into the scrotum; but, after the tumour is extirpated, this portion ascends again, and of itself returns into its original situation. The same thing happens after the operation for strangulated inguinal hernia. The hernial sac retracts and reascends progressively towards the ring. This alone would prove, that the cellular tissue which surrounds the spermatic chord, and unites it to the hernial sac, is highly endued with the property of yielding, and afterwards returning to its original state. Can the same property be refused to the cellular tissue which unites the sac to the surrounding parts?"

"While the inguinal hernia is recent, and not of much size, the cellular tissue in question possesses all its elasticity, and hence, the hernial sac and the spermatic chord may easily ascend towards the abdominal ring. I have had occasion (says Scarpa) to make this observation upon the dead body of a man, who had an incipient inguinal hernia. The small hernial sac was capable of being pushed back into the ring with the utmost facility; and in carefully examining the parts, both within and without the belly, it appeared to me, that the cellular substance, which united the sac to the spermatic chord and cremaster muscle, was disposed to yield equally from without inwards, and in the direction precisely opposite; that is to say, it made an equal resistance to the protrusion and the reduction of the hernial sac. Monteggia has seen a case exactly similar; although, according to his own expressions (*Institut. Chirurg. t. iii. sec. 2. p. 249.*), the hernial sac was not very small, it adhered very loosely to the surrounding parts, and it admitted of being entirely reduced into the abdomen with great facility."

In large old scrotal hernia, Scarpa allows, that such reduction is quite impracticable:—"In these, the cellular tissue which unites the sac to the spermatic chord and cremaster muscle, has acquired such a density, that it does not oppose less resistance to the further enlargement of the hernia, than to the efforts of the surgeon who endeavours to effect its reduction." (*Scarpa, Traité des Hernies, p. 57, &c.*)

In the dead subject, Cloquet found the sac of a direct inguinal hernia reduced into the abdomen, whither it seemed to have been drawn by a piece of omentum adherent to what had, in its protruded state, been its funulus. (*Recherches sur les Causes, &c. des Hernies, p. 102.*) The investigations of the same author prove, that complete or incom-

plete inversions of the sac may also happen in the femoral and direct inguinal hernia, without the existence of any adhesion; but that the intimate union between the sac and spermatic chord hinders the event in external or common inguinal ruptures. Le Dran dissected a case, in which the sac of a femoral hernia, with its contents, had been returned into the abdomen in a mass. Dupuytren saw a similar case. (*Clin. Chir. t. i. p. 559.*) And in another place, he states, that he had seen forty instances of herniæ being returned in a mass, without any abatement of the bad symptoms. (*P. 564.*) The observations of Cloquet also tend to confirm the possibility of the latter occurrence, which he describes as happening with more facility in the internal or direct inguinal rupture, than in the crural, and with most difficulty in the external or oblique inguinal hernia.

In females, when a bubonocoele occurs (which is uncommon), the round ligament of the uterus bears the same relation to the tumor, as the spermatic chord in males. According to Sir Astley Cooper, the sac is much more considerable above the abdominal ring than below it; and hence difficulty in the operation. All the cases which he has seen have been intestinal. The stricture is, in almost all cases, at a considerable distance above the abdominal ring; it may be divided upwards, or outwards, with safety, as the epigastric artery is situated more towards the linea alba. (See *Lancet*, vol. ii. p. 172.)

Mr. Lawrence had a very rare instance pointed out to him, in which a bubonocoele in a female was situated on the inner side of the epigastric artery. On the 12th of March, 1831, I operated upon Mrs. Smith, of No. 14, Cumberland-street, Middlesex Hospital, for a strangulated internal bubonocoele: she recovered in the most favourable manner. A still rarer case was examined by Hesselbach: it was not only an example of internal bubonocoele in a woman, but of one in which the epigastric artery arose from the obturator artery an inch from the origin of this latter vessel from the inner side of the external iliac; the obturator first passed an inch obliquely downwards and inwards over the crural vein, and immediately afterwards, on the horizontal ramus of the pubes, made a sudden turn backward and downward to the obturator foramen; and at this bend arose the epigastric artery, which ran transversely inward along the horizontal ramus of the pubes, behind the neck of the hernial sac, at the inner side of which it ascended to the rectus muscle, accompanied by the ligamentous remains of the umbilical arteries, which were close behind it. (*Ueber den Ursprung, &c., der Leisten-und-Schenkelbrüche, p. 17.*)

MARKS OF DISCRIMINATION BETWEEN INGUINAL HERNIA AND OTHER DISEASES.

The disorders in which a mistake may possibly be made, are *Varicocele*, *Bubo*, *Hydrocele*, and *Hernia Humoralis*, or *Inflamed Testicle*.

For an account of the manner of distinguishing the first complaint from a bubonocoele, see *VARICOCELE*.

"The circumscribed incompressible hardness, the situation of the tumour, and its being free from all connection with the spermatic process, will sufficiently point out a bubo, at least while it is in a recent state; and when it is in any

degree suppurated, he must have a very small share of the *tactus eruditus*, who cannot feel the difference between matter, and either a piece of intestine, or omentum.

"The perfect equality of the whole tumour, the freedom and smallness of the spermatic process above it, the power of feeling the spermatic vessels and the vas deferens in that process, its being void of pain upon being handled, the fluctuation of the water, the gradual formation of the swelling, its having begun below and proceeded upwards, its not being affected by any posture or action of the patient, nor increased by his coughing or sneezing, together with the absolute impossibility of feeling the testicle at the bottom of the scrotum, will always, to an intelligent person, prove the disease to be a hydrocele." The transparency of a hydrocele is also another criterion. Mr. Pott, however, allows that there are some exceptions, in which the testicle cannot be felt at the bottom of the scrotum, in cases of hernia.

In recent bubonocoeles, while the hernial sac is thin, has not been long, or very much distended, and the scrotum still preserves a regularity of figure, the testicle may almost always be easily felt at the inferior and posterior part of the tumour. But, in old ruptures, which have been long down, in which the quantity of contents is large, the sac considerably thickened, and the scrotum of an irregular figure, the testicle frequently cannot be felt, neither is it in general easily felt in the *congenital hernia* for obvious reasons."

On one point, Sir Astley Cooper differs from Mr. Pott. "The hydrocele," he observes, "involves the spermatic chord and testes, so as to render them with difficulty distinguished by the touch; whilst, in hernia, they may in general be readily felt behind the tumour." The discrepancy may be reconciled by supposing that one of these eminent surgeons is speaking of a hydrocele of great size, which obscures the chord and that the other is alluding to the disease in a less advanced stage. Sir Astley Cooper has seen cases of hydrocele, "in which there was unusual difficulty in deciding upon the nature of the complaint. When it becomes so large as to extend upwards through the abdominal ring to the abdomen, the form of the tumour is precisely the same as that of hernia; and it even dilates when the patient coughs, owing to the sudden pressure upon that part of it which lies above the ring. The transparency, the fluctuating feel, and the observed progress of the swelling from below upwards, are then the only distinguishing marks.

"A tumour sometimes appears in the scrotum, which descends in the erect posture, returns when the body is recumbent, distends upon coughing, fluctuates, and is transparent. This disease is a collection of water, which runs backwards and forwards, between the cavity of the abdomen and that of the tunica vaginalis, owing to the opening of this membranous sheath never having been closed. When this disease is complicated with ascites, the part becomes distended to an enormous size. It is readily distinguished from a hernia by its transparency and fluctuation." (See *A. Cooper on Hernia*, part i. p. 16. ed. 2.)

Hydrocele of the spermatic cord is another case still more likely to be mistaken for a hernia than the common form of hydrocele. See HYDROCELE. When situated entirely below the ring, its want of

connexion with the abdomen makes it readily distinguishable from a hernia; but when it passes within the ring to the abdomen, some difficulty occurs in understanding its nature. If there is no transparency, and the fluctuation is indistinct, the surgeon should be very cautious in operating on such a tumour.

Sir Astley Cooper was requested to see a boy, who had a tumour, extending from the upper part of the scrotum through the abdominal ring, along the chord to the abdomen; but it did not project sufficiently to enable Sir Astley to judge whether there was either fluctuation or transparency. However, as the tumour interfered with the boy's pursuits, he cut down upon it with extreme caution. When he had reached the surface of the cyst, he found the spermatic vessels running upon it, and was obliged to open the lateral portion of the cyst to avoid them. This sac contained a piece of small intestine, every where adherent to its inner surface, so as to have prevented reduction. The vas deferens was felt behind the sac. The hernia had, therefore, insinuated itself between the spermatic blood-vessels and the vas deferens. (See *A. Cooper on Hernia*, ed. by C. Aston Key, part i. p. 61.)

Dr. J. B. Davidge, late professor of anatomy in the University of Maryland, had frequently been consulted by persons who had been wearing trusses for years, while their disease was merely hydrocele of the chord; and, in one case, the sac had been burst by the violent efforts made to reduce it. Dr. Reese of New York, has also known this mistake committed in several instances. In another, a surgeon, deceived by such a hydrocele happening to be attended with long and obstinate constipation, nausea, vomiting, hiccough, abdominal distention, pain in the tumour, &c., dissected down to what he supposed to be the hernial sac, and divided the tendon of the external oblique, when the hydrocele gave way and its contents were discharged. (*Amer. ed. of this Dict.*) It seems extraordinary that the surgeon in this case should have divided the abdominal ring, before he had opened the sac, or ascertained the situation of the stricture, so as to know whether the tendon of the external oblique required to be cut or not. The operation of opening the cyst of the hydrocele, though performed unawares, was only a common method of cure, and, in fact, ended in it. The manner of proceeding I am unable to account for, unless it was intended to try Petit's plan of cutting the stricture and reducing the hernia, without opening the peritoneal sac at all.

In the *hernia humoralis*, the pain in the testicle, its enlargement, the hardened state of the epididymis, and the generally preceding gonorrhoea, are circumstances fully elucidating the diagnosis. The observation of Pott, that in inflammation of the testicle, the spermatic chord is exempt from all unnatural fulness, is not correct. I have known it enormously swollen and accompanied by obstinate constipation and vomiting. indeed, the swelling, when the case arises from gonorrhoea, mostly commences in the chord. "Nothing," says Sir Astley Cooper, "but great want of attention can cause a hernia to be confounded with an enlargement of the testis. This latter is sufficiently distinguishable, not only by the absence of symptoms, characterising hernia," but also by the form of the gland, its weight, the pain, and that peculiar and intoler-

able sensation always produced by pressure on this organ. (*Obs.*)

Hæmatocele is recognised from a hernial tumour by adverting to its cause, which is a wound or contusion of the scrotum; its firmness; the attendant dark redness of the skin; its freedom from impulse when the patient coughs, and of the upper part of the chord from swelling. (*Sir A. Cooper, ib.*)

Hernia may be complicated either with hydrocele, or sarcocele. Sir A. Cooper mentions an instance in which there was on each side a diseased testicle, and a hydrocele communicating with the abdomen. (*On Hernia, ed. 2. part i. p. 17.*) See HYDROCELE.

INGUINAL HERNIA WITHIN THE CANAL.

When the parts only protrude into the inguinal canal, and not out of its lower aperture, they are covered by the aponeurosis of the external oblique muscle. The transverse and internal oblique muscles pass over the neck of the hernia, and cause the strangulation when it happens. The tumour is small; for, if the protrusion increases, the parts escape through the lower opening of the canal. Exceptions, however, are on record. Thus, Mr. Lawrence dissected a case in a female, where the aponeurosis of the external oblique was distended by a swelling equal in bulk to two fists, while another portion of the sac, as large as an egg, projected through the ring. Hesselbach's 8th plate also represents a hernia within the canal, of considerable size, in a female. As, in the ordinary circumstances of this form of inguinal hernia, there is no very manifest swelling, the case is no doubt often looked upon and treated, as Sir Astley Cooper remarks, as an inflammation of the bowels. (*On Inguinal and Congenital Hernia, p. 48.*)

When an inguinal hernia does not descend through the abdominal ring, but only into the canal for the spermatic chord, it is covered by the aponeurosis of the external oblique muscle, and the swelling is small and undefined.

Now and then, the testicle does not descend into the scrotum till a late period, and its first appearance at the ring, in order to get into its natural situation, may be mistaken for a hernia: unless the surgeon pay attention to the absence of the testicle from the scrotum, and the peculiar sensation occasioned by pressing the swelling.

POINTS OF DIFFERENCE BETWEEN THE EXTERNAL AND INTERNAL INGUINAL HERNIA, &c.

According to Hesselbach, the characteristic marks of the external bubonocoele and scrotal hernia, are: 1st. The direction of the tumor in the groin. 2dly. The fleshy fibres of the cremaster. 3dly. The position of the spermatic chord and testis. 4thly. The situation of the epigastric artery. 5thly. The origin of the hernia itself. 6thly. A preternatural shape of the body of the hernial sac.

1. The neck of the hernial sac, distended by the protruded viscera, raises up the front side of the inguinal canal, and superincumbent integuments, into an oblong swelling, which extends obliquely inwards and downwards towards the abdominal ring, and terminates in the tumor, formed by the body of the hernial sac. From its origin it becomes gradually more prominent and broad; and the greater the quantity of viscera protruded, and the larger the body of the sac, the more manifest

is this oblique swelling, particularly when the neck of the hernia is of its natural length. In strangulated cases, the direction of the tumor is still more striking, every part of the hernial sac being then considerably distended. When the inguinal canal, and of course the neck of the hernial sac, are shortened, the swelling undergoes a proportional diminution in its length; and then its resemblance to the tumor attending an internal inguinal hernia, where the opening through which the parts pass is long and slanting, is so great, that the cases can only be discriminated by one circumstance, viz., the situation of the spermatic chord; and even this criterion is of course wanting in females. (*Hesselbach, p. 57, 58.*) Hesselbach clearly explains, that the obliquity of the swelling is seated in the neck of the hernial sac. He observes, that when an internal bubonocoele in a female subject passes into the labium, the descent takes place in a very sloping direction inwards, and therefore may at first be supposed to be an external case. But, on further examination, the oblique swelling will be found to occupy the body of the hernial sac, and to reach upwards and outwards from the labium to the abdominal ring. Now, this hernia cannot be mistaken for an external bubonocoele, the course of which from the ring is obliquely upwards and outwards. As Sir Astley Cooper has remarked, if there be any obliquity of an internal or direct inguinal hernia, it will incline towards the linea alba.

Hesselbach reminds us, that an internal inguinal or scrotal hernia may be conjoined with an external incomplete bubonocoele; a kind of case easily made out with a little attention; for the place of division between the two sacs is indicated by a more or less deep groove. The nature of the disease will also be still clearer, if one of the tumors admit of reduction. A specimen of such a double hernia is to be seen in the museum at Würzburg.

It is further noticed by Hesselbach, that when the situations of the external and internal hernia are compared, the first of these swellings will be found to be rather further than the other, from the symphysis of the pubes; a difference ascribed to the effect of the internal oblique muscle, the lower fibres of which, attached to the horizontal ramus of the pubes, run in a curved direction transversely over the anterior and inner part of the neck of the hernial sac, and are applied so closely to it, that it cannot approach quite so much towards the symphysis of the pubes, as the neck of the internal bubonocoele does. The muscular fibres in question are situated directly behind the inner pillar of the abdominal ring.

2. Most of the fibres of the cremaster lie on the back of the neck of the sac, but others are also scattered over its external and internal sides. Some fibres may also be perceived on its fore part, which are remarkable, because they run in a transverse curved direction with their convexity downwards, and two fasciculi of which descend below the abdominal ring. These are the fibres of the cremaster, which proceed within the ring transversely upwards over the spermatic chord, and are pushed out of that opening by the hernial sac. These arched fleshy fibres are not always, though generally, perceptible; and, when they are present on the fore part of the hernial sac, Hesselbach accounts them a sure criterion of an external scrotal

hernia; but, he has not yet ascertained, whether they are visible, while the rupture is confined to the groin.

3. The spermatic cord passes behind the oblique hernia, and not on the outer side of it, as in a direct case.

4. The situation of the epigastric artery, and its displacement inwards by the neck of the sac, of an oblique hernia, have been sufficiently explained.

5. With respect to the mode in which the oblique hernia originates, the disease sometimes takes place suddenly, without any exciting cause being observed, capable of accounting for the effect. Here, says Hesselbach, the predisposing cause must have been great. In this quick manner, the congenital hernia, which is one of the oblique cases, frequently arises. The direct inguinal hernia is observed mostly to take place very suddenly, yet only after violent occasional causes. Sir Astley Cooper records two cases from external violence: one in a gentleman who received a blow on the groin in riding; the other in a boy, in consequence of a kick from his schoolmaster. In the greater number of cases, he has found the direct inguinal hernia accompanied by diseases of the urethra. "One of the specimens (says he) in my possession, contains six herniæ of this kind." After death, several strictures were met with in the urethra, behind one of which a stone was impacted. (*On Abdominal Hernia*, part i. p. 67.)

6. A preternatural form of the body of the hernial sac, Hesselbach remarks, is particularly seated in the sheath of the spermatic cord, and can never happen in the internal or direct scrotal hernia; for, it is only in oblique cases, that the above sheath is ever converted into the hernial sac. Hesselbach here refers to the partial contraction, often noticed at the lower part of the above sheath in cases of congenital hernia; a circumstance, which is always discovered previously to the business of dividing the ring.

In adults, an oblique inguinal, or scrotal hernia, on the right side, contains some of the ileum, and, when the swelling is large, it may include the cæcum, and sometimes a piece of omentum. In one child, ten weeks old, and in another still younger, the appendix vermiformis was protruded and connected by a natural band to the posterior side of the peritoneum. When, in these ruptures of the right side, the cæcum, or, in those of the left, the colon, are met with closely adherent to the hinder side of the hernial sac, the adhesion is not to be looked upon as the effect of disease, since it is the perfectly natural connection of those bowels with the peritoneum. On the left side, the parts most commonly protruded, are the colon and omentum.

With regard to the internal, or direct inguinal hernia, the place of its first protrusion has been already described. The protruded peritoneum and viscera, according to Hesselbach's account, pass from behind straight forwards, between the fibres of what he names the internal inguinal ligament, and the fleshy fibres of the internal oblique muscle: they then pass, at the inner side of the spermatic cord, out of the abdominal ring, where the hernia presents a circular globular swelling, suddenly formed in consequence of some violent effort. The neck of the hernial sac is very short; shorter, than it can ever be in an oblique inguinal hernia; and, when the tumour is of the above shape,

the passage through which it passes is angular, narrower in some instances, than others, and its margin is tendinous. Sir Astley Cooper has never known it acquire a size equal to that which the oblique inguinal hernia sometimes attains. (*On Abdominal Hernia*, part i. p. 67.) From the few cases, which Hesselbach has seen of this form of the disease, he is also led to believe that the hernial sac is rarely so large as in the oblique inguinal hernia. (P. 41.) According to Sir Astley Cooper, the direct inguinal hernia occurs when the tendon of the transversalis is unnaturally weak, does not exist at all, or has been broken. (*On Inguinal Hernia*, p. 51.) Cloquet states, that the sac either propels before it, and thus receives a covering from the fascia transversalis, or passes through an opening in it. (*Recherches Anat.* p. 83.) In another work, he gives the particulars of a direct inguinal hernia of the right side, where the protrusion took place through a laceration in the fascia transversalis. (*Pathologie Chirurgicale*, p. 126.) Mr. Lawrence dissected a case, where the fascia was neither thinner than usual nor broken, but it had been protruded before the peritoneum, and formed a thick aponeurotic covering to the hernial sac. Mr. Stanley has always found it thus covered; and some specimens, illustrative of the fact, have been placed by him in the museum of St. Bartholomew's Hospital. (*On Ruptures*, p. 209. 211. ed. 4.) According to Langenbeck, this is the usual state of the parts. (*Comment* § 105. tab. 17, 18, & 19.) Examined by accurate dissection, the course of the direct inguinal hernia appears to Sir Astley Cooper to be as follows:—"The sac first appears between the fibres of the tendon of the transversalis, nearly an inch directly above the ring, generally protruding before it the fascia transversalis. It then passes under the lower edge of the tendon of the internal oblique muscle. The epigastric artery runs upon the outer side of the hernial sac. The spermatic cord has no connection with it above the ring. The hernia then emerges from the abdominal ring, the spermatic cord being on its outer side, and it is covered with the fascia given off by the tendon of the external oblique, but not by the cremaster muscle." (*On Abdominal Hernia*, part i. p. 67. ed. 2.) There is some diversity in the descriptions given of the coverings of the direct inguinal hernia. In the dissection of a double scrotal hernia by Mr. Todd, where both protrusions were of the direct kind, "the cremaster muscle, on one side, was distinctly spread out on the fore part of the sac; while, on the other side, the character of the muscle was completely lost." (See *Dublin Hospital Reports*, vol. i. p. 231.) In a case described by M. Jules Cloquet, the coverings were besides the integuments and superficial fascia, 1. the intercolumnar fascia; 2. fleshy and aponeurotic fibres of the internal oblique muscle; 3. a thin fibro-cellular covering derived from the margin of a lacerated opening, in the fascia transversalis, by which the hernia had escaped; 4. the hernial sac itself. (See *Jules Cloquet, Pathologie Chir.* p. 126. 4to.) In general, if the hernia is at all covered by the cremaster, it can only be just at its outer part, as represented in the plate in Sir Astley Cooper's great work. (See p. 70. part i. ed. by Mr. C. Astor Key.) There must necessarily be some variety in the number of coverings of this hernia, in different cases, according to the circumstance of its being attended, or not, with a laceration.

tion of the conjoined tendon of the internal oblique and transverse muscles. If weak, they may yield and form a covering. Sometimes, however, as already stated, the tendon of the transverse muscle is lacerated, and the hernia passes out, under that of the internal oblique. The fascia transversalis may be completely lacerated, or it may be dilated into another investment. We may say, then, that the direct hernia is at all events not much covered by the cremaster, but that it may have one covering which the oblique hernia has not; namely, that which is formed by a weak and dilated portion of the tendon of the transversalis muscle. In other respects, the coverings of the two herniæ are alike. The earlier dissections made by Hesselbach, led him to suppose, that the opening, through which the protrusion happens, is always annular, and the swelling in front of the ring globular; but subsequent cases, which he has met with, have informed him, that the opening is frequently sloping and longish; in which circumstance, the resemblance of the tumour to that of the external bubonocoele with a shortened neck, is such, that the only mark of distinction between the two cases is the position of the spermatic cord. In females, even this criterion is of course deficient. (*Hesselbach*, p. 57.) Though individuals of almost every age are subject to internal bubonocoeles, they are much less common, than external cases. According to Hesselbach, they may be known by the following characters:—1. The swelling, formed by the body of the hernial sac, immediately in front of the abdominal ring. 2. The situation of the spermatic cord. 3. That of the epigastric artery.

1. The neck of the hernial sac, besides being very short, does not, like that of an external inguinal hernia, take an oblique direction, but advances straight from behind forwards, through the abdominal ring; and, as the body of the sac lies directly over the neck, none of the swelling formed by the distension of the latter part can be felt; nor does any other tumour, produced by the body of a hernial sac, ever cause a circular spherical swelling directly before the abdominal ring. The situation of the neck of this kind of hernia must already apprise us, that the internal bubonocoele is nearer than the external to the symphysis of the pubes; or, as Sir Astley Cooper states, the tumour below the abdominal ring is situated nearer the penis, than the swelling caused by an external or oblique inguinal hernia. (*On Abdominal Hernia*, part i. p. 67. ed. 2.) In women, the shape of the tumour is the only character, by which the case can be distinguished. (*Hesselbach*, p. 43.) Above the abdominal ring, as Sir Astley Cooper has explained, "the sac passes directly upwards, so that no part of it takes the usual oblique direction towards the anterior superior spinous process of the ilium, but rather the contrary direction towards the linea alba."

2. The spermatic cord passes on the outer side of the direct inguinal hernia, instead of behind it, as in oblique cases, particularly at and above the abdominal ring. (See Sir A. Cooper, *Op. cit.* part i. p. 67. ed. 2.) Hesselbach describes the cord as lying either upon the outer side, or outer half of the fore part of the upper portion of the hernial sac, the blood-vessels forwards, and the vas deferens backwards. When the sac is adherent to the whole length of the cord, the testis is not situated, under the fundus of the sac, as in the

oblique scrotal hernia, but either at the fore part or outer side of the body of the sac. The hernial sac, as far as the abdominal ring, is excluded from the common peritoneal covering of the spermatic cord; but, at this opening, it descends between the cord and the internal thin part of the sheath of the cremaster, which, however, is somewhat stronger towards the front and outer side of the hernia, over which part alone the fleshy fibres of the cremaster are spread. (*Hesselbach*, p. 44.)

3. The epigastric artery always ascends obliquely inwards at the outer side of the neck of the hernial sac. Hesselbach has never seen but one case of internal bubonocoele, in which there was a deviation from this rule. The example has been already mentioned; and was one in which the epigastric artery arose from the obturator about an inch from the origin of this last vessel. The viscera, usually contained in an internal inguinal or scrotal hernia, on the right side, are the lower part of the small intestines, and sometimes omentum; on the left, a part of the small intestines, frequently omentum, and, when the tumour is large, the colon may also protrude. A protrusion of the bladder may accompany the disease, but that organ is of course always excluded from the cavity of the hernial sac. When the remains of the umbilical cord are situated more outward than usual, and lie over the centre of the space, at which the protrusion happens, an internal bubonocoele may be double, the prolapsus happening on each side of that ligamentous substance, which is itself also pushed outwards. In consequence of the accidental presence of some very strong tendinous fibres at the centre of the fascia, called by Hesselbach the internal inguinal ligament, there may also be two distinct protrusions, with separate hernial sacs. (P. 46.)

When the surgeon, by a due consideration of the foregoing circumstances, has formed a judgment respecting the nature of the hernia, he will be better qualified to regulate the treatment of the case. Thus, in the external inguinal hernia, he will know that the pressure employed for the reduction of the bowels should be made in the direction of the neck of the hernial sac, viz. obliquely upwards and outwards, towards the anterior superior spinous process of the ilium; but, that when the neck of the same kind of hernia is very short, and the posterior side of the inguinal canal has been removed, the pressure should be made nearly in a straight line from before backwards. For what Hesselbach terms the long-necked external inguinal hernia, the pad of a truss should be so constructed as not merely to press upon the abdominal ring, but also upon the neck of the sac and the inner opening of the inguinal canal. But, when the neck of the hernia is very short, the pad should be nearly of the same form, as that required for an internal inguinal hernia. (*Hesselbach*, p. 38.; and *Brünninghausen, Gemeinnütziger Unterricht über die Brüche*, &c. Würzb. 1811.) For this last case, or the direct inguinal hernia, Sir Astley Cooper recommends the truss to be longer, than for an oblique bubonocoele, because the hole, through which the sac emerges from the abdomen, is one inch and a half farther inwards towards the pubes. (*Op. cit.* part i. p. 67.) In attempting the reduction of an internal inguinal hernia, the pressure should be directed nearly straight backwards; and

the pad of the truss should only act upon the abdominal ring. (*Hesselbach*, p. 46.) The direction given by Sir Astley Cooper is, that the tumour should be grasped with one hand, "but the fingers of the other are to be placed at the abdominal ring to knead the hernia at that part, directing the pressure upwards and inwards, instead of upwards and outwards." (*Id.*) It is a case in which the intestine often continues strangulated after the reduction within the ring. (*Sir A. Cooper*; see *Lancet*, vol. ii. p. 142.)

OPERATION FOR STRANGULATED INGUINAL HERNIA.

Sir Astley Cooper particularly recommends operations for strangulated hernia to be performed before any peritoneal tenderness exists, which renders the issue very doubtful, though the parts be liberated by the division of the stricture. Such tenderness is not to be confounded with the tension produced by the inflation of the intestines. (*On Abdominal Hernia*, part i. p. 36. ed. 2.) "The hernia of the very young and the very old require the operation less frequently than those of the middle period of life, when the fibres are firmer and the muscular strength more robust. In the tenderness of youth and the relaxation of age, the reduction of the hernia by the taxis is almost always practicable; and it is principally in old persons that much time elapses before the strangulation produces fatal effects; the period of their sufferings having been known to be protracted to twenty days. (*Sir A. Cooper*, *Op. cit.* part i. p. 37. ed. 2.)

The operation consists in dividing the integuments; dissecting down to the sac, and opening it, removing the stricture, and replacing the protruded viscera. The hair is first to be shaved from the pubes.

The external incision should begin an inch above the external angle of the ring, and extend over the middle of the tumour to its lower part; except when the swelling is large, in which circumstance, the cut need not extend so far down, as will be presently noticed. The advantage of beginning the wound so high is to obtain convenient room for the incision of the stricture. By this first cut the external pudic branch of the femoral artery may be divided: it crosses the hernial sac near the abdominal ring, and sometimes bleeds so freely as to require to be immediately tied. In general, however, a ligature is unnecessary.

When this incision is carried low down, the caution given by Camper should always be remembered, viz., that there is a possibility of dividing the spermatic vessels, should they happen to be situated, as they sometimes are, in front of the hernia. And, in order to avoid such an accident, which is particularly apt to occur in cases of internal inguinal or scrotal hernia, the incision through the skin should be made obliquely downwards and inwards. (*Hesselbach*, p. 46.) The division of the integuments brings into view the fascia, which is sent off from the tendon of the external oblique muscle, and covers the hernial sac.

The layers of tendinous fibres, cellular substance, &c. intervening between the skin and sac, should be carefully divided, one after another, with the knife and dissecting forceps; the edge of the former instrument being turned horizontally, lest the incisions be carried too deeply at once, and the viscera contained in the sac wounded.

After making a small opening through a part of the fascia covering the sac, some practitioners introduce a director, and divide this fascia upward and downward, as far as the tumour extends. The same manner they next pursue with regard to the cremaster muscle. Thus the sac becomes completely exposed. When this method is followed, Sir A. Cooper advises the incisions not to be carried upward nearer than one inch to the abdominal ring, for reasons which will be presently explained.

However, it may be rationally doubted whether there is any good in these formal and successive divisions of the whole length of the coverings of the sac, and it is certain that they protract the operation; for the manner in which the sac adheres to the outer investment of it, prevents the latter from being raised and cut without trouble and delay. As the grand object, after the skin has been divided, is to make a small opening into the sac sufficient for the introduction of a director, dissecting down at one particular place answers every purpose, and enables us, in the end, to lay open the whole of the sac and its coverings in the shortest time. Let the operator only take care to raise the successive layers of fibres with the forceps, and divide the apex of each elevated portion with the knife held horizontally. As there is commonly a quantity of fluid in the sac, and it gravitates to the lower part, to which the intestine seldom quite descends, this is certainly the safest situation for making the first opening into the sac. The operator, however, should not rely upon the presence of such fluid, and cut too boldly; for sometimes it is absent, and the viscera may be in immediate contact with, nay, adherent to, the inner surface of the sac.

The circular arrangement of the vessels of a piece of intestine, and its smooth polished surface, sufficiently distinguish it from the hernial sac, which has a rough cellular surface, and is always connected with the surrounding parts; although these adhesions, in a very recent case, may be but slight. (*Lawrence on Ruptures*, p. 232. ed. 4.)

I have mentioned, that Sir A. Cooper, only advises cutting the fascia, and other coverings of the sac, under the skin, to within an inch of the abdominal ring; and, of course, he also recommends limiting the division of the sac itself to the same extent. His reasons for this practice are, to avoid making the closure of the wound more difficult, and to lessen the danger of peritoneal inflammation.

Having laid open the hernial sac with a probe-pointed bistoury, guided by a director, or the forefinger, introduced into the opening, made at the lower part of the sac, the next desideratum is to divide the stricture, unless the viscera admit of being easily reduced without such an incision being made, as occasionally happens.

According to Sir Astley Cooper, the abdominal ring is the principal point of strangulation in old and large hernia; and, in other cases, the stricture is more commonly seated at the internal ring, where the spermatic chord first quits the abdomen. "The strangulating pressure is here made by the internal oblique and transversalis muscle and its tendon, which pass over the hernial sac in a semicircular direction, and by the fascia transversalis, arising from Poupart's ligament, the semicircular border of which passes under the sac." (*See Sir A. Cooper on Hernia*, part i. p. 29. ed. 2.)

Experience proves, I think, that the stricture

may be situated either at the abdominal ring, and be formed by the margins of this opening, or at the upper opening of the inguinal canal, about one inch and a half, in a direction upward and outward, from the opening in the tendon of the external oblique muscle; or the strangulation may be caused by the semicircular edge of the transversalis muscle and its tendon, which pass over the neck of the hernial sac, and by the portion of the transverse fascia, arising from Poupart's ligament, the semicircular border of which passes, as Sir Astley Cooper represents, under this part of the sac.

Dupuytren calculated, that in at least eight out of every nine cases of strangulated bubonocoele the stricture was seated at the neck of the hernial sac. (*Clin. Chir.* t. i. p. 558.) This observation also led him to believe, that such stricture was formed by the neck of the sac itself, in consequence of change in the structure and disposition of this part of the peritonæum. In a recent protrusion, however, it is manifest that the strangulation cannot depend upon any thickening of the neck of the sac. We shall presently find also, notwithstanding the statement of Dupuytren respecting the great frequency of strangulation by the neck of the hernial sac, that he takes into the account the pressure may be sharp margins of the inner ring. Hernia, constituting bulky external swellings, he found less subject to be strangulated in the neck of the sac, than cylindrical ones; but congenital herniæ the most liable of all to a stricture so situated. He remarks, that, whenever the stricture is at the neck of the sac, the whole, one half, a third, or a quarter, of the hernia, may be pushed towards the abdomen, whence it afterwards descends again; but that for these circumstances to happen, the tumour must be cylindrical, the inguinal canal wide, and the peritonæum not adherent. If, says Dupuytren, the stricture were at the abdominal ring, within the canal, or at its upper orifice, the tumour could not undergo such movement, because these parts are nearly unyielding, while the neck of the sac is quite otherwise, on account of the looseness of its connections. Dupuytren cautions surgeons not to be deceived by this apparent reduction; but, to use every possible means to make the parts descend again; and, if these will not answer, he advises dividing the ring, and drawing down the intestine. He had been called upon to adopt this practice in more than ten cases in the Hôtel Dieu. (*Clin. Chir.* t. i. p. 565.) Another observation made by this celebrated surgeon, is, that when the stricture is situated at the abdominal ring, the tumour, formed by the hernia, does not reach above this point. All the track of the inguinal canal is undetended, soft, and indolent to the touch, while the ring itself is closed, hard, and tense. On the other hand, when the stricture is at the neck of the hernial sac, that is, as high up as the superior orifice of the inguinal canal, this canal is always full, hard, and painful; and a cylindrical tumour can be felt, directed from below upwards, and from within outwards. So far is the ring from causing the constriction, that the finger may sometimes be insinuated between its margin and the protruded parts. In some patients Dupuytren found the strangulation existing all along the inguinal canal; a case, in which he recommends that canal to be laid open its whole length by dividing its upper border. He also

notices the occasional existence of two strictures, a slight one at the abdominal ring, and a closer one at the neck of the sac. (*Op. cit.* p. 565.)

The recollection of the frequent situation of the stricture higher up than the abdominal ring, is of vast practical importance. I have seen several cases, where surgeons, imagining that the abdominal ring caused the strangulation, divided it, and then pushed the hernia seemingly into the abdomen, but in reality only into the inguinal canal. The bad symptoms of course went on, and the patients lost their lives. Dupuytren was present at an operation where the same things happened. We should therefore, be careful to ascertain the seat of stricture, by drawing the protruded bowel gently down, and introducing the finger within the sac.

It is observed by Dupuytren, that when the stricture is placed at the upper orifice of the inguinal canal, the parts sooner become gangrenous, because the edges of this opening are so sharp, that they make great pressure on the neck of the sac; while the abdominal ring, which is wider, and has blunter margins, causes a slower strangulation, and less pressure on the intestine. In the first case, the operation must in general be performed sooner than in the last. (*Dupuytren, Clin. Chir.* t. i. p. 566—569.)

When the mouth of the hernial sac becomes the seat of stricture, Sir Astley Cooper ascribes the circumstance to its inner part having been thickened by the pressure of the tendons of the internal oblique and transverse muscles; and “if a truss has occasioned much pressure on its outer side, the whole circle of the sac becomes thickened in consequence. Thus, the cause of the stricture at the mouth of the sac is occasioned by parts external to the sac.” (*Sir A. Cooper He* p. 30. part i. vol. 2.)

The common, and probably the best, practice, is to divide the hernial sac, together with the stricture. When this is situated at the abdominal ring, the surgeon is to introduce the end of a director a little way into the neck of the sac, within the aperture in the tendon, and with a probe-pointed bistoury, guided on the latter instrument, he is to cut the stricture upward and outward, or else directly upward; a manner, which Sir A. Cooper recommends, because it is applicable to all cases, even the less frequent ones, in which the hernia protrudes at the inner side of the epigastric artery; and, in all common instances, we know that this vessel runs upward round the inner side of the neck of the sac; a course prohibiting the division of the stricture upward and inward.

In the external or oblique inguinal hernia, the method of cutting the stricture upward and outward is perfectly safe; but when the case is what Hesselbach calls internal, and the viscera descend on the inner side of the epigastric artery, it is a plan, which would endanger the latter vessel, and ought never to be adopted, notwithstanding any statement made in its favour by Rudtorffer. (*Abhandlung über die einfachste und sicherste Operations-Methode eingesperrter Leisten- und Schenkelbrüche.* Wien. 1808.) As the epigastric artery ascends between the fascia transversalis, and the peritonæum, and not directly behind the tendon of the external oblique muscle, it is manifest, that the abdominal ring itself may be safely divided in any direction, so far as that vessel is concerned. It is with reference to the division of a stricture more

● deeply seated at or near the internal ring, that the direction of the cut is of the highest importance in relation to the epigastric artery. Sir A. Cooper's rule of always cutting in one direction, viz. upward, which I believe was first advised by Rougemont, and afterwards by Autenrieth. (*Dissert. Moment. circa Herniotom. præcipue circa evitandam Art. Epigastr. Læsionem.* Tub. 1799.) is an excellent one, because it is easy for the memory, and will answer very well, even when it is not in the power of the surgeon to pronounce positively, whether the case is a short-necked external bubo-nocele, or an internal one with an oblong oval fissure, cases having a great external resemblance, especially in women, in whom there is not the spermatic chord as a criterion; for, after all, this part, when present, is the surest guide, and that on which Desault founded his perfectly safe advice, viz., when the chord is at the posterior or inner side of the neck of the hernial sac, to divide the ring upwards and outwards, but inwards and upwards when it lay at the outer or on the fore part of the sac. (*Œuvres Chir. par Bichat, t. ii.*) At all events, this advice is subject but to one exception, which is the very rare one of the epigastric running round the inner side of the neck of the sac in an internal bubo-nocele; a possibility which has been already explained, and which lends Hesselbach particularly to recommend, with Sir Astley Cooper, the division of the ring, in every internal or direct inguinal hernia, to be made straight upwards. (P. 47.) Indeed, the long-necked external bubo-nocele is the only case, in which he thinks the latter plan should give way to that of cutting upwards and outwards. The safety and propriety of the method of always cutting upward, are strikingly illustrated by what Scarpa observes. He states, that the right direction of the incision of the ring is directly upwards, parallel to the linea alba. "I have (says he) operated in the way which I recommend, upon several dead subjects, who had either external, or internal inguinal hernia, directing my incision in the course of a line drawn from the upper part of the ring parallel to the linea alba: in all, I constantly left the epigastric artery untouched, even when I extended the cut about an inch above the inguinal ring." (*Scarpa, Traité Pratique des Hernies, p. 111.*) Only one objection, so far as I know, has been made to this plan, and it is founded on the alleged impossibility of introducing the knife, so as to cut straight upwards, when the neck of the hernial sac is long, because then the posterior side of the inguinal canal is in the way. (*Hesselbach, p. 40.*) No more of the parts, forming the stricture should be cut, than is just sufficient for allowing the protruded viscera to be reduced, without bruising, or otherwise hurting them; and, if the stricture be at the abdominal ring, I consider the middle of its upper column to be as good a point as any for the requisite incision.

Sir A. Cooper, in his valuable work on the Inguinal Hernia, advises a mode of dividing the stricture, considerably different from the usual method. He directs the finger of the operator to be introduced into the sac (which in his plan, we know, is left undivided for the space of one inch below the ring.) When the stricture is felt, a probe-pointed bistoury is to be conveyed over the front of the sac into the ring (between the two parts), and the latter only is then to be divided, in the direction upward, opposite the middle of the

neck of the sac, and to an extent just sufficient to allow the protruded parts to be returned into the abdomen, without being hurt. The two chief advantages which Sir A. Cooper imputes to this method, are, that the danger of peritoneal inflammation will be less, and that the epigastric artery, if wounded, would not bleed into the abdomen. With regard to this proposal, it has been observed by Mr. Lawrence, "An accurate comparative trial of both methods would be necessary, in order to determine the weight of the first reason. The second circumstance cannot be a matter of any importance, if we cut in such a direction as will avoid the risk of wounding the artery. Many circumstances present themselves as objections to this proposal. The manœuvre itself, although perhaps easy to the experienced hand of so able an anatomist as Sir A. Cooper, would, I am convinced, be found highly difficult, if not impracticable, by the generality of surgeons. This difficulty arises from the firm manner, in which the sac and surrounding parts are connected, we might almost say, consolidated together. The experience of Richter (*Traité des Hernies, p. 118.*) shows, that this objection is founded in reality. He once tried to divide the ring, without cutting the sac, but he found it impracticable. If the stricture is so tight, as to prevent the introduction of the finger, there must be great danger of wounding the protruded parts. The practice would still be not advisable, even if it could be rendered as easy as the common method of operating. Sir Astley leaves an inch of the sac, below the ring, undivided: thus a bag remains ready to receive any future protrusion, and the chance of a radical cure is diminished." (*See Lawrence on Ruptures, p. 249. ed. 4.*)

Mr. Aston Key has proposed to revive the method of operating, adopted by Polit and the second Monro; viz., that of removing the stricture and replacing the protruded intestine, without dividing the sac. (*See Mem. on the Advantages, &c. of Dividing the Stricture in Strangulated Hernia, on the Outside of the Sac, &c. Lond. 1833.*) Mr. Key concludes from various cases, which he has recorded, that the principal cause of the fatality of operations for hernia, is exposure, or injury of the intestine, or both, and consequent peritoneal inflammation. "The exposure of a bowel in a state of incipient, or active inflammation, (says Mr. Key) the handling it in this susceptible state, the incision made into a peritoneal bag already disposed to, if not in an actual state of inflammation, are, as every surgeon will admit, (and as his forcible efforts to reduce the hernia without the knife prove that he feels them to be,) dangers of no ordinary magnitude to a patient labouring under a strangulated intestine. I do not feel that I have exaggerated the risk of inflammation; for, frequently, enteritis comes on, when at the time of the operation the bowel appears to be healthy, and the abdomen free from tenderness; and when general inflammation precedes the operation, the release of the intestine by the knife rarely succeeds in checking it." (P. 51.)

Mr. Key dwells likewise upon the great danger of roughly handling a hernia, particularly a large one, and of employing much force in repeated and long continued efforts at reduction by means of the taxis. He argues, that, as these proceedings cannot fail to bruise the protruded bowel, this part, like other contused tissues, must have a much

better chance of recovery if its surface be not exposed. Mr. Key does not however, recommend the plan of not opening the sac in every example. For instance he acknowledges, that some forms of adhesion, either of the intestinal folds to one another, or to the sac, or to its neck, may render it necessary to open the sac more or less extensively. A case of adherent omentum does not, however, appear to Mr. Key a case, in which it is always requisite to open the sac. The first case, in which he tried the method, which he advocates, was an old irreducible umbilical hernia, in which a fold of intestine had recently protruded. On dividing the edge of the tendon, slight pressure caused the bowel to return into the abdomen. The object of removing diseased omentum with the knife, or ligature, does not appear to Mr. Key to be always a good ground for laying open the sac. Gangrene of the protruded intestine seems to him to be a case absolutely requiring that the sac should be opened. So also is the case of strangulation by the neck of the sac itself, though he deems such an occurrence rare.

The following is Mr. Key's description of his method in inguinal hernia: "The incision should begin at the neck of the tumour, or where it seems to quit the abdomen, and should be continued downwards for about an inch and a half. This will lay bare the lower portion of the external oblique tendon, where it forms the ring. A small opening should then be made in the tendon, just above the ring, sufficient to admit the end of the director, which will enable the operator to ascertain if the stricture be at the upper, or lower opening. The size of the hernia, and the length of time it has existed, will in some measure serve to guide him, but he may immediately decide the point by passing the director downward under the edge of the external ring, and feeling, whether it embraces the tumour firmly, or not, or by making pressure on the swelling below, he may feel if the fluid contents of the tumour can be forced upward above the ring, so as to distend the sac in the inguinal canal. This point being decided, if the stricture be at the lower ring, he has only to pass his director under its margin, and to divide it to a sufficient extent.

"If the stricture exists higher up, at the neck of the sac, where it will be found in the majority of herniæ of this description, the opening in the tendon should be enlarged to the extent shown in the second drawing, for the purpose of passing the director under the deeper stricture. The lower margin of the two muscles will be brought into view, with some of the descending fibres of the cremaster. These may be separated by disturbing the cellular membrane with the end of the director; and the instrument may then be introduced under the transversalis muscle till it reaches the stricture. The director, thus introduced, passes before the fascia transversalis, and all risk of wounding the peritoneum, or epigastric artery, is then obviated; but, when that fascia is very thin, it will perhaps often allow the director to pass beneath it.

"The instrument should be depressed upon the sac, in order to carry its point under the border of the transversalis, which may be divided to the extent required. This operation is more difficult, than the division of the stricture in femoral hernia. The principal difficulty lies in the accurate separation of the lower edge of the internal oblique muscle, for the easy passage of the director. The

stricture, however, is not so firm in inguinal, as in femoral hernia, and the introduction of the director under the transversalis tendon will not be difficult, when it is fairly passed up to the neck of the sac, before the attempt is made. The steps of the operation will be much the same in those smaller herniæ, which are lodged in the inguinal canal." (*C. Aston Key, Op. cit.*)

Respecting this mode of operating, I may observe, that there can be no doubt of its being calculated to lessen the risk of the patient being destroyed by peritonitis; but I apprehend that the greater difficulty of accomplishing it, than the common operation, and the fact of some excellent anatomists having been baffled in their attempts to perform it on the living subject; will continue to prevent its general adoption. I have known the attempt made in one or two instances, and given up. However if a surgeon were confident, that he could execute the plan, (and Mr. Key's directions would greatly assist him,) I would not object to his doing so, if there were no circumstances in the case, likely to render the opening of the sac necessary. The method, I think, is not likely to be commonly followed.

If the stricture should be at the inner opening of the canal for the spermatic chord, Sir A. Cooper advises the operator to introduce his finger into the sac, as far as the stricture, and then to insinuate a probe-pointed bistoury, with the flat part of its blade turned towards the finger, between the front of the sac and the abdominal ring, till it arrives under the stricture formed by the lower edge of the transversalis and obliquus internus. Then the edge of the instrument is to be turned forward and the stricture, cut in the direction upward. This plan of not cutting the neck of the sac, is liable to all the objections stated by Mr. Lawrence, in regard to the case, in which the strangulation takes place at the abdominal ring. Sir A. Cooper's bistoury is a very proper one for dividing the stricture, as it only has a cutting edge to a certain distance from the point. Perhaps, on the whole, we may infer, that it is both most easy and advantageous to divide the neck of the sac, together with the stricture, whether this be situated at the ring, or more inward. The method of cutting the stricture from without inwards, I consider objectionable, on the ground of the risk of wounding the bowels in this mode, being greater, than that of any accident from wounding the epigastric artery, when it arises in an unusual manner, and deviates from its regular course; a reflection which has made Dr. Hesselbach, junior, an advocate for the practice. (*See Sicherste Art des Bruchschnittes*, 4to. Bamberg. 1819.)

When the stricture is at the upper opening of the inguinal canal, the ring should not be cut, unless it prevent the operator from reaching the more deeply seated strangulation, as is often the case.

M. Dupuytren cuts the stricture upwards and forwards, using no director in this stage of the operation, because, as he says, the bistoury is apt to slip out of the groove, and wound the intestine. (*See Clin. Chir. t. i. p. 600.*)

Room being made for the reduction of the protruded parts into the abdomen, by the division of the stricture, they are to be immediately returned, if sound, and free from adhesions. This object is considerably facilitated by bending the thigh. The intestines are to be reduced before the omc-

tum, but, when a portion of mesentery is protruded, it is to be returned before either of the preceding parts. The intestine should always be reduced, unless it be found in a state of actual mortification. It often appears so altered in colour, that an uninformed person would deem it improper to return it into the abdomen. However, if such alteration should not amount to a real mortification, experience justifies the reduction of the part. Sir A. Cooper has judiciously cautioned the operator not to mistake the dark chocolate-brown discolorations for a state of gangrene. With these the protruded part is frequently found affected; and, as they generally produce no permanent mischief, they ought to be carefully discriminated from the black-purple, or lead-coloured spots, which usually precede mortification. To determine whether a discoloured portion of intestine be positively mortified, some recommend pressing forward the blood contained in the veins; and if they fill again, it is looked upon as a proof that the bowel is still possessed of life.

In returning a piece of intestine into the abdomen, the surgeon should first introduce the part nearest the ring, into this aperture, and hold it there till another portion has succeeded it. This method is to be continued till the whole of the protruded bowel is reduced.

The employment of force or violence, in the endeavours to return the contents of a hernia in the operation, cannot be too severely reprobated; a method the more pernicious, because such parts are more or less in a state of inflammation.

It is always better to enlarge the stricture, than pinch and bruise the bowel in trying to get it through an opening which is too small. Distension of the intestine sometimes prevents the reduction, but, when this is the only impediment, the part may generally be returned, as soon as its contents have been compressed into the intestinal canal within the stricture. It is better, however, to dilate the strangulation a little more, than use any force in trying to get the intestine back into the abdomen in the manner just suggested.

Reduction is sometimes impeded by the protruded parts adhering to each other, or to the hernial sac. The intestines are not often very firmly adherent together. The omentum and inside of the sac are the parts, which are most subject to become intimately connected by adhesions. The fingers will, commonly, serve for breaking any recent slight adhesions which may have taken place between the intestines and inside of the hernial sac.

When those adhesions are firm, and of long standing they must be cautiously divided with the knife; an object which can be most easily and safely accomplished, in case they are long enough to permit the intestine to be elevated a little way from the surface of the sac. But, provided their firmness and shortness keep the external coat of the bowel and inner surface of the sac in close contact, the greatest care is requisite in separating the parts with a knife, so as to avoid wounding the intestine. In doing this, the most prudent and safe method, is not to cut too near the bowel, but rather to remove the adherent parts of the sac, and return them with the intestine into the abdomen. Every preternatural connection should always be separated before the viscera are reduced: Sir A. Cooper mentions, that a fatal obstruction to the passage of the intestinal matter has arisen from the mere ad-

hesion of the two sides of a fold of intestine together. (P. 31.) When the adhesions which prevent reduction are situated about the neck of the sac, and out of the operator's view, it is best to make the wound through the skin and abdominal ring somewhat larger, so as to be able to separate the adhesions with more safety.

Having reduced the parts, the operator should introduce his finger for the purpose of being sure that they are fairly and freely returned into the abdomen, and no longer suffer constriction, either from the inner opening, from the ring, or the parts just within the cavity of the peritoneum.

In strangulated enterocoeles the peritoneal coat of the bowel is capable of bearing the pressure, longer than the mucous, which is soon circularly divided by it. But, if the strangulation has lasted two, or three days, the cellular tissue is cut through; and, in some instances, even the peritoneal coat itself. In operating upon such cases, the bowel should not be drawn out at all, before a free division of the stricture has been made, because it would occasion a risk of tearing one portion of the intestine from the other, and producing an extravasation in the abdomen. (See *Dupuytren, Clin. Chir.* t. i. p. 569.)

Sometimes a strangulated hernia is complicated with a hydrocele; a circumstance which may render it necessary either to cut through the latter swelling, or to limit the incision into the hernial sac, according as the hydrocele happens to cover the whole of the front of the sac, as seen by M. Cloquet and Mr. Stanley, or merely to advance in front of the lower part of the rupture. (*Laurence on Ruptures*, p. 276. ed. 4.) See HYDROCELE.

TREATMENT OF THE OMENTUM.

In an entero-epiplocele, this part, if healthy and free from gangrene, is to be reduced after the intestine. When, however, it is much diseased, thickened, and indurated, as it frequently is found to be, after remaining any considerable time in a hernial sac, the morbid part should be cut off. Its reduction in this circumstance would be highly improper, both because an immoderate enlargement of the wound would be necessary, in order to be able to put the diseased mass back into the abdomen, and because, when reduced, it would, in all probability, excite inflammation of the surrounding parts, and bring on dangerous symptoms. (See *Iley*, p. 172.)

The diseased omentum should always be cut off with a knife; and if any of its arteries should bleed, they ought to be taken up with a tenaculum, and tied separately with a small ligature. An unreasonable apprehension of hemorrhage from the cut end of the omentum has led many operators to put a ligature all round this part, just above the diseased portion which they were about to remove. This practice cannot be reprobated in terms too severe; for a frequent effect of it is to bring on a fatal inflammation, and even mortification of the omentum, extending within the abdomen, as high as the stomach and transverse arch of the colon. Sir Astley Cooper has remarked with great truth, that it is surprising this custom should ever have prevailed. The very object of the operation is to extricate the omentum from its strangulated state, arising from the pressure of the surrounding tendon; and no sooner has this been done than the surgeon includes it in a ligature,

which produces a more perfect constriction, than that which existed before the operation was undertaken.

"When the omentum has suffered strangulation for a few days, says Mr. Lawrence, it often becomes of a dark red or livid colour; and there is an appearance, on cutting it, as if some blood were extravasated in its substance. This, I believe, is the state, which surgeons have generally described under the term of gangrene." (P. 262.)

When cut in this state, it does not bleed. I need hardly observe, that the dead part must be amputated, and never reduced. Some have advised leaving the omentum in the wound, especially in cases of old herniæ, in which it has been a long while protruded. He mentions cases, showing that granulations form very well, and that the wound becomes firmly healed when this plan is followed. (P. 180, &c.) Every one, however, will acknowledge the truth of what Mr. Lawrence says on this subject. The method "is attended with no particular advantage, but certainly exposes the patient to the possibility of ill consequences. The omentum, left in the wound, must be liable to injury, inflammation, or disease. Unnatural adhesions, formed by this part, have greatly impaired the functions of the stomach. Cases are recorded, where the unfortunate patient has never been able to take more than a certain quantity of food without bringing on instant vomiting; and even where it has been necessary for all the meals to be taken in the recumbent position, with the trunk curved and the thighs bent. (Gunn.) To avoid the possibility of such afflicting consequences, we should, after removing any diseased portion, carefully replace the sound part of the omentum in the abdominal cavity." (On Ruptures, p. 291. ed. 4.)

M. Dupuytren objected to the plan of cutting away the omentum, on account of the tediousness of the process of taking up the arteries, some of which may not after all be tied, and then hemorrhage will take place. He also bears testimony to the danger of including the mass of omentum in a ligature. His practice consisted, therefore, in reducing the omentum, if possible, after largely dilating the stricture. He admits, however, that there will be a considerable chance of inflammation from the efforts made in the reduction; and that local and general bleeding, and other antiphlogistic measures, may be called for. (Clin. Chir. t. i. p. 597.) The prudence of reducing a large mass of diseased or hypertrophied omentum I must continue to doubt, notwithstanding the authority of Dupuytren. I have seen it done, but almost always with an unfavourable result.●

TREATMENT WHEN THE INTESTINE IN THE SAC IS MORTIFIED.

Sometimes, on opening the hernial sac, the intestine is found to be in a gangrenous state, although the occurrence could not be previously known, owing to the integuments and the hernial sac itself not being affected with the same mischief. In ordinary cases, however, both the skin and sac become gangrenous at the same time with the contents of the hernia. The tumour, which was previously tense and elastic, becomes soft, doughy, emphysematous, and of a purple colour. Sometimes the parts also now spontaneously return; but the patient generally survives only a few hours.

Sir A. Cooper has accurately remarked, that in other instances, the skin, covering the swelling, sloughs to a considerable extent, the intestine gives way, and, as the feces find vent at the wound, the symptoms of strangulation soon subside. When the patient continues to live in these circumstances, the living part of the intestine becomes adherent to the hernial sac, the sloughs separate and come away, and thus an artificial anus is established, through which the feces are sometimes discharged during the remainder of life. (See ANUS, ARTIFICIAL.)

Frequently, however, things take a more prosperous course; the feces gradually resume their former route to the rectum, and, in proportion as the artificial anus becomes unnecessary, it is shut up. Many instances of this sort have fallen under my own observation. (See ANUS, ARTIFICIAL.) The chance of a favourable event is much greater in some kinds of herniæ than in others. When the strangulation only includes a part of the diameter of the gut, the feces are sometimes only partially discharged through the mortified opening. This quantity lessens as the wound heals, and the patient gets perfectly well. (Louis, Mém. de l'Acad. de Chir. t. iii.; P. S. Palm, De Epiplo-enterocele crurali incarcerata sphacelata, cum depreditione notabili substantiæ intestini, sponte separati, feliciter curata aëre naturali restituta, 4to. Tub. 1748.; Haller, Disp. Chir. t. iii.) A small gangrenous spot or two may end in the same manner. Mortification, as well as wounds, of the large intestines, is much more frequently followed by a recovery than the same affection and similar injuries of the small intestines. Mortification of the cæcum and its appendix, in a hernial sac, has happened several times without materially disturbing the usual course of the feces to the anus, and the patients have soon recovered. (Med. Obs. and Inq. vol. iii. p. 162.; Hey's Pract. Obs. p. 162, &c.)

The grand thing, on which the establishment of the continuous state of the intestinal canal depends, in all these cases, is the adhesion which the living portion of the bowel, adjoining the mortified part, contracts with the peritoneum all round. In this manner, the escape of the contents of the bowels into the cavity of the peritoneum becomes in general completely prevented. The two ends of the sound portion of intestine, after the mortified part has separated, open into a membranous cavity, which previously constituted a portion of the peritoneal sac, and now unites the extremities of the gut. The gradual contraction of the wound closes the membranous cavity externally, and thus the continuity of the canal is restored. The two ends, however, are not joined so as to form a continued cylindrical tube, like that of the natural gut; but they are united at an angle more or less acute and the matter, which goes from one to the other, describes a half circle in a newly formed membranous cavity that completes the canal; a subject which has been more fully explained in another part of this work. (See ANUS, ARTIFICIAL.)

It is an observation of Sir A. Cooper, that the degree of danger, attending an artificial anus, depends on the vicinity of the sphacelated part of the intestinal canal to the stomach. Thus, if the opening be in the jejunum, there is such a small extent of surface for absorption between it and the stomach that the patient dies of inanition.

Let us now suppose, that the mortified state of the intestine has only been discovered after laying open the hernial sac in the operation. The mischief may only consist of one or more spots, or of the whole diameter of the protruded bowel. In the first case, the proper practice is to divide the stricture, and return the intestine into the abdomen, with the mortified spots towards the wound. Mild purgatives and clysters are then to be exhibited. The most favourable mode, in which a case of this kind ends, is when the intestinal matter gradually resumes its natural course, after being either partly or entirely discharged from the wound. But sometimes the patient sinks under the disease, or an artificial anus continues for life.

The repeated observations of modern surgeons have now decided that no ligature, passed through the mesentery, to keep the gangrenous part of the bowel near the wound, is at all necessary. The parts in the neighbourhood of the ring have all become adherent together, in consequence of inflammation, at the same time that the parts in the hernial sac mortified; and, of course, the partially gangrenous bowel, when reduced, is mechanically hindered by these adhesions, from slipping far from the wound. Desault and De la Faye both confirm the fact that the intestine never recedes far from the ring; and, even were it to do so, the adhesions which it soon contracts to the adjacent surfaces would, as Petit has explained, completely circumscribe any matter which might be effused, and hinder it from being extravasated among the convolutions of the viscera. (*Mém. de l'Acad. de Chir.* t. i. li.)

When the chief part, or the whole, of the diameter of the protruded bowel is mortified, the first and most urgent indication is to relieve the bad symptoms arising from the distension of the intestinal canal above the stricture. "Let a free incision, says Mr. Lawrence, be made through the mortified part of the gut, in order to procure that evacuation of the loaded canal which nature attempts by the process of gangrene." If the intestine has already given way, a free division of the integuments and sac allows the exit of the accumulated matter; and the opening in the gut may be enlarged, if necessary. (*On Ruptures*, p. 299. ed. 4.) By such treatment, Sir Astley Cooper rescued from the grave a female, who was pregnant at the time of the operation, and was some months afterwards safely brought to bed. (*On Abdominal Hernia*, part i. p. 49. ed. 2.)

Here the division of the stricture is unnecessary, since all the mischief which the bowel can receive from it is done. This subject is well explained by Mr. Travers. (See *Ing. into the Process of Nature in repairing Injuries of the Intestines*, &c. p. 300, &c.) Mild purgatives and clysters will be proper to unload the bowels, and determine the course of the feces towards the anus. Should, however, the stricture appear, after the mortification, to impede the free escape of the intestinal contents, a moderate dilatation of it must undoubtedly be proper.

Mr. Lawrence has clearly exposed the impropriety of sewing the ends of the intestinal canal together, introducing one within the other, supported by a cylinder of isinglass, &c. put into their cavity, in those cases in which the whole circle of the intestine has mortified and been cut away, as was advised by former writers. By drawing the

intestine out of the cavity, in order to remove the dead part, the adhesions behind the ring, on which the prospect of a cure chiefly depends, must be entirely destroyed; and new irritation and inflammation must be unavoidably produced, by handling and sewing an inflamed part. The adhesions would even be likely to render the scheme impracticable, as happened in a case related in the *Journ. de M. Le Roux*, t. xxi. p. 260. (*On Ruptures*, p. 314. ed. 4.)

Instead of such practice, Mr. Lawrence judiciously recommends dilating the stricture, and leaving the subsequent progress of the cure entirely to nature. The sloughs will be cast off, and the ends of the gut are retained by the adhesive process in a state of apposition to each other, the most favourable for their union. Thus, there is a chance of the continuity of the intestinal canal becoming established again.

Whatever experiments it may be allowable to make in wounds with protrusion and division of the bowels, nothing, I think, is now more completely established, than the absurdity and danger of attempting to stitch the bowels in cases of hernia.

OPERATION FOR LARGE INGUINAL HERNIA.

When the tumour is of long standing, exceedingly large, perhaps extending half way down to the knees, and its contents have never admitted of being completely reduced, the indication is to divide the stricture, provided a strangulation take place; but without laying open the hernial sac, or attempting to reduce the part.

The reasons against the common plan of operating, under such circumstances, are, the difficulty of separating all the old adhesions, the hazardous inflammation which would be excited by laying open so vast a tumour, and the probability that parts, so long protruded, might even bring on serious complaints, if reduced. J. L. Petit, and, afterwards, Dr. Monro, advised the sac not to be opened. (See *Mal. Chir.* t. ii. p. 372.; *Description of Bursa Mucosa*, 1783.) Mr. Lawrence recommends an incision of two or three inches in length to be made through the integuments over the abdominal ring. The fascia covering the hernial sac is then to be exposed by dissection, and an opening made in it. This will permit a grooved director to be put under the tendon; and the probe-pointed bistoury may be conducted, by means of the groove, to the part that requires division. If great difficulty should be experienced in accomplishing our object in this manner, a small aperture may be made in the sac near the ring, when the tendon may be divided with ease. The parts, after being thus liberated, should be returned into the belly by pressure on the swelling, if adhesions do not prevent it: at all events, they generally admit of being replaced in part. (*Lawrence on Ruptures*, p. 269. ed. 4.) A very interesting case has been recorded, in which the foregoing advice was deviated from, and a large scrotal hernia laid open; when it was found that nearly a foot of the colon was contained in the swelling, and could not be reduced. The integuments could not cover it; yet its surface granulated, the skin extended itself as the cicatrix contracted, over the swelling, which also diminished, and, in about six weeks, the cure was completed. (See *Journ. of Foreign Med.* No. xv. p. 460.)

OPERATION WHEN THE HERNIA IS SO SMALL THAT IT DOES NOT PROTRUDE EXTERNALLY THROUGH THE RING.

In this kind of case, there is little appearance of external tumour; consequently the disease is likely to be overlooked by the patient and surgeon, and some other cause assigned for the series of symptoms. The manner of operating, in this form of the disease, differs from that in the common scrotal hernia: the incision is to be made in the direction of the spermatic cord, and the stricture will be found at the internal ring. (*A. Cooper on Inguinal Hernia.*)

TREATMENT AFTER THE OPERATION.

Evacuations from the bowels should be immediately promoted by means of clysters, oleum ricini, or small doses of sulphate of magnesia, dissolved in peppermint water; but the patient should not be allowed to quit the recumbent position, or get on the night-stool, as doing so is apt to bring on a protrusion of the bowels again. (See case in *Lancet*, vol. ii. p. 148.) The safest plan is to let something be put under him for the reception of the feces. In the course of another day, if costiveness follow the effects of the first medicines, and tenderness and tension of the belly come on, local and general bleeding, with the exhibition of liberal doses of calomel joined with opium, are strongly indicated. For some time the diet is to be low. When symptoms of inflammation of the bowels and peritoneum threaten the patient, general bleeding, leeches on the abdomen, fomentations, blisters, doses of the oleum ricini, and clysters, are the means deserving of most dependence, and should be resorted to, without the least delay. In these circumstances, the warm bath, sometimes recommended, I think is more likely to do harm than good, by the disturbance to which it subjects the patient. When all danger of peritoneal inflammation is past, and the patient is very low and weak, bark, wine, cordials, and a generous diet, must be directed. The effervescent saline draught with opium is the best medicine for quieting the disturbance of the stomach after the operation. Opium and cordials are the most eligible for checking diarrhoea. As the operation does not usually prevent the parts from becoming protruded again, a truss must be applied before the patient leaves his bed, and afterwards constantly worn.

OPERATION FOR STRANGULATED DIRECT INGUINAL HERNIA.

Sir Astley Cooper directs an incision to be made through the integuments, along the middle of the tumour, from its upper to its lower part, following the longitudinal direction of the swelling, so that, if it has any inclination inwards towards the umbilicus, the incision is to incline in the same way. The fascia being thus exposed is to be divided, over the surface of the tumour, from the abdominal ring down to its lower extremity. The hernial sac is then to be cautiously opened from an inch below the ring. The finger is then passed into the sac, and the stricture felt for. If it is at the abdominal ring, Sir Astley Cooper introduces a blunt-pointed bistoury between the sac and the ring, and cuts the latter directly upwards. If the stricture is above the ring, he follows it with the knife still in the same direction and anterior to it, op-

posite the middle of the mouth of the sac, till the dilatation is sufficient to allow his finger to slip into the cavity of the abdomen. Then the protruded parts, if in a fit state for reduction, are to be returned. "The parts (he observes) anterior to the sac, above the ring, and divided by the knife, are the tendons of the transversalis and internal oblique." (*See Sir A. Cooper, Op. cit. part i. p. 68. ed. 2.*)

Mr. C. H. Todd had an opportunity of dissecting an exceedingly uncommon variety of direct inguinal hernia, where the parts, "instead of passing anterior to the chord, protruded between the chord and the inferior pillar of the ring; so that the chord formed a sort of arch, embracing the neck of the sac for nearly two thirds of its circumference, close to the external abdominal opening." (*See Dublin Hospital Reports, vol. i. p. 231.*) Hence, in operating on inguinal hernia, Mr. Todd always makes it a rule, after exposing the superficial fascia, and before dividing the parts contiguous to the neck of the sac, "to feel and minutely examine those parts (particularly if they appear unusually bulky," and to satisfy himself as to the situation of the spermatic chord. "Having done this (says he), I proceed with confidence to expose the superior pillar of the ring, which ought, in every instance, to be completely denuded before a bistoury is introduced to cut the stricture." (*Ib.*)

PROPOSALS FOR THE RADICAL CURE OF THE BUBONOCÆLE.

Of castrating the patient, applying caustic, or of the operation of the punctum aureum with this view, I need only say that they are barbarous, and not at all calculated for the attainment of the desired end. A description of these methods may be found in *Paré, Wiseman, &c.*

The old operation, termed the *royal stitch*, was one of the most promising plans. It consisted in putting a ligature under the neck of the hernial sac, close to the abdominal ring, and then tying that part of the sac, so as to render it impervious by the adhesive inflammation thus excited. The royal stitch, performed in this manner, has been actually attended with success. (*Heister, vol. ii.*) The umbilical rupture was cured by Savard on similar principles; and Desault radically cured nine cases of exomphalos in children by tying the hernial sac.

Schmucker cured two irreducible ruptures, free from strangulation, by cutting away the body of the sac, after tying its neck. (*Chir. Wahrnehmungen, b. ii.*) In one case, Sir A. Cooper found cutting away the sac alone insufficient.

Petit, Sharp, Acrel, &c., record cases, which prove the danger and general inefficacy of the royal stitch.

Richter recommends scarifying the neck of the sac, with the view of producing an adhesion of its sides to each other; a plan which, he says, he found successful.

From the account, however, which has been given of the anatomy of the bubonocœle, it is obvious that none of these methods can do more, than obliterate the sac as high as the ring, and never that portion of it which is within the inguinal canal. Hence the neck of the sac must still remain open for the descent of the viscera. This consideration, and that of the chances of bud and

fatal symptoms from any operation undertaken solely for this purpose, and not urgently required for the relief of strangulation, are the grounds on which these experiments are now disapproved.

In 1829, M. Belmas suggested the scheme of introducing into the upper part of the hernial sac a little bladder or pouch, made of goldbeater's skin, and filled with air. The plastic matter (fibrine), which is soon effused, penetrates the material of which the little bladder is composed, and becomes, in some measure, combined with it. *The whole is alleged to acquire organisation*, and to contract adhesions to the ring and neck of the sac, so as to constitute a barrier against the descent of the viscera. The plan is asserted to have succeeded both on man and animals. The particulars, which are curious, are given by M. Velpeau. (*See Nouv. Elem. de Méd. Opér.* t. ii. p. 306.)

Mr. Jameson, of Baltimore, even ventured, at the urgent solicitation of a lady, whose hernia (a femoral one) had returned after having been strangulated and operated upon, to try to accomplish a radical cure on Tulliacotian principles. In fact, he is stated to have formed a flap of the shape of a lancet, out of the integuments, with its broad end towards the former wound. After having been carefully raised, and twisted into the suitable direction, it was introduced into the sac within the crural canal. Here it was secured by closing the wound with sutures, and applying a bandage. This venturesome proceeding is alleged to have been completely successful. The experiment has not yet, I believe, been tried in any other case; and doubts may be entertained whether it deserves it, unless the patient were determined voluntarily to place his life in serious danger, instead of being content with the relief afforded by a truss.

One of the most recent proposals for the radical cure of hernia, is the employment of firm wooden blocks, in the place of a soft pad with the truss. A favourable report upon the subject has been drawn up by Dr. Reynell Coates and other American surgeons.

CRURAL OR FEMORAL HERNIA.

Verheyen, who wrote in 1710, first distinctly pointed out the nature of crural hernia, which, until then, had been generally confounded with bubonocèle.

The parts composing this kind of hernia always protrude under Poupert's ligament, and the swelling is situated towards the inner part of the bend of the thigh. The rupture descends on the internal side of the femoral artery and vein, between these vessels and the os pubis, through the *crural ring or canal* for the transmission of the same vessels. And, as Hesselbach has remarked, the inner opening of this ring or canal is the predisposing cause of the disease; the peritoneum, spread over it, being gradually propelled into it by various occasional causes, so as to complete the tendency to hernia. The actual protrusion of the bowels may be formed either suddenly, or by degrees. As soon as the bowels have once passed the outer aperture, or what Cloquet terms more properly the lower opening of the crural canal, the hernia has more room for extending itself forwards, and to each side, and the integuments now become elevated into an oval swelling, the long diameter of which is nearly transverse. (*Hesselbach, p. 47.*)

Gimbernat names the passage, through which the femoral hernia protrudes from the abdomen, the *crural*, *Hoy* the *femoral ring*, and *Cloquet* the *crural canal*.

Females are particularly subject to this kind of rupture. It has been computed, that nineteen out of twenty married women, afflicted with hernia, have this kind; but that not one out of an hundred unmarried females, or out of the same number of men, have this form of the disease. (*Arnaud.*) I was lately consulted by the friends of a little girl, about eight years old, who has an unequivocal femoral hernia.

"The crural hernia," says Scarpa, "is frequently observed in women, who have had several children; it very seldom afflicts young girls, and still more rarely men. In the latter, the viscera can more easily escape through the inguinal ring, by following the spermatic cord, than they can descend along the crural vessels, and raise the margin of the aponeurosis of the external oblique muscle, that forms the crural arch. In women, an opposite disposition prevails, in consequence of the smallness of the inguinal ring, which, in them, only gives passage to the round ligament of the uterus, and, besides, is situated lower down and nearer the pubes, than it is in men, whilst, on the contrary, the crural arch is more extensive, by reason of the wider form of the pelvis. Morgagni expressly says, that he never met with the crural hernia in the dead body of any male subject. *Mihi, ut verum fatear, nisi nondum in facinus accidit ut eam viderem.* (*De Sed. et Caus. Morb. epi-t.* xxxiv. xv.) Camper gives us to understand almost the same thing. (*Icones Herniarum, in Praefat.*) Hévin often operated for this kind of hernia in females, but only once in the male subject. (*Pathol. et Therap.* p. 406.) Sandifort and Walter have both seen but a single instance of it in the dead body of the male subject. (*Obs. Anat. Pathol.* cap. iv. p. 72.; *Syllabe Comment. Anat.* p. 24, obs. 21.) Arnaud himself, to whom modern surgery is highly indebted for many important precepts on the operation for the strangulated crural hernia in both sexes, candidly confesses, that he had never had an opportunity of dissecting a hernia of this kind in the male subject." (*Scarpa, Traité des Hernies*, p. 201.)

Scarpa had at his disposal a male subject, in which there was a crural hernia, and he availed himself of the opportunity of examining the parts with the utmost care. He first injected the blood-vessels; he afterwards attentively dissected all the parts concerned in the disease; and he has published an exact description of the particulars, illustrated by an engraving.

According to Hesselbach, the femoral hernia, though not common in men, is more frequent than is generally believed, and often overlooked, on account of its being very small. (*Ueber den Ursprung, &c. der Leisten- und Schenkelbrüche*, p. 47.) Thus, in an example published in a modern work, an inguinal and femoral hernia were met with together in a gentleman sixty-three years of age. On examination of the body after death, a small piece of intestine, forming a crural hernia, was found strangulated, and concealed under an inguinal rupture and a mass of fat. (*Sir C. Bell's Surgical Obs.* vol. i. p. 187.)

Mr. Lawrence states, that the femoral rupture is not so uncommon in men, as several authors

would lead us to suppose. He has seen many instances of it. (*On Ruptures*, p. 409. note, ed. 4.) Dr. Breschet, it seems, has also seen as many as thirty examples of it in the practice of Dupuytren. (*Consid. et Obs. Anat. &c. sur la Hernie Fem.* in his *Concours*, p. 42.)

According to the observations of Scarpa, and all the best modern writers upon surgery, the crural hernia forms, both in the male and female subject, in the cellular substance, which accompanies the crural vessels below Poupart's ligament. The swelling follows the internal side of those vessels, and gradually descends into the fold of the thigh, between the sartorius, gracilis, and pectineus muscles. "Many surgeons believe (says Scarpa) that the hernial sac, and the intestines which it contains, are ordinarily situated above the crural vessels and the trunk of the vena saphena, and sometimes between these vessels and the anterior superior spine of the ilium. But, so far as my knowledge extends, this assertion is not supported by a single accurate description of the crural hernia in the early stage. It is true, that when the tumour has in time acquired a large size, and its fundus is inclined in a parallel manner to the fold of the thigh, it partly or entirely covers the crural vessels, and even the crural nerve, as Walker says he once observed. (*Sylloge Comment. Anat.* p. 24.) But it is not thence to be concluded, that the tumour in the beginning descended over the crural vessels, much less be-twixt them and the anterior superior spinous process of the ilium. Neither must it be imagined, that the neck of the hernial sac becomes removed from the inner to the outer side of these vessels. If these two cases ever happen, they must be very rare; and the best authors, who have treated of crural hernia, concur in stating, that, in performing the operation, they have constantly found the viscera situated at the inner side of the crural vessels, but never at their outside. Even when the tumour, after acquiring a considerable size, is situated transversely over the crural vessels, the neck of the hernial sac has always been found upon their inner side, that is to say, between them and the pubes. Le Dran (*Observ. de Chir.* t. ii. p. 2.); La Faye (*Cours d'Opérations de Dionis*, p. 358.); Petit (*Œuvres Posthumes*, t. ii. p. 219.); Morgagni (*De Sed. et Caus. Morb.* epist. xxxiv. xv.); Arnaud (*Mém. de Chir.* tom. ii. p. 768.); Gunz (*De Herniis Libellus*, p. 78.); Bertrandi (*Trattato delle Operazioni*, t. i. Annot. p. 218.); Pott (*Chirurg. Works*, vol. ii. p. 152.); Desault (*Traité des Mal. Chirurg.* pp. 191—195.); B. Bell (*A System of Surgery*, vol. i. p. 387.); Richter (*Traité des Hernies*, chap. xxxiv.); Nessel (*Institut. Chir.* t. ii. p. 198.); Lassus (*Méd. Opér.* t. i. p. 198.), and many other writers, all concur upon this point. "In support of their opinion (says Scarpa) I could cite a great number of cases of my own, which I have collected either in operating on several individuals for crural hernia, or in dissecting the same kind of hernia in the bodies of many female subjects, and in that of the man from whom I have taken the 8th plate. Lastly, also, having had an opportunity of dissecting, in a female, an enormous crural hernia, which descended one third of the way down the thigh, I observed, that the neck of the sac did not encroach at all upon the crural vessels, but lay entirely on their inner side." (*Scarpa, Traité des Hernies*,

pp. 203. 206.) The tumour, on account of its situation, is liable to be mistaken for an enlarged inguinal gland; and many fatal events are recorded to have happened from the surgeon's ignorance of the existence of the disease. Mr. Lawrence once saw an hospital surgeon mistake a crural hernia for a glandular tumour, and the patient died, without any attempt being made to afford relief by the operation. (P. 413. ed. 4.) (See also Petit, *Mal. Chir.* t. ii. p. 293, &c.) A gland can only become enlarged by the gradual effects of inflammation; the swelling of a crural hernia comes on in a momentary and sudden manner, and, when strangulated, occasions the train of symptoms already described in our account of the inguinal hernia, which symptoms an enlarged gland could never occasion. Such circumstances seem to be sufficiently discriminative; though the feel of the two kinds of swelling is often not of itself enough to make the surgeon decided in his opinion. It is particularly remarked by Hesselbach, that, while a femoral hernia is incomplete, that is to say, within the outer opening of the passage, through which the parts descend, the disease presents itself as a round firm swelling, on the outer side of which the femoral artery can be felt pulsating; this small hernia may be mistaken for an inflamed gland, and the case can only be discriminated by the history of its origin and symptoms. (*Ueber den Ursprung der Leisten- und Schenkelbrüche*, p. 51.) A femoral hernia may be mistaken for a bubonoele, when the expanded part of the swelling lies over Poupart's ligament. As the taxis and operation for the first case ought to be done differently from those for the latter, the error may lead to very bad consequences. *The femoral hernia, however, may always be discriminated, by the neck of the tumour having Poupart's ligament above it. In the bubonoele, the spine of the pubes is behind and below this part of the sac; but, in the femoral hernia, it is on the same horizontal level, and a little on the inside of it.* (See Lawrence on *Ruptures*, p. 414. ed. 4.)

In the male subject, "the crural hernia, in the early stage, says Scarpa, is situated so deeply in the bend of the thigh that it is difficult, even in the thinnest persons, to feel its neck; and, in examining its circumference with the extremity of the finger, the tendinous margin of the opening, through which the parts are protruded, can only be perceived with considerable difficulty. On the contrary, the inguinal hernia, however small it may be, is always less deeply situated: it is about half an inch above the bend of the thigh. In carrying the finger round its neck, the tendinous margin of the inguinal ring can be easily felt at its circumference; and, at the posterior part of the small tumour the chord, composed of the spermatic vessels, is distinguishable. *When the crural hernia has acquired a considerable size, its neck is always deeply situated in the bend of the thigh; but its body and fundus assume an oval form, and their great diameter is situated transversely in the bend of the thigh.* Whatever may be the size of the inguinal hernia, it always presents a tumour of a pyramidal form, the base or fundus of which, far from being directed towards the ilium, follows exactly the direction of the spermatic chord, and descends exactly into the scrotum. Besides the symptoms common to all hernial swellings, the crural hernia, when it has attained a certain size,

presents some others, which are peculiar to it, such as a sense of stupor and heaviness in the thigh, and œdema of the leg, and even of the foot, of the same side." The reason, why œdema and numbness of the limb are particularly remarkable in cases of femoral hernia, is justly referred by Hesselbach to the circumstance of the femoral vessels and nerves, with numerous lymphatics, taking their course through the crural ring; and, according to his observations, the numbness and œdema are especially great, when the protrusion is omentum, which makes stronger pressure on the vessels and nerves than commonly happens in a case of enterocele. (P. 53.)

One case is recorded in which the pressure of an omental femoral hernia on the great vessels, had produced a varicose state of the vein, and a partial obliteration of the artery. (See Jules Cloquet, *Pathologie Chir.* p. 88.)

This kind of hernia is not disposed to attain so large a size as that which a bubonocœle frequently exhibits. Yet, sometimes its magnitude is considerable, and its contents numerous. Thus, an instance was published by Professor Lallement, in which a femoral hernia, of forty years standing, contained the uterus, Fallopian tubes, the ovaries, a part of the vagina, and a considerable piece of the omentum. (See *Bulletins de la Faculté*, Janvier, 1816; and Jules Cloquet, in *Pathol. Chir.* p. 104.)

"In women, however, (as Scarpa observes) it is less easy to distinguish the crural hernia from the inguinal. In fact, the absence of the spermatic chord, and the nearer situation of the ring to the crural arch, may easily occasion a mistake. Sometimes, a woman may even be supposed to have a double crural hernia of the same side, whilst of these two distinct, though neighbouring herniæ, one may be inguinal, and the other crural. Arnaud (*Mém. de Chir.* t. ii. p. 605.) relates an instance of such a mistake." (Scarpa, *Traité des Hernies*, pp. 207, 208.)

This interesting writer takes occasion to observe further, upon this part of the subject, that the portion of the inferior pillar of the abdominal ring, which separates this opening from the internal and inferior angle of the crural arch, is so slender in women, that it is sometimes hard to distinguish the crural from the inguinal hernia, which is not the case in male patients.

Until a few years ago, the stricture, in cases of femoral hernia, was always supposed to be produced by Poupart's ligament. A change of opinion on this subject, however, has latterly taken place, in consequence of the observations made by Gimbernat in 1793. "In the crural hernia (says he), the aperture through which the parts issue, is not formed by two bands (as in the inguinal hernia), but it is a foramen almost round, proceeding from the internal margin of the crural arch (Poupart's ligament), near its insertion into the branch of the os pubis, between this bone and the iliac vein; so that, in this hernia, the branch of the os pubis is situated more internally than the intestine, and a little behind, the vein externally, and behind, and the internal border of the arch, before. Now it is this border which always forms the strangulation." (See *A New Method of operating for the Femoral Hernia.*)

The utility of knowing, that it is not Poupart's ligament which produces the strangulation, is

insisted upon by Gimbernat as exceedingly important; for we then know, that cutting the lower and outer border of the external oblique muscle is quite erroneous. This proceeding is the more to be reprobated, because the lower pillar of the abdominal ring, in both sexes, will be divided by directing the incision upward, or upward and inward; and thus the abdominal and crural rings will be made into one common aperture, large enough to make the future occurrence of hernia very likely to happen. In the male, there is also considerable danger of the spermatic chord being cut. Cutting Poupart's ligament obliquely outwards is attended with still more danger; for the epigastric artery will infallibly be divided at its origin; and with all these hazards, the incision must be quite useless, unless carried on to the internal edge of the crural arch. (Gimbernat, p. 16.)

The inclination, however, of several modern writers to refer the strangulation entirely to Gimbernat's ligament is not sanctioned by the most careful observers, like Hesselbach and Langenbeck. (*Neue Bibl.* b. ii. p. 132.) The former justly remarks, that a complete femoral hernia may be strangulated in two places, either at the outer or inner opening of the passage, through which the protrusion happens. Nay, says he, that the strangulation is sometimes caused by the outer opening was known to former surgeons, for they remarked, that the constriction was removed by dividing the fascia. (P. 53.) And, in addition to these two modes of strangulation, is to be enumerated a third, in which the viscera are constricted by protruding through some weaker point, or accidental opening, in the anterior parietes of the crural canal (Hesselbach, p. 48; Cloquet, *Recherches Anat.* p. 85; also Langenbeck, *Op. cit.* p. 132.); or even through an aperture in the inner side of this passage, as we had depicted in the twentieth plate of Langenbeck's treatise "*De Structura Peritonæi.*"

When the dissection is begun at the inside of the inguinal region, the following circumstances are noticed: after the removal of the peritonæum from the abdominal muscles, and from the psoas, iliacus internus, and the great vessels, the inner surface of the transversalis still has an investment, which Sir Astley Cooper first described, and named *fascia transversalis*, and which is always a white glistening aponeurosis. From the place, where the femoral artery lies under Poupart's ligament, to the anterior superior spine of the ilium, the preceding fascia is extended in a strong fibrous form behind the inner surface of Poupart's ligament, and a thin continuation of it is extended over the iliacus internus and psoas muscles, where it is called, by Sir A. Cooper and Cloquet, the *fascia iliaca*. The fascia of the transverse muscle closes the belly behind Poupart's ligament, as completely as the peritonæum does, so that between the femoral artery and the anterior superior spine of the ilium none of the bowels can protrude, which occurrence is still farther prevented by the fascia lata, which, below Poupart's ligament, is closely attached to the muscles of the thigh. By the pelvis being thus shut up, the origin of a crural hernia on the outside of the femoral vessels is rendered quite impossible. (See Langenbeck, *Neue Bibl.* b. ii. p. 112, &c.) This part of the explanation very nearly resembles that delivered by Sir A. Cooper, except that the latter describes the iliac fascia, and not

what Cloquet calls the transverse fascia, as closing the pelvis from the spine of the ilium to the crural vessels. But this difference is easily accounted for, by the circumstance of Sir A. Cooper extending the name fascia iliaca beyond the limits given it by Cloquet and Langenbeck.

"From that part of the crural arch extending from the anterior superior spinous process of the ilium, to the outer edge of the external iliac artery (says Sir Astley Cooper) a strong fascia will be found to arise, extending upwards over the iliacus and psoas muscles. It may be traced inwards behind the femoral vessels, as far as the linea ileopectinea, being attached at that line to the ligament of the pubis, and to the tendon of the psoas parvus, when that muscle is present. This fascia has been particularly described by Gimbernat, and should be called fascia iliaca. If the fascia iliaca be carefully traced, it will be found to arise from the outer half of the crural arch, in conjunction with the outer portion of the fascia transversalis; the latter ascending before the peritoneum, while the former passes up behind that membrane; they unite at the outer side of the transversalis muscle, and appear as one continuous production. By the union of these two fasciæ at Poupart's ligament, and their separation to enclose the viscera, the contents of the abdomen are thus received into a blind funnel, and are prevented descending on the outer side of the iliac vessels. If the latter vessels be raised, the fascia iliaca will be seen descending behind them, as far down the thigh as the origin of the profunda, thus forming the posterior part of the sheath. Thus a sheath is formed, enveloping the femoral artery, vein, and absorbent vessels, anteriorly, by the descent of the fascia transversalis, posteriorly by a similar process from the fascia iliaca, and by the union of these at the inner and back part of the sheath, the bag is rendered complete. At the upper part the sheath is broad, but, as it descends, it becomes more closely applied to the femoral vein and artery, giving it the appearance of a funnel. It is at the upper and inner part of this funnel, that the absorbent vessels enter the sheath, giving it, as has been already remarked, a cribriform appearance. This part of the sheath is much looser in its texture than the portion investing the artery and vein which is firm and unyielding on the fore part of the sheath, where the latter is united to Poupart's ligament.

"If the sheath be opened, the contents will be found separated by two membranous septa; one passing between the artery and vein, and a second, equally distinct, between the vein and the absorbents. The septum is formed by a process from the fascia transversalis passing backwards to attach itself to the fascia iliaca." Sir Astley Cooper then proceeds to explain, that the artery and vein completely fill up the space in the sheath allotted to them; while the absorbents are loosely connected. (See Sir A. Cooper on *Hernia*, p. 10. part i. ed. 2.)

Near the anterior superior spinous process of the ilium, Langenbeck remarks, that the fascia of the transverse muscle has some strong fibres, which proceed inwards under the internal opening of the inguinal canal, of which they form, as it were, the bottom, and are named by Hesselbach, the *internal inguinal ligament*. They go over the femoral artery and vein, are connected above with the fascia of the transverse muscle, and below are continued into the fascia of the psoas and iliac

muscles. Where these fibres pass over the femoral vessels, they expand into a firm aponeurosis, which, "passing downwards, is intimately attached at the inner side of the femoral vein to the horizontal branch of the os pubis, close to the symphysis, and then joins the aponeurosis of the recti muscles. The expanded portion of the foregoing tendinous fibres, thus continued along the crista of the os pubis to the sheath of the rectus, forms the inner surface of Gimbernat's, or the *femoral or crural ligament*. The inner edge of this ligament is falciform and concave, the concavity being turned towards the femoral vein. Now where the fascia of the transverse muscle extends downwards, on the outer side of the crural artery, to the fascia of the psoas and iliac muscles, so as to close the pelvis between that vessel and the anterior superior spinous process of the ilium, it also forms, like Gimbernat's ligament, a falciform edge, the concavity of which lies close over the external convexity of the crural artery. Thus, partly by the concave edge of Gimbernat's ligament, directed towards the crural vein, and partly by the concave edge of the extension of the fascia of the transverse muscle to the fascia iliaca, which edge is turned towards the crural artery, an aperture is produced, through which the femoral vessels pass out of the pelvis. This opening is named by Cloquet the *upper opening of the crural canal*, or, as many English surgeons would say, of the *crural or femoral ring*. By Hesselbach, it is called the *internal opening for the femoral vessels*. However, as these vessels do not lie loosely and unconnectedly in this aperture, the opening itself is shut up, as it were, and cannot be seen without dissection.

On the above described fascia, there is a considerable quantity of cellular tissue which covers the vessels in the pelvis, forms a sort of sheath for the crural artery and vein, and accompanies these vessels through the inner opening of the crural canal, or ring, which is itself accurately shut up by it. When this cellular tissue is removed, the white glistening fasciæ are plainly seen passing through the same opening, and coming nearer together in a funnel-like manner. (See also Sir A. Cooper on *Hernia*, p. 10, part i.) Where the fascia of the transverse muscle forms the outer falciform edge of this aperture, and is passing over the arteria circumflexa ili to the psoas and iliac muscles, it sends off through the opening, a process which becomes connected with the outer side of the crural canal, or ring; while from the internal inguinal ligament which lies above this opening, and constitutes the upper edge of the inner aperture of the crural canal, a production is sent, which is connected with the anterior side of this canal. As for the posterior and inner sides, they have a connection with the fasciæ of the psoas and levator ani.

When the groin is externally dissected, in order to have a view of the crural ring or canal, on the outside of the pelvis, the following appearances present themselves:—after the removal of the common integuments, one finds below Poupart's ligament, a quantity of fat, glands, lymphatics, veins, and arteries, which vessels come out through small openings in the fascia lata. As soon as the outer surface of the external oblique muscle is cleared, its aponeurosis is found to become stronger at the anterior superior spinous process of the ilium, and its fibres to collect together, and assume the form of a band, which is Poupart's ligament,

called by Hesselbach the *external inguinal ligament*, and by Gimbernat, Cloquet, and others, the *crural arch*. This ligament, as is well known, passes obliquely, inwards and downwards, towards the os pubis, and after forming the external pillar of the abdominal ring, is first closely inserted into the angle, or tubercle of the os pubis, and then being continued inwards, or backwards, in the form of a firm fascia, is attached to the horizontal ramus of that bone, making the *anterior or outer face of Gimbernat's, or the femoral, ligament*, which is consequently produced by the junction of Poupart's with Hesselbach's internal inguinal ligament along the spine of the os pubis. Thus, just as the internal inguinal ligament is a strengthened part of the fascia of the transverse muscle, the outer inguinal ligament, (or, as it is here commonly called, Poupart's ligament,) is produced by the strengthened fibres of the lower portion of the aponeurosis of the external oblique muscle, the fibres of it, making the external pillar of the ring, being continued further towards the symphysis of the pubes, in the form of the outer surface of Gimbernat's ligament. (*Langenbeck, Neue Bibl. b. ii. pp. 120, 121.*) Some English surgeons make the formation of Gimbernat's, or the femoral ligament more simple; thus, Mr. Lawrence states, that when Poupart's ligament approaches the pubes, "it becomes suddenly broader; that it is fixed by this broad portion, along the whole length of the angle and crista of the pubes; that it has a rounded and strong anterior edge, a thin and sharp posterior margin; and that the former of these is nearer to the surface, while the latter is comparatively deeply seated. The breadth of this part varies, in different subjects; it is generally from three quarters of an inch to an inch. Sometimes, as Gimbernat has stated, it measures more than an inch. Dr. Monro has observed, that it is broader in the male than in the female subject; and, from this structure, he explains in part the more rare occurrence of this rupture in the male." (*P. 363. ed. 3.*)

The fascia lata, which is spread over the muscles of the thigh, is only a continuation of the aponeurosis of the external oblique muscle, and, as it proceeds downwards from Poupart's ligament, is very closely attached to the muscles of the thigh, all the way from the anterior superior spinous process of the ilium to the femoral artery, drawing, as it were, Poupart's ligament downwards and inwards, or backwards, towards the cavity of the pelvis, so as to give to its external edge a convex appearance, and shut up the outside of the pelvis, from the anterior superior spine of the ilium as far as the crural nerve and artery, so firmly, that the formation of a femoral hernia at this part is impossible. And, if small apertures, filled with fat, be discernible in this portion of the fascia lata, still no hernia can here take place because, as Langenbeck has already explained, here the interior of the pelvis is again shut up by fasciæ already described.

Under the fascia lata are situated the anterior crural nerve, the vein, and artery. The vena saphena magna lies on the outside of it, and passes through an opening in it into the femoral vein. This aperture in the fascia lata is at the inner side of the groin, opposite the internal opening of the crural ring, or canal. It is named by Hesselbach the *external aperture for the femoral vessels*, and described by him as an oblique fissure about fif-

teen lines in length. He takes notice of its external semilunar edge, and two horns which are directed inwards; the parts first particularly described by Mr. A. Burns of Glasgow, under the name of the *semilunar or falciform process of the fascia lata*. The lower horn bends rather inwards and upwards, and terminates in the production of the fascia lata spread over the pectinialis muscle. The upper horn, which is less curved, buries itself under the external pillar of the abdominal ring. Over the lower horn of the opening, just now described, the vena saphena magna ascends into the femoral vein. Through the same aperture also pass nearly all the superficial lymphatics of the lower extremity. According to Cloquet, the fascia lata consists of two layers, of which the anterior superficial one is closely attached to the crural arch, extends over the femoral vessels, and forms the anterior side of the crural canal. The other layer near the pubes, quits the former, and, covering the pectinialis muscle, constitutes the hinder side of that canal. The anterior layer of the fascia then forms an oval aperture, through which the vena saphena passes, and which is considered by Cloquet as the *lower opening of the crural canal*. This opening called by Hesselbach the *external foramen for the femoral vessels*, is well delineated both in his excellent work, and in the twenty-third plate of Langenbeck's book. (*De Structura Perineuri, Testiculorum Tunici, &c. 8vo. Gott. 1817.*) According to the investigations of the last anatomist, as soon as the integuments are removed, this opening in the fascia lata, with its external semilunar edge and two horns are regularly seen. The front side of the crural canal is formed by the fascia lata. Where this fascia proceeds in the form of Hesselbach's upper horn under and behind the external pillar of the abdominal ring and makes the outer layer of Gimbernat's ligament, it is continued as a thin aponeurosis over the vena saphena, so that it makes not merely the upper horn, but reaches further downwards and forms the outer side of the crural canal. The outer side then of the crural canal, or ring, according to Langenbeck, extends from the outer semilunar edge of the external opening for the femoral vessels, or as English surgeons would say, from the edge of the *falciform process of the fascia lata*. The larger the preceding thin continuation of fascia is, the smaller is the external opening for the femoral vessels, the more is the upper horn bent downwards, and the more determinate is the form of the canal. (*Langenbeck, Neue Bibl. b. ii. pp. 124, 125.*)

According to Mr. Lawrence, "at the upper and anterior part of the limb, the fascia lata consists of two portions, an external and an internal, with distinct insertions. The former, which is the thickest and strongest, covers the sartorius and rectus femoris, and is inserted into Poupart's ligament, from the anterior superior spine of the ilium to the inner edge of the femoral vein. The latter thinner and weaker, covers the pectineus and abductor muscles, and is inserted into the pubes, in front of the origin of the former. It passes behind the femoral vessels, and is there continuous with the iliac fascia, while the external portion covers these vessels anteriorly, just below the crural arch, and the vessels themselves are consequently situated between these two divisions of the fascia." (*On Ruptures, p. 391. ed. 4.*)

Where the insertion of the fascia lata into Pou-

part's ligament ends, it forms what Mr. Burns of Glasgow calls the *falciform process*, the upper part of which is attached to the above ligament, while the lower proceeds farther down the thigh. The concavity of the falciform process is directed towards the pubes. This anatomical connection is one chief cause, why extending the thigh and rotating it outward, render the crural arch tense.

The hernia being situated in front of the pectineus, must of course be exterior to the pubic portion of the fascia lata. This part of the subject is rendered very clear in the works of Sir Astley Cooper, Lawrence, Hesselbach, Langenbeck, and Jones Quain. The variety of crural hernia, which descends further than usual in the sheath of the femoral vessel, lies of course under the continuation of the iliac portion of the fascia lata.

Mr. Lawrence states, that "the upper end of the falciform process passes over the upper and outer part of the neck of the tumour; it is then folded under the crural arch, and continues into the thin posterior border. The iliac vein is placed on its outer side; the pubes is directly behind it; and the upper and inner parts are bounded by the thin posterior edge of Poupart's ligament. It is this part which forms the strangulation." (*On Ruptures*, p. 404. ed. 4.) While, however, the latter statement is made by this gentleman and others, Sir Astley Cooper as positively declares, that the stricture is never situated at Gimbernat's ligament, but at the crural arch, just where the viscera leave the abdomen. He also mentions, that he has known the stricture continue after the division of that ligament, and the patient die. The view taken of this part of the subject, by Hesselbach and Langenbeck, I have already explained.

The inner side of the crural ring or canal, as already explained, is connected with the fascia of the transverse muscle. And, according to Langenbeck, below the part of the fascia lata, which forms the external foramen for the femoral vessels, the front side of the crural canal is sometimes formed by a continuation of the fascia of the transverse muscle, as he found was the case in both groins of one female subject. In such a case, there is a good deal of fat between the fascia lata, and the aponeurosis of the transverse muscle, and the two parts are easily separable. Langenbeck admits, however, that the same appearance may arise from a splitting of the layers of the fascia lata. Frequently the front side of the crural ring is so short that the opening cannot rightly be termed a canal, and it is always shorter than the posterior side. When the outer side exists, it is extended across the inner over the space between the two horns, and is then connected with the aponeurosis of the pectinalis derived from the fascia of the psoas and levator ani muscles. In the anterior and inner sides of the crural canal, there are some small openings. Doubtless this structure is referred to by Hesselbach, when he says, that in the male subject the outer opening for the femoral vessels is farther closed by a net-like web of tendinous fasciculi. The posterior side of the crural canal, or ring, is entirely formed by the part of the fascia of the psoas, which enters its inner opening, and joins the aponeurosis of the pectinalis muscle. The outer side of the canal lies under the fascia lata, and joins the anterior and posterior sides, where the aponeuroses of the transverse and iliac muscles proceed to the outside femoral artery. Langen-

beck thinks the opening, by which the vena saphena passes over the lower horn of the falciform process of the fascia lata, might be named the *lower aperture of the crural canal*. (See Langenbeck's *Neue Bibl. für die Chirurgie*, b. ii. pp. 126, 127. 8vo. Hanover, 1819.)

According to Hesselbach, in femoral hernia, the two openings of the passage now termed the crural or femoral ring, are one half larger than natural. The outer portion of the inner of these apertures is propelled more outward, and with it the epigastric artery. The femoral vein no longer lies at the external end of this opening, but rather at the back of the canal or passage. The external semilunar edge (the falciform process) of the outer opening is carried more outward and upward, and is tightly applied over the distended hernial sac. In this state of the parts the outer opening forms an oval firm tendinous ring, the direction of which, like that of the inner opening for the passage of the femoral vessels, is transverse. The neck of the hernial sac is that portion of it, which lies within the canal between the two openings. The posterior side of this canal, or passage, now frequently named the crural, or femoral ring, is longer than the anterior. In one large hernia, Hesselbach found it an inch and a half in length, but the anterior side of the passage more than one third shorter. The greatest diameter of the inner opening was one inch five lines, while that of the outer one was only one inch, four lines. Most of the posterior part of the neck of the hernial sac, with the hinder side of the canal, lies upon, the pectineus muscle, and towards the outer side upon the femoral vein. The neck of the hernial sac adheres more firmly to the anterior, than to the posterior side of the passage. At the outer opening of the passage, the neck terminates at almost a right angle forwards in the body of the sac, the upper portion of which lies upon Poupart's ligament, but the largest part of it is situated on the deep seated layer of the femoral fascia, by which the outer side of the body of the sac, as high as the neck, is separated from the crural vessels and nerves. In the male subject, when the tendinous fibres, mixed with the cellular substance covering the outer opening of the passage, make great resistance at particular points, the hernial sac of a femoral hernia may be double, or even divided into several pouches, a preparation exhibiting which occurrence is in the anatomical museum at Würzburg. (Hesselbach, p. 48.) Except in a few cases, in which the origin and course of the epigastric artery are unusual, this vessel runs very close to the external side of the neck of the hernial sac, much nearer than it does in an internal bubonocoele.

The sac of the femoral hernia is exceedingly narrow at its neck; and, where its body begins, it becomes expanded in a globular form: the sac of the bubonocoele is generally of an oblong pyramidal shape. The body of the sac of the femoral hernia, makes a right angle with the neck, by being thrown forward and upward, a circumstance very necessary to be known in trying to reduce the part by the taxis. Though the tumour formed by the body of the sac is oval and nearly transverse, it is found when attentively examined, to take the direction of the groin, which extends obliquely downwards and inwards, the outer rather smaller end of the swelling being somewhat higher than the inner. (Hesselbach, p. 50.)

The sac of the femoral hernia is said by Sir A.

Cooper to be covered by a kind of membranous expansion, consisting of condensed cellular substance, and named by him the *fascia propria*, which is thus described:—"A thin fascia naturally covers the opening, through which the hernia descends on the posterior part of the

When the hernia, therefore, enters the sheath, it pushes this fascia before it, so that the sac may be perfectly drawn from its inner side, and the fascia which covers it, left distinct. The fascia which forms the crural sheath, and in which are placed the hole or holes for the absorbent vessels, is also protruded forwards, and is united with the other, so that the two become thus consolidated into one. If a large hernia is examined, the fascia is only found to proceed upwards, as far as the edge of the orifice on the inner side of the crural sheath; by which the hernia descends; but, in a small hernia it passes into the abdomen, as far as the peritoneum, and forms a pouch, from which the hernial sac may be withdrawn, leaving this, forming a complete bag over the hernia." (*On Hernia*, part 2. p. 6.)

The thin fascia, described by Sir Astley Cooper, as shutting up the crural canal, and protruded by the viscera, is the septum crurale of M. Cloquet; who observes, that it resists the finger, when we endeavour to pass it from above downwards beneath the crural arch. It is always perforated by small apertures for the passage of lymphatics. One of these apertures, more considerable than the rest, is central, and sometimes occupied by an elongated absorbent gland. The sac of femoral hernia sometimes pushes before it, the septum crurale; and, in other instances, protrudes through one of its apertures, which may then become a cause of stricture. (See *J. Cloquet, On Hernia*, p. 40. tr. by McWhinnie.)

By Sir Astley Cooper, M. Cloquet, and the generality of modern surgeons, the femoral hernia is described as protruding into the sheath of the femoral vessels. The correctness of this description, however, Mr. Guthrie does not admit; but only because he will not consider the passage for the lymphatics, on the pubic side of the septum, situated at the internal border of the femoral vein, as a portion of that sheath. "In all the dissections of femoral hernia (says Mr. Guthrie) I have had an opportunity of making, the septum crurale of Cloquet, or the fascia propria of Sir Astley Cooper, formed a distinct sac, separated from the septum on the inside of the femoral vein, by a mass of condensed cellular structure, sometimes more than half an inch in thickness. The septum had been elongated into an outer sac for the hernia, and had gone down by the side of the sheath of the vein. The hernial sac, or peritoneum, is not then projected into the sheath of the femoral vessels, but into a separate sac, which it forms for itself by the side of them." (*On Inguinal and Femoral Hernia*, p. 32.) Here the difference of opinion turns entirely upon the point, whether the passage for the absorbent vessels at the inner side of the septum, or the pubic edge of the vein, is a compartment of the femoral sheath or not.

In every dissection of femoral hernia, performed by Mr. Todd, this thin fascia, the septum crurale, was sufficiently evident. It appears to him, however, that the *fascia propria* is formed, not only of a portion of this thin internal fascia, but also, in many instances, of all the dilatable parts inter-

posed between the hernial sac and the superficial fascia; and that its thickness will depend on the thickness and structure of these parts; on the alterations produced in them by inflammation and pressure; and on the perforated portion of the crural sheath, in some cases, composing a layer of this fascia; while, in others, the hernia dilates, and is protruded through one of the foramina, frequently pushing before it a large absorbent gland from the orifice of the sheath." (*C. H. Todd, in Dublin Hospital Reports*, vol. i. p. 248.)

As explained by Sir A. Cooper, a weak spongyrosis, derived from the superficial fascia of the bend of the thigh, covers the swelling, and lies immediately beneath the skin and adipose substance. Under this fascia is the condensed cellular substance or fascia propria joined with the expansion of the crural sheath, then some adipose substance, and lastly, the true peritoneal sac itself. It is of infinite use to remember these several investments in operating, lest the hernial sac should be supposed to be divided, while it is not so.

All late writers on hernia, have remarked how very small the aperture is, through which the viscera protrude in the femoral rupture; how much greater the constriction generally is, than in the bubonocoele; consequently, how much more rapid the symptoms are; how much less frequently the taxis succeeds; and how much more dangerous delay proves. (See *Sir A. Cooper, Hey, Lawrence, &c.*)

Though the crural ring is almost always small, yet, in a few instances, in which the tumour is large, and of long standing, it becomes very capacious, just as the opening often becomes, through which the inguinal hernia protrudes. Dr. Thomson, of Edinburgh, Mr. Hey, and Mr. Lawrence, have related examples of this kind.

The remarks already made, concerning the treatment of hernia, before having recourse to the knife, are all applicable to the present case, and need not be repeated. In attempting to reduce the femoral hernia by the taxis, the surgeon should recollect, however, that relaxing Poupart's ligament, and the femoral fascia, is of the highest consequence. Hence, the thigh should be bent, and rolled inwards. The pressure ought, also, to be first made downwards, in order to push the swelling off Poupart's ligament; and afterwards, the parts should be propelled backwards, and then upwards, so that they may return through the crural canal and ring. For the direction of the crural canal is vertical in the greater part of its extent; its superior aperture faces upwards and backwards towards the abdominal cavity, whilst its inferior (the opening for the vena saphena) is directed forwards. The canal, therefore, has three different axes, which by their union, represent the form of the letter Z; the superior branch of which, resting upon the pubes, would form the axis of the superior aperture of the canal, and which has a direction downwards and forwards. Its middle branch would represent that of the canal itself, which is vertical; whilst the inferior would pass out directly forwards, through the opening for the vena saphena, in a direction corresponding to the axis of this aperture. (See *M. Jules Cloquet, On Inguinal and Femoral Hernia*, p. 37. tr. by McWhinnie.)

OPERATION FOR THE FEMORAL, OR CRURAL HERNIA.

Sir A. Cooper says, "The incision of the integuments is to be begun an inch and a half above the crural arch, in a line with the middle of the tumour, and extended downwards to the centre of the tumour below the arch. A second incision, nearly at right angles with the other, is next made, beginning from the middle of the inner side of the tumour, and extending across it to the outer side, so that the form of this double incision will be that of the letter T reversed." The angular flaps are, of course, to be next dissected off, and reflected. Dupuytren also makes the external wound of a similar shape, the first cut being always parallel to the femoral vessels. (*Breschet, Op. cit. p. 169.*)

The making of two incisions, however, is not deemed necessary by the majority of surgeons; and, in all the numerous operations which I have seen performed in St. Bartholomew's Hospital during my apprenticeship there, and afterwards, and in eight cases, upon which I have operated myself, a transverse wound was not necessary. The division of the skin should begin about an inch above the crural ring, and be continued obliquely downwards and outwards. In this manner, we cut exactly over the place, where the incision of the stricture should be made. (See *Lawrence, p. 425. ed. 4.*)

"The first incision (Sir A. Cooper remarks) exposes the superficial fascia, which is given off by the external oblique muscle, and which covers the anterior part of the hernial sac; but, if the patient is thin, and the hernia has not been long formed, this fascia escapes observation, as it is then slight and delicate, and adheres closely to the inner side of the skin. When this fascia is divided, the tumour is so far exposed, that the circumscribed form of the hernia may be distinctly seen; and a person, not well acquainted with the anatomy of the parts, would readily suppose that the sac itself was now laid bare. This, however, is not the case, for it is still enveloped by a membrane, which is the fascia, that the hernial sac pushes before it, as it passes through the inner side of the crural sheath. This membrane, the fascia propria, is to be next divided longitudinally from the neck to the fundus of the sac; and if the subject is fat, an adipose membrane lies between it and the sac, from which it may be distinguished, by seeing the cellular membrane passing from its inner side to the surface of the sac.

"This is, in my opinion, the most difficult part of the operation; for the fascia propria is very liable to be mistaken for the sac itself; so that, when it is divided, it is supposed, that the sac is exposed, and the intestine is laid bare: following upon this idea, the stricture is divided in the outer part of the sac, and the intestine, still strangulated, is pushed, with the unopened sac, into the cavity of the abdomen.

"The hernial sac being exposed, is to be next opened; and, to divide it with safety, it is best to punch up a small part of it between the finger and thumb, to move the thumb upon the finger, by which the intestine is distinctly felt, and may be separated from the inner side of the sac; and then to cut into the sac, by placing the blade of the knife horizontally. Into this opening, a director should be passed, and the sac opened from its fundus to the crural sheath." (*On Crural and Umbilical Hernia.*)

Sometimes the contents of the hernia, thus exposed, admit of being returned, without the further use of the knife. When this object, however, cannot be readily done, the protruded parts should never suffer injury from repeated manual attempts; and it is best to divide the stricture at once.

The merit of having first proposed the safest plan of cutting Poupart's ligament, even before surgeons were aware of the parts which really form the strangulation, is assigned by Gimbernat to Mr. B. Bell, who introduced his finger below Poupart's ligament, between the ligament and the intestine (an evident proof, says Gimbernat, that there was no strangulation there); he then made a very superficial incision from above downwards, into the thickest part of the ligament to its lower edge; and, without cutting quite through it, he continued his incision about an inch. He rested the back of the scalpel upon his finger, which served as a guide to the instrument, and, at the same time, as a defence to the intestine. The incision, however, having been continued for an inch, would, as Gimbernat remarks, inevitably cut the internal edge of the crural arch. Now, cutting this, only for a few lines, gives sufficient room for the easy reduction of the parts, and there is no necessity to touch the ligament, as it never occasions the strangulation. (*Gimbernat, p. 27.*)

Gimbernat's method of dividing the stricture, in cases of femoral hernia, is now frequently regarded as the safest and most effectual. "Introduce, along the internal side of the intestine, a cannulated or grooved sound with a blunt end, and a channel of sufficient depth. This is to be directed obliquely inwards, till it enter the crural ring, which will be known by the increased resistance; as also when its point rests upon the branch of the os pubis. Then suspend the introduction; and keeping the sound (with your left hand, if you are operating on the right side, and v. v.) firmly resting upon the branch of the os pubis, so that its back shall be turned towards the intestine, and its canal to the symphysis pubis, introduce gently with your other hand, into the groove of the sound, a bistoury, with a narrow blade and blunt end, till it enter the ring. Its entry will be known, as before, by a little increase of resistance. Cautiously press the bistoury to the end of the canal; and employing your two hands at once, carry both instruments close along the branch to the body of the os pubis, drawing them out at the same time. By this easy operation, you will divide the internal edge of the crural arch at its extremity, and within four or five lines of its duplicature; the remainder continuing firmly attached by the inferior band, or pillar, of which it is the continuation. This simple incision being thus made, without the smallest danger, the internal border of the arch, which forms the strangulation, will be considerably relaxed, and the parts will be reduced with the greatest ease. (*Gimbernat, p. 45, 46.*)

Mr. Lawrence thus executes Gimbernat's plan:—"It will generally be practicable (says he) to introduce the tip of the finger, or of the nail, under the edge of the tendon, the fibres of which should be carefully divided in succession, with the probe-pointed knife, until we have gained just sufficient room to replace the contents of the swelling. When the tightness of the stricture prevents the operator

from using his finger as a guide, he will employ the deeply-grooved curved director, introducing it as near as he can to the pubes. In both cases, the blunt end only of the curved knife should be passed beyond the stricture, that the division may be effected without risk to the arteries, in case they should not follow their usual course." The intestine should be protected by the operator's left fore-finger, or, if that cannot be spared, it may be held aside by an assistant. (*On Ruptures*, p. 432. ed. 4.)

Mr. Todd has always found the division of a few fibres of Gimbernat's ligament effectual. (*Dublin Hospital Reports*, vol. i. p. 254.) The following are his directions: after the sac has been opened, "let the operator pass the fore-finger of his left hand (if the hernia be on the right side, and *vice versa*,) as far as he can, without using force, into the neck of the sac, the back of the nail being turned towards the pubes, and its extremity applied to the edge of Gimbernat's ligament. Sir Astley Cooper's bistoury is then to be introduced, the finger serving as a conductor for it, the bistoury being held so, that its edge shall look towards Poupart's ligament, and one of its sides be in contact with the nail of the conducting finger, between which, and Gimbernat's ligament, it is to be passed. Having ascertained with the blunt extremity of the bistoury, that it is fairly introduced into the crural ring, the intestine being protected, as much as possible, by the left hand of the operator, the edge of the bistoury is to be turned towards the pubes, and being pushed a little further into the ring, the sharp portion of its edge will be brought into contact with Gimbernat's ligament, and will divide a few fibres of it. The operator is still to keep the conducting finger between the intestine and bistoury, as thus he will be enabled to perceive the dilatation of the ring, and to judge of the extent to which it may be necessary to enlarge it." (*C. H. Todd*.)

Sir A. Cooper recommends the stricture to be divided "obliquely inwards and upwards, at right angles to the crural arch." In consequence of the very deep situation of the posterior edge of the crural arch, and the tight manner in which the protruded viscera are surrounded by the tendon, this excellent surgeon considers, that the intestine is in great danger of being wounded with the knife, or, if held aside sufficiently, of being torn. Hence, his custom is to divide the stricture on its anterior part, as far as the front margin of the crural arch, directing the edge of the knife upwards and inwards. If this is not sufficient, he afterwards cuts the thin posterior border of the tendon in the same direction.

After advising us to open the sac of a femoral hernia with particular care, on account of its being much thinner than that of a bubonocoele, and (as might be added) on account of its seldom containing any fluid, and often having no omentum in it covering the intestine, Mr. Hey remarks: "The stricture made upon the prolapsed parts is very great, as I have already observed; but if the tip of the finger can be introduced within the femoral ring, to guide the bubonocoele knife, a small incision (for the ring is narrow) will be sufficient to set the parts at liberty. If the tip of the finger cannot be introduced at the proper place, a director with a deep groove must be used instead of the finger; but I prefer the latter. The finger or director should not be introduced very near the great vessels, but

on that side of the intestine or omentum which is nearest to the symphysis of the ossa pubis. The incision may then be made directly upwards. The surgeon must take especial care to introduce his finger or director within that part where he finds the stricture to be the greatest, which, in this species of hernia, is the most interior part of the wound." (*P. 155*.)

Gimbernat's mode is preferable to Mr. Hey's, because, were the operation done on a male, cutting directly upward would endanger the spermatic chord. In order to obviate this risk, Sir A. Cooper makes a small incision above Poupart's ligament, and draws the chord out of the way of the knife, with a bent probe.

Mr. Lawrence has noticed, that an "incision of the most interior part of the stricture is free from all danger in the ordinary course of the vessels. But that variety, in which the obturator artery, arising from the epigastric, runs along the inner margin of the sac, seems to preclude us from cutting even in this direction." Hesselbach met with a remarkable instance of such irregularity in the origin and course of the obturator artery in the body of a female, in whom there were two small crural herniæ. On the right side, the epigastric and obturator arteries arose, by a common trunk, from the crural artery below Poupart's ligament. They soon separated from one another; the epigastric taking its ordinary course upwards at the outer side of the neck of the hernial sac, while the obturator made a considerable turn, and ran transversely inwards over the strong fibres of the femoral ligament, and encircled the anterior and inner side of the neck of the hernia, whence it afterwards proceeded obliquely downwards and outwards, behind the horizontal branch of the os pubis, towards the obturator foramen. (*Hesselbach*, p. 52.) A mode of operating has been proposed (*Edin. Med. and Surg. Journal*, vol. ii. p. 205.), with the view of avoiding this danger. We are directed to make an incision through the aponeurosis of the external oblique muscle, just above the crural arch, and in a direction parallel to that part; to introduce a director under the stricture from this opening, and to divide the tendon to the requisite extent, by means of a curved knife passed along the groove. (*On Ruptures*, p. 430. ed. 4.) For reasons which Mr. Lawrence states, this plan is certainly not altogether eligible; and, upon the whole, Gimbernat's method of cutting the stricture is safer.

Dupuytren uses a curved probe-pointed bistoury, that cuts with its convexity: it is conducted flat on the left fore-finger, and with it, under the stricture, and then its edge is turned upwards, the incision being extended through the upper end of the falciform process to the margin of the crural arch. (*Breschet, Concours, &c.* p. 182.)

It is remarked by Mr. Guthrie, that the falciform process, which lies over the femoral artery, and passes inwards to attach itself to Poupart's ligament, and to form the anterior part of Gimbernat's ligament, is inserted also into the os pubis, on a plane lower, than the insertion of the inferior pillar of Poupart's ligament, so that "it forms an arch, exterior to the septum crurale, which, when it is forced to descend, is compelled to pass under it; and it is this, and not Poupart's ligament, which causes the greatest compression on the hernia, and is the seat of external stricture." (*Op. cit.* p. 32.)

This gentleman has heard of more than one instance, in which the obturator artery was wounded by dividing Gimbernat's ligament horizontally: he is therefore in favour of dividing directly upwards, "that portion of the fascia lata, which is attached to Gimbernat's ligament, and to the pubes, as well as the fascia propria." If this should be insufficient, he would then have recourse to the horizontal incision.

Monro computes, that the obturator artery may arise from the epigastric once in twenty-five or thirty subjects. But, allowing that it originates more frequently, it then does not always deviate from its usual course along the outside of the sac. Sir A. Cooper says, "In all cases, which I have myself dissected, where this variety existed with crural hernia, the obturator has passed into the pelvis, on the outer side of the neck of the sac, entirely out of the reach of any danger of the knife." (*On Crural Hernia*, p. 21.) Mr. Lawrence concludes, that the comparative number of instances, in which it is found on the opposite side, cannot be more than one in twenty, and consequently, if we admit that the obturator artery arises from the epigastric once in five times, it would only be liable to be wounded once in a hundred operations. (P. 412, ed. 3.)

When the origin and course of the epigastric artery differ from what is common, this vessel, as Hesselbach remarks, sometimes passes inwards along the horizontal branch of the os pubis, ere it ascends towards the rectus muscle; and when this variation exists in a case of femoral hernia, the artery does not pass over the outer side of the neck of the sac, but first under it, and then round its inner side. Hesselbach has seen only one instance of this irregularity of the epigastric artery in a female, and never in a male subject. (*Ueber den Ursprung, &c., der Leisten und-Schenkelhübe*, p. 52.)

The industrious Cloquet examined 250 bodies, for the purpose of estimating the average number of cases, in which the origin and course of the obturator artery are different from what is most common. He found, that when this artery and the epigastric arise by one common trunk, they sometimes separate from each other above, and rarely below, the upper opening of the crural canal. In the first case, the longer their common trunk is, the closer do they lie to Gimbernat's ligament, and to the inner edge of the upper opening of the above canal. In the second case, the common trunk of these arteries arises within this canal, and the two vessels then return into the abdomen. In 160 bodies, of which 87 were male, and 73 female, the obturator artery arose on both sides from the hypogastric; and only in 56, of which 21 were male, and 35 female, did it originate on both sides from the epigastric. In 28, of which 15 were male, and 13 female, the obturator arose on one side from the hypogastric, and on the other from the epigastric. In six bodies, viz. two male, and four female, it originated from the crural. (*Rech. Anat. sur les Hernies*, 4to. Paris.)

It is observed by Professor Scarpa, that "the round ligament of the uterus, in passing through the abdominal muscles, follows precisely the same track as the spermatic chord. It is equally situated behind Poupart's ligament, with the difference, that it does not become so distinct from the internal extremity of this ligament, as the spermatic chord

does, because it has not so far to run, in order to get from that ligament to the inguinal ring, the latter opening being situated lower in the female than the male subject. The round ligament, like the spermatic chord, also crosses the epigastric artery, before reaching the inguinal ring. And as the crural hernia always begins at the internal and inferior angle of the arch of this name, as well in the male as the female, it follows that, in the two sexes, the epigastric artery remains in its natural situation, and invariably corresponds to the external side of the neck of the crural hernia; whilst the spermatic chord in men, and the round ligament in women, pass over the extremity of the front of the neck of the hernial sac. In the operation for the crural hernia, in females, the incision of the neck of the hernial sac, and crural arch, when directed upward towards the linea alba, cannot wound the epigastric artery, which it is of the most consequence to avoid; but it always divides, either totally, or partially, the round ligament of the uterus, which cannot lead to any dangerous hemorrhage; for, except in the period of pregnancy, the arteries of the round ligament are very small; they are almost obliterated in women advanced in years; and, in general, they are quite capillary in the extremity of the ligament adjoining the ring. Hence, it cannot be surprising, that so many crural herniae have been successfully operated upon in women, by cutting the hernial sac and crural arch directly upward, while not a single instance can be cited of such an incision being made in man without mischief, although, in both sexes, the epigastric artery may have been avoided in operating by this process." (*Scarpa, Traité des Hernies*, p. 240.)

In operating upon the crural hernia in males, Scarpa recommends us to follow a method, which he calls new, but which, in fact, is the same as that advised by Gimbernat. "I have found (says Scarpa) that, in man, the neck of the hernial sac may be divided without danger, by giving to the incision a direction exactly contrary to that which is practised in the female subject. After having opened the hernial sac, it is to be drawn outward by one of its sides sufficiently to allow the introduction of a small director between its neck and the strangulated intestine, the groove of the instrument being turned downwards towards the internal and inferior angle of the crural arch. A pointed bistoury, the edge of which is also to be directed downwards towards the point of insertion of Poupart's ligament to the pubes, is to be pushed along the groove. By the means the neck of the hernial sac will be divided its whole length, at its internal and inferior side, and Poupart's ligament will be cut close to its attachment, to the top of the os pubis. The epigastric artery will certainly be avoided, because it lies upon the opposite side of the hernial sac. As for the spermatic chord, I have demonstrated, that it is situated on the forepart of the neck of the hernial sac; consequently, it cannot be touched by an incision made from above downwards, whilst it is constantly cut in the ordinary method, since the knife is carried from below upwards. In the first case, this part may be the more easily avoided, as it lies at some distance from the internal and inferior angle of the crural arch. In fact, it is at this place that it quits, as we have seen, the edge of Poupart's ligament, in order to ascend towards the inguinal ring. The

incision that I propose (says Scarpa) not only has the advantage of slitting open the neck of the hernial sac its whole length, it also divides a part of the insertion of Poupart's ligament into the upper part of the os pubis, a thing that greatly contributes to relax the crural arch, and facilitate the reduction of the viscera; of those, at least, which are not adherent to the sac." (*Scarpa, Op. cit. p. 235.*)

Hesselbach considers an incision through the outer side of the crural ring safer than one through Gimbernat's ligament; and safer in women than men. In women, he recommends the cut to be made through the middle of the fore part of the ring, nearly straight upwards, or a little inclined inwards, in which mode the epigastric artery cannot be hurt, whether it lie at the outer, or inner side of the neck of the sac. In men, this incision, directed obliquely upwards and inwards, he says, cannot be made, on account of the nearness of the spermatic chord; therefore, in the male subject, he advises cutting the inner side of the opening, that is to say, Gimbernat's or the femoral ligament, directly inwards towards the symphysis of the os pubis. (*Ueber den Ursprung der Leisten-und-Schenkelbrüche, p. 54.*) When the epigastric, or obturator, artery deviates from its usual course, and surrounds the inner side of the neck of the hernia (which variety can never be ascertained *a priori*), a wound of the vessel Hesselbach regards as unavoidable.

From the views taken of femoral hernia in this article, I consider the unrestricted direction always to cut Gimbernat's ligament in the operation, to be erroneous. For, as Langenbeck has stated, the seat of strangulation may either be in the external aperture of the crural canal, or in an opening of the front or inner side of this passage, or in its inner opening, where indeed Gimbernat's ligament and the attachment of the falciform process of the fascia lata to it, are truly concerned. When the strangulation is of the two first descriptions, he states, that only the fascia lata need be cut; but, in the third, most frequent case, the inner semi-lunar edge of the crural ring should be divided. In all cases, says Langenbeck, whether the strangulation be caused by the inner or external opening of the crural canal, or by an aperture in the front parietes of this passage, the stricture must be cut inwards, as directing the cut in the least outwards would injure the epigastric artery. When it is perceived, in the operation, that the neck of the hernial sac is strangulated, close below and behind the external pillar of the abdominal ring, the inner opening of the crural canal must be divided inwards, with the knife directed along the horizontal ramus of the os pubis, under the external pillar of the ring, towards the symphysis of the pubes. If, in such a case, the knife were carried inwards and upwards, that part of Poupart's ligament forming the upper side of the crural canal might be cut and the spermatic artery injured. (*Neue Bibl. b. ii. p. 133.*)

Dr. Trüstedt has published some remarks, in favour of employing dilatation, instead of an incision, in the operation for the strangulated crural hernia. He observes, that even when the common trunk of the obturator and epigastric arteries is short, the bowels may protrude under the first of these arteries, which will lie upon the upper and inner side of the hernia. In an operation performed upon a woman, in La Charité at Berlin,

for a strangulated femoral hernia, the crural ligament was divided in Gimbernat's way by an incision, exactly parallel to the horizontal ramus of the os pubis, and the obturator artery was wounded. The patient died eight days after the operation, having been previously attacked by trismus and opisthotonos. On dissection, about six ounces of putrid blood were found in the lesser cavity of the pelvis, and the above artery cut. The vessel arose from the epigastric, ran over the upper edge of the inner opening of the crural canal, or ring, and then descended along its inner edge, towards the obturator foramen. This occasional course of the obturator artery leads Dr. Trüstedt to suggest the following rules:—If, after the hernial sac is opened, the bowels cannot be returned, the outer opening of the crural canal should be cut directly inwards, in order to produce a considerable relaxation. But, if the reduction should yet be impracticable (the strangulation being at the inner opening of the canal), then an attempt is to be made to insinuate the end of the finger through the constriction; a plan said to have answered very often in the practice of Surgeon-General Rust. Should the resistance be too great, however, for this method to succeed, Trüstedt advises the crural ligament to be forcibly drawn inwards and upwards towards the navel, with Arnaud's tenaculum, assisted by the introduction of the finger, or with two hooks. When this plan fails, he recommends Schreger's practice of dividing the anterior edge of Poupart's ligament with a pair of blunt-pointed scissors, and then the use of Arnaud's tenaculum again. (*See Rust's Magazin für die gesammte Heilkunde, b. iii. h. 2.*) The consideration, however, which will ever prevent the common adoption of Dr. Trüstedt's suggestion, is, that fifty times more lives would be lost by the mischief done to the protruded bowels by the forcible introduction of the fingers and hooks, than by hemorrhage from the obturator, or epigastric artery, when the course of the vessel is irregular.

Mr. Aston Key, who is an advocate for not opening the sac, makes the following remarks. The inverted T incision, usual in the operation for femoral hernia, may be, in most cases, reduced to a single incision, either at right angles to Poupart's ligament, or in a transverse direction across the tumour. "I have not (says he) made trial of the perpendicular form of incision, but a single transverse one I have found sufficient, when the integuments have been loose, and the tumour not large. The superficial fascia adheres firmly to the common integuments, and is usually turned aside with them, especially when the latter are pinched up for the purpose of making the first incision. The fascia propria is, therefore, quickly exposed, and forms the first distinct covering of the tumour, being darker than the more superficial investment. It is under the outer layer of this fascia, that the adipose structure is formed, which often assumes the appearance of omentum. The director easily makes its way under this fatty matter, as far as the neck of the sac, which lies deeper than the operator at first supposes. The point of the director should be applied rather to the inner, than to the outer part of the neck of the sac, as it will be found to pass more easily under the stricture at this part. It should not at first be attempted to be thrust under the stricture, as the firmness of the parts, forming the stricture, would resist it. But

the seat of stricture being felt, the operator should depress the end of the director upon the sac, which will yield before it, and then, by an onward movement, the director slides under the stricture." Mr. Key takes the opportunity of remarking, that the constriction, at the femoral aperture, is not entirely produced by a process from Poupert's ligament, but, in part, by a tendinous band on the forepart of the femoral sheath, when the fascia transversalis passes in a funnel-form behind Gimbernat's ligament to be inserted into the pubes. (See *Mem. on the Advantages of dividing the Stricture, &c., on the outside of the Sac*, p. 142—145. 8vo. Lond. 1833.)

Of late years, a fact of considerable interest has been ascertained in relation to femoral hernia; viz. that the constriction of the bowel by the smallness of the aperture and the sharp edge of Poupert's ligament, is so great, that either a permanent contraction of the part, ulceration of the internal and muscular coats, or even that of the serous coat also may occur, followed by fatal extravasation, after the reduction of the hernia by the operation. (*Chevalier, in Med. Chir. Trans.* vol. iv. p. 324.; *Breschet, Op. cit.*, obs. 2.; *Lawrence*, p. 442. ed. 4.) Hence, the latter gentleman is an advocate for gently drawing out the bowel, after liberating it from stricture: if no reason be found to apprehend perforation of the tube, he advises its reduction; but, in the opposite case, he directs it to be left out of the abdomen, rather than that the patient should be exposed to the danger of effusion into the abdomen. (P. 444.)

CONGENITAL HERNIA.

Before the beginning of the sixth month of the foetal state, the testicle is situated just below the kidney, upon the psoas muscle, where it receives its arteries from the aorta, and sends its vein on the right side into the lower vena cava, and, on the left, into the renal vein; and where also it receives a covering from the peritoneum, just like the other abdominal viscera. From the lower part of the testicle and epididymis proceeds a long fibrous substance, called the *gubernaculum*, and it lies in the track which that organ afterwards follows in its descent into the scrotum. The gubernaculum is believed to have some influence in guiding the testicle in the right course to its final situation. Between the beginning of the sixth month, and end of the seventh, the testicle has either descended as low as just above the abdominal ring, or else is passing through it, or arrived a little below it. (*Wrisberg, Comm. Reg. Societ. Götting.* 1785.)

When the testicle passes through the abdominal ring into the scrotum, it is received into a production of the peritoneum, which afterwards constitutes the tunica vaginalis; while that peritoneal investment, which was given to the testicle in the loins, is closely adherent to this body, and forms what is named the tunica albuginea.

According to Sir Astley Cooper, it is in the eighth month, that the testis passes out of the abdominal ring, "bringing with it a portion of the peritoneum, which is previously somewhat looser at the lower part of the abdomen, than elsewhere, and which becomes afterwards the tunica vaginalis." (*On Hernia*, part i. p. 74. ed. 2.)

After the descent of the testicle into the scro-

tum, the communication, between the cavity of the tunica vaginalis and that of the abdomen, commonly becomes obliterated, which latter event is usually effected before birth, sometimes not till afterwards; and, in a few subjects, even as late as the adult state.

In the congenital hernia, the protruded viscera are situated in the tunica vaginalis, in contact with the testicle; having descended into this position before the closure of the communication with the abdomen. Of course, the tunica vaginalis itself is the hernial sac. The nature of this case was not understood, until it was elucidated by Haller in 1755, and the two Hunters in 1762 and 1764. (See *W. Hunter's Med. Comment.*; *Haller's Opuscula Patholog. and Opera Minora*, &c.) Before the periods here specified, surgeons imputed the circumstance of the contents of the hernia and testicle being in contact, to the bowels having made their way, by laceration, through the tunica vaginalis, from the ordinary hernial sac of a bubonocoele.

From the term *congenital*, we might suppose, that this hernia always existed at the time of birth. The protrusion, however, seldom occurs till after this period, on the operation of the usual exciting causes of hernia in general. It does not commonly happen till some months after birth; and, in certain instances, not till a late period. Mr. Hey relates a case, in which a hernia congenita was first formed in a young man, aged sixteen, whose right testis had, a little while before the attack of the disease, descended into the scrotum. In the generality of cases, which actually take place when the testicle descends into the scrotum before birth, the event may be referred to that organ having contracted an adhesion to a piece of intestine, or omentum, in its passage to the ring. In an infant, which died a few hours after birth, Wrisberg found one testicle, which had not passed the ring, adhering, by means of a few slender filaments, to the omentum, just above this aperture. Sometimes, adhesions of the testicle to the adjacent viscera, instead of leading to the formation of a congenital hernia, only prevent the descent of the former organ. Cloquet examined the body of an old man, in which the left testicle lay on the psoas and iliacus muscles, connected to the sigmoid flexure of the colon, while an inguinal hernia existed on the same side. (*Recherches*, &c. p. 24.) Sometimes, no protrusion at all happens, even though the communication between the tunica vaginalis and abdomen continue open in the adult subject, as is particularly exemplified in a case, recorded by Hesselbach, where such communication existed on each side in a man, thirty-eight years of age, without any hernia. (*Med. Chir. Zeitung*, 1819, p. 110.) The hernia may protrude for the first time in an adult. (See *Case by Sir A. Cooper, On Hernia*, part i. p. 75. ed. 2.)

The appearance of a hernia in very early infancy, Mr. Pott observes, will always make it probable that it is of this kind; but, he was not correct in asserting, that in an adult, there is no reason for supposing his rupture to be of this sort, but his having been afflicted with it from his infancy; and that there is no external mark, or character, whereby it can be certainly distinguished from one contained in a common hernial sac. This statement is erroneous, inasmuch as the

hernia congenita, while the bowels are down, is attended with difficulty or impossibility of feeling the testis, which part in the common scrotal hernia is always distinguishable under the fundus of the hernial sac.

Mr. Pott notices, that "in very young children, a piece of intestine, or omentum, may get pretty low down in the sac, while the testicle is still in the groin, or even within the abdomen. In this case, the application of a truss would be highly improper; for, in the latter, it might prevent the descent of the testicle from the belly into the scrotum; in the former, it must necessarily bruise and injure it, give a great deal of unnecessary pain, and can prove of no real use. Such bandage, therefore, ought never to be applied on a rupture in an infant, unless the testicle can be fairly felt in the scrotum, after the gut or caul is replaced; and when it can be so felt, a truss can never be put on too soon." This is also the advice delivered by Sir A. Cooper.

As Mr. Pott has explained, an old rupture, originally congenital, is subject to a stricture made by the sac itself, as well as to that produced by the abdominal ring, or, as might have been added, to that caused by the superior opening of the inguinal canal. The fact he noticed several times, both in the dead and in the living. "I have seen (says he) such stricture made by the sac of one of these hernias, as produced all those bad symptoms which render the operation necessary: and I have met with two different strictures, at near an inch distance from each other, in the body of a dead boy, about fourteen, one of which begirt the intestine so tight, that I could not disengage it without dividing the sac.

"In this kind of hernia I have also more frequently found connections and adhesions of the parts to each other, than in the common one; (See also *Sir A. Cooper, Op. cit. part i, p. 78.*) but there is one kind of connection sometimes met with in the congenital hernia, which can never be found in a common hernial sac, and which may require all the dexterity of an operator to set free; I mean that of the intestine with the testicle.

"If a large quantity of fluid should be collected in the sac of a congenital hernia, and, by adhesions and connections of the parts within, the entrance into it from the abdomen should be totally closed, (a case which I have twice seen) the tightness of the tumour, the difficulty of distinguishing the testicle, and the fluctuation of the fluid, may occasion it to be mistaken for a common hydrocele; and if, without attending to other circumstances, but trusting merely to the feel and look of the scrotum, a puncture be hastily made, it may create a great deal of trouble, and possibly do fatal mischief." (*Works, vol. ii.*)

This complication may be known by returning all the contents of the tumour into the abdomen, while the patient is in the horizontal posture. "Then, by putting the finger against the abdominal ring, the water will slip by it, and fall down into the scrotum, producing a transparent tumour, or true hydrocele; after which, if the pressure of the finger is a little lessened at the ring, and the patient is desired to cough, the intestine and omentum will be felt falling down into their former situation." (See *Sir A. Cooper, on Hernia, part i. p. 75. ed. 2.*)

Mr. Pott also believed, that common ruptures, or those in a peritoneal sac, are generally gradually formed, that is, they are first inguinal, and by degrees become scrotal; but that the congenital are seldom remembered by the patient to have been in the groin only. As the tunica vaginalis is thicker than the peritoneum, the contents of a congenital hernia are not so easily felt, as those of a common rupture. In children, the hernia generally contains intestine only, the omentum not being in them sufficiently long commonly to protrude.

The sac of a congenital hernia, especially when the case is strangulated, is every where equally tense, (*Hesselbach, p. 36.*) and below it the testis cannot be felt.

The reader must not conclude, however, from the above account, that every rupture in children is congenital. Mr. Lawrence has related a case of strangulated baboonocoele, which took place in an infant only fourteen months old. (*P. 65. ed. 3.*)

The common inguinal hernia, which first protrudes at the inner opening of the inguinal canal, and which has the epigastric artery on the inner side of its neck, has been named by Hesselbach *external*; while the less common instance, in which the viscera burst directly through the aponeuroses of the transverse and internal oblique muscles, and pass directly out of the abdominal ring, leaving the epigastric artery on the outer side of the neck of the sac, is distinguished by the epithet *internal*. (*Anat. Chir. Abhandlung über den Ursprung der Leistenbrüche; Würzb. 1806.*) "The inguinal congenital hernia (says Scarpa) cannot be divided into *external* and *internal*; it is evident, that it must always be external, since the neck of the tunica vaginalis invariably corresponds to the point, at which the spermatic chord passes under the margin of the transverse muscle. As for other circumstances, the tunica vaginalis lies in its whole course in the same manner as the sac of a common inguinal hernia: like this, it passes completely through the inguinal canal from one end to the other, resting upon the anterior surface of the spermatic chord. Consequently, it passes between the separation of the inferior fibres of the obliquus internus, and the principal origin of the cremaster muscle. (See *Wrisberg, Synlog.*)

coming out of the ring, as it is always united to the spermatic chord, it is enclosed in the muscular and aponeurotic sheath of the cremaster muscle, which accompanies it to the bottom of the scrotum. Since the tunica vaginalis, including the displaced viscera, enters the inguinal canal on the outside of the point, at which the spermatic chord crosses the epigastric artery, it is manifest, that, as it follows exactly the direction of this chord, it must also cross the artery, and remove it from the outer to the inner side of the ring, according to the mechanism already explained in speaking of the common inguinal hernia. Hence, the displacement of the epigastric artery constantly happens in the inguinal congenital, just as it does in the ordinary external inguinal hernia.

"But, if these two species of inguinal hernia have some analogy to each other, in regard to the parts which constitute them, yet, they present some remarkable differences. 1. The common inguinal hernia, whether internal, or external, when it ex-

tends into the scrotum, cannot descend beyond the point at which the spermatic vessels enter the testicle. There the cellular substance of the spermatic chord terminates. There the hernial sac must also unavoidably terminate. On the contrary, in the congenital hernia, the viscera may descend lower than the testicle, with which they are in immediate contact; and, at length, they even occupy the situation of this organ, which is then pushed upward and backward. 2. In the case of a congenital hernia, the descent of the viscera from the groin to the scrotum commonly takes place in a very short time, and in some measure precipitately: it is much slower and more gradual in the ordinary inguinal hernia. The reason of this difference is very plain. In the first case, the descent of the testicle, and the formation of the tunica vaginalis, have opened and prepared the way, which the viscera must follow in forming a protrusion; while, in the second, the hernial sac cannot descend into the scrotum, but by gradually elongating the layers of the cellular substance, which joins it to the surrounding parts. This fact is so generally known, that experienced practitioners consider the promptitude, with which the viscera have descended from the groin to the bottom of the scrotum, as a characteristic sign of a scrotal congenital hernia." (*Scarpa, Traité des Hernies*, p. 73, &c.; *Hesselbach*, p. 35. *Pott*; *Sir A. Cooper*, part i. p. 79, ed. 2.)

In the hernia congenita, the spermatic artery and vein are sometimes on one side of it, and the vas deferens behind it. A preparation, exhibiting this alteration of the chord, may be seen in the museum of St. Thomas's Hospital.

If circumstances will admit of a truss being applied and worn, in cases of congenital hernia, in young subjects, there will be a considerable chance of a radical cure being effected, in consequence of the natural propensity of the opening between the abdomen and tunica vaginalis to become closed.

In the operation, the surgeon has to lay open the tunica vaginalis, instead of a common hernial sac; but, as Sir Astley Cooper judiciously recommends, that membrane should not be opened low down; 1st, because a sufficiency of it should always be left to cover the testicle; and, 2dly, because the spermatic artery and vein are situated obliquely on the front and lower portion of the tumour. The incision should begin at the upper part of the abdominal ring, and, in large hernie, extend to a little above the testicle. This lays bare the fascia and cremaster muscle, which cover the tunica vaginalis. This latter membrane is then to be cautiously opened, and divided in the direction of the first incision, to within an inch of the abdominal ring above; but downwards no lower, than the upper part of the testicle, as a sufficient quantity of the tunica vaginalis should be left to cover this organ. (*See Sir A. Cooper*, *Op. cit.* p. 78. part. ii.) If the hernia were large, and it had been for any time irreducible, the same experienced surgeon would advise the return of the parts without inspection, if the stricture could be removed without opening the tunica vaginalis. The stricture is to be divided on the same principle as that of an inguinal hernia, and much in the same manner. As in a scrotal congenital hernia, the parts are separated on the outside of the epigastric artery, the stricture may be safely divided towards the testicle as well as directly upwards. (*Laurence*, *Hernia*, p. 507. ed. 4.) The tunica vaginalis

having been opened, the finger is to be passed into it, the seat of stricture ascertained, and, if this be at the abdominal ring, Sir A. Cooper recommends the dilatation to be made by insinuating the knife between the sac and the ring. "If, says he, 'the impediment to the return of the hernia is formed by the transversalis muscle, the knife (still on the anterior side of the sac) is to be carried up to it, (the stricture) through the ring; but, if the stricture is in the tunica vaginalis itself, at its orifice into the abdomen, the knife must be introduced within it, and the strictured part cautiously divided.'" (*Op. cit.* part ii. p. 78.) According to Sir Astley Cooper, the stricture is generally about an inch and a half from the abdominal ring, except in large cases, when it is nearer to it. The parts having been reduced, the edges of the wound are to be brought together, and retained so by means of one or two sutures, and sticking-plaster.

Instances of strangulated congenital inguinal hernia in young children, are exceedingly rare. Their possibility, however, should be remembered, and even the occasional necessity for operating. Thus, Mr. Adams was called upon to perform the operation on a child, eighteen months old, with this species of hernia strangulated; and the case ended favourably. (*See Dublin Journ. of Med. Science*, vol. ii. p. 321.)

A new species of hernia congenita was described by the late Mr. Hey, in which a sac, containing the viscera, is included in the tunica vaginalis. He conceived, that it arose from the parts being protruded, after the communication between the abdomen and tunica vaginalis had been closed, but not effectually, so that the peritoneum was carried down along with the intestine, and formed a hernial sac within the tunica vaginalis. Such a hernia can only be produced, while the original tunica vaginalis remains, in the form of a bag, as high as the abdominal ring. Sir Astley Cooper believes, that the tunica vaginalis becomes closed at the ring, but remains open above and below it. (*On Hernia*, part. i. ed. 2.) Mr. Hey called the case *hernia infantilis*; Sir A. Cooper *encysted vaginal hernia*. The testis is not involved, and can be distinctly felt below the hernia. The tunica vaginalis ought, in this case, to be freely opened. The strangulation, which arises from the contracted state of the mouth of the sac, may be safely divided, either upwards, as directed by Sir Astley Cooper, or upwards and outwards. Operators should be aware of the possibility of having a sac to divide, after laying open the tunica vaginalis. (*See Hey's Practical Obs.* p. 221. *Dr. Ballingall*, in *Edin. Med. Journ.* No. 87, p. 464.; and *Sir A. Cooper's Work On Hernia*, p. 79. part i. ed. 2.)

Mr. C. H. Todd mentions various anatomical facts, which convince him, that "the generally received opinion, respecting the formation of hernia infantilis, is erroneous; and that, in no instance, is the sac in actual contact with the testicle." Mr. Todd believes, that the hernial sac is protruded completely within the cellular sheath of the chord; and that, when it depends near to the point of insertion of the spermatic vessels into the testicle, its fundus comes in contact with the upper part of the tunica vaginalis testis, and receives from it, on its lower surface a serous covering, proportioned to the magnitude of the tumour, or degree of distension of the sac. He also thinks, that, although this hernia is more easily formed in an infant, it may

occur at any period of life. In University College Hospital, two examples of this hernia have occurred in adult persons, within the last two years. It is a case that appears to be often combined with hydrocele. The most certain diagnostic symptoms, seem to Mr. Todd to be; first, the testicle being situated at the lowest part of the hernia, although the tumour is unusually large. Secondly, the possibility of making the fluid in the tunica vaginalis, when a fluid is lodged in it pass, by means of a little pressure, for some distance in front of the hernial sac, towards the abdominal ring. If an operation were necessary for the relief of strangulation, Mr. Todd deems it quite practicable in many instances to open the hernial sac, without dividing the tunica vaginalis. The prudence of acting in this way, however, will depend on the extent of that part of the anterior surface of the sac, which is not covered by the serous membrane of the testicle. Mr. Todd would not extend the incision to the bottom of the tumour, and, after cautiously opening the sac, near the abdominal ring, he would make the dilatation of it downwards, the finger having been previously introduced to ascertain the distance to which the fundus of the sac depends. (See C. H. Todd, in *Dublin Hospital Reports*, vol. i. p. 232, &c.)

UMBILICAL HERNIA, OR EXOMPHALOS.

"The exomphalos, or umbilical rupture, (says Pott) is so called from its situation, and has (like other herniæ) for its general contents, a portion of intestine or omentum, or both. In old umbilical ruptures, the quantity of omentum is sometimes very great. Mr. Ranby says, that he found two eels and a half of intestine in one of these, with about a third part of the stomach, all adhering together. Mr. Gay and Mr. Nourse found the liver in the sac of an umbilical hernia; and Bohnius says, that he did also. But whatever are the contents, they are originally contained in the sac, formed by the protrusion of the peritoneum. In recent and small ruptures, this sac is very visible; but in old, and large ones, it is broken through at the knot of the navel, by the pressure and weight of the contents, and is not always to be distinguished; which is the reason why it has by some been doubted whether this kind of rupture has a hernial sac or not.

"Infants are very subject to this disease in a small degree, from the separation of the funiculus; but in general they either get rid of it as they gather strength, or are easily cured by wearing a proper bandage. It is of still more consequence to get this disorder cured in females, even than in males, that its return, when they are become adult and pregnant, may be prevented as much as possible; for at this time it often happens, from the too great distention of the belly, or from unguarded motion when the parts are upon the stretch. During gestation, it is often very troublesome, but, after delivery, if the contents have contracted no adhesion, they will often return, and may be kept in their place by a proper bandage.

"If such bandage was always put on in time, and worn constantly, the disease might in general be kept within moderate bounds, and some of the very terrible consequences which often attend it might be prevented. The woman who has the smallest degree of it, and who, from her age and situation,

has reason to expect children after its appearance, should be particularly careful to keep it restrained.

"In some the entrance of the sac is large, and the parts easily reducible; in others they are difficult, and in some absolutely irreducible. Of the last kind many have been suspended for years, in a proper bag, and have given little or no trouble. They who are afflicted with this disorder, who are, advanced in life, and in whom it is large, are generally subject to colics, diarrhœas, and, if the intestinal canal be at all obstructed, to very troublesome vomitings.—Hence, patients are often supposed to labour under a stricture, when they really do not. It therefore behoves such to take great care to keep that tube as clean and free as possible, and neither to eat or drink any thing likely to make any disturbance in that part." (*Pott on Ruptures*, vol. ii.)

The writings of Sir A. Cooper, Scarpa, (*Traité des Hernies*, p. 327.) and all the most accurate moderns, confirm the fact described by Pott, that in the umbilical rupture, there is a hernial sac, just as in other instances of herniæ. Every anatomist knows, that, behind the opening in the linea alba at the umbilicus, the peritoneum is complete, and consequently must protrude along with the viscera, in cases of exomphalos. In the only two cases which Sir A. Cooper had seen of a deficiency of the sac, the membrane has been partially absorbed, or lacerated, so as to allow the protrusion of its contents, and threaten, from this cause, a double stricture. Similar appearances, less closely inspected, probably gave rise to the opinion so firmly maintained by Dionis, De la Faye, Garengeot, and J. L. Petit, that, in the umbilical hernia, the peritoneum was always lacerated, and there was no hernial sac. Early infancy is most subject to umbilical hernia, strictly so called, in which the parts protrude through the navel; while the other periods of life are more liable to false umbilical hernia, or such as arise in the vicinity of the umbilicus. (*Œuvres Chir. de Desault*, t. ii. p. 315.)

Besides a true hernial sac, the exomphalos is also covered by a more superficial expansion, consisting of condensed cellular substance. In operating, however, a surgeon should always cut with great caution; for the integuments and hernial sac, in front of the tumour, are inseparably adherent; and sometimes, in large cases, when an absorption of part of the sac has been caused by the pressure of the bowels, they are even found adherent to the integuments.

Pregnant women, and dropsical and corpulent subjects, are peculiarly liable to the exomphalos. In adults, when there is intestine in the sac, there is almost always omentum. The transverse arch of the colon is observed to be particularly often contained in umbilical hernia, but the small intestines are not unfrequently protruded: and even the cœcum has been found in a rupture at the navel. (See *Lawrence on Ruptures*, p. 454, 455. ed. 4.)

In the true umbilical hernia, the stricture is made by the tendinous opening in the linea alba. Let us next consider the umbilical hernia in the three particular forms, in which it has been noticed by the latest writers.

CONGENITAL UMBILICAL HERNIA.

Dr. Hamilton met with about two cases of this kind annually, for the space of seventeen years;

and they strictly deserve the epithet *congenital*, as they appear at birth. The funis ends in a sort of bag, containing some of the viscera, which pass out of the abdomen through an aperture in the situation of the navel. The swelling is not covered with skin, so that the contents of the hernia can be seen through the thin distended covering of the chord. The disease is owing to a preternatural deficiency in the abdominal muscles, and the hope of cure must be regulated by the size of the malformation, and quantity of viscera protruded.

The plans of cure proposed, consist of the employment of a ligature, or of a bandage. The latter seems preferable, and was practised by Mr. Hey, as follows:—Having reduced the intestine, he desired an assistant to hold the funis compressed sufficiently near the abdomen, to keep the bowel from returning into the hernial sac,

"I procured (says he) some plaster spread upon leather, cut into circular pieces, and laid upon one another in a conical form. This compress I placed upon the navel, after I had brought the skin on each side of the aperture into contact, and had laid one of the lips a little over the other. I then put round the child's abdomen a linen belt; and placed upon the navel, a thick, circular, quilted pad, formed about two inches from one extremity of the belt.

"This bandage kept the intestine securely within the abdomen, and was renewed occasionally. The funis was separated about a week after birth; and at the expiration of a fortnight from that time, the aperture at the navel was so far contracted, that the crying of the child, when the bandage was removed, did not cause the least protrusion. I thought it proper, however, to continue the use of the bandage a little while longer. A small substance, like fungous flesh, projected, after the funis had dropped off, about half an inch from the bottom of that depression which the navel forms. A dossil of lint spread with cerat. e lapide calaminari, and assisted by the pressure of the bandage, brought on a complete cicatrisation." (P. 227.)

This gentleman has related another example, in which the intestines were quite uncovered, and inflamed, the sac having burst in delivery. The parts were reduced, but the child died. (See also *G. A. Fried de Fatu Intestinis plane nudis extra Abdomen propendentibus nato*. Argent. 1769.)

UMBILICAL HERNIA IN CHILDREN.

The umbilical hernia which is sometimes formed in the fetus, from causes difficult of explanation, takes place, in other instances, at the moment of delivery; and then, as Sabatier remarks, should it be tied by mistake, with the funis, death would be the consequence. Most frequently, however, it is not till the second, third, or fourth month after birth, that the disease occurs; and the numerous cases, collected by Desault, prove that, of ten infants attacked with this hernia, nine become afflicted at the periods here specified.

The umbilicus, still open, now begins to contract, so as to close the cicatrix; which soon forms an obstacle capable of preventing a protrusion of the viscera. Sometimes, however, the repeated crying of the child propels the viscera through the opening, and thus the closure of the cicatrix of the umbilicus is prevented. By degrees, the umbilical ring becomes more and more dilated, the quantity of protruded bowel increases, and thus a tumour

arises, which, from being of trivial size at first, at length attains the size of an egg, or large walnut, and presents itself with all the characteristic marks of a hernia.

The presence of a piece of intestine and omentum in the tumour, keeps the umbilicus open, and opposes the continual tendency which it has to close. Such tendency, however, being sometimes superior to the resistance of the protruded parts, forces them back into the abdomen, obliterates the opening through which they passed, and thus the spontaneous cure of the umbilical hernia in children is accomplished. Two cases, illustrative of this fact, are related by Bichat. (*Œuvres Chir. de Desault*, t. ii. p. 318.)

Nature, however, does not effect many such cures; and when the case is left to her alone, she not only fails in bringing about a radical cure, but gradually renders it impossible. In short, the propensity of the opening to close diminishes, and is lost, as the subject grows older.

Thus, the umbilical hernia of children seems to be essentially different from that of adults, in the tendency of the aperture to contract. Hence the ease of effecting a radical cure in children, and the almost utter impossibility of doing so in adults. In the former, it is enough to keep the intestines from protruding, and the opening becomes of itself obliterated; in the latter, the opening always remains, whether the bowels continue in it or not. This indisposition of the aperture to contract in the adult, also frequently depends upon the protrusion not being through the umbilical ring itself, but through a fissure in the vicinity of it, not endued with the same natural tendency to close, which the umbilicus possesses in young subjects. In fact, it would appear from the observations of Scarpa, that, unless a grown up person has had the protrusion from infancy, it never occurs exactly through the umbilical ring itself.

The means of curing the umbilical hernia of children, are compression, and the ligature. The former is the most modern; the latter the most ancient treatment, being mentioned by Celsus. The design of both is the same, viz. to prevent the lodgment of the protruded viscera in the opening of the umbilicus, and thus facilitate the approximation of its sides. To accomplish this end, the ligature retrenches the hernial sac, and skin pushed before it; and, by the union of the cut parts, a cicatrix is produced, which hinders the protrusion of the viscera. At the same time, the sides of the opening, obeying their natural tendency, compression closes the deficiency, or opening, in the parietes of the abdomen; hinders the protrusion of the bowels, and keeps these parts from resisting the contraction of the sac. Desault's method, which much resembled that of Savard, is described by Bichat. The child must be placed on its back, with its thighs a little bent, and its head inclined towards the chest. The surgeon is to reduce the protruded parts, and to hold them so with his finger, at the same time that he raises the hernial sac, and rubs its sides between his fingers, so as to be sure, that there is nothing contained in it. Being certain, that the parts, which he lifts up, are only the skin and sac, he is to direct an assistant to surround their base several times with a waxed ligature, of middling size, each turn being tied with a double knot, in such a manner as only to occasion little pain. The tumour, thus tied, is to be covered with

lint, which is to be supported with one or two compresses, and a circular bandage, secured with a scapulary. By the following day, a slight swelling has commonly taken place in the constricted parts. On the second, or third day, the parts shrink, and then the ligature becomes loose, so that a fresh one must now be applied in the same manner as the first, taking care to draw it a little more tightly. The sensibility of the parts, increased by the inflammation, which the constriction of the ligature has already produced, usually renders this second ligature more painful. After the operation, the same dressings as at first are to be applied. The tumor soon becomes discoloured, livid, and smaller. A third ligature, put on in the same way as the preceding ones, entirely obstructs the circulation in it. The part turns black and flaccid, and commonly falls off on the eighth or tenth day. A small ulcer is left, which, being properly dressed, very soon heals, and leaves a cicatrix sufficiently strong to resist the impulse occasioned by coughing, or other efforts of the abdominal muscles. For two or three months, however, after the operation, the child should wear a circular bandage, in order to prevent, with still greater certainty, the viscera from being propelled against the cicatrix, so as to interrupt the process of nature, which is now producing a gradual closure of the umbilical opening.

Mr. Pott notices the plan of curing the exomphalos with the ligature, and expresses himself strongly against the practice in general. To adults the plan is not applicable. Mr. Pott was decidedly in favour of compression; and he observes, that in young subjects, and small hernia, a bandage, worn a proper time, generally proves a perfect cure. (Vol. ii.)

Anxious that this work should be strictly impartial, I next proceed to relate what has been more recently urged against the employment of the ligature for the cure of the umbilical hernia in children.

The incessant care that a bandage requires, either to keep it clean, or make it always keep up the proper degree of pressure, renders its employment difficult in the children of the poorer classes. Scarpa expresses his opinion, that this was what induced Desault to revive the operation for the umbilical hernia by the ligature, nearly such as is described by Celsus; an operation (continues Scarpa), which, a long while since, and for good reasons, was altogether abandoned. Desault himself has put some restrictions to the employment of the ligature, since he observes, that this method does not radically cure the umbilical hernia of children, arrived at the age of four years; and, that, even in the youngest children, a radical cure cannot be effected by the ligature, unless a methodical compression of the navel, by means of a bandage, be kept up immediately after the operation, and for two or three months. It is perhaps to the omission of this last means, that a relapse is to be ascribed in several of the children operated upon by Desault. "*Desault avoit remis en vigueur la ligature tombée en désuétude. Il s'abusoit sur sa valeur; et il n'est pas difficile d'en connaître la cause. Tous les enfans qu'il opéreroit à l'Hôtel-Dieu sortoient guéris, et n'y revenoient plus: on regardoit alors comme radicale une guérison momentanée.*" (Richerand, *Névrographie Chir.* t. ii. p. 453.) "I have carefully watched (says Scarpa) the imme-

diate effects, and the more or less remote consequences of tying the umbilical hernia, either simply, or by means of a needle and double ligature; and, after a considerable number of such cases, I believe I can assert, that this operation, however performed, is not always exempt from grave and sometimes dangerous accidents. I can also add, that it never procures a truly radical cure, unless the cicatrix, occasioned by it in the umbilical region, be submitted for some months to a methodical and uninterrupted compression. It is not so uncommon, as some surgeons pretend, to see arise, after the application of the ligature, a fever attended with symptoms of most violent irritation, and acute sufferings, which cause incessant crying, and sometimes convulsions. The ulcer, which is produced by the detachment of the swelling, is always very large and difficult to heal. Every now and then, it becomes painful, and emits fungous granulations, even though dressed with dry applications.

"Lastly, it has been explained by a celebrated surgeon (*Paletta Mémor. de l'Institut*, tom. ii. part 1.), that the umbilical vein and the suspensory ligament of the liver, being included in the ligature of the umbilical hernia, the inflammation, which originates in these parts, may, perhaps, in certain cases, be communicated to the liver, so as to put the child's life in great danger. When, in consequence of the ligature, symptoms of violent irritation come on, they are ordinarily attributed to certain individual circumstances, such as extreme sensibility, or a particular disposition to spasm. Hence, it is believed, that they should be considered as exceptions, which do not exclude the general rule, and prove nothing against the utility of the operation. But, how (says Scarpa) can the surgeon ascertain the existence, or non-existence of these individual dispositions, in the children, upon which he is to operate? Assuredly, those subjects, in which I have had occasion to notice the above accidents, enjoyed, before the operation, perfect health in every respect.

"Whatever process be adopted for tying the umbilical hernia, it is evident, that the tumour can only be constricted as far as a little way on this side of the aponeurotic ring of the umbilicus, whence it follows, that the integuments must always remain prominent and relaxed for a certain extent, at the front and circumference of this opening. Also, after the separation of the strangulated portion, there necessarily remains, under the cicatrix, a portion of the hernial sac, and of the loose integuments, which covered it; and as the cicatrix itself never acquires sufficient firmness to resist the impulse of the viscera, which tend to insinuate themselves into the remains of the hernial sac, the hernia, sooner or later, reappears, and, in a short time, becomes larger, than it was before the operation. If the subject is a little girl, it may be apprehended that the first pregnancy will cause a recurrence of the hernia; for, it is known, that, during gestation, the external cicatrix of the umbilicus is considerably distended, and much disposed to give way."

Scarpa then notices, that "after the separation of the tumour, there always remains, between the aponeurotic ring of the navel, and the integuments, a small cavity, formed by the neck of the hernial sac; a cavity into which the viscera begin to insinuate themselves after the operation, so as to hinder the complete contraction of the umbilical

ring. The demonstration of what I have advanced is, in some measure, to be found in the old method of operating for the inguinal hernia, not in a strangulated state, by the ligature of the hernial sac and spermatic chord. Most of the herniæ, operated upon by this barbarous process, were subject to relapses, because, in all probability, the cicatrix was not sufficiently firm to resist the impulse of the viscera, which entered the remains of the hernial sac. In the same manner, after the common operation for the strangulated inguinal hernia, although the cicatrix is formed very near the ring, there is no prudent surgeon, who does not advise the patient to wear a bandage the rest of his life; observation having proved that the hernia is still liable to recur.

"The experience of several ages leaves no doubt, that compression alone is an extremely efficacious method of radically curing the umbilical hernia of young subjects. It is attended with no risk; and, provided it be executed with the requisite caution, it is hardly ever necessary to continue it longer than two or three months for the purpose of obtaining a complete cure. On the other side, if it be clearly proved, by all that I have been observing, that the ligature never accomplishes a perfect cure without compression, it is manifest, that it cannot be at all advantageous for the children of the poor, since a bandage cannot be dispensed with. It may be said, that, in general, it does not shorten the treatment; for, in the most successful cases, the ulcer caused by it, is not healed in less than a month; and, in order to make the cure certain, an exact compression must be afterwards kept up, by means of a bandage, two months longer. It has already been stated, that three months are ordinarily sufficient for obtaining a radical cure by the mere employment of a compressive bandage." (*Scarpa, Traité des Hernies*, p. 344—349.)

M. Girard published a Memoir on the Umbilical Hernia of Children, which was read to the Medical Society of Lyons, in May 1811; and the object of which was to recommend compression as an effectual means of cure. The arguments used were very similar to those adduced by Scarpa. In the course of the discussion, M. Cartier affirmed, that he had seen many children operated upon by Desault, who were not cured of their hernia. (See *Journ. Gén. de Méd.* t. xli. 1811.) The subject was afterwards taken up by the Medical Society of Paris, and the result of the debate was, that the employment of the ligature ought to be rejected. 1. Because the cure of umbilical herniæ is often accomplished by nature alone. 2. Because compression, either alone, or aided by tonic remedies, always succeeds. 3. Because the operation of the ligature deserves the triple reproach of being painful, and not free from danger, if unfortunately a piece of intestine should chance to be included in the ligature; of not succeeding in general, except with the assistance of compression; and of being sometimes uselessly practised, as Desault himself gives us instances of. According to M. Cayol, the insufficiency of the ligature was long since acknowledged by Sabatier, Lassus, Richerand, &c.

The treatment by compression is universally preferred by British surgeons.

UMBILICAL HERNIA IN ADULT SUBJECTS.

This case is to be treated on the principles common to all aneurisms. When reducible, the parts should be kept up with a bandage, or truss; which

plan, however, in grown up persons, affords no hope of a radical cure. Mr. Hey has described some very good trusses for the exomphalos, which are applicable to children, when compression is preferred, as well as to adult subjects. One was invented by the late Mr. Harrison, an ingenious mechanic at Leeds.

"It consists of two pieces of thin elastic steel, which surround the sides of the abdomen, and nearly meet behind. At their anterior extremity they form conjointly an oval ring; to one side of which is fastened a spring of steel of the form represented in the plate in Hey's work. At the end of this spring is placed the pad or bolster that presses upon the hernia. By the elasticity of this spring, the hernia is repressed in every position of the body, and is thereby retained constantly within the abdomen. A piece of calico or jean is fastened to each side of the oval ring, having a continued loop at its edge, through which a piece of tape is put, that may be tied behind the body. This contrivance helps to preserve the instrument steady in its proper situation." (*Practical Obs. in Surgery*, p. 231.) In the second edition of the preceding work, another truss for exomphalos is described; the invention of Mr. England, of Leeds.

"When the exomphalos is irreducible and large, the tumour must be supported with bandages."

It is observed by Scarpa, that the umbilical hernia, and those of the linea alba, are less subject to be strangulated, than the inguinal and femoral herniæ; but that, when they are unfortunately affected with strangulation, the symptoms are more intense, and gangrene comes on more rapidly, than in every other species of rupture. If the operation be performed, the event is frequently unfavourable, because it is generally done too late. This practical fact is proved by the experience of the most celebrated surgeons of every age. "*Il est certain (says Dionis) que de cette opération il en périt plus qu'il n'en réchappe.*" (*Cours d'Opérations*, p. 98. ed. 1777, avec les notes de La Faye.) He also adds, that they who have the misfortune to be afflicted with an exomphalos should rather dispense with their shirt, than a bandage. Heister says nearly the same thing. (*Instit. Chirurg.* t. ii. cap. 94.)

When the omentum alone is strangulated in the exomphalos, or hernia of the linea alba, observation proves, that the symptoms are not less intense, than when the intestine is also incarcerated. There is this difference, however, that when the omentum alone is strangulated, only nausea occurs, and, if vomiting should likewise take place, it is less frequent and violent than when the bowel itself is strangulated. In the first case, the stools are hardly ever entirely suppressed. The proximity of the stomach is, no doubt, the reason, why the strangulation of the omentum, in the umbilical hernia, occasions far more intense symptoms of sympathetic irritation, than the strangulation of the same viscus in the inguinal, or crural hernia.

Here, the operation is not only always necessary, but urgently required. It is not materially different from that, which is practised for strangulated inguinal and crural herniæ; but, in general, it demands greater circumspection, on account of the connection, or intimate adhesions, which frequently exist between the integuments and hernial sac, and also the adhesions, which often prevail between the latter part and the omentum which it contains.

The situation of the intestine, which is frequently covered by, and enveloped in the omentum, is another circumstance deserving earnest attention. (*Scarpa, Traité des Hernies*, p. 361, 362.)

Mr. Pott is not such an advocate as Scarpa for the early performance of the operation in cases of exomphalos:—"The umbilical, like the inguinal hernia, becomes the subject of chirurgic operation, when the parts are not reducible by the hand only, and are so bound as to produce bad symptoms. But though I have, in the inguinal and scrotal herniæ, advised the early use of the knife, I cannot press it so much in this: the success of it is very rare, and I should make it the last remedy. Indeed, I am much inclined to believe, that the bad symptoms which attend these cases are most frequently owing to disorders in the intestinal canal, and not so often to a stricture made on it at the navel, as is supposed. I do not say that the latter does not sometimes happen; it certainly does; but it is often believed to be the case when it is not.

"When the operation becomes necessary, it consists in dividing the skin and hernial sac, in such manner as shall set the intestine free from stricture, and enable the surgeon to return it into the abdomen." (*Pott, On Ruptures*.)

The rest of the conduct of the surgeon is to be regulated by the usual principles.

The division of the stricture is properly recommended to be made directly upward, in the course of the linea alba.

In consequence of the great fatality of the usual operation for the exomphalos, I think the plan suggested, and successfully practised by Sir A. Cooper, in two instances, should always be adopted whenever the tumour is large, and free from gangrene; a plan, that has also received the high sanction of that distinguished anatomist and surgeon, Professor Scarpa. (*Traité des Hernies*, p. 362.) Perhaps, I might safely add, that when the parts admit of being reduced, without laying open the sac, this method should always be preferred. It consists in making an incision just sufficient to divide the stricture, without opening the sac at all, or, at all events, no more of it than is inevitable.

In umbilical hernia, of not a large size, Sir A. Cooper recommends the following plan of operating:—"As the opening into the abdomen is placed towards the upper part of the tumour, I began the incision a little below it, that is, at the middle of the swelling, and extended it to its lowest part. I then made a second incision at the upper part of the first, and at right angles with it, so that the double incision was in the form of the letter T, the top of which crossed the middle of the tumour. The integuments being thus divided, the angles of the incision were turned down, which exposed a considerable portion of the hernial sac. This being then carefully opened, the finger was passed below the intestines to the orifice of the sac at the umbilicus, and the probe-pointed bistoury being introduced upon it, I directed it into the opening at the navel, and divided the linea alba downwards, to the requisite degree, instead of upwards, as in the former operation. When the omentum and intestine are returned, the portion of integument and sac, which is left, falls over the opening at the umbilicus, covers it, and unites to its edge, and thus lessens the risk of peritoneal inflammation, by more readily closing the wound." (*On Cruel and Umbilical Hernia*.)

* LESS FREQUENT KINDS OF HERNIA.

The *ventral hernia*, described by Celsus, is not common; it may appear at almost any point of the anterior part of the belly, but is most frequently found between the recti muscles. The portion of intestine, &c. is always contained in a sac, made by the protrusion of the peritoneum. Sir A. Cooper imputes the disease to the dilatation of the natural foramina for the transmission of vessels, to congenital deficiencies, lacerations, and wounds, of the abdominal muscles, or their tendons. In small ventral herniæ, a second fascia is found beneath the superficial one; but, in large cases, the latter is the only one covering the sac.

Herniæ in the course of the linea alba sometimes occur so near the umbilicus, that they are liable to be mistaken for true umbilical ruptures. They may take place either above, or below the navel. The first case, however, is more frequent than the second; and the following is the reason of this circumstance, according to the opinion of Scarpa:—"The upper half of the linea alba, that which extends from the ensiform cartilage to the umbilicus is naturally broader and weaker than the lower half, the recti muscle coming nearer and nearer together, as they descend from the navel to the pubes." (*Scarpa, Traité de Hernies*, p. 333.)

The hernial sac of ruptures at the upper part of the linea alba may contain a noose of intestine, and a piece of the omentum, though, in most cases, a portion of the latter membrane alone forms the contents. In some subjects, the linea alba is so disposed to give way, that several herniæ are observed to be formed successively in the interspace between the ensiform cartilage and the umbilicus.

M. Jules Cloquet has recorded a case of ventral hernia, reaching from the ensiform cartilage to the pubes. The skin, covering it, was so thin, that the convolutions of the bowels were plainly visible. The cicatrix of the navel was perceptible rather towards the left side of the swelling. (See *Pathologie, Chir.* p. 102.)

"With respect to the small hernia (says Scarpa) which is considered as formed by the stomach, and concerning which Hoin and Garengeot have written so much (without either of them having related, at least to my knowledge, a single example proved by dissection), it is at least unproved, that it was exclusively formed by this viscus. I do not see, why the other viscera, particularly the omentum and transverse colon, might not also contribute to it. In my judgment, it only differs from other herniæ of the linea alba, in being situated on the left side of the ensiform cartilage, a situation that must materially influence the symptoms of the case. In fact, whatever may be the viscera, which form it, a sympathetic irritation of the stomach is occasioned, that is much more intense, than that which ordinarily accompanies umbilical herniæ, those of the lower part of the linea alba, or, in short, all other herniæ, which are more remote from the stomach." (*Op. cit.* p. 334.)

The following are the circumstances, by which the umbilical hernia, and that which occurs in the linea alba near the navel, may be discriminated.

The first, whether in the infant, or the adult, has a roundish neck, or pedicle, at the circum-

ference of which, the aponeurotic edge of the umbilical ring can be felt. Whatever may be its size, its body always retains nearly a spherical shape. Neither at its apex, nor its sides, is any wrinkling of the skin, or anything like the cicatrix of the navel, distinguishable. At some points of the surface of the tumour, the skin is merely somewhat paler and thinner, than elsewhere.

On the contrary, the hernia of the linea alba has a neck, or pedicle, of an oval form, like the fissure, through which it is protruded. The body of the tumour is also constantly oval. If the finger be pressed deeply round its neck, the edges of the opening in the linea alba can be felt; and, if the hernia be situated very near the umbilical ring, the cicatrix of the navel may be observed upon one side of it, which cicatrix retains its rugosity and all its natural appearance; a certain indication, that the viscera are not protruded through the umbilical ring. (*Scarpa, Traité des Hernies*, p. 336.)

The distinction, which Scarpa has established between the umbilical hernia, properly so called, and those of the linea alba, is not useless in regard to practice. Indeed, when the latter are left to themselves, they make much slower progress than the former. On account of their smallness, they frequently escape notice, particularly in fat persons, and when situated at the side of the ensiform cartilage. They occasion, however, complaints of the stomach, habitual colics, especially after meals; and, unfortunately for the patient, he may be tormented a very long time by these indispositions, before the true cause of them is discovered.

The umbilical hernia may be known from the earliest period of its formation, by the alteration, which it produces in the cicatrix of the navel, and the rapidity of its increase.

In other respects, these two kinds of hernia demand the same means of cure; but those of the linea alba, *cæteris paribus*, are more difficult to cure, than ruptures at the umbilicus. This is probably owing to the natural tendency, which the umbilical ring has to close, when the hernia is kept well reduced, whilst accidental openings in the linea alba have not the same advantage. (*Scarpa*, p. 340.)

When a common ventral hernia has been reduced, should be kept in its place by means of a bandage or truss. When strangulated, it admits, more frequently, than most other cases, of being relieved by medical treatment. If attended with stricture, which cannot otherwise be relieved, that stricture must be carefully divided. Sir A. Cooper recommends the valvular incision, and the dilatation to be made, either upward or downward, according to the relative situation of the tumour and epigastric artery, which crosses the lower part of the linea semilunaris.

Pudendal Hernia.—This is the name assigned by Sir A. Cooper to the hernia, which descends between the vagina and ramus ischii, and forms an oblong tumour in the labium, capable of being traced within the pelvis, as far as the os uteri. He thinks, that this case has sometimes been mistaken for a hernia of the foramen ovale. When reducible, a common female bandage, or the truss used for a prolapsus uteri, should be worn. A pessary, unless very large, could not well keep

the parts from descending, as the protrusion happens so far from the vagina. Sir A. Cooper is of opinion, that, when strangulated, this hernia, in consequence of the yielding nature of the parts, may generally be reduced, by pressing them, with gentle and regular force, against the inner side of the branch of the ischium. If not, the warm bath, bleeding, and tobacco clysters, are advised. Were an operation indispensable, the incision should be made in the labium, the lower part of the sac carefully opened, and with a concealed bistoury, directed by the finger, in the vagina. the stricture should be cut directly inward, towards the vagina. The bladder should be emptied, both before the manual attempts at reduction and the operation. (*On Crural Hernia*, &c. p. 64.)

Vaginal Hernia.—A tumour occurs within the os externum. It is elastic, but not painful. When compressed, it readily recedes; but is reproduced by coughing, or even without it, when the pressure is removed. The inconveniences produced are an inability to undergo much exercise or exertion; for, every effort of this sort brings on a sense of bearing down. The vaginal hernia protrudes in the space, left between the uterus and rectum. This space is bounded below by the peritoneum, which membrane is forced downwards towards the perineum; but, being unable to protrude further in that direction, is pushed towards the back part of the vagina. In one case, Sir A. Cooper advised the use of a pessary; but the plan was neglected. Probably, these cases are always intestinal.

Some hernia protrude at the anterior part of the vagina. (*Sir A. Cooper, On Crural Hernia*, p. 65, 66.)

Perineal Hernia.—In men, the parts protrude between the bladder and rectum; in women, between the rectum and vagina. The hernia does not project, so as to form an external tumour; and, in men, its existence can only be distinguished by examination in the rectum. In women, it may be detected both from this part and the vagina.

In case of strangulation, perhaps this hernia might be reduced by pressure from within the rectum. An interesting case of perineal hernia, which took place from the peritoneum being wounded with the gorget in lithotomy, is related by Mr. Bromfield. (*Chirurgical Obs.* p. 264.)

The reducible perineal hernia in women may be kept from descending, by means of a large pessary. Both this kind of rupture and the vaginal may prove very dangerous in cases of pregnancy. (See *Smellie's Midwifery*, case 5.)

Sacro-rectal Hernia.—In a young infant, where the ossification of the sacrum was incomplete, a protrusion is said to have been met with through an opening in that bone. The possibility of such a case should be remembered, in order that the disease may not be mistaken for spina bifida. (See *Journ. of Foreign Med.* No. 16. p. 616.)

Thyroid Hernia, or Hernia Foraminis Ovale.—In the anterior and upper part of the obturator ligament, there is an opening, through which the obturator artery, vein, and nerve proceed, and through which, occasionally, a piece of omentum, or intestine, is protruded, covered by

a part of the peritoneum, which constitutes the hernial sac.

In the case, which Sir A. Cooper met with, the hernia descended above the obturatores muscles. The os pubis was in front of the neck of the sac; three-fourths of it were surrounded by the obturator ligament; and the fundus of the sac lay beneath the pectineus and adductor brevis muscles. The obturator nerve and artery were situated behind the neck of the sac, a little towards its inner side. This species of hernia can only form an outward tumour, when very large. (Garengot, however, met with an instance, in which there was not only a swelling, but one attended with symptoms of strangulation: he reduced the hernia, which went up with a gurgling noise; the symptoms were stopped, and stools soon followed.)

M. Jules Cloquet gives the particulars of a thyroid hernia, met with in the dead body of a woman; aged about fifty. It formed a slight roundish tumour in the lower part of the left groin; and the skin over it was of a purple colour. On opening the abdomen, all the upper portion of the small intestines was inflamed, and enormously distended with liquid feces and gas. A noose of the bowel, which was strangulated in the thyroid foramen, had given way at two points just above the stricture, and the intestinal matter had escaped freely into the cavity of the peritoneum. A piece of omentum also protruded at the upper part of the thyroid foramen, together with the intestine. On dissection, M. Cloquet found the hernia covered successively by the skin and superficial fascia; the fascia lata; and the middle adductor and pectineus muscles, which were raised up by the protrusion which had passed between the fibres of the adductor brevis. There were two saphenous veins, which, as well as the crural vessels, were somewhat displaced outwards by the tumour. The tumour was oblong, with an oblique direction, from above inwards, and it was divided by a constriction into two portions; the larger above, the smaller below. The upper portion ascended towards the spine of the pubes, in front of the obturator externus, and behind some fibres of the adductor brevis. This part of the sac was higher up, than the opening by which the hernia had escaped. The obturator vessels and nerve, and the hypogastric vein, lay to the outer side and behind the neck of the sac, below which the artery divided into two branches. The lower of these passed behind the sac to be distributed to the obturator externus, and adductor brevis; while the other passed also behind the sac, and then turning round its inner side, on a level with the neck, proceeded in front of it to the pectineus. The sac rested posteriorly on the obturator externus muscle, which it had separated from the ligament. (See *Jules Cloquet, Pathologie, Chir.* p. 107.)

The hernia of the foramen ovale, when reducible, must be kept up with a suitable truss; and if it were strangulated, and not capable of relief from the usual means, an operation would be requisite, though attended with difficulties. The division of the obturator ligament and mouth of the sac should be made inwards, to avoid the obturator artery. If this vessel, however, were to arise in common with the epigastric artery, it would be exposed to injury by following this plan. (See *Garengot in Mém. de l'Acad. de*

Chir. t. i. Sir A. Cooper, *On Crural Hernia, &c.* p. 70.)

Cystocele.—As Mr. Pott observes, 'The urinary bladder is also liable to be thrust forth from its proper situation, either through the opening in the oblique muscle, like the inguinal hernia, or under Poupart's ligament, in the same manner as the femoral.'

"This is not a very frequent species of hernia, but does happen, and has as plain and determined a character as any other.

"It has been mentioned by Bartholin, T. Dom. Sala, Platerus, Bonetus, Ruysch, Petit, Mery, Verdier, &c. In one of the histories given by the latter, the urachus, and impervious umbilical artery on the left side, were drawn through the tendon into the scrotum, with the bladder; in another, he found four calculi.

"Ruysch gives an account of one complicated with a mortified bubonocoele. Petit says, he felt several calculi in one, which were afterwards discharged through the urethra. (See also *J. G. F. John de insoluta Calculi Ingentis per Scrotum Exclusionem*. Wittenburg, 1750.)

"Bartholin speaks of T. Dom. Sala as the first discoverer of the disease, and quotes a case from him, in which the patient had all the symptoms of a stone in his bladder: the stone could never be felt by the sound, but was found in the bladder (which had passed into the groin) after death." (*Pott*.)

According to Sir Astley Cooper, the increase or diminution of the size of the tumour is not much affected by the position of the patient's body, but depends more upon the accumulation, or evacuation of urine. "This variation of size, however, is not always observable, as the bladder does not always discharge the whole of its contents, when the patient makes water; that part of the viscus within the pelvis completely emptying itself, while the portion within the scrotum remains distended, as before the attempt to void the urine. Persons, therefore, labouring under this complaint are sometimes under the necessity of raising the scrotum, and pressing upon it, in order to force its contents into the pelvic portion of the bladder, by which means the whole volume of water is discharged by the urethra." Another troublesome symptom is frequent desire to make water, caused by its imperfect evacuation. The fluctuation might lead to a suspicion of hydrocele; but, in the two cases, seen by Sir Astley Cooper, there was no transparency. (*On Hernia*, part ii. p. 63.)

This circumstance, together with the return of the urine into the bladder in the pelvis, and the consequent desire to make water, or the tumour being compressed, will prevent such a mistake. But Bertrand met with a case, in which such recession of the urine could not be made to take place by pressure. Verdier gives a case, in which a calculus in the protruded part of the bladder, was mistaken for a bubo, and caustic was applied, by which an urinary fistulous opening was produced.

As the bladder is only covered in part by the peritoneum, the hernia cystica has no sac; and when complicated with a bubonocoele, that portion of the bladder which forms the cystic hernia lies between the intestinal hernia and the spermatic chord—that is, the intestinal hernia must be anterior to the cystic.

The vesical hernia is believed by Sir Astley Cooper to have its origin in a relaxed state of the bladder, and he suspects, that the protrusion may also be promoted by neglect to empty the bladder at the time required. The bladder thus becomes distended laterally; and then reaches the superior opening of the inguinal canal, through which it is forced by the pressure of the superincumbent viscera, and the action of the diaphragm and abdominal muscles. "As the anterior and lateral parts of the bladder are, in some degree, devoid of peritoneal covering, the bladder at first enters the inguinal canal; without bringing that membrane with it; but, as soon as the fundus begins to descend, the peritoneum accompanies it; and with the sac, thus formed, intestine and omentum afterwards protrude." (See Sir A. Cooper, *On Hernia*, part ii. p. 64. ed. 2.)

While recent, this kind of hernia is reducible, and should be kept up with a truss. When it is of any date, or has arrived to any considerable size, as Pott remarks, the urine cannot be discharged, without lifting up, and compressing the scrotum: the outer surface of the bladder is now become adherent to the cellular membrane, and the patient must be contented with a suspensory bag.

"In case of complication with a bubonocoele, if the operation becomes necessary, great care must be taken not to open the bladder instead of the sac, to which it will always be found to be posterior."

Verdier and Sharp have accurately described the cystocoele. Pott has recorded two cases, which fell under his observation. (Vol. iii.) Pott mentions a cystic hernia in perinæo; and several cases of its occurrence in the female. (*Acad. de Chir.* t. 4.) Pott cut into one cystocoele by mistake. Mention is made (*Edin. Surg. Journ.* vol. iv. p. 512.) of a cystic hernia, which protruded between the origins of the levator ani, and obturator internus muscles: the tumour made its appearance in the pudendum of an old woman. A similar case is published in Sir Astley Cooper's work, as communicated to him, by Mr. Burns, of Glasgow. Sir Astley has also recorded the particulars of the dissection of two inguinal cystocoeles.

An instance of protrusion of the bladder through a wound, caused by a bullock's horn, is recorded by Larrey. (*Mém. de Chir. Mil.* t. 4. p. 289.)

Ischiatic Hernia.—This disease is very rare. A case, however, which was strangulated, and undiscovered till after death, is related in Sir A. Cooper's second part of his work on hernia. It was communicated by Dr. Jones, sc celebrated for his book on hemorrhage. The disease happened in a young man, aged 27. On opening the abdomen, the ileum was found to have descended on the right side of the rectum into the pelvis, and a fold of it was protruded into a small sac, which passed out of the pelvis at the ischiatic notch. The intestine was adherent to the sac at two points: the strangulated part, and about three inches on each side, were very black. The intestine towards the stomach were much distended with air; and here and there had a livid spot on them. A dark spot was even found on the stomach itself, just above the pylorus. The colon was exceedingly contracted, as far as its normal flexure. A small orifice was found in the

side of the pelvis, in front of, but a little above, the sciatic nerve, and on the forepart of the pyramiformis muscle. The sac lay under the glutæus maximus muscle, and its orifice was before the internal iliac artery, below the obturator artery, but above the vein. Sir A. Cooper remarks, that a reducible case might be kept up with a spring-truss, and, that if an operation were requisite, the orifice of the sac should be dilated directly forwards. (*On Crural Hernia*, &c. p. 73.)

Phrenic Hernia.—The abdominal viscera are occasionally protruded through the diaphragm, either through some of the natural apertures in this muscle, or deficiencies, or wounds, and lacerations in it. The second kind of case is the most frequent:—Morgagni furnishes an instance of the first. Two cases, related by Dr. Macauley, in *Med. Obs. and Inq.* vol. i.; two more detailed in the *Medical Records, and Researches*; and two others published by Sir A. Cooper, are instances of the second sort: and another case has been lately recorded by the latter gentleman, affording an example of the third kind. A laceration of the diaphragm by fractured ribs, has produced a hernia. A case of this kind was dissected by Mr. Travers, at Guy's Hospital. (*Med. Chir. Trans.* vol. vi. p. 375.) In this last volume may also be found the particulars of an interesting example, in which a considerable part of the large curvature of the stomach was protruded through a fissure of the diaphragm. The accident was unattended with any fracture of the ribs, and was caused by the upsetting of a stage-coach, on which the patient was an outside passenger. Before death, he vomited up a large quantity of blood, and a small semicircular aperture was discovered on dissection in the lower part of the strangulated portion of the stomach. (P. 378, 379.) See also B. Stehelin, *Tentamen, Med. qual ventriculum, qui in thoracem migraverat*, &c. describit, 1721 (in *Halleri Disp. Anat.* tom. vi. p. 675.) Hildanus, Paré, Petit, Schenck, &c., also mention cases of phrenic hernia. The disease is quite out of the reach of art.

Mesenteric Hernia.—If one of the layers of the mesentery be torn by a blow, while the other remains in its natural state, the intestines may insinuate themselves into the aperture, and form a kind of hernia. The same consequence may result from a natural deficiency in one of these layers. Sir A. Cooper records a case, in which all the small intestines, except the duodenum, were thus circumstanced. The symptoms during life were unknown. (*On Crural Hernia*, &c., p. 82.)

Mesocolic Hernia.—So named by Sir Astley Cooper, when the bowels glide between the layers of the mesocolon. A specimen of this disease is preserved at St. Thomas's Hospital.

Every surgeon should be aware, that the intestines may be strangulated within the abdomen from the following causes:—1. Apertures in the omentum, mesentery, or mesocolon, through which the intestine protrudes. 2. Adhesions, leaving an aperture, in which a piece of intestine becomes confined. 3. Membranous bands at the mouths of hernial sacs, which becoming elongated, by the frequent protrusion and return of the viscera, surround the intestine, so as to strangle them within the abdomen, when returned from the sac. (See Sir A. Cooper, *On Crural Hernia*, &c. p. 86.)

Pott remarks, that "Ruysch gives an account

of an impregnated uterus being found on the outside of the abdominal opening; and so do Hildanus and Sennertus. Ruysch also gives an account of an entire spleen having passed the tendon of the oblique muscle. And I have myself seen the ovary removed by incision, after they had been some months in the groin." (Vol. ii.)

Franco, Traité des Hernies, &c., 8vo. Lyons, 1561. *Littre*, Observation sur une Nouvelle Espèce de Hernie; Mém. de l'Acad. des Sciences, 1700. *Mery*, in the same work, 1701. *Littre* sur une Hernie Rare; same work, 1714. *Heister*, Instit. Chirurg. et de Hernia Incarcerata Suppurata non semper lethali. *Peysson*, Observations, &c. sur la Cure des Hernies avec Gangrene, Mém. de l'Acad. de Chir. t. i. *J. G. Guiz*, Obs.: Anatomico-chirurgicarum de Herniis Libellus, Lips. 1744; et Prælusio Invitatoria in qua de Etero-Epiptoclo agogab. Lips. 1746. *Arnau*d on Hernias, 1748; also his Mém. de Chir. Haller de Herniis Congenitis, 1749. *Garengot* sur plusieurs Hernies singulières; Mém. de l'Acad. de Chir. t. ii. *Morcan* sur les Suites d'une Hernie Opérée; Mém. de l'Acad. de Chir. t. iii. *Haller*, Herniarum Annotationes; extant. in Opuscul. Pathol. 1755. *J. C. Blanc*, Nouvelle Méthode d'Opérer les Hernies; avec un Essai sur les Hernies, par M. Hoin; Orleans, 1767. 8vo. *Louis*, Réflexions sur l'Opération de la Hernie; Mém. de l'Acad. de Chir. t. iv. *Hann*, Essai sur les Hernies rares et peu connues, 1767. *Pott's* Works, vols. ii and iii. *Goursaud* sur la Différence des Causes de l'Etranglement des Hernies, Mém. de l'Acad. de Chir. t. iv. *Le Dran*, Opérations de Chir. et Obs. de Chir. obs. 57. *F. Hildanus*, cent. v. obs. 54. *J. L. Petit*, Mal. Chir. tom. ii. *S. Sharp*, On the Operations, and in his Critical Inquiry. *Bertrand*, Traité des Opérations; et Exemple d'une Hernie fornicée du Cote droit par l'Intestin Iléum seulement, dont une Portion s'étoit échappée par une des Échancrures Ischiatiques. en se glissant sur les Ligaments Sacrosciatiques; Mém. de Chir. t. ii. *Saltzman*, Disp. de Vesicæ Urinariæ Herniâ, 1712. *Mery* sur les Descendues de la Vessie; Acad. des Sciences, 1713. *J. L. Petit* sur les Hernies de la Vessie; Acad. des Sciences, 1717. *Ferdard*, Recherches sur la Hernie de la Vessie; Mém. de l'Acad. de Chir. t. ii. *Drouot*, Disp. de Herniâ Vesicæ Urinariæ, Argent. 1732. *Leuret*, Obs. sur la Hernie de la Vessie; Mém. de l'Acad. de Chir. t. ii. *P. Petit* (le jeune) sur les Hernies de la Vessie, et de l'Étomac; Acad. de Chir. t. iv. *Vater* de Lienis Prolapsione, 1746. *M. Moudiere*, in Archiv. Générâles, Sept. 1834; an interesting Memoir. *M. G. Pannanus*, De Entero-Oschocele antiquâ, Restitutio Sacri Herniosi Ischelier peracti, absque Bracherlet et Sennertianâ Language, 1748. *La Peyronie* sur un Etranglement de l'Intestin causé intérieurement par l'Adhérence de l'Épiploon au-dessus de l'Anneau; Mém. de l'Acad. de Chir. t. i. *Tonnart*, in Acad. des Sciences, 1764. *Reichter*, Vonden Büchen, in 2 vols. 1778, 1779; or the French transl. by Rougemont, 4to. Bonn, 1783. *A. G. Richter*, De Hernia Incarcerata una cum Sacro suo reponi per Anulum Abdominalium posse mouet, 4to. Gott. 1777. *Winck's* Pract. Obs. on Herniæ, 8vo. Lond. 1788. *Schnucker's* Chir. Wahrnehm. 1774, 1789. *Desault*, Œuvres Chir. par Bichat, t. ii. *Hey's* Pract. Obs. in Surgery, ed. 3. *Sandifort*, Observ. Anat. Pathol. ito. Lugd. 1777, et Icones Herniæ Inguinalis Congenitæ, ito. Lugd. 1781. *Camper's* Demonstrat. Anat. Pathol. 1760; and his Icones Herniarum, ed. à Sommering, fol. Francof. 1801. *Dr. Hunter's* Med. Comment. 1762, 1764. *Mouru*, in Edin. Med. Essays; and the ed. of his works by his son. *Gimbernat's* Account of a New Method of operating for Femoral Hernia, transl. from the Spanish by Beddoes, 8vo. 1795. Also the German transl. with additions by Schreger, 12mo. Nürenb. 1817. *Sir A. Cooper*, On Inguinal and Congenital Hernia, fol. Lond. 1804; and, On Crural and Umbilical Hernia, fol. Lond. 1807; by far the most important and original works ever published on the subject, as, in them are anticipated most of the valuable observations, in relation to the anatomy and pathology of hernia, promulgated by Hesselbach, Scarpa, Langenbeck, and others. The last ed. by C. Aston Key, is improved in arrangement, and by numerous interesting notes. *A. Mouru*, On Crural Hernia, 1803; and the Morbid Anatomy of the Human Gullet, Stomach, and Intestines, 8vo. Edin. 1811. *Sabater*, Médecine Opératoire, t. i. *Chopart et Desault*, Parisian Surgical Journal. *Wrisberg*, in Comment. Reg. Societ. Götting. 1778. *Schnucker's* Vermischte Chir. Schriften. *Haller's* Opera Minora, and Disputationes Chir. F. X. *Rudtorffer*, Abhandlung über die einfachste und sicherste Operations-methode Eingesperrter Leisten-und-Schenkel brüche, 2 bände, 8vo. Wien, 1808. *Sull'ernie* Mémoire Anatomico-chirurgique di Antonio Scarpa, ediz. nuova, 1819; or the French transl. by Cayol, 1812; or the English, by Whistart. *Sir C. Bell's* Surgical Obs. pt. ii. p. 177, &c. London, 1816. *Pelletan*, Clinique Chir. t. iii. *B. Travers* on Injuries of the In-

testines, &c. 1812. A Case of Hernia Ventrliculi through a Laceration of the Diaphragm, by T. *Wheeler*, in Med. Chir. Trans. vol. vi. p. 374. *F. C. Hesselbach*, Disquisitiones Anatomico-pathologicae de Ortu et Progressu Herniarum Inguinalium et Cruralium, cum tab. 17. æneis, 4to. Würzburg, 1816: the original edition in German was first published in 1806. Also Beschreibung und Abbildung eines neuen Instrumentes zur sichern Entdeckung und Stillung einer beidem Bruchschlitze entstandenen gefährlichen Blutung, 4to. Würzb. 1815. *Sommering* über die Ursache, &c. de Brüche am Bauchen und Becken, ausser der Nabel und Leistenegend, 8vo. Frankof. 1811. *B. G. Schreger*, Versuche Chirurgische, t. i. p. 149, &c. Versuche zur Vervollkommnung der Herniotomie, 8vo. Nürnberg, 1811. Also b. ii. ueber einige Hernien ausser der Nabel und Leistenegend, p. 155-8vo. Nürnberg, 1818. *F. J. Trusted*, De Extensione in Solvendis Herniis Cruralibus incarceratis præ Incisione prestantia, 4to. Berol. 1816. *J. C. Hesselbach*, Die Sicherste Art der Bruchschlitze in der Leiste, 4to. Bamh. et Würzb. 1819. *B. G. Seiler*, Obs. nonnullæ Testiculorum ex Abdomine in Scrotum Descensu, et Partium Genitalium Anomalis, 4to. Lips. 1817. *J. Cloquet*, Recherches Anat. sur les Hernies, 4to. Paris, 1819, or tr. by M. Whinnie, 8vo. Lond. 1835. Also Pathologie Chir. 4to. Paris, 1831. *C. J. M. Langenbeck*, Commentarius de Structurâ Peritonæi, Testiculorum Tunics, corumque ex Abdomine in Scrotum Descensu ad Illustrandam Herniarum indolem, 8vo. Gött. 1817. *Langenbeck*, Bibl. für die Chir. b. iv. st. 3.; and Neu. Bibl. b. ii. p. 112, &c. Gött. 1819. *Walther* de Herniâ Crurali, 4to. Lips. 1820. *G. Breschet*, Considérations sur la Hernie Femorale, in his Concours, &c. *J. Symes*, On the Fasciæ of the Groin; Edin. Med. Journ. No. 81. p. 295. *W. Lawrence*, On Ruptures, 8vo. ed. 4. Lond. 1821; a work of great merit and accuracy. *A. Velpeau*, Nouv. Elém. de Méd. Opér. t. ii. 8vo. Paris, 1832. *M. le Baron Dupuytren*, in Leçons Orales de Clinique Chir. t. i. p. 557. *G. J. Guthrie*, on some points connected with the Anatomy and Surgery of Inguinal and Femoral Herniæ, 4to. Lond. 1833. *C. Aston Key*, in Lond. Med. Gaz. 1833, 1831. Also Memoir, On the advantages of dividing the Structure; &c. on the outside of the Sac, 8vo. Lond. 1833.

HERNIA CEREBRI. (*Fungus Cerebri*.)

Encephalocele.) There are two principal kinds of hernia cerebri: one presents itself in young infants, before the ossification of the skull is completed; the other takes place after the destruction of a part of the skull by the operation of the trephine, accidental violence, or disease.

The congenital hernia cerebri of infants occurs, however, in two very different forms: in one, it is covered by the scalp; in the other, the corresponding integuments of the head, and sometimes even the dura mater, are deficient.

The common encephalocele, met with in newborn children, seems to originate from the imperfect ossification of the skull, especially in the situation of the fontanella, and sutures. This case is characterised by a soft swelling, of an equal round shape, which is attended with a pulsation corresponding with that of the pulse: it yields and disappears under pressure, offers no alteration in the colour of the skin, and is circumscribed by the margin of the defective portion of the skull. (*Ferrand*, in Mém. de l'Acad. de Chir. t. xiii. in 12mo. p. 102.) In general, the mental faculties are not affected; and we read of one example, in which a patient had such a hernia cerebri thirty-three years, without his intellects ever having been impaired during the whole of that period. (*Op. cit.* t. v. in 4to. p. 863.)

It is tolerably well established, that the congenital hernia cerebri, which arises from the incomplete ossification of the skull, and is covered by the scalp, ought to be treated by the application of constant, yet moderate, pressure. M. Salleneuve communicated to the Royal Academy of Surgery in France an example of the good effects of this treatment, which reduces the size of the tumour, and accomplishes a perfect cure as soon

as the ossification is completed. M. Salleneuve put a piece of thin sheet lead, properly covered with soft linen, under the child's cap, to which it was sewed in a suitable situation, and the degree of pressure was increased, or lessened, according as circumstances required, by tightening or loosening the cap. (*Op. cit.* p. 103. t. xiii. ed. 12mo.)

The experience of Callisen also confirms the fact that hernia cerebri, when of moderate size, may be cured by the foregoing method, the aperture becoming gradually closed. But he adds, that large tumours of this description, especially when situated about the occiput, scarcely admit of any means of relief, except the employment of some contrivance to protect them from external injury. (*System. Chir. Hodierna*, vol. ii. p. 513, 514. ed. 1800.)

When the ossification of the sutures in children is late, the cerebellum, as well as the cerebrum, is liable to protrusion. In 1813, two such cases occurred at Paris. In one, Professor Lallemand mistook the disease for a common tumour, and commenced an operation for its removal, when, after making some of the necessary incisions, his proceedings were stopped by his seeing the white silvery colour of the dura mater, and that the swelling came out of an aperture in the occipital bone. The day after the operation the child was seized with violent pain in the head, had a hard pulse, prostration of strength, vomiting, &c., and died in the course of a week. On dissection, a part of the tentorium, and an elongation of the two lobes of the cerebellum, about as large as a nut, were found in the protruded sac of the dura mater. Several abscesses were also discovered in the substance of the cerebellum. The other example fell under the observation of M. Baffos: upon the death of the child, the dissection evinced similar appearances. (*Richerand, Nosographie Chir.* t. ii. p. 319. ed. 4.)

Such facts should teach the surgeon to be particularly cautious in ascertaining the nature of tumours about the back part of the head, before he ventures to attempt their removal.

The second kind of congenital encephalocele is that, in which not only large portions of the cranium, but also more or less of the integuments of the head, are deficient. It is rather to be regarded as a malformation, than a disease; and, indeed, in most instances, the infants are still-born. The case sometimes consists of the protrusion of most of the brain through the inferior and posterior fontanelle, so that the child is born with a largish bag, on the back of its head, hanging down over the posterior part of the neck. Several specimens of these malformations, taken from infants born in the Hospice de la Maternité, are preserved in the museum of the Faculté de Médecine at Paris. (*Richerand, Nosogr. Chir.* t. ii. p. 316. ed. 4.) In the year 1810, a remarkable case of this last description of congenital hernia cerebri was published by Dr. Burrows. "The whole of the forehead, summit, and a great part of the occiput, were deficient; and in lieu of them a substance projected of a light mulberry colour, and of the mushroom form, except that it was proportionably broader. From the deficiency of bone, the eyes appeared to project much more than usual. The child lived six days without either taking sustenance, or having any evacuation." On dissection, the scalp, the os frontis, the parietal,

and a great part of the occipital bones, were wanting. Through the parts, at which these bones were deficient, the cerebrum projected, exhibiting its usual convolutions. It was covered with the pia mater; was of a mulberry colour; appeared to be more vascular, than the pia mater usually is; and the edge of the scalp adhered to the neck of the tumour. The cerebellum was not more than one-fourth of its usual size; for, the posterior part of the os occipitis was much nearer to the sella turcica, than natural. The child was destitute of the power of voluntary motion, and all the secretions appeared to be stopped. (*Sec Med. Chir. Trans.* vol. ii. p. 52.)

The most interesting species of hernia cerebri to the practitioner, is that which sometimes arises after the removal of a portion of the skull by the trephine, or the destruction of part of it by disease. Numerous examples of this disease are recorded; and I have myself seen several instances of it. Although the case has attracted considerable notice, modern surgeons are far from entertaining settled opinions, concerning the exact nature of the tumour.

In one example, recorded by Abernethy, the hernia cerebri arose on the tenth day after trephining, and was as large as a pigeon's egg. The pia mater, covering it, was inflamed; and a turbid serum was discharged at the sides of the swelling, from beneath the dura mater. On the eleventh day, the tumour was as large as a hen's egg, smooth, and ready to burst. The man died the next day. On examination, the swelling was found still larger, and of a dark colour, with an irregular granulated surface. This appearance was owing to coagulated blood, which adhered to its surface, as the part had bled so much, that the patient's cap was rendered quite stiff with blood. The pia mater was in general much inflamed, and, as well as the dura mater, was deficient at the place of the tumour. The deeper part of the swelling seemed to consist of fibrous coagulated blood, and it was found to originate about an inch below the surface of the brain.

Mr. Abernethy explains the formation of the disease as follows:—"In consequence of the brain being injured to some depth beneath the surface, disease of the vessels, and consequent effusion of the blood had ensued: the effusion was, for a time, restrained by the superincumbent brain and its membranes; but, these gradually yielding to the expansive force exerted from within, and at last giving way altogether, the fluid blood oozed out and congealed upon the surface of the tumour." An organised fungus can hardly be produced so rapidly as these tumours are formed. (*On Injuries of the Head, in Surgical Works*, vol. ii. p. 53.)

On the contrary, Sir C. Bell declares, that the swelling is vascular and organised. (*Operative Surgery*, vol. i.) Dr. John Thomson also entertains a different opinion from that of Abernethy, respecting the mode in which these hernia cerebri are formed; but, I question whether he may not have confounded with the disease now under consideration, fungous tumours of the dura mater. At least, some of the cases, to which he alludes, as a reason for his sentiment concerning their mode of formation, must have been the disease so well described by M. Louis. (*See DURA MATER.*) The reader, however, must judge for himself from the following passage:—"In a considerable number of

those who had the cranium severely contused, or fractured by musket-balls (says Dr. Thomson), fungous growths took place through the openings, which had been made at first by the ball, or afterwards by the trepan. These growths, I am inclined to believe, are the consequence of a contusion of the substance of the brain, and of the membranes that cover it, which gives rise to the formation of a new, organised substance, different in its texture from brain; and are not, as some late writers would endeavour to persuade us, simply protrusions of the brain, resulting from the removal of the natural resistance, which is made to them by the dura mater and cranium. *I have known instances of substances, similar to these growths, forming on the surface of the brain, immediately under the place where the cranium had received a contusion, in cases in which the trepan had not been applied, or any portion of the cranium removed.*

"Fungus of the brain, in the greater number of instances, in which we had an opportunity of observing it, was accompanied either with stupor or paralysis, and other symptoms of compressed brain. In a fracture of the vertex of the cranium, produced by a musket-ball, and followed by a fungus of the brain, the paralysis took place in the lower extremities. In a case of wound, made by a musket-ball on the right side of the forehead, and in which spiculae of bone had been driven in upon the brain, a large fungus protruded. The formation of this fungus was followed by slow pulse, stupor, dilated pupils, slight strabismus, and distortion of the mouth. In the progress of this case, escharotics were applied to the fungus, portions of it were torn off by the patient, and all of it that was exterior to the cranium was twice pared off by the knife, with an apparent alleviation, rather than aggravation, of the symptoms. On the death of this patient, nearly the whole of the right hemisphere of the brain was found converted into a soft pulpy mass. The left hemisphere was not changed in structure, though much vascular turgescence appeared on its surface." (See Dr. J. Thomson's Report of Obs. made in the Military Hospitals in Belgium, p. 57, 58.)

From the investigations of Mr. Stanley, the fact is placed beyond all doubt, that a part of the brain occasionally constitutes the substance of hernia cerebri; and he thus confirms the opinion formerly entertained upon this point by Quesnay and Louis. Thus, in the first case which Mr. Stanley has recorded, "the whole tumour was sliced off with a scalpel. During the operation, the boy gave no manifestation of positive pain, although not unconscious of what we were doing. Considerable hemorrhage took place from the surface of the brain, exposed by the removal of the tumour, the blood being thrown with great force, and to a considerable distance, from numerous vessels, which were attempted to be secured, but ineffectually, by ligatures. After a short time, however, the bleeding ceased. On examination of the part, which had been cut off, its exterior was found to consist merely of a layer of the coagulated blood: the rest of the mass was brain, possessing a natural appearance, the distinction between the cortical and medullary matter being readily seen, with the convolutions and pia mater dipping down between them." In the dissection after death, "all that part of the dura mater, adjacent to the ulcerated aperture, through which the brain had protruded,

was black, sloughy, and much thickened. The exposed surface of the brain, from which the portion had been cut off, exhibited a softened and broken-down texture; a state of disorganisation, which extended deep into its substance. About an ounce of fetid and dark-coloured fluid was found between the dura mater and arachnoid membrane. Several small effusions of blood were met with, both between the membranes and in the substance of the brain. The arachnoid membrane was thickened and opaque over each hemisphere. The vessels on the surface, and in the substance of the brain, were remarkably free from blood. The lateral ventricles were large, and filled with transparent fluid, and there was some found between the membranes at the basis, so that, altogether, the quantity from these two sources was very considerable." (See Med. Chir. Trans. vol. viii. p. 15—17.) In another dissection, a considerable quantity of pus was found on the arachnoid membrane, on each side of the falx. (P. 27.) In most of the cases of hernia cerebri, which I have seen, the patient was at first more or less sensible, but labouring under severe nervous agitation. The stupor, paralysis, and other symptoms of compressed brain, noticed by Dr. J. Thomson, did not take place, till the latter stage of the disease, and then convulsive twitches of the muscles and strabismus occasionally came on. (See Med. Chir. Trans. p. 26.) The disease is usually attended with great frequency of the pulse.

With regard to the cause of the protrusion, it is a subject very difficult of explanation, because if the origin of the tumour depended simply on the removal of a portion of the skull, or on any changes of the dimensions of the brain in expiration, the effect would always follow such causes, and prevail in all patients. From the particulars of the dissections, performed by Mr. Abernethy and Mr. Stanley, and those referred to by Dr. J. Thomson, it is clear that hernia cerebri is a disease connected with deep-seated changes throughout a great part of the brain. (See also Larrey, *Mém. de Chir. Mal.* t. iv. p. 206.) The substance of this organ is found more or less pulpy and disorganised; and after death, large effusions of serum, and even sometimes of blood, and purulent matter are observed. These appearances leave no doubt of the disease being associated with inflammatory action within the head. It is highly probable, therefore, that a hernia cerebri is only produced when these deep-seated changes are conjoined with the removal of bone. The changes alluded to may be supposed to cause an increase in the general contents of the skull, and thus a disposition to protrusion, as rapid as the serum and other fluids are effused. This statement, however, can only be received as an hypothesis, because we find, that in one of the dissections, described by Mr. Stanley, "there existed a considerable space between the upper surface of the right hemisphere, all around the situation of the protrusion, and the internal surface of the dura mater, while, in every other part, the brain and dura mater were in close contact." (See Med. Chir. Trans. vol. viii. p. 27.) Now, the idea of an empty space within the cranium is rather inconsistent with the supposition that the brain is thrust out, in consequence of changes which augment the quantity of the general contents of the skull, unless such

space were filled with air, that had no external communication.

When the bad symptoms disappear, on the tumour being no longer confined by the dura mater, some practitioners deem it best to interfere as little as possible, and let the tumour drop off in pieces. (See *Edinb. Med. Comment.* vol. i. p. 98. *Med. Museum*, vol. iv. p. 463.) The mildest dressings are to be employed; but whether the protrusion should be resisted by pressure or not, seems unsettled.

When the tumour acquires considerable size, it may be pared off with a knife, as was done by Mr. Hill, in several instances, with success. (*Cases in Surgery*, 8vo. Edinb. 1772.)

In one of the cases, published by Mr. Stanley, the patient, a boy about eleven years of age, recovered after the upper part of the tumour had been pared off, and some of the removed substance was found to consist decidedly both of cortical and medullary substance. In this instance, the reproduction of the tumour was checked by firm pressure with graduated compresses, and a bandage. The protruded brain gradually lost its natural colour: it acquired a light yellow appearance, was split into several portions, and a very fetid odour exhaled from it. Its substance daily became softer, ultimately acquiring almost a semi-fluid state, and in this condition, the whole mass gradually wasted away. *Fresh granulations arose to fill up the vacancy, and they were manifestly produced from the exposed substance of the brain.* Compression being continued, the part now quickly healed up. (See *Med. Chir. Trans.* p. 20, 21.) In a third case, the part of the tumour cut off consisted entirely of cortical and medullary substance, quite healthy in its appearance (p. 24); and subsequently granulations were formed from the exposed surface of the brain. The case, however, had a fatal termination. By the removal of the swelling, and the use of compression, one cure was effected by Mr. Prince. (See *Edin. Med. and Surgical Journ.* vol. ix.)

Richerand affirms, indeed, generally, that when the brain is exposed, in consequence of an injury of the head, the encephalocoele should be cut down with a knife, and repressed by gentle compression. (See *Nosogr. Chir.* t. ii. p. 318. ed. 4.)

Sir A. Cooper is also an advocate for pressure, made with adhesive plaster; and a compress of lint wet with liquor calcei: his aim is to reduce the swelling to a level with the bone, when, he says, the scalp will heal over it. (*Lectures*, vol. i. p. 317.)

The cases published by Mr. Stanley are rather favourable to the employment of pressure, inasmuch as it appeared evidently to check the protrusion, and was mostly borne without inconvenience. The idea, however, that when the brain protrudes through the dura mater, pressure can effect its return, is, as Mr. Stanley judiciously observes, quite untenable. (*Med. Chir. Trans.* vol. viii. p. 36.)

Quesnay mentions an instance in which a patient tore off the protruded mass himself, and the cavity healed up. (*Mém. de l'Acad. de Chir.* t. i.) Van Swieten relates a case, in which the swelling was repeatedly removed with a ligature, and a cure ensued. (*Comment.* t. i. p. 440.) The danger of applying styptics, and irritating applications, is shown by Hillman, obs. 14, and Mr. Hill, p. 198. Larrey considers the treatment by excision,

pressure, and, spirituous applications, hurtful and dangerous: his advice is merely to apply to the swelling a pledget of slightly camphorated oil of camomile; to have recourse to cooling aperient beverages; to remove all kinds of irritation; to exclude the air; and apply the dressings with great gentleness. By these means, the only case which Larrey ever saw recover, was saved; and in it the tumour was small. (*Mém. de Chir. Mil.* t. iv. p. 206.)

Quesnay sur la Multiplicité des Trépan, in *Mém. de l'Acad. Royale de Chirurgie*, t. ii. p. 25. 56. ed. in 12mo. M. Corv'n's Dissert. in Haller's *Disputat. Chir.* vol. ii. *Mém. sur l'Encephalocoele*, par M. Ferrand, in *Mém. de l'Acad. de Chir.* t. xiii. p. 96. edit. 12mo. *Iassus*, *Pathologie Chir.* t. ii. p. 140. edit. 1809. *Abernethy's Essay on Injuries of the Head*. *Hill's Cases in Surgery*. *Rivortes*, in *Med. Chir. Trans.* vol. ii. *Callien*, *Systema Chirurgiae* Hotterianæ, vol. ii. p. 512. edit. 1800. *Sir C. Bell's Operative Surgery*, vol. 1. *Richter's Anfangsgründe der Wundarzneikunst*, b. ii. p. 197. ed. 1802. *Richerand*, *Nosographie Chir.* t. ii. p. 316. ed. 4. Paris, 1815. *D. J. Thomson's Report of Observations made in the Military Hospitals in Belgium*, p. 87. Edinb. 1816. *Dupuch*, *Précis Elementaire des Maladies Chir.* t. ii. p. 447, et seq. Paris, 1810. *Credé and Sand*, in Haller's *Disputat. Chir.* t. 1. *E. Stanley*, in *Med. Chir. Trans.* vol. vii. 1. a paper, containing many valuable observations. *M. de Barrow Larrey*, in *Mém. de Chir. Mil.* t. iv. p. 203, &c. *Hausen's Military Surgery*, p. 311. 3^e ed. 2. *A. Schenken*, *De Cerebri Tumorebus*, Edinb. 1810. *J. C. Schoenlein*, *von der Hirnmetamorphose*, 8vo. Würzh. 1816.

HERNIA HUMORALIS. Orchitis. Inflammation of the testicle, especially when produced by irritation in the urethra, gonorrhoea, the use of bougies, &c. As the term is founded upon the exploded doctrine of the translation of humours, from one part to another, the sooner its employment is abandoned the better. The case is considered under the word *Testicle*.

HERPES. (from ἑρπῆς, to creep.) Nothing could be more confused and undefined, than the idea conveyed by the term *herpes*, as generally employed until a few years ago, when the judicious distinctions, proposed by the late Dr. Willan, began to have due influence. The appellation, *herpes*, is limited "to a vesicular disease, which, in most of its forms, passes through a regular course of increase, maturation, and decline, and terminates in about ten, twelve, or fourteen days. The vesicles arise in distinct, but irregular clusters, which commonly appear in quick succession, and they are set near together, upon an inflamed base, which extends a little way beyond the margin of each cluster. The eruption is preceded, when it is extensive, by considerable constitutional disorder, and is accompanied with a sensation of heat and tingling, sometimes with severe deep-seated pain, in the parts affected. The lymph of the vesicles, which is at first clear and colourless, becomes gradually milky and opaque, and ultimately concretes into scabs; but, in some cases, a copious discharge of it takes place, and tedious ulcerations ensue. The disorder is not contagious in any of its forms." (See *Bateman's Practical Synopsis of Cutaneous Diseases*, p. 221, 222. edit. 3.) This author notices six species of the complaint: viz. herpes phlyctenodes; herpes zoster; herpes circinatus; herpes labialis; herpes præputialis; and herpes iris.

As most of these cases more properly belong to the physician, than surgeon, I shall briefly describe three of them.

According to Dr. Bateman, the *herpes zoster*, or *shingles*, is mostly preceded, for two or three days, by languor, and loss of appetite, rigors, headach,

sickness, and a frequent pulse, together with a scalding heat, and tingling in the skin, and shooting pains through the chest and epigastrium. Sometimes, however, the precursory febrile symptoms are very slight. Upon some part of the trunk, several red patches occur, of an irregular form, at a little distance from each other, upon each of which numerous small elevations appear clustered together. These, if examined minutely, are found to be distinctly vesicular; and in the course of twenty-four hours, they enlarge to the size of small pearls, and are perfectly transparent, being filled with a limpid fluid. For three or four days, fresh clusters continue to arise, always extending themselves nearly in a line with the first, towards the spine at one end, and towards the linea alba at the other. While the new clusters are appearing, the vesicles of the first lose their transparency, and, on the fourth day, acquire a milky, or yellowish hue, which is soon followed by a bluish, or livid colour, of the basis of the vesicles, and of the contained fluid. They now become somewhat confluent and flatten, or subside. About this time they frequently break and discharge, for three or four days a serous fluid, which at length concretes into thin dark scabs. These fall off about the twelfth or fourteenth day, leaving the surface of the subjacent skin in a red and tender state; and when the ulceration and discharge have been considerable, numerous cicatrices, or pits, are left. All the clusters go through a similar series of changes.

Young persons, from the age of twelve to twenty-five, are most frequently affected; although aged persons are not altogether exempt from the complaint, and suffer severely from the pain of it. Summer and autumn are the seasons, in which it is most common. Sometimes it supervenes to bowel complaints, and the chronic pains remaining after acute pulmonary diseases. In the treatment, Dr. Bateman thinks gentle laxatives, and diaphoretics, with occasional anodynes, when the severe deep-seated pains occur, all that is necessary. No external application is requisite, unless the vesicles be abraded by the friction of the clothes, which are then liable to adhere to the parts: in this case a little simple ointment may be interposed. For a fuller account, see *Bateman's Pract. Synopsis*, p. 226, &c.

Herpes circinatus, or ringworm, makes its appearance in small circular patches, in which the vesicles arise only round the circumference; these are small, with moderately red bases, and contain a transparent fluid, which is discharged in three or four days, when little prominent dark scabs form over them. The central area, in each vesicular ring, is at first free from any eruption; but, the surface becomes somewhat rough, and of a dull red colour, and throws off an exfoliation, as the vesicular eruption declines, which terminates in about a week, with a falling off of the scabs. A succession of these vesicular circles usually arises on the face and neck, or arms and shoulders, thus protracting the case for two or three weeks.

The itching and tingling, which are the only inconveniences of the affection, may be relieved by the application of the popular remedy, ink, solutions of the salts of iron, copper, zinc, borax, alum, &c. Rayer has convinced himself that cold water, or linen wetted with cold water, is an equally beneficial application. (*Mal. de la Peau*, t. i. p. 246.) Some additional interesting observations on other

forms of the herpes circinatus, may be found in Dr. Bateman's Synopsis, from which I have extracted the few preceding particulars.

Herpes præputialis. This local variety of herpes was not noticed by Dr. Willan, and we are indebted to Dr. Bateman for a description of it. The complaint begins with extreme itching, and with some sense of heat in the prepuce, on which one or two red patches occur, about the size of a silver penny. Upon these are clustered five or six minute transparent vesicles. In twenty-four or thirty hours, the vesicles enlarge, become of a milky hue, and lose their transparency; and on the third day, they are coherent, and have almost a pustular appearance. If the eruption is seated on that surface of the prepuce, which is next the glans, so that the vesicles are kept moist, they commonly break about the fourth or fifth day, and form a small ulceration upon each patch. This discharges a little turbid serum, and has a white base, with a slight elevation at the edges; and by an inaccurate or inexperienced observer it may be readily mistaken for chancre, more especially if any escharotic has been applied, which produces irritation, and a deep-seated hardness, like that of a true chancre. If not irritated, the slight ulceration begins to heal about the ninth or tenth day. When the patches occur on the outside of the prepuce, the duration of the eruption is shorter, and ulceration does not actually take place.

In the treatment, Dr. Bateman recommends the avoidance of all stimulating, and moist or unctuous applications; and if the complaint be within the prepuce, he advises the interposition of a little bit of dry lint between the sore and the glans. (See also Houston, in *Med. Phys. Journ.* vol. xxiii.; Fean, *On Ulceration of the Genital Organs*, p. 27. 8vo., Lond. 1819; and *Obs. upon Herpes of the Prepuce*, in *Edin. Med. Journ.* vol. vii.)

As this gentleman has truly remarked, this case is particularly deserving of notice, because it has often been considered and treated as a chancre.

For additional information respecting herpes, I beg leave to refer the reader to the publications of Drs. Willan and Bateman, and that of M. P. Rayer, of which enlarged editions in French and English have recently appeared.

HORDEOLUM. (dim. of *hordeum*, barley.) A little tumour on the eye-lid resembling a barley-corn. *A sty.* As Scarpa remarks, the sty is strictly only a little boil, which projects from the edge of the eye-lids, frequently near the great angle of the eye. Like the furunculus, it is of a dark-red colour, much inflamed, and a great deal more painful than might be expected, considering its small size. The latter circumstance is partly owing to the vehemence of the inflammation, and partly to the exquisite sensibility and tension of the skin covering the edge of the eye-lids. On this account, the hordeolum very often excites fever and restlessness in delicate, irritable constitutions; it suppurates slowly and imperfectly; and, when suppurated, has no tendency to burst.

The sty, like other furunculous inflammations, forms an exception to the general rule, that the best mode, in which inflammatory swellings can end is resolution. For, whenever a furunculous inflammation extends so deeply as to destroy any of the cellular substance, the little tumour can never be resolved, or only imperfectly so. This event, in-

deed, would rather be hurtful, since there would still remain behind a greater or smaller portion of dead cellular membrane; which, sooner or later might bring on a renewal of the stye in the same place as before, or else become converted into a hard indolent body, deforming the edge of the eyelid, and termed *grando*.

The resolution of the incipient hordeolum may be effected in that stage of it, in which the inflammation only interests the skin, and not the cellular substance underneath, as is the case on the first appearance of the disease. Now repellent, cold applications are useful, particularly ice. But when the hordeolum has affected, and destroyed any of the cellular membrane underneath, every topical repellent application is absolutely useless, and even hurtful; and the patient should have recourse to emollient anodyne remedies. The hordeolum and eyelids should be covered with a warm soft bread and milk poultice, which ought to be renewed very often. When a white point makes its appearance on the apex of the little tumour, Scarpa says, the surgeon should not be in a hurry to let out the small quantity of serous matter, which exists between the skin and dead portion of cellular membrane. It is better that he should wait till the skin, within this white point, has become somewhat thinner, so as to burst of itself, and give ready vent, not merely to the little serous matter, but to all the dead cellular membrane, which constitutes the chief part of the disease. When the contents of the little tumour are slow in making their way outward, through the opening, the surgeon, gently compressing the base of the stye, ought to force them out. After this all the symptoms of the disease will disappear, and the cavity, left by the dead cellular membrane in the centre of the little tumour, will be found quite filled up, and healed in the course of twenty-four hours.

Sometimes, though seldom, this process of nature, destined to detach the dead from the living cellular membrane, only takes place incompletely, and a small fragment of yellow dead cellular substance still continues fixed in the cavity, and hinders the cure. In this circumstance, the further employment of emollient poultices is of little or no service. The surgeon should now touch the cavity with nitrate of silver scraped to a point, or, dip the point of a camel-hair pencil in sulphuric acid, and touch the inside of the stye with it, one or more times, until the sloughy cellular membrane comes away. After this, the small cavity remaining will soon close. Should the eye-lid continue afterwards a little swollen and oedematous, this affection may be removed by applying the lotio plumbi acet. containing a little spirit of wine. Some persons are often annoyed with this disease. This is most frequent in persons who live on acrid irritating food, and drink spirits. The stye, which occurs and relapses so frequently, in scrofulous children, is readily curable by means of sulphate of quinine, and rubbing the tumour, when not inflamed, with any smooth hard body, like a plain gold ring. (See H. Middlemore, *On Dis. of the Eye*, vol. ii. p. 772.) Chronic styes may occasionally be made to suppurate, by applying to them stimulating salves. (See W. Mackenzie, *On Dis. of the Eye*, p. 158, ed. 2.) (See Scarpa, *Sulle Malattie degli Occhi*, cap. ii. Guthrie's *Operative Surgery of the Eye*, p. 107. H. Middlemore, *On Dis. of the Eye*, vol. ii. p. 770. 8vo. Lond. 1835.)

HOSPITAL GANGRENE. (*Phagedæna Gangranosa*; *Putrid* or *Malignant Ulcer*; *Hospital Sore*; *Gangrana Contagiosa*.) A severe and peculiar species of humid gangrene, or rather a combination of this affection with phagedenic ulceration. It is particularly characterised by its contagious or infectious nature; its disposition to attack wounds, or ulcers, in crowded hospitals, or other situations, where many of these cases are brought together; and its tendency to convert the soft parts affected into a putrid, glutinous, or pulpy substance, in which no trace of their original texture is discernible. (*Delpsch, Précis Élém. des Mal. Chr. t. i. p. 123.*) It is generally believed to be communicated from one sore or wound to another, by its contagious nature; but whether the infection can be transferred only by actual contact, or both in this way, and through the medium of the atmosphere, is a question on which the best authors differ. The first origin of the disease, however, is a mysterious subject, which cannot invariably be explained on any certain principles, as will be hereafter noticed.

From the researches of Mr. Blackadder, it appears probable, that several of the ancient writers, in their descriptions of foul gangrenous bleeding ulcers, must have alluded to the same kind of disease, which is now usually denominated hospital gangrene. Besides the use of the actual cautery, which, according to the modern French writers, is the surest means of arresting this distemper, several of the ancients appear also to have employed for its cure armeniac applications; as, for instance, Aetius, Paulus, Rolandus, Avicenna, Guido, &c. The only doubt, whether these authors actually referred to hospital gangrene, depends upon their not having generally described its contagious nature. But, on this point, I recommend Mr. Blackadder's valuable treatise to be consulted. (P. 76, &c.)

Although La Motte made cursory mention of hospital gangrene in 1722, under the name of *poenitence*, and stated, that it had occurred in the Hôtel Dieu at Paris, the first distinct modern account of this disease is contained in the 3d vol. of the posthumous works of Pouteau, published in 1783. In the year 1788, Dussausy, who succeeded Pouteau as chief surgeon of the Hôtel Dieu at Lyons, also published a short treatise on the disorder. The first very accurate description of hospital gangrene in the English language, appeared in the 6th vol. of the *London Medical Journal*, printed in 1785. The account is entitled, "Observations on the Putrid Ulcer, by Mr. Gillespie, surgeon of the Royal Navy." In the edition of Dr. Rollo's work on Diabetes, published 1797, there is a section on this subject, entitled, "A short account of a morbid poison, acting on sores; and of the method of destroying it." In 1799, Sir Gilbert Blane, in the 3rd edit. of his book on the Diseases of Seamen, gave an account of hospital gangrene under the name of malignant ulcer; and Dr. Trotter, in the 2d vol. of his *Medicina Nautica*, published in the same year, described that affection by the same appellation. In the third vol. of the same work, Dr. Trotter added to his first account several valuable communications, relating to this disease, received from surgeons of the royal navy. Mr. John Bell also made hospital gangrene the subject of particular remark, in the 1st vol. of his *Principles of Surgery*, published in

1801. According to Dr. Thomson, two excellent theses were likewise published on it in the University of Edinburgh: the first entitled, "De Gangrænâ Contagiosâ," by Dr. Leslie, in 1804; the second by Dr. Charles Johnson, in 1805, under the title of "De Gangrænâ Contagiosâ Nosocomiale." (See *Lectures on Inflammation*, p. 456—458.)

Professor Thomson's account of the subject, published in 1813, contained the fullest history of the disease, at that time collected. Boyer afterwards gave a very fair account of the distemper. (See *Traité des Mal. Chir.* t. i. p. 320., 8vo, Paris, 1814.)

These descriptions were followed by the valuable essay of Delpsch, entitled, "Mémoire sur la Complication des Plaies et des Ulcères connue sous le nom de Pourriture d'Hôpital," 1815; some interesting observations by Dr. Heenen, in the *London Medical Repository* for March, 1815; a Paper by Professor Brugmann, of Leyden, in the "Annales de Littérature Méd." vol. xix., 1815; and the treatise of Mr. Blackadder, which contains some of the best remarks ever made concerning this affection, and is entitled "Observations on Phagedæna Gangrænosa, 8vo. Edinb. 1818." To these publications are to be added the interesting remarks of Mr. R. Welbank, On Sloughing Phagedæna, contained in the 11th vol. of the *Med. Chir. Trans.*; and those of Dr. Bogue, recorded in the 3d vol. of the *Edin. Med. Chir. Trans.*

According to Mr. Blackadder, who is a believer in the doctrine of the complaint being only communicable by the direct application of the infectious matter, when the morbid matter, which produces the disease, has been applied to some part of the surface of the body, from which the cuticle has been removed, as by a blister, one or more small vesicles first appear, which are filled with a watery fluid, or bloody serum of a livid, or reddish-brown colour. The situation of the vesicle is generally at the edge of the sore. Its size is not unfrequently that of a split garden pea, and is easily ruptured, the pellicle which covers it being very thin. When the vesicle is filled with a watery fluid, and has not been ruptured, it assumes the appearance of a greyish-white, or ash-coloured slough, but when it contains a dark-coloured fluid, or has been ruptured, it puts on the appearance of a thin coagulum of blood, of a dirty, brownish-black colour. During the formation of the vesicle, there is generally a change in the sensation of the sore, accompanied with a painful feel like that of the sting of a gnat.

After a slough is formed, it spreads with more or less rapidity, until it occupies the whole surface of the original sore; and, when left to itself (which seldom happens), there is little or no discharge, but the slough acquires daily greater thickness.

"When the formation of the slough has been interrupted, the stinging sensation becomes more frequent and acute; phagedenic ulceration quickly commences; and such is frequently the rapidity of its progress; that even in the course of a few hours a very considerable excavation will be formed, while the parts in the vicinity retain their usual healthy appearance." The cavity, the edges of which are well defined, is filled with a thick glutinous matter, which adheres strongly to the subjacent parts. When this matter is removed, the

surface underneath presents itself of a fine granular texture, which, in almost all instances, is possessed of extreme sensibility, and is very apt to bleed, when the operation of cleaning is not performed with great delicacy. At each dressing the circumference of the cavity is found enlarged, and if there are more than one, they generally run into each other. The progress of the disease is much quicker in some individuals than others, but it never ceases, until the whole surface of the original sore is occupied. The stinging pain gradually becomes of a darting or lancinating kind; and either about the fourth, or sixth day, from the time when the morbid matter had access to the sore, or afterwards, at the period of what may be termed secondary inflammation, the lymphatic vessels and glands are apt to become affected. The discharge becomes more copious, its colour varying from a dirty yellowish white to a mixture of yellow, black and brown, depending upon the quantity of blood mixed with it.

"The soft parts, in the immediate vicinity of the sore, daily become more painful, tumefied, and indurated; and, in a great number of cases, particularly in those of plethoric and irritable habits, an attack of acute inflammation speedily supervenes, and is accompanied by a great increase of pain, the sensation being described to be such as if the sore were burning. The period, at which this inflammation begins to subside, is by no means regular. Sometimes it subsides in the course of two days, and sometimes it continues upwards of five; depending very much on the constitution and previous habits of patient, as well as the treatment that has been adopted. During its progress, the thick, putrid-looking, and frequently spongy slough which is formed on the sore, becomes more and more moist, and of a pulpy consistence. (Hence this form of disease is actually named by Gerson, *pulpy gangrene*.) In the course of a few days, a very offensive matter begins to be discharged at its edges. The slough then begins to separate; by and by, it is thrown off; but only to prepare the way for an extension of the disease by a continued process of ulceration, and by a recurrence of the last-mentioned symptoms." (Blackadder, *On Phagedæna Gangrænosa*, p. 28—30.)

The first symptoms, which indicate hospital gangrene in a wound, or ulcer, are, a more or less acute pain, and a viscid whitish exudation on the surface of the granulations, which lose their vermilion colour, and present at several points spots of a greyish or dirty-white hue, resembling venereal ulcers, or aphthæ. These ulcerated points, thus engrafted (as it were) upon the original ulcer, soon spread, and join together, so as to give to the whole surface of the solution of continuity a grey ash-colour. The surface also becomes more or less indurated, and sometimes bleeds. A red, purplish oedematous circle of a greater, or lesser extent, is next formed in the surrounding skin. Sometimes, when the patient is of a good habit, the causes of infection less active, and the constitution sufficiently strong, the disorder now stops. According to Boyer, it may not even extend to the whole surface of the ulcer. But, most frequently, its progress is extremely rapid, and occasionally quite terrifying. The edges of the wound, or ulcer, become hardened and everted; the granulations are large and tumid,

being swelled up, as Boyer asserts, with a considerable quantity of gas. They are afterwards detached in the form of soft reddish sloughs, which very much resemble the substance of the fetal brain, in a putrid state. From day to day, until nature either alone, or aided by art, puts limits to the disorder, it invades new parts both in breadth and depth, so that its ravages extend to aponeuroses, muscles, blood-vessels, nerves, tendons, the periosteum, and even the bones themselves.

Amongst a number of severe cases, which fell under the notice of Mr. Blackadder, "there was one, in which the half of the cranium was denuded, the bones having become black as charcoal, and the integuments detached posteriorly to the second cervical vertebra, and anteriorly to the middle of the zygomatic process of the temporal bone; and this was originally a superficial wound of the scalp. In another case, the muscles, large arteries, and nerves of both thighs were exposed and dissected, the integuments and cellular substance being entirely removed, with the exception of only a narrow strip of the former, which remained on the outer side of the thighs. This was also originally a simple flesh wound. In other instances, the cavities of the knee, ankle, elbow, and wrist, joints were laid extensively open, and, in one unfortunate case, the integuments and cellular substance, on the anterior parts of the neck, were destroyed, exhibiting a horrid spectacle, the trachea being also wounded." (*On Phagedæna Gangrenosa*, p. 3.)

According to the last experienced author, when the disease attacks an old sore, where a considerable depth of new flesh has been formed, the first thing generally observed is a small dark-coloured spot, usually situated at the edge of the sore. But, he states, that, in several cases of ulcers, the disease, when carefully watched, was found to begin in the form of a vesicle, filled with a livid, or brownish-black fluid, which afterwards burst, and assumed the appearance of the dark coloured spot, which is commonly first noticed. Mr. Blackadder always found, that when there had been a considerable bed of new flesh formed, the phagedenic ulceration made comparatively a very slow progress, and put on rather the appearance of mercurial phagedæna, until the morbid matter had found access to the natural texture of the part, when the progress of the disease became suddenly accelerated; acute inflammation supervened; and a large slough was formed. (*Op. cit.* p. 31.) He notices, that when the morbid matter is inserted in a puncture, or scratch, the first progress of the disease bears a resemblance to that of a part inoculated with vaccine matter. The primary inflammation in gangrenous phagedæna commences at the end of the second, or early on the third day; the inflammation is at its height about the sixth; when the scab begins to form in one disease, phagedenic ulceration begins in the other, and, when allowed to proceed, soon affords sufficient proof of the non-identity of the two diseases. (P. 33.)

When the disease attacks a recent gunshot wound, the discharge, two or three days after infection, is found to be lessened, and to have become more of a sanious, than purulent nature. The sore has a certain dry and rigid appearance; its edges are more defined, somewhat elevated,

and sharpened; the patient is sensible of a change in the usual sensation in the sore, and complains of an occasional stinging sensation, resembling that produced by the sting of a gnat. At this period, but sometimes a day or two later, the integuments at the edge of the sore become inflamed, and the surface of the sore itself assumes a livid or purple colour, and appears as if covered with a fine pellicle, such as is formed on a coagulum of blood. (*On Phagedæna Gangrenosa*, p. 33.)

At Bilbao, the disease, in cases of wound, is said generally to have commenced with a sudden attack of severe pain in the head and eyes, tightness about the forehead, want of sleep, loss of appetite, a quick pulse, and other febrile symptoms; while the wound, which had been healthy and granulating, at once became tumid, dry, and painful, losing its florid colour, and assuming a dry and glossy coat. (*Hennen, On Military Surgery*, p. 214. ed. 2.) When left to itself the above-described pellicle gradually increases in thickness, forming what has been termed a slough. But, Mr. Blackadder observes, that, at this period, the process of the disease is hardly in any two instances precisely alike. Generally, in the course of from five, to ten, or fifteen days, a thick spongy, and putrid-looking slough is formed over the whole surface of the sore, and which is more or less of an ash, or blackish-brown colour. When the pellicle is destroyed, as frequently happens in the process of cleaning, it is not in every case reproduced; but, an offensive matter begins to be discharged, which becomes daily more copious, and of a dirty yellow colour, and ropy consistence, and very adherent to the sore. The substance, which formed the apparent bottom of the wound, is raised up, and pushing back the edges, makes the sore appear considerably enlarged. The edges, which are usually jagged, or pectinated, become extremely irritable, of a deep red colour, and dotted, on their inner surface, with numerous small, elevated, and angry-looking points, which may be considered as one of the characteristic marks of the disease. The surrounding integuments become indurated and inflamed, assuming, not unfrequently, an anæmic appearance; and the patient complains of a constant burning, lancinating pain. In the vicinity of the sore, the integuments become more and more of a dark-red colour, in consequence of the violence of the inflammation, which is of an erysipelatous nature, and apt to terminate in sloughing, and carry off the patient. However, the inflammatory symptoms are sometimes mild, and, in other cases, exceedingly violent: a fact accounted for by differences of constitution. (*Blackadder*, p. 34.)

In the hospitals at Bilbao, if the incipient stage was overlooked, the febrile symptoms very soon became aggravated; the skin around the sore assumed a highly florid colour, which shortly became darker, then bluish, and at last black, with a disposition to vesicate; while the rest of the limb betrayed a tendency to œdema. All these threatening appearances occurred within twenty-four hours, and, at this period, also, the wound, whatever might have been its original shape, soon assumed the circular form. The sore now acquired hard, prominent, ragged edges, giving it a cup-like appearance, with particular points of the lip of a dirty yellow hue, while the bottom of the cavity was

lined with a flabby blackish slough. The gangrene still advancing, fresh sloughs were rapidly formed; the increasing cup-like cavity was filled up and overtopped by them, and the erysipelatous livor and vesication of the surrounding skin gained ground, while chains of inflamed lymphatics could be traced from the sores to the adjoining glands, these exciting inflammation and suppuration, which often furnished a new nidus for gangrene. The face of the sufferer assumed a ghastly anxious appearance: his eyes became haggard and deeply tinged with bile; his tongue covered with a brownish, or blackish fur; his appetite entirely failed; and his pulse was feeble and accelerated. In this stage, the weakness and irritability of the patient was such, that the slightest change of posture put him to torture, increased by his inability to steady the limb, which, if lifted from the bed, was seized with tremors and spasmodic twitches. (*Hennen's Military Surgery*, p. 215, 216. ed. 2.) Authors vary considerably in their descriptions of the state of the tongue. "Dr. Hennen found it brownish, or blackish; Delpech whitish, or yellowish. (*Précis Elém.* t. i. p. 125); and Mr. Blackadder, covered with a white mucus. (P. 39.)

It is explained by Mr. Blackadder, that when the disease attacks a large recent wound, the whole surface of the injury is sometimes affected from the first; while, in other instances, the disorder commences on, or near the lips of the sore. When the patient is of an inflammatory diathesis, the sore is generally attacked with acute inflammation between the seventh and fourteenth days; and the slough is softer, and of a pulpy consistence; matter, of a strong and peculiar odour, and of a dirty brownish, grey colour, begins to ooze out at its edges, and becomes daily more copious. The inflammation gradually subsides; the slough becomes loosened, and finally detached, leaving the subjacent muscles, bones, fasciæ, or ligaments, completely exposed. When the constitution is not prone to acute inflammation, the slough remains long adherent; the discharge is very copious, and burrows under the skin, which then mortifies. Sometimes, after the detachment of a slough, florid granulations spring up, and, notwithstanding a slight recurrence of the phagedenic ulceration, the parts heal up by the almost unassisted operation of nature. However, most commonly, after the muscles are exposed, they continue to be gradually dissected; their connecting cellular membrane is completely destroyed, and they are left covered with an offensive, greasy-looking matter.

According to Mr. Blackadder, when a muscle has been wounded, it swells sometimes to a great size, and quickly assumes the appearance of a large coagulum, being altogether deprived of irritability. When it has not been wounded, but has become inflamed, it generally assumes a pale colour, with an appearance as if distended with a fluid, and, occasionally, before losing its vitality, acquires a very surprising bulk; but, when no inflammation has supervened, the muscles become of a pale brick colour, waste away daily, and the patient loses all power in them. As the disease advances, the integuments are undermined, and slough; and hemorrhage from small vessels is a common occurrence; but, in a more advanced stage, some of the large vessels are apt to give way, and the bleeding from them frequently destroys the patient.

"When a stump is the site of the disease, and the patient is of a plethoric habit, or accustomed to live freely, the symptoms soon begin to indicate the existence of an intense inflammatory action through its whole substance, the tumefaction, pain, and heat increase rapidly, so that, in a few days, the stump shall have acquired more than twice its former size, being at the same time much indurated, and causing the most excruciating pain. In this state, the patient has, in some instances, become delirious, and has been cut off by an effusion taking place into some of the larger cavities. It more commonly happens, however, that gangrene seizes upon the integuments, and cellular substance; large sloughs are thrown off; and some of the large blood-vessels giving way, the patient sinks under the effects of repeated hemorrhage. For it is commonly found, that the usual modes of stopping hemorrhage from a stump are, in such cases, either inadmissible, or totally inefficacious.

"Sometimes, the progress of the disease in a stump is more gradual, but in the end nearly as fatal; the inflammation is much less acute; there is comparatively but little tumefaction, and the pain is much less severe; but, the discharge is much more copious, and the cellular substance, connecting the integuments and muscles, is rapidly destroyed. Hemorrhage generally comes on later than in the preceding instance, but it is the most common cause of death." (*Blackadder on Phagedæna Gangræna*, p. 33—39.)

It is observed by another writer, that artery seems to be the texture, which resists most powerfully the destructive action of hospital gangrene (*Thomson's Lectures*, p. 460.); a remark quite at variance with the statement of Delpech (*Précis Elém.* t. i. p. 129.); but intended to refer, as I conceive, to cases in which the femoral, brachial, or other large artery is seen for several days completely denuded, in the midst of the ravages of the distemper, yet not giving way. I have seen the same thing frequently exemplified in mercurial phagedæna, as well in the groin as in the arm. As for the smaller arteries, they are quickly destroyed, together with other parts.

"In some rare cases (says Dr. Hennen) I have seen the femoral and axillary arteries pulsating awfully, and apparently unaffected with disease; while all the surrounding parts were completely destroyed; but, in a vast majority of cases, the blood-vessels partook of the general disease, in which they were imbedded. They were not only completely separated from their natural connections, but their coats sloughed away at the immediate point of disease, while the disposition extended far beyond the apparently affected spot. Hence, our ligatures but too often failed on the main branches, and any attempt on the smaller was invariably injurious. We here naturally induced to tie the artery considerably above the seat of the disease; and this was done once on the femoral, and twice on the axillary artery below the clavicle: the former burst on the third, each of the latter on the second day, afterwards." Dr. Hennen further remarks, that, in general, the great vessels sloughed long after the acute symptoms of the disease had abated, and that, in severe cases, the eleventh day of the disease was always dreaded. (*On Military Surgery*, p. 221. ed. 2.) The indisposition of the large vessels to close,

when taken up in the common way, appears terrible to three causes: viz. the tendency to rapid ulceration in the arteries in the situation of the ligatures; the formation of no effectual coagulum in the extremity of the vessel, like what happens in other cases of mortification; and the general incapacity of nature in examples of hospital gangrene to establish any process, which can be accompanied with healthy adhesive inflammation.

In the last stage of the disease, as it occurred in the military hospitals at Bilboa, the surface of the sore was constantly covered with a bloody oozing, and, on lifting up the edge of the flabby slough, the probe was tinged with dark-coloured grumous blood, with which also its track became immediately filled. Repeated and copious venous bleedings now came on, which rapidly carried off the patient: the sloughs, whether they fell off spontaneously, or were detached by cut, were quickly succeeded by others, and brought into view thickly-studded specks of arterial blood. At length, an artery gave way, which was generally torn through in the attempt to secure it with a ligature: the tourniquet, or other pressure, was now applied, but in vain; for, while it checked the bleeding, it accelerated the death of the limb, which became frightfully swelled and horribly fetid. Incessant retchings came on, and with coma, involuntary stools, and hiccough, closed the scene. Often, however, the patient survived this acute state of the disease, and sank under severe irritation, absorption of putrid matter, and extensive loss of substance, with common hectic symptoms. (See *Hemen's Mil. Surgery*, p. 217. ed. 2.) In the disease at Bilboa, the skin and cellular substance seemed to be the parts originally and principally affected. This, says Dr. Hennen, was obvious, even in the living body; but, on dissection, the disease of these parts was frequently observed to spread much further, than external appearances indicated, as a diseased track was often found running up into the groin, or axilla, and completely dissecting the muscles and great vessels. (On *Military Surgery*, p. 219. ed. 2.) When the disease had occupied the outside of the chest, the same gentleman found the lungs in two cases, and the pericardium in a third, covered with gangrenous spots; and when the parietes of the abdomen had been attacked, he often observed the same appearances on the liver. (P. 220.)

Hospital gangrene must be regarded as one of the most serious and dangerous complications, to which wounds and ulcers are liable. When the solution of continuity is large, or of long standing, the disorder commits great ravages, renews its attacks repeatedly, and the relapses prove exceedingly obstinate. The same thing is said to happen, when it affects persons labouring under scorbutic or venereal complaints. Hospital gangrene proves particularly dangerous, and mostly fatal, when it complicates large contused wounds, attended with badly fractured bones. All the soft parts of the injured limb are then frequently observed to be progressively destroyed, and the unfortunate patient falls a victim, either to typhoid symptoms, frequent hemorrhages, or hectic complaints. From what has been stated, however, the disease varies considerably in its severity in different cases, being sometimes of small extent, and even capable almost of a spontaneous cure. Patients have been known to continue afflicted more than a month;

and when the duration of the disease was thus lengthened, the cases almost always had a fatal termination. In a few cases, the wound puts on a favourable appearance again between the sixth and ninth days; and, in slight examples, the amendment is manifested between the third and fifth. Whatever may be the period of the complaint, its wished-for termination is always announced by a diminution of pain; the pus acquiring a white colour, and more consistence, and losing its fetid nauseous smell. The edges of the ulcer subside, while its surface becomes less irregular, and puts on more of the vermilion colour. The red, purplish, oedematous circle, which surrounds the disease, assumes a true inflammatory nature; and the solution of continuity, restored to a simple state, heals up with tolerable quickness, even when the destruction of soft parts is somewhat considerable, unless any fresh untoward circumstances occur to interrupt cicatrization. But sometimes, when the patient is on the point of being completely well again, his condition is suddenly altered for the worse; ulcerated spots make their appearance on the cicatrix, and these spreading in different directions occasion a relapse, which may happen several times.

According to Dr. Boggie, a relapse, and even repeated relapses, are very common, as his own experience fully convinced him; and he adverts to a case reported by Dr. Hennen, in which the patient survived twelve different attacks, and sunk under the thirteenth. (See *Edinb. Med. Chir. Trans.* vol. iii. p. 8.) So far as the observations of Dr. Boggie went, hospital gangrene was more frequent and severe in hot weather than cold. (See *Edinb. Med. Chir. Trans.* vol. iii. p. 13.)

From numerous cases of this disease, seen by Mr. Blackadder at Passage, in Spain, this gentleman made the following conclusions:—

1. That the morbid action could almost always be detected in the wound, or sore, previously to the occurrence of any constitutional affection.
2. That in several instances, the constitution did not become affected, until some considerable time after the disease had manifested itself in the sore.
3. That when the disease was situated on the inferior extremities, the lymphatic vessels, and glands in the groin, were observed to be in a state of irritation, giving pain on pressure, and were sometimes enlarged, before the constitution showed evident marks of derangement.
4. That the constitutional affection, though sometimes irregular, was in many cases contemporary with the second, or inflammatory stage.
5. That all parts of the body were equally liable to become affected with this disease.
6. That when a patient had more than one wound, or sore, it frequently happened, that the disease was confined to one of the sores, while the other remained perfectly healthy, and this even when they were at no great distance from each other. (On *Phagedana Gangranosa*, p. 19.)

Thus, Mr. Blackadder espouses the opinion, that hospital gangrene is at first a local, and not a constitutional disease, that is to say, not necessarily preceded, or originally accompanied, by any diseased action in the system. It is highly important to weigh this distinction well; not only because it is yet the chief point of difference amongst the best writers on this subject, but because it involves

very directly every theory, respecting the causes of the disease, and the great question, whether its ravages are to be resisted principally by local or constitutional means, or by remedies of both descriptions together.

In the hospital gangrene, observed by Dr. Rollo in the Artillery Hospital at Woolwich, "the action of the poison seemed to be limited and confined to specific effects. *The first were local, producing only a general affection, by a more extensive operation on the sore.* Five or six days from the appearance of the small ulcer or ulceration; when it had extended over one third of the former sore, with pain and redness in the course of the lymphatics, and the glands, through which they led, with enlargement of them, general indisposition of the body became evident." Delpech, in his interesting memoir, particularly notices, that the constitutional symptoms *always occurred the last in order of succession.*

Mr. Blackadder distinctly declares, that in no instance, which he had had an opportunity of observing, did the constitutional symptoms of gangrenous phagedæna precede the local, unless the case be held an exception, in which a stump became affected, after amputation had been performed, on account of the previous effects of the disease. The period, at which the constitution begins to exhibit symptoms of irritation, (he says) is extremely irregular,—sometimes as early as the third or fourth day, and sometimes even as late as the twentieth. The countenance assumes an anxious, or feverish aspect; the appetite is impaired; the desire for liquids increases; and the tongue is covered with a white mucus. The bowels are generally rather constipated; and the pulse, what may be termed, rather irritated, than accelerated. But, the general symptoms may assume an inflammatory, or typhoid character, according as the causes of one of these modifications may predominate. According to Mr. Blackadder, when an inflammatory diathesis prevails, the system becomes gradually more irritated, until an attack of acute inflammation seizes upon the sore, and which frequently happens about the end of the second week. At this period, the pulse is frequent and sharp, and it is not uncommon for the patient to be seized with one or more shivering fits, succeeded by a great increase of heat, but seldom or never terminating in a profuse perspiration. The cold fit is sometimes followed by a bilious discharge from the intestines, and mitigation of the febrile disorder. If the local mischief be not arrested, the strength becomes daily more and more exhausted; the fever loses its inflammatory character; and, unless the patient be cut off by hemorrhage, he falls a victim to extreme debility. When the disease has a typhoid character, the pulse is small and frequent; the appetite and strength gradually fail; and the patient at last sinks, retaining his mental faculties to the last. Not unfrequently, diarrhoea hastens the event. (*Blackadder on Phagedæna Gangrænosa*, p. 39, 40.)

The sloughing phagedæna seen by Mr. R. Welbank, generally in the cleft of the nates, in the groin, or at the inner and upper part of the thigh, in the lowest class of prostitutes, and, according to his description, certainly resembling hospital gangrene, was attended, in its early stages, with little or no disturbance of the system; a circumstance

which he also mentions as favourable to the doctrine that the disease is of a local nature. (*See Med. Chir. Trans.* vol. xi, p. 365.)

On the other hand, the generality of writers, nay, even some of those who represent the disease as always proceeding from a species of infection applied to the wound, take into the account the operation of constitutional causes, as predisposing to, and of course preceding, the local symptoms. Dr. J. Thomson believes, that the constitutional symptoms mostly precede the local. (*On Inflammation*, p. 459.) The same sentiment is professed throughout Dr. Hennen's remarks, who placed reliance chiefly upon internal remedies, and regarded external applications as merely a secondary object. (*On Military Surgery*, p. 222, ed. 2.) To this part of the subject I shall return, after adverting to the causes of hospital gangrene.

The hospital gangrene, which occurred in the Artillery Hospital at Woolwich, and was described by Dr. Rollo, did not attack specific sores; Venereal, scrofulous, and variolous ulcers were not attacked, although the patients lay in the wards, where the disease prevailed.

Professor Thomson admits, that specific sores are less liable to attacks of hospital gangrene, than common wounds and ulcers; but he declares that he has frequently seen it attack cancerous and venereal ulcers. (*On Inflammation*, p. 460.)

Dr. Hennen mentions a remarkable instance, which also proves the possibility of a specific sore becoming affected, and fatal from this cause, in forty-eight hours after the patient had first been exposed to the infection. Dr. Hennen relates the fact to prove, that the contagion may be received without a long residence in a tainted air. The patient "who had just landed from England, and was under the influence of mercury, employed for a venereal complaint, died within forty-eight hours after his admission, the gangrene having seized on an open bubo in his groin, eroding the great vessels in the neighbourhood, and absolutely destroying the abdominal parietes to a large extent." (*Principles of Military Surgery*, p. 218, ed. 2.)

The effects of hospital gangrene should be carefully discriminated from those of the scurvy. Ulcers attacked with hospital gangrene, are not affected in any degree like scorbutic ulcers, by the use of vegetable diet and lemon-juice; and they occur among men, who are fed upon fresh meat and vegetables, as readily as they do among those who have been fed altogether upon salt provisions. (*Thomson's Lectures on Inflammation*, p. 482.) Hospital gangrene is almost always accompanied with severe febrile symptoms; but, "as to fevers (says Dr. Lind), it may indeed be doubted whether there be any such as are purely and truly scorbutic. The disease is altogether of a chronic nature; and fevers may be justly reckoned amongst its adventitious symptoms." (*Treatise on the Scurvy*, p. 106.) In cases of hospital gangrene, the general symptoms of scurvy are also absent, such as soreness and bleeding of the gums, livid blotches and wheals on the fleshy part of the legs, cedematous, ankles, &c.

Hospital gangrene (says Boyer) is a species of humid gangrene, which attacks in some degree epidemically the wounds and ulcers of patients, who happen to be crowded together in an unhealthy place.

Its occasional causes are: the situation of an

hospital upon a low marshy ground; the vicinity of some source of infection; the uncleanness of the individuals, or of the articles for their use; the crowded state of the wards, especially when they are small and badly ventilated; lastly, every thing that tends to corrupt the air which the patients breathe. An infected atmosphere may produce in the most simple wounds unfavourable changes, partly, as Boyer conceives, by its immediate action on the surface of the wound, but no doubt, principally, by its *harmful* influence upon the whole animal economy. The foregoing causes have also sometimes produced alarming and obstinate gangrenes of an epidemic kind, or, at least, a state of the constitution, under the influence of which all wounds and ulcers constantly took on a bad aspect, and were often complicated with the worst gangrenous mischief. Vigaroux saw such an epidemic disease prevail for twenty months in the two hospitals of Montpellier; and he states, that the most powerful antiseptics were of little avail against the disorder, which often invaded the slightest scratches.

In general, this epidemic species of gangrene is not observed in new-built hospitals, nor in those, which are erected out of the central parts of cities upon high ground. Hospital gangrene may occur in any season; but, it is most common after the sultry heat of summer.

A bilious constitution, mental trouble, unwholesome or insufficient food, a scorbutic diathesis, great debility, and fevers of a dangerous type, are also reckoned by the French surgeons as so many predisposing causes of hospital gangrene.

The observations of Pouteau, and those of some other practitioners, convincingly prove, that hospital gangrene may be communicated to the most simple wound or ulcer in a subject of the best constitution, and breathing the purest air, by merely putting into contact with such wound, or ulcer, sponges, lint, or charpie, impregnated with the infection of this peculiar disorder. But this inoculation is conceived to be the more alarming, and to take effect the more quickly, in proportion as patients have been more exposed to the influence of such causes as are themselves capable of producing the disease, and also in proportion as the kind of constitution predisposes to it.

Although the contagious nature of hospital gangrene has been generally admitted by all the best informed writers on the subject, the doctrine was not considered by Dr. Trotter as having a good foundation. Modern authors, however, have not joined this latter gentleman, and Dr. J. Thomson, Dr. Hennen, Mr. Blackadder, and Mr. R. Welbank, all believe, that the disorder is infectious. "The contagious nature of hospital gangrene (says Professor Thomson) appears to me to be sufficiently proved, 1st, By the fact, that it may be communicated by sponges, charpie, bandages, and clothing to persons at a distance from those infected with it. 2dly, By its having been observed to attack the slight wounds of surgeons, or their mates, who were employed in dressing infected persons; and that even in circumstances where the medical men so employed did not live in the same apartment with the infected. 3dly, By our being able often to trace its progress distinctly from a single individual through a succession of patients. 4thly, By its attacking recent wounds, as well as old sores, and that in a short time after they are brought near to

a patient affected with the disease. 5thly, By our being able to prevent the progress of the disease in particular situations, by removing the infected person, before the contagion, which his sores emit, has had time to operate. 6thly, By its continuing long in one particular ward of an hospital, or in one particular ship, without appearing in other wards, or ships, if pains be taken to prevent intercourse between the infected and uninfected." (*Lectures on Inflammation*, p. 484.) But although there can be no doubt of the disease spreading partly by its contagious nature, it appears to me equally certain, that the number of cases is also often increased by the continued operation of the same causes, which produced the earliest instance of the disorder in any particular hospital. A similar belief is expressed by Dr. Boggie. (See *Edin. Med. Chir. Trans.* vol. iii. p. 25.)

It is alleged, that when once a patient has taken the infection, he cannot avoid the consequences, whatever precautions he may adopt. Thus, Boyer informs us, that he has seen hospital gangrene take place in wounded patients, who, in the hope of escaping this epidemic affection, had quitted the infected hospital, and retired to elevated situations, where they breathed the most salubrious air. (See *Traité des Mal. Chir.* t. i. p. 322.)

The bad state of the air of a crowded hospital as Mr. Blackadder observes, is a ready means of accounting for the origin of phagedæna gangrænosa; but there are various reasons for considering such explanation not altogether satisfactory; and he mentions a case, in which the wound of a soldier was found affected with the disease, on his first arrival at an hospital, after having been accidentally detained with two other wounded comrades, for five or six days, partly in an open building, and partly in a boat, quite exposed to stormy weather. (p. 45.); Dr. Hennen likewise gives an account of about thirty fresh-wounded men, in whom hospital gangrene first appeared in their journey from Vittoria to the hospital near Bilboa. (*Principles of Military Surgery*, p. 214. ed. 2.) Dr. Rollo also remarks, that some men in quarters were affected with this disease. And according to Mr. J. Bell, "there is no hospital, however small, airy, or well regulated, where this epidemic ulcer is not to be found at times." (*Principles of Surgery*, vol. i. p. 112.) For a refutation of the opinion, that the disease strictly merits the epithets *endemic*, and *epidemic*, I must refer the reader to the observations of Mr. Blackadder. (P. 143, &c.) Delpsch remarks, that the causes of the disease do not appear to have depended upon the state of the atmosphere (p. 25.); and in almost every instance, he traced the propagation of the disorder to the direct application of the morbid matter to the sores. However, he joins Pouteau in the belief, that it may be communicated through the medium of the atmosphere; an occurrence, which Mr. Blackadder doubts, or rather considers as very rare and only possible, where the effluvia are allowed to accumulate in a most negligent manner, so as to resemble a vapour bath, which mode he would also regard as equivalent to inoculation. (*On Phagedæna Gangrænosa*, p. 156.) On the whole, I am disposed to think the views, which Mr. Blackadder has taken of the manner in which the disease is communicated, the most correct, and that, while particular states of the air and constitution certainly modify the disorder, they cannot ge-

nerally have any share in giving origin to the disease: I say generally, because, as various facts oblige us to admit, that hospital gangrene sometimes arises, without having been communicated from any patient previously affected, it is impossible to assert, that the earliest example of it, under such circumstances, may not arise from the operation of some unknown and inexplicable circumstances on the constitution, or, in other words, from the state of the system itself. Nor can a doubt be entertained, that, at all events, the disorder is most apt to break out in crowded, badly ventilated hospitals, and in them appear more extensively and malignantly, than in others which are well regulated, properly ventilated, and healthily situated. But the idea entertained by Delpech, that hospital gangrene may originate from the same contagion as typhus, or other diseases, is merely an unsupported, irrational, conjecture, quite as destitute of truth, as the suppositions about the endemial and epidemic character of the complaint, independent of its infectious nature. The question, how the first example of the disorder originates, is at present a perfect mystery; but, as it cannot be referred to contagion, or inoculation, we should recollect, that whatever produces it in one individual, may produce it in another, similarly circumstanced, and, on this principle, the disorder may sometimes be formed independently, and at the same time, in a greater or lesser number of patients in the same hospital, as well as spread from these to others by infection.

With the view of preventing the disorder, the wards, in which the wounded are placed, should not be crowded; they ought to be freely ventilated, and, if possible, not communicate. The utmost attention to cleanliness should be paid, and all filth and stagnant water removed. It has been asserted, but with what accuracy I cannot determine, that the predisposition of the wounded to this species of gangrene may be lessened by a well-chosen diet, by drinks acidulated with vegetable acids, or with the sulphuric acid, and by the moderate use of wine. The state of the stomach and bowels should be particularly attended to, and, if out of order, emetics and purgatives ought to be immediately employed, and repeated according to circumstances. The dressings should be applied with extreme attention to cleanliness, and too much care cannot be taken to prevent the infectious matter of one wound from coming into contact with another through the medium of sponges (see *Welbank in Med. Chir. Trans.* vol. xi. p. 365.), instruments, &c. "Whatever may be the source of the disease (says a late writer), it is at least sufficiently ascertained, that when it occurs, its propagation is only to be prevented by the most rigid attention to cleanliness, and by insulating the person, or persons affected, so as to prevent all direct intercourse between them and the other patients; for, so far as I have had an opportunity of observing, ninety-nine cases in the hundred were evidently produced by a direct application of the morbid matter to the wounds, dressings, &c.; while others, who were, in every other respect, equally exposed to its operation, never caught the disease. In attempting to prove this by experiment, I have placed three patients with clean wounds alternately between three other patients, severely affected with the disease. They lay in a part of a ward, which was appropriated for patients who were labouring under

the disease, and of whom there were at the time a considerable number. Their beds were on the floor, and not more than two feet distant from each other; but, all direct intercourse was forbidden, and they were made fully aware of the consequences that would follow from inattention to their instructions. The result of this trial was, that not one of the clean wounds assumed the morbid action peculiar to the disease, nor was the curative process in any degree impeded." (*Blackadder on Phagedæna Gangrenosa*, p. 46.)

As many experienced writers assert, that the disease may also be communicated from one person to another through the medium of effluvia in the air, I am firmly persuaded that, in the present state of our knowledge of the subject, the cautions respecting ventilation and cleanliness (the chief practical deduction from the latter doctrine) are highly necessary and important. This sentiment may be adopted, without implicit faith being placed in the opinion, that the disorder can actually be transmitted from one person to another through contagion in the air, because, whether the last idea be true, or not, attention to cleanliness and ventilation must be beneficial to the health, in this, as in every other species of gangrene; and, on this principle, it must be serviceable in diminishing the severity, if not the frequency and extent, of the disease, as I am myself disposed to believe from the consideration of all the evidence adduced. These observations are strengthened by the fact, that it was chiefly in the front wards of St. Bartholomew's Hospital that the disorder committed its ravages in that institution. (See *Med. Chir. Trans.* vol. xi. p. 365.) Where circumstances will permit, an entire removal of the patients from the place, in which the disease has either had its first formation, or spread to any extent, appears likewise to be a most beneficial measure. But, when this change of the wards, or hospital, is impracticable, the air which the patients breathe, should be purified, by renewing it as much as possible, fixing ventilators, and especially by using the oxygenated muriatic acid fumigations, as recommended by Guyton-Morveau, or else those of the nitric acid.

The nitric acid fumigations are made by putting into a glass vessel, on the ground, half an ounce of concentrated sulphuric acid, to which an equal quantity of nitre is to be added *gradatim*. The mixture is to be stirred with a glass tube, when an abundance of white vapour will be produced.

The oxygenated muriatic acid fumigations are made, by mixing three ounces two drams of common salt with five drams of the black oxide of manganese in powder. These two ingredients are to be triturated together; they are then to be put into a glass vessel; one ounce two drams of water are to be added, and then, if the ward or chamber be uninhabited, one ounce seven drams of sulphuric acid are to be poured upon the mixture all at once; or, gradually, if the patients are there. This quantity will be sufficient for a very large ward.

When one or more of the patients, afflicted with the disorder, before it has become general, are lying in a badly ventilated part of the ward, the surgeon can partly counterbalance the disadvantage of not having a fresh ward, by causing the patients to be put into a more airy part of the ward, and as far as possible from the quarter in which they contracted the disease.

With regard to internal medicines, while irritation and febrile heat accompany hospital gangrene, diluent acid drinks are proper, such as nitrated whey sweetened with syrup of violets, lemonade, &c. Blood-letting is admissible in but few instances; not merely because the orifice made by the lancet may, according to some accounts, become gangrenous, but because the fever, which accompanies hospital gangrene, is usually of the typhoid character. (*Thomson*, p. 493.)

Mr. Blackadder, like Dr. Thomson, does not entertain a favourable opinion of venesection, as a general practice, though he would not object to the abstraction of a small quantity of blood, when, owing to the plethoric habit of the patient, *previous treatment*, and other causes, an inflammatory action in the system is present. The same practice, under similar conditions, is also sanctioned by Dr. Boggie. (*Edinb. Med. Chir. Trans.* vol. iii. p. 34.) Mr. Blackadder conceives, that all danger of the disease attacking the wound made with the lancet may be obviated, if care be taken that the arm of the patient, the hands of the surgeon, his lancet, and the subsequent dressings, be perfectly free from contamination, and that the patient be prevented from undoing the bandage, or touching the incision made with the lancet, before it is cicatrised. (P. 135.) Dr. Boggie has bled many in this disease, but never seen a single instance of gangrene after the operation. (*Edinb. Med. Chir. Trans.* vol. iii. p. 35.) Mr. Blackadder thinks, however, that blood-letting should be avoided as much as possible, particularly when the previous injury has been extensive. "A general debility of the system, is one of the symptoms which are most to be dreaded; for, when once it takes place, there is no other disease in which it is removed with greater difficulty." (P. 137.) How different these sentiments are from those of Dr. Hennen, who, in speaking of the effects of venesection, when the disorder was accompanied with an inflammatory diathesis, employs the following expressions: "The very patients themselves implored the use of the lancet." For several months "we used no other remedy, either as a cure or preventive."—"We never observed any of the lancet-wounds assume a gangrenous appearance, although previously, in almost every other instance, the slightest puncture festered." (*On Military Surgery*, p. 224. ed. 2.) Mr. Welbank also states, that moderate venesection may be adopted with advantage while the disease is superficial, and the constitution not much affected, particularly in plethoric habits. (*Med. Chir. Trans.* vol. xi. p. 368.)

In the beginning of the constitutional attack, Pouteau and Dusassoy particularly recommended emetics; and Mr. Higgs, Dr. J. Thomson, and Dr. Hennen, are all advocates for this practice, though the latter gentleman makes his evidence rather ambiguous, by a subjoined note, in which he mentions that want of success, &c. led to the trial of venesection. (*Op. cit.* 222.) As for Mr. Blackadder, he deems the employment of emetics at the commencement of hospital gangrene useful only when the stomach is foul. (*On Phagedæna Gangrenosa*, p. 134.) Dr. Boggie found emetics generally very inferior to purgatives. (*Edinb. Med. Chir. Trans.* vol. iii. p. 37.) He chiefly approves of them when the stomach is loaded, and the fever of a bilious character. In the early stage of the case, writers seem all to agree about the utility

of purgative and laxative medicines. When there is debility, good generous wine should be allowed, either by itself, or mixed with lemonade, according to circumstances. Bark is in general more hurtful than useful: Mr. Welbank objects to it generally, on account of the common disposition to diarrhoea in the advanced stages of the disease (*Med. Chir. Trans.* vol. xi. p. 368.); and Dr. Hennen assures us, that he has seen great harm done by large and injudicious doses of this drug, before full evacuations had taken place, and the sloughs begun to separate. Boyer allows, however, that it may be beneficially given, when the feverish heat has abated, and the debility is very great.

In all stages of this disease, unattended with diarrhoea, acids are proper. The sulphuric acid is that which is given with most success; but the acidulous tartrate of potassa is also an excellent medicine. From two drams to half an ounce may be given every day, and the best plan is to make an acid drink with it, which should be sweetened and strained.

In severe cases, attended with a quick and feeble pulse, depression, restlessness, and anxiety, an opiate becomes necessary. "So long as we wish to excite a degree of moisture on the skin (says Professor Thomson), Dover's powder, or laudanum with antimonial wine, form in general the best opiates." This gentleman, however, is not an advocate for the employment of opium, in the early stage of hospital gangrene, while the heat and other febrile symptoms are at their height. (*See Lectures on Inflammation*, p. 494, 495.) According to Mr. Welbank's experience, narcotics are beneficial, and he has seen a most irritable state of the stomach improve rapidly, and a foul furred tongue become clean, on the administration of large doses of opium at regular intervals. (*See Med. Chir. Trans.* vol. xi. p. 368.) Camphor, in large and frequent doses, was highly praised by I.

From what has been said of internal remedies, it is evident, that none of them can be regarded as means at all to be depended upon, for arresting the ravages of hospital gangrene, however advantageous they may prove in palliating general symptoms, removing particular complications, enabling the system to support the effects of the local disorder for a greater length of time, or, in a few cases, even placing nature in a condition to throw off the diseased parts herself, and communicate to the subjacent living flesh a healthy action.

If credit can be given to several of the authors, who have had the most extensive opportunities of attending to the nature of hospital gangrene, the local treatment is far more effectual than internal medicines.

"I was told by several of the French surgeons (says a late visitor to Paris), that they did not rely at all on internal means for stopping the progress of hospital gangrene, and that their experience had proved them to be insufficient, if not wholly inefficacious. Dupuytren, in reply to the account I gave him of the practice and opinions of English surgeons on this subject, assured me, that he had no confidence in any but local applications, and that internal remedies alone, as far as he had found, did almost nothing." The same remark has been made in a modern publication on hospital gangrene (*Delpsch, Mém. sur la Complication des Plaies, &c.* 1815), "although it seems to be rather at variance with its being a constitutional and con-

tagious disease, which the author has admitted." (See *Sketches of the Medical Schools of Paris*, by J. G. Crosse, p. 83.)

Perhaps, every antiseptic application that can be mentioned, has been tried as a dressing for wounds, or ulcers, affected with hospital gangrene. All watery applications, and common poultices and fomentations, are generally condemned, as inefficacious, and even hurtful. Dr. Boggie, however, is an advocate for cold lotions in the incipient inflammatory stage. Solutions of the chlorides of lime and soda have also been tried, and various reports made of their efficacy. I believe, that they will not stop true hospital gangrene.

Dussassoy was convinced, by the observation of numerous cases, that the best application is powder of bark. He recommends the wound to be covered with several layers of this powder, which are then to be moistened with turpentine. When this composition dries, he asserts, that it forms a fragile sort of coat, at the sides of which, and through which, the discharge escapes. After twenty-four hours the first coat is to be removed, and a fresh one applied. In general, according to this writer, four or five such dressings are sufficient in simple cases, where the disorder is confined to the skin and cellular substance. Healthy inflammation then occurs, the sloughs come away, and the wound puts on a healing appearance. In bad cases, Dussassoy sometimes added one-fifth of powdered muriate of ammonia to the bark. When this treatment failed, the actual cautery was used.

On the subject of bark, as a local application to hospital gangrene, I need only remark, that it is now entirely relinquished, either as possessing no efficacy (*Delpech*), or even aggravating the symptoms (*Blackadder*).

The milder forms of the disease appear sometimes to have yielded to the application of the vegetable and diluted mineral acids; viz. hmejuice, lemon-juice, vinegar; and the diluted nitric and muriatic acids. And the same observation may be made, with respect to solutions of the nitrates of silver and mercury. The two latter substances, and the oxygenated muriatic acid, and gas, were found by Dr. Rollo to be capable of effecting cure. *Delpech*, in particular, speaks of the benefit derived from the application of strong vinegar, after all the pulpy viscid matter has been carefully wiped away from the surface of the living flesh. The vinegar is then poured on the ulcer, which is to be covered with charpie wet with the same liquid. When the case is too far advanced for this treatment to answer, *Delpech* tries caustics, especially the nitrate of silver; and, if these fail, he has recourse to the actual cautery; and when the sloughs are very thick, so as to hinder the cautery from acting to a sufficient depth, he prefers thrusting into the sloughs, down to the living flesh, angular pieces of caustic potash at small distances from each other! (*Précis Elém. des Mal. Chir.* t. i. p. 151.) Surely, this must be far more torturing, and less certain of success, than removing the sloughs, and applying the cautery.

Though the actual cautery is generally admitted to be one of the most powerful means of stopping the progress of hospital gangrene, the surgeons of this country entertain a strong aversion to the practice; and I confess, that my own dislike to it is such as would always lead me to

prefer any other treatment, from which equal efficacy would result. At the same time, it must be granted, that if the actual cautery will more certainly arrest some forms of hospital gangrene, than any other known applications, the surgeon's duty is to put out of the question his own prejudices against it, and consider only his patient's welfare. I am far from thinking, however, that while there are such powerful caustics as the undiluted mineral acids, and a dressing so effectual as a solution of arsenic, it can often be absolutely necessary to employ red-hot irons.

The merit of having pointed out in modern times the great efficacy of Fowler's solution of arsenic, or liquor arsenicalis, as an application to phagedæna gangrænosæ, belongs to Mr. Blackadder. In answer to the objection, that the external use of arsenic is not attended with danger, he assures us, that he has heard but of one instance of hospital gangrene, in which any deleterious effects were supposed to arise from the absorption of the arsenic; and the patient in question was very soon cured of his uneasy, and possibly merely nervous symptoms. (P. 50.)

"The first thing to be attended to in every case of disease (says Mr. Blackadder) is cleanliness, which, if always of great importance, is, in this instance, indispensable. The surface of the body ought to be made, and kept, perfectly clean, by means of the tepid bath, or otherwise, by a plentiful use of soap; and the linen, and bed-clothes, should be frequently changed, particularly when soiled with matter from the sore." In order to make the sore perfectly clean, and free it from the viscous discharge, without producing considerable bleeding, and pain, Mr. Blackadder recommends two large tin hospital trays to be filled with a weak solution of the subcarbonate of potash. One of these solutions is to be cold, the other tepid; because sometimes one, and sometimes the other, is found most agreeable to the patient's feelings, though the warm is the most effectual in cleansing the sore. The liquid is to be poured over the sore, and received into a basin, which ought to be immediately emptied into another vessel placed at a distance from the patient. During this ablution, the glutinous matter, which adheres to the sore, may be gently detached, by means of small dossils of fine tow, or lint; but these (says Mr. Blackadder) should never be used for two different patients, rigid economy, on occasions such as this, being a very mistaken principle. In these cases, the use of sponges (he justly observes) ought to be entirely laid aside, as they can seldom be used more than once with safety. When the sore has been thus cleaned, a piece of fine dry lint is to be spread over its surface, and gently pressed into all its depressions with the points of the fingers. When the lint is removed, a quantity of the discharge will be found adhering to it; and this operation must be repeated with fresh pieces of lint, until the surface of the sore is made perfectly clean and dry.

According to Mr. Blackadder, the solution of arsenic will generally be found strong enough, when diluted with an equal part of water; but, in slight cases, it answered, when weakened with twice its quantity of water; and, in a few examples, it was employed without being at all diluted. Several pieces of lint of the same shape as the sore, but a little larger, are to be prepared: one of these, soaked in the solution, is now to be

applied to the cleaned surface of the sore, and renewed, every fifteen or thirty minutes, according to the time in which it becomes dry. When the heat and inflammation are considerable, great relief will be derived from the frequent application of linen cloths, moistened with cold water, which must be kept from weakening the arsenical solution by means of a small piece of oil-skin laid over the pieces of lint. When the disease extends into the track of a gunshot wound, Mr. Blackadder uses a syringe for cleaning the sore and introducing the solution. "A slip of fine lint, well soaked in the solution, may also be inserted by means of a probe, into the bottom of the wound; and when the openings are at no great distance (from each other), and not in the immediate vicinity of the large nerves, and blood-vessels, the lint may be drawn through the wound in the form of a seton." (P. 53.) When the pain caused by the application is very severe, and the constitution is irritable, and debilitated, Mr. Blackadder prescribes an opiate, though he remarks, that this practice will seldom be absolutely necessary. The morbid action in the sore is destroyed by the arsenical solution sooner, or later, in different cases: *the best plan is to continue the application, until an insensible, dark-coloured, dry slough, occupies the whole surface of the sore, and until the patient is completely relieved from the burning and lancinating pain.*

After the slough is formed, Mr. Blackadder employs an ointment, composed of equal parts of the oil of turpentine and the yellow resinous ointment, or, of two parts of Venice turpentine to one of the resinous ointment. "These, being melted and mixed together, are to be poured over the sore, as hot as the patient can possibly bear." A pledget of dry lint, or tow, and a bandage, are then applied; and this dressing may be renewed two or three times a day, the sore being each time carefully washed with the solution of potass. As soon as any part of the slough is loosened, Mr. Blackadder removes it with a pair of curved scissors. With the view of expediting the separation of the slough, he sometimes employed a linseed-meal poultice, which had the desired effect, but was found to be too relaxing. When it is used, therefore, Mr. Blackadder found it expedient, at each dressing, to touch the new granulations with the nitrate of silver.

After the detachment of the slough, Mr. Blackadder dresses the sore with the above mentioned ointment cold, or with the addition of a small proportion of the subacetate of copper. The pledget of this ointment is covered with a piece of oil-skin, lightly rubbed over with soap, and a firm bandage is applied to the whole limb. (See *Obs. on Phagedena Gangrenosa*, p. 46, &c. 8vo. Edinb. 1818.) The author declares, that, after the introduction of the above treatment (with the exception of stupas attacked with hospital gangrene), he never saw an instance, in which the remedy failed, when applied in time, and in a proper manner; "that is, before the disease had made such progress, as to preclude all rational hope of success from that, or any other mode of treatment." (P. 23.)

In Dr. Rollo's *Treatise on Diabetes*, published in 1797, the opinion is plainly stated, that the progress of hospital gangrene might be stopped by successive topical applications, and, in the same work, Mr. Smith says, that, "if an actual

course to the strong nitrous acid." According to Mr. Blackadder, the oxygenated muriate of mercury, and the nitrous acid, were much recommended and employed by surgeons, in the 16th and 17th centuries, as escharotics, in cases of gangrene and foul ulcers. (P. 113.) Several army-surgeons have informed me, that the undiluted nitrous acid was successfully used as an application to hospital gangrene in the military hospitals at Antwerp, in the year 1815; but, that other strong acids had an equally good effect. Dr. J. Thomson also notices, that, "the application of caustic substances, such as the strong mineral acids, the solutions of potass, corrosive sublimate, and arsenic, seemed at Antwerp to arrest the progress of this sore, without exciting inflammation." (*Report of Obs. made in the Military Hospitals in Belgium.*)

Delpach was informed by some British surgeons, belonging to the Anglo-Portuguese army in the Peninsula, that the muriatic acid was in common use in the hospitals of that army, as a local application for checking the progress of hospital gangrene, being employed in a diluted state for slight cases and in a concentrated caustic form for others.

In St. Bartholomew's Hospital, the undiluted nitric acid has been used with great success, as a local application to phagedenic gangrenous ulcers. "If the disease be not far advanced (says Mr. Welbank), I at once apply the undiluted acid, after cleansing the surface with tepid water, and absorbing the moisture with lint. Where, however, there is a thick and pulpy slough, it is better to remove as much of it as possible, with forceps and scissors, before the application is made. The surrounding parts being then protected by a thick coating of lard, or cacao, I proceed to press steadily, and for some minutes, a thick pledget of lint, previously immersed in the undiluted acid, on every point of the diseased surface, till it appears converted into a firm and dry mass. The parts may be then covered with simple dressings, and evaporation kept up by cooling lotions. As the application occasions more or less pain, from half an hour to one or two hours, I have generally given 20 or 30 drops of laudanum at the time of using it. It is always prudent, often necessary, to remove the eschar at the end of 16 or 20 hours." When the patients have become perfectly free from pain, and the parts below the slough are found healthy and florid, Mr. Welbank treats the sore as a common wound or ulcer, though he has found stimulating dressings generally the best, as the ceratum lapidis caliminaris, or a solution of two or three grains of the nitrate of silver in an ounce of distilled water. But, when there is a recurrence of pain at any point, or over the general surface of the sore, whether the affection be slight or severe, the slough superficial or deep, he recommends the employment of the undiluted acid again. (See *Med. Chir. Trans.* vol. xi. p. 369.)

Pouteau, Dussanoy, Boyer, and Delpach, all bear testimony to the efficacy of the actual cautery, and they repeat the application of it, until the whole surface of the ulcer is converted into a firm hard eschar. Even the edges of the solution of continuity should not be spared—"Ils doivent être torréfiés et rôtis pour ainsi dire." (Boyer, *Maladies Chir.* t. i. p. 332.) The latter surgeon then covers the eschar with a thick stratum of bark, moistened with turpentine. This application is to be removed in twenty-four, thirty-six, or forty-

eight hours, and the surgeon is then to judge from the appearance of the flesh, and the quality of the discharge, whether a further repetition of the cautery will be necessary.

About three years ago, I attended, at Halliford, a child that had been extensively burnt: and when the parts were nearly healed, the sore was attacked with hospital gangrene, the ravages of which soon proved fatal. The cottage in which this case happened, was noted for its crowded and uncleanly state. The chloride of soda was tried in vain.

Poutcau, Œuvres Posthumes, t. iii. published 1783. *Dussanoy*, Dissertation et Observations sur la Gangrène des Hôpitaux, &c. 8vo. Genève, 1788. *Morreau et Burdin*, Essai sur la Gangrène Humide des Hôpitaux, 47:66. *Observations on the Putrid Ulcer*, by L. *Gillespie*, in London Medical Journal, vol. vi. 1795. *Adolfs*, On Diabetes, 1797. *Sir Gilbert Blane*, On the Diseases of Seamen, ed. 3. 1797. *Trotter's Medicina Nautica*, vols. ii. and iii. published 1799. *John Bell's Principles of Surgery*, vol. i. 1801. *Wolf Plouquet*, De Gangrænâ sic dictâ Nosocomiorum. Tub. 1802. *Léclaire*, De Gangrænâ Contagiosa, Edin. 1804. *Johnson*, De Gangrænâ Contagiosa Nosocomiale. Edin. 1805. *J. Thomson's Lectures on Inflammation*, p. 456. et seq. Edin. 1813: and Report of Oils. made in the Military Hospitals of Belgium, 8vo. Edin. 1816. *J. Hennen*, Principles of Military Surgery, p. 210, &c. 8vo. Edin. 1820. *C. J. M. Langenbeck*, Neue Bibl. 2. b. p. 611, &c. Hanover, 1820. Mém. sur la Complication des Plaies et des Ulcères connue sous le Nom de Pourriture d'Hôpital, par J. *Delpech*, 8vo. Paris, 1815. Also, Précis Élémentaire des Maladies Chir. t. i. p. 123, &c. Paris, 1816. *Brugmanns und Delpech*, Ueber den Hospitalbrand, übersetzt mit Anmerkungen und Anhang, von Kiese, J. Jenna, 1815. *Joyner*, Maladies Chir. t. i. p. 320. Paris, 1814. Sketches of the Medical Schools of Paris, by J. G. *Crosse*, p. 82. London, 1815. *H. Home Blackadder*, Obs. on Phagedæna Gangrænosa, 8vo. Edin. 1818: the best treatise on the subject. *J. L. Brauer*, Obs. de Gangrænâ Nosocomiale, 4to. Lips. 1820. *R. Welbank*, On Sloughing Phagedæna, in Med. Chir. Trans. vol. xi. 8vo. Lond. 1821: a valuable essay. *J. Boggie*, in Edin. Med. Chir. Trans. vol. iii. 1828. *A. C. Ivichison*, Practical Obs. in Surgery, ed. 2.

For the rest of the subject of gangrene, see MORTIFICATION.

HYDRARGYRIA. A peculiar eruption, occasioned by the use of mercury, and named in Dr. Bateman's Synopsis *eczema rubrum*. (See MERCURY.)

HYDRIODATE OF POTASSA. Frequently employed externally, in conjunction with iard, for promoting the absorption of collections of fluid, and serofulous and other indolent swellings. The hydriodate "aids the solution of iodine in water, and, on this account, it is given in combination with iodine in aqueous fluids. M. Lugol's formula is of iodine gr. j½, hydriodate of potassa gr. ijsa. and distilled water f ʒ viij. One fourth part of this solution is to be administered in divided doses, in the course of the day. M. Lugol forms a bath also of iodine by similar means." (See A. T. Thomson's *Elem. of Materia Med.* p. 853. ed. 2.) I have known the hydriodate of potassa given internally in doses, gradually increased up to 10 or 15 grs. thrice a day, disperse ascites. Frictions, with the ointment over the abdomen were simultaneously resorted to. But, of all the uses of the hydriodate, its efficacy in syphilis appears the most important in practice. (See SCROFULA and VENEREAL DISEASE.)

HYDROCELE. (from *ὕδωρ*, water, and *κύλη*, a tumour.) The term *hydrocele*, if used in a literal sense, means any tumour containing water; and occasionally we hear of hydroceles of the neck, which are cysts formed in that region, which contain a serous fluid, and sometimes attain considerable magnitude. We hear now and then of hydroceles in women, which are collections of a

similar fluid in the canal of Nuck. (*Regnoli*; see *Révue Méd.* Oct. 1834.) We much more frequently meet with collections of fluid in a hernial sac, constituting another kind of hydrocele. But, in ordinary surgical language, hydrocele signifies a collection of fluid in the tunica vaginalis of the testicle, or in a cyst formed in the spermatic cord. The *hydrocele by infiltration* of French writers, is only an oedematous or anasarous swelling of the scrotum.

ANASARCOUS TUMOUR OF THE SCROTUM

Is most frequently only a symptom of a dropsical habit, and very often accompanies ascites. *Idiopathic hydrocele* by infiltration rarely occurs but in new-born infants and in men of advanced age. (*Dupuytren*, *Clin. Chir.* t. iv. p. 436.)

Mr. Pott describes it, "as an equal, soft tumour, possessing every part of the cellular membrane, in which both the testicles are enveloped; and, consequently, it is generally as large on one side as on the other; it leaves the skin of its natural colour, or, to speak more properly, it does not redden or inflame it; if the quantity of water be not large, nor the distension great, the skin preserves some degree of rugosity; the tumour has a doughy kind of feel; easily receives, and for a while retains, the impression of the fingers; the raphe, or seam, of the scrotum divides the swelling nearly equally; the spermatic process is perfectly free, and of its natural size; and the testicles seem to be in the middle of the loaded membrane. This is the appearance when the disease is in a moderate degree. But if the quantity of extravasated serum be large, or the disease farther advanced, the skin, instead of being wrinkled, is smooth, tense, and plainly shows the limpid state of the fluid underneath: it is cold to the touch, does not so long retain the impression of the finger, and is always accompanied with a similar distension of the skin of the penis; the preputium of which is sometimes so enlarged, and so twisted, and distorted, as to make a very disagreeable appearance. These are the local symptoms: to which it may be added, that a yellow countenance, a loss of appetite, a deficiency of urinary secretion, swelled legs, a hard belly, and mucous stools, are its very frequent companions."

As the cellular tissue on one side of the scrotum is a continuation of that, which is situated on the other, and both freely communicate, the accounts, delivered by certain authors, of the possibility of this species of hydrocele being confined to one side of the scrotum, are not credited by Boyer. At all events, such a case is extremely rare, and when it happens, is probably induced by the irritation of the urine in infants, or of the friction of the clothes in old persons, only acting upon a part of the scrotum. (See *Dict. des Sciences Méd.* t. xxii. p. 193.) If the cellular tissue under any of the investments of the spermatic cord, or tunica vaginalis, were anasarous, then, indeed, as M. Velpeau observes, the swelling might be confined to one cord or one side of the scrotum. (See *Nouv. Élém. de Méd. Opér.* t. iii. p. 507; also *Dupuytren*, *Clin. Chir.* t. iv. p. 436.) Such a case, as Dupuytren observes, would require more or less free incision, instead of a small puncture.

The cure of the original disease, when it arises from constitutional causes, comes within the province of the physician, and requires a course of internal medicine: but, sometimes, the loaded scro-

tum and penis are so troublesome to the patient, and in such danger of mortification, that a reduction of their size becomes absolutely necessary. As Mr. Pott observes, the means of making this discharge are two; viz. puncture and incision: the former is made with the point of a lancet; the latter with the same instrument, or with a knife. Wounds in anasarctous or dropsical habits, are apt to inflame, are very difficultly brought to suppuration, and often prove gangrenous. But, the larger and deeper the wounds are, the more probable are these bad consequences.

As the cavities of the cellular tissue of the scrotum all communicate together, small punctures serve as well as a large incision, for the discharge of the fluid contained in them; and consequently, upon this ground, no reason exists for making any extensive, painful, and hazardous wound. Even one or more punctures should only be made when the distension of the skin of the scrotum is such as absolutely to require the fluid to be discharged. Care should also be taken not to multiply the punctures unnecessarily, nor to let them be made too near together. Boyer had a case, in which the making of very slight punctures in an anasarctous scrotum, was followed by the total destruction of this part, denudation of the testis and cord, and the patient's death, attended with dreadful suffering. (See *Dict. des Sciences Méd.* t. xxii. p. 195; 196.)

When the oedematous state of the scrotum is not the effect of a general constitutional disease, but proceeds entirely from a local cause, such as friction, or the irritation of the urine, the mode of treatment consists in the removal of the cause, the use of fomentations, astringent lotions, and the exhibition of aperient medicines. In elderly subjects, the wearing of a bag-truss is recommended for the prevention of the complaint.

HYDROCELE OF THE SPERMATIC CORD

Is of two kinds: the first is described as an oedematous affection, extending to more or less of the cellular tissue around the spermatic vessels, and sometimes named the *diffused hydrocele of the cord*; the second form of the disease is that, in which the fluid is collected in a particular cavity, or cyst, which has no communication with the cavities of the common cellular tissue of the cord. This case is denominated, accordingly, *encysted hydrocele of the cord*. The cellular substance, situated behind the bag of the peritoneum, surrounds the spermatic vessels, passes with them through the inguinal ring, and accompanies them to their insertion in the testicle. As Scarpa has likewise explained in his great work on hernia, the spermatic vessels, their cellular sheath, and the tunica vaginalis, are all enclosed in the musculo-aponeurotic sheath of the cremaster. When a *diffused hydrocele of the spermatic cord* is dissected, the sheath of the cremaster is found under the integuments, varying in size and compactness according to the duration and bulk of the disease. Under it appears the cellular covering of the cord, thickened, distended with fluid, and seeming at first somewhat like a hernial sac. When cut, a great deal of serum is discharged, and the tumour sinks and disappears in a greater or lesser degree. The spermatic vessels, which had been previously concealed by the enlarged cellular tissue, now become visible. The cells, which, in the unoperated state, are scarcely perceptible to the

unassisted eye, are found to have become vesicles filled with fluid, and some of them are large enough to receive the end of a finger. When the tumour is large and of long standing, the cells are remarked to become more delicate towards its bottom, and in this situation disappear, only one large cavity filled with fluid being here found. Hence, according to Scarpa, a fluctuation is plainly distinguishable at the lowest part of the swelling. The serum contained in the cells is generally limpid; but sometimes yellow, albuminous, or gelatinous. The base of the swelling, however large or old it be, corresponds to the point at which the spermatic vessels join the testis, or, at most, it extends a very little behind this organ, and, between the two, there is a semicircular groove, which varies in depth and extent. If the tunica vaginalis be opened, a dense septum is felt at its inner and lower part, cutting off all communication between this sac and the base of the tumour. (See Scarpa, *Memoria sull' Idrocele del Cordone Spermatico*, 4to. Pavia, 1823.)

That the cellular tissue of the cord is often distended with an aqueous fluid, when the scrotum is anasarctous and the habit dropsical, cannot admit of doubt; and hence it is a frequent attendant on the case, which has been described as the hydrocele oedematodes. But, as I have never seen an instance in which such disease was restricted to the cellular texture of the cord, I am led to suppose that it is a very uncommon case. The following is said by Mr. Pott to be the state of the disease, while of moderate size. The scrotal bag is free from all appearance of disease; except that when the skin is not corrugated, it seems rather fuller, and hangs rather lower on that side than on the other, and if suspended lightly on the palm of the hand, feels heavier: the testicle, with its epididymis, is to be felt perfectly distinct below this fulness, neither enlarged, nor in any manner altered from its natural state: the spermatic process is considerably larger than it ought to be, and feels like a varix, or like an omental hernia, according to the different size of the tumour: it has a pyramidal kind of form, broader at the bottom than at the top: by gentle and continued pressure it seems gradually to recede or go up, but drops down again immediately upon removing the pressure; and that as freely in a supine, as in an erect, posture: it is attended with a very small degree of pain or uneasiness; which uneasiness is not felt in the scrotum, where the tumefaction is, but in the loins.

According to Scarpa, its shape is at first nearly cylindrical, and does not become pyramidal till afterwards. However large the swelling may be, the penis never appears so much retracted under the integuments of the pubes as in a common hydrocele of equal size. When the lower part is compressed, the fluid recedes towards the groin slowly and difficultly, whilst in the hydrocele of the tunica vaginalis, the same kind of pressure at once forces the fluid to the apex of the tumour and distends it, and the testis cannot be felt (as in the diffused hydrocele) below the swelling.

When a diffused hydrocele of the cord extends into the ring, it is not easily distinguished from an omental hernia. In both cases, says Scarpa, the tumour is at first of a cylindrical shape, and afterwards becomes pyramidal: both kinds of swelling are soft and flexible; both little, if at all sensible; and both admit of reduction with difficulty. No doubt, the best criterion of the hernia, if it be re-

fluctible, will be derived from the circumstance of its generally not re-appearing, while the patient continues to lie down, though Scarpa has seen a few exceptions.

While it is small, it is hardly an object of surgery, and may be kept from being troublesome by means of a suspensory; but when it is large, it is very inconvenient both from size and weight, and, according to Pott, the only method of cure which it admits, viz. that of making a free incision into the swelling, is far from being void of hazard. This is especially true, when the disease is complicated with constitutional disorder. Thus Pott and Scarpa have known the inflammation, consequent to an extensive incision, have a fatal termination. As the cavities of the cellular texture, in which this hydrocele forms, all communicate together, it appears to me that the necessity for a free incision for the discharge of the fluid, is not so manifest, as the observations of Pott would lead us to suppose; and that a moderate opening would be likely to answer every purpose, with much greater safety. Before having recourse to the knife, we should try the effect of friction with camphorated mercurial or iodine liniments, and a suspensory bandage.

ENCYSTED HYDROCELE OF THE SPERMATIC CORD
Is sometimes met with, especially in young subjects and children. The same kind of disease also sometimes occurs in the round ligament of the uterus, and accompanies it through the abdominal ring. Hydrocele of the cord was known to the ancients, and has been accurately described by Al-bucasis, Celsus, Paulus Aegineta, &c. Its frequency, though much greater than that of diffused hydrocele of the cord, considered as a distinct disease independent of general anasarca, is not at all equal to that of hydrocele of the tunica vaginalis. Richerand has calculated, that the average proportion of encysted hydroceles of the cord to those of the latter description is not more than as one to two hundred. (*Neogr. Chir.* t. iv. p. 262. ed. 4.) The swelling is mostly situated at the middle part of the cord, between the testicle and groin, and is generally of an oblong figure. Whether large or small, it is commonly rather tense, and consequently the fluctuation of the water within it, not always immediately, or easily perceptible. It gives no pain, is perfectly circumscribed, and has no communication, either with the cavity of the belly above, or that of the vaginal coat below it. The testis and its epididymis are perfectly and distinctly to be felt below the tumour, and are absolutely independent of it. The upper part of the spermatic cord is most frequently very distinguishable. The swelling does not retain the impression of the fingers; and, when lightly struck upon, sounds as if it contained wind only. It undergoes no alteration from change of the patient's posture; it is not affected by his coughing, sneezing, &c.; and it has no effect on the discharge per anum.

Scarpa observes, that the diagnosis is more difficult, when the encysted hydrocele is of considerable bulk, because the testis is buried, as it were, in the tumour. Here, says he, if that portion of the swelling, which projects forward and somewhat laterally at its lower part, be softish, smooth, and very sensible, whilst the rest presents the character of a collection of fluid, the first and smaller portion is the testis in its healthy state; and the other portion an encysted hydrocele of the cord.

The two diseases with which this kind of hydrocele is most likely to be combined, are, a hydrocele of the tunica vaginalis, and a hernia. The free state of the upper part of the spermatic cord, while the tumour is forming below; the gradual accumulation of the fluid, and consequently the gradual growth of the swelling; the indolent and unaltering state of it; its being incapable of reduction, or return into the belly from the first; its being always unaffected by the patient's coughing or sneezing; and its transparency and fluctuation; will distinguish it from a hernia.

The cyst is described by Scarpa as consisting of two layers; first the sheath of the cremaster, and under it the cellular structure of the cord, more or less thickened. The under surface is irregular, fringed, and in some places villous.

In general the pressure of an encysted hydrocele pushes the testis a little lower in the scrotum, than natural, and rather forwards. Scarpa found this organ, however, in one instance considerably wasted, and adherent to the tunica vaginalis.

Several writers describe this kind of hydrocele, as in fact a common encysted tumour, formed in the cellular substance, between the vas deferens and spermatic vessels. (*Delpach, Précis Elém. des Mal. Chir.* t. iii. p. 464.) Yet, since ordinary encysted swellings are very difficult to disperse, there is probably some difference between the two affections; at least, if the observation of Mr. Pott be correct, that, in young children, the encysted hydrocele of the cord frequently dissipates in a short time, especially if assisted by warm fomentation and an open belly.

If it be not absorbed, "the point of a lancet will give discharge to the water; and, in young children, will most frequently produce a cure; but, in adults, the cyst, formed by the pressure of the fluid, does sometimes become so thick, as to require division through its whole length; which operation may in general be performed with great ease, and perfect safety." Mr. Pott says in general, because it is most frequently so; though he has seen even this, slight as it may seem, prove troublesome, hazardous, and fatal.

The late Sir J. Earle proposed treating this case in the same way as the hydrocele of the tunica vaginalis, viz. by an injection of red wine and water. (*On Hydrocele*, p. 154. edit. 2.) However, an injection frequently fails, and is less certain to answer than the excision of a part of the cyst, or even a simple incision in it, properly dressed afterwards. If there were the least uncertainty about the nature of the disease, an injection should never be resorted to. Dupuytren cites an instance, in which a fatal attack of peritonitis was brought on by an injection in consequence of the swelling having a communication with the cavity of the abdomen. A cautious incision into the cyst, in an obscure case, is the safest plan; it clears away all doubt. (*See Dupuytren, Clin. Chir.* t. iv. p. 443.) The operation, which is described by Bertrandi, Hey, Richerand, &c. consists in cutting down to the cyst, and removing the fore part of it, while the portion, closely attached to the cord, is allowed to remain. I have practised this operation with success in three or four examples. The cavity is then to have a little soft lint put into it; which is to be retained with a T bandage. In this way the wound is to be dressed, till granulations have filled up the cavity. In removing a piece of

the cyst, care must be taken not to injure the spermatic vessels. (*Dupuytren, Clin. Chir. t. iv. p. 443.*) Some surgeons merely cut into the swelling, and then introduce the lint. Sir Astley Cooper cures this hydrocele by passing a small seton, of three or four threads, through it, which is a mild and certain method. (See *Sir A. Cooper on the Stricture, &c. of the Testis.*) Sir B. Brodie takes out the seton in about a week. Hydatid tumours have been occasionally met with, in the spermatic cord, and may be mistaken for encysted, and especially cellular, hydroceles. Dupuytren knew several individuals of the same family, who were afflicted with this curious disease, all of whom he cured by laying open the cyst. (See *Clin. Chir. t. iv. p. 454.*)

On account of the difficulty, and even impossibility, of precisely ascertaining the relations of the spermatic vessels to the hydrocele of the cord, the incision through the parts should be made slowly and cautiously. (See *Dupuytren, vol. cit. p. 443.*)

Besides the foregoing varieties of hydrocele, there are two others, which are sometimes also termed encysted; one lies between the inner fold of the tunica vaginalis, and the tunica albuginea, covering the glandular structure of the testicle; the other is situated between the epididymis, and the inner layer of the tunica vaginalis, the tunica albuginea here not intervening.

HYDROCELE OF THE TUNICA VAGINALIS,

Or common hydrocele, is an accumulation of fluid in the cavity of this membrane, without any open communication existing between such cavity, and that of the peritoneum. If this communication prevailed, the disease would be termed *congenital hydrocele*, which is less frequently met with.

Hydrocele of the vaginal coat is a disease from which no time of life is exempt. not only adults are subject to it, but young children are frequently afflicted with it, and infants sometimes born with it. (*Pott.*) It is also remarked to be particularly common in old men, and persons who ride a good deal on horseback. (*Delpech, Précis Élém. des Mal. Chir. t. iii. p. 177.*)

The causes of hydrocele of the tunica vaginalis can scarcely be said to be at all understood; and when Mr. Pott observes, that whatever tends to increase the secretion of fluid into the cavity of that membrane, beyond the due and necessary quantity, or to prevent its being taken up and carried off by the absorbent vessels, must contribute to the production of the disease, the question, as Sir Astley Cooper observes, is really avoided. The latter expresses his own belief, that diminished absorption is very rarely the cause; dropsical swellings being generally the result of an increased secretion from the arteries. Common hydrocele seems to this eminent surgeon to be rather the result of relaxation in the arteries and veins, than the effect of inflammation, the exhalant arterial orifices pouring out more fluid than natural; and he has ascertained by injection, that the absorbent vessels of the spermatic cord are much larger on the side where hydroceles exist, than on the opposite one. (*Sir A. Cooper on the Stricture, &c. of the Testis, p. 176.*) Ruysch had a suspicion, that the hydrocele might arise from a varicose state of the spermatic veins; but, though these are sometimes varicose in patients afflicted with the disease, the latter affection more fre-

quently exists without the condition of the veins specified, so that it can hardly be regarded as a cause of the effusion of fluid in the tunica vaginalis. In most instances a hydrocele takes place without any evident cause; though, in a few cases, it has appeared to be the effect of a contusion, or of rough, long-continued friction of the scrotum. The disease is observed to affect persons of the best health, and most robust constitutions, as well as others; and its existence seems quite unconnected with dropsy, or debility. In short, it may be regarded as a disease entirely of a local nature. Its production is so slow and gradual, and at the same time so void of pain, that the patient seldom attends to it, until it is of some size. Sometimes, however, it is produced very suddenly, and soon attains considerable magnitude.

In general, at its first beginning, the tumour is rather round; but, as it increases, it frequently assumes a pyriform kind of figure, with its larger extremity downward: sometimes it is hard, and almost incompressible, so that, in some few instances, it has been mistaken for an induration of the testicle; at other times, it is so soft and lax, that both the testicle, and the fluid surrounding it, are easily discoverable. It is perfectly indolent, in itself, and may be rather strongly pressed without pain; though its weight sometimes produces some small degree of uneasiness in the back. According to Mr. Pott, the transparency of the tumour is the most fallible and uncertain sign belonging to it; it is a circumstance, says he, which does not depend upon the quantity, colour, or consistence of the fluid constituting the disease, so much as on the uncertain thickness or thinness of the containing bag, and of the coverings of the tunica vaginalis. If they are thin, the fluid limpid, and the accumulation made so quick as not to give the tunica vaginalis time to thicken much, the rays of light may sometimes be seen to pass through the tumour. The fluid is most frequently transparent, and of a pale yellow, straw, or amber colour; sometimes it is inclined to a greenish cast; sometimes it is dark, turbid, and bloody; and, sometimes, it is perfectly thin and limpid. When transparent, and of a yellowish colour, it resembles the serum of the blood, being coagulable by heat, or nitric acid, but contains less albumen. (*Sir B. Brodie, Med. Gaz. vol. xiii. p. 89.*) According to Boyer, the colour of the fluid makes no difference in the prognosis; and he tells us, that, by means of an injection, he cured a hydrocele that contained a violet-coloured fluid, which deposited a thick sediment. (*Dict. des Sciences Méd. t. xxii. p. 214.*) When a hydrocele has existed for a very long time, cartilaginous bodies are sometimes found in the fluid. (*Sir A. Cooper on the Stricture, &c. of the Testis, p. 173.*) M. Laennec met with cartilaginous formations in the tunica vaginalis, exactly like those sometimes extracted from the synovial cavities. (See *Andral, Anat. Pathol. t. i. p. 285.*) Occasionally, particles of white flaky matter, or of a shining greasy substance, believed to be adipocire, are blended with the fluid. (*Sir A. Cooper on the Testis, p. 173; Sir B. Brodie, Med. Gaz. vol. xiii. p. 89.*) With respect to Mr. Pott's remarks on the transparency of the swelling, as a symptom of hydrocele, they are correct, inasmuch as the absence of this sign is no proof that the disease is not of this nature. But, on the other hand, it should have been explained, that, when the transparency is pre-

sent, it is one of the surest marks of this species of hydrocele.

M. Segalos has proposed a plan for facilitating the diagnosis of hydrocele; it consists in examining the transparency of the tumour, when its nature is doubtful, by means of a tube, which is open at its two extremities, and, by isolating the external luminous rays, enables the eye to appreciate better those refracted by the tumour.

A thickened state of the vaginal coat is chiefly met with in old cases, and, according to Sir Astley Cooper, in patients who have long resided in hot climates.

In most cases, the spermatic cord may be distinctly felt at its exit from the abdominal muscle, or in the groin; which will always distinguish this complaint from an intestinal hernia. But, in a few examples, the vaginal coat is distended so high, and is so full, that it is extremely difficult, nay, almost impossible, to feel the spermatic cord; and the same kind of obscurity is sometimes occasioned by the addition of an encysted hydrocele of the cord; or by the case being combined with hernia.

Occasionally, the tumour is constricted in its middle, so as to present the hour-glass shape. This is the *hydrocele en bissac* of French pathologists. The two portions, for a certain time, communicate, but at length, the opening between them may become obliterated. A gentleman applied to Sir Benjamin Brodie, with an hour-glass hydrocele. The latter drew off the water from the lower part, and in doing that emptied also the upper. The patient went to the same surgeon a year afterwards, and the operation was repeated; but the upper compartment did not discharge itself, as it did previously, through the aperture below, the constriction having now completely obliterated the communication. Another puncture was therefore requisite. (Sir B. Brodie, *Lond. Med. Gaz.* for 1833-34, p. 91.)

In a hydrocele of the tunica vaginalis, the swelling is first noticed at the lower part of the scrotum, whence it ascends in front of the testicle and spermatic cord. The progress of the disease is generally so slow, that six or even eighteen months elapse, before the tumour approaches the abdominal ring. And, amongst other characters of the case, are to be noticed the disappearance of the corrugations of the scrotum by the effect of the distention; inclination of the raphe to the opposite side; a diminished appearance of the penis, from a good deal of its integuments being drawn over the hydrocele, when this is bulky; the great lightness of the swelling, in relation to its size; and the possibility of feeling a fluctuation, when the fingers of one hand are applied to one side of the tumour, and the surgeon slightly taps with the fingers of his other hand, upon an opposite point of the swelling.

With respect to the fluctuation, however, it is, as Boyer remarks, sometimes evident, sometimes obscure, and, in other instances, not distinguishable at all. (*Dict. des Sciences Méd.* t. xxii. p. 200.) These differences depend much on the quantity of fluid, and the thickness or thinness of the vaginal coat.

When the tumour is large it makes the dress project, and is a serious disfigurement. It is then always in the way, and liable to be ruptured by an accidental blow. In this case, sometimes a blood-vessel is burst, and the hydrocele is con-

verted into hæmatocele. (See HÆMATOCELE.)

In other instances there is no internal effusion of blood, the fluid escapes into the cellular tissue, and the swelling subsides. Sir B. Brodie mentions a case, in which these circumstances happened, but the disease returned, and was afterwards cured in the usual way. (See *Lond. Med. Gaz.* vol. xiii. p. 90.) Bertrandi and Sabatier have known a cure follow violent efforts in coughing, or expelling the urine. Loder records a cure, which arose from the tunica vaginalis being burst by the kick of a horse. Similar facts are cited by MM. Boyer, Serre, and Bertrandi. In a case under M. Roux, on the day fixed upon for tapping the hydrocele, the fluid had all disappeared. (See *Alf. Velpeau, Nouv. Élém. de Méd. Opér.* t. iii. p. 511.)

In the hydroceles of children, the testis occupies a lower situation, than the same organ in the hydroceles of adult persons, and the swelling passes further up towards the abdominal ring. The hydrocele, in fact, is in them situated rather in front of the chord, than the testis, which is always at the lower and back part of the swelling. (See *Dict. des Sciences Méd.* t. xxii. p. 199.) The common situation of the testis is two thirds of the way down the tumour, at its posterior part. But as Sir Astley Cooper has correctly explained, a great deal of irregularity, in this respect, is met with, the testis being sometimes in front of the hydrocele; a circumstance arising from the existence of adhesions between the middle and outer coat of that organ at its fore part, previously to the formation of the hydrocele. The testis is sometimes found at the bottom of the swelling, as is exemplified in a preparation shown by the same gentleman, where the fluid had been prevented from descending below and in front of the testis, by the middle and outer coats of that organ being so connected together by the adhesive inflammation. He has one specimen, in which the fluid was situated only at the sides of the testis, adhesions having prevented its accumulation at other points; and another, in which the hydrocele seems as if it had arisen from the tunica vaginalis, in the same manner as an aneurismal sac is occasionally formed from the coats of an artery. (Sir A. Cooper on the Testis, &c.) A man was brought to the Hôtel Dieu, from another hospital, in which an attempt to puncture his hydrocele had been made, but nothing came out of the opening but blood and serosity; and the scrotum, instead of subsiding, had undergone an immediate increase of size. By vigorous antiphlogistic treatment, he at length got into the same condition in which he was previously to the operation. M. Dupuytren, having placed the tumour between his eye and a lighted candle, perceived that the swelling was transparent at its posterior part, but opaque in front at the point where the puncture had been made; which opacity he pronounced to be caused by the testicle. Taking hold of this opaque part with his fingers, he then made a puncture further back, and discharged the fluid. (*Clin. Chir.* t. iv. p. 437.) A case, where the trocar had been passed into the testicle, which was adherent in front, is also reported by Sir Astley Cooper. (*On the Testis* p. 168.) These facts prove the necessity of always endeavouring to learn the precise situation of the testis by manual examination, before an operation is attempted. When the surgeon presses rather strongly on that organ, he will feel the part much

riener, than the rest of the tumour, and the patient will complain of a severe and peculiar pain.

A hydrocele of the tunica vaginalis may be complicated with disease of the testis, hernia, cirrhotic, hydrocele of a hernial sac, or encysted hydrocele of the cord.

A collection of fluid in the tunica vaginalis, complicated with chronic induration and enlargement of the testicle, is well known under the name of *hydro-sarcocele*.

"Here (as Sir Benjamin Brodie has remarked), there is local cause of irritation. The tumour of the testicle keeps up an increased secretion of fluid from the inner surface of the tunica vaginalis, just in the same manner as a solid tumour of any kind, projecting into the cavity of the abdomen, may lay the foundation of one kind of ascites, or as a medullary tumour of the lung, projecting into the cavity of the chest, may produce hydrothorax." (*Lond. Med. Gaz.* vol. xiii. p. 89.)

A hydrocele may be known from a sarcocele by the following circumstances: in a sarcocele, the tumour mostly retains the shape of the testicle, being oval, and a little flattened at the sides, and its size becomes considerable in a short time, without ascending so near the abdominal ring, as a hydrocele does, when of the same magnitude. A large hydrocele leaves no interspace between that opening and the tumour, so that it is difficult to take hold of, and lift up the spermatic cord; but, in a sarcocele, there is always a space between the tumour and the ring, where the cord can be distinctly felt. Lastly, in sarcocele, the tumour is always opaque, and its weight, in reference to its size, much more considerable than that of a hydrocele. (See *Richerand, Nosogr. Chir.* t. iv. p. 267. ed. 4.; and *Sir A. Cooper*, p. 174.) The latter disease generally only produces inconvenience by its bulk, or the excoriations sometimes caused between the scrotum and the thigh; but a diseased testis occasions dragging pains in the loins and neighbouring hip. The hardness is not a symptom which can be trusted alone, as a criterion of a diseased testicle; for when a hydrocele is extremely distended, it often feels so indurated as to deceive practitioners of great experience, and a thickened, hardened state of the tunica vaginalis may facilitate the mistake. On the other hand, a medullary tumour of the testicle frequently presents a feel so elastic, and like that of fluid, that some of the most experienced surgeons are often deceived, and make a puncture on the supposition of the disease being hydrocele. I have known this done in several instances, and always without any ill consequences, the wound having soon healed up. In some instances of *hydro sarcocele*, the nature of the disease sometimes remains questionable, until the evacuation of the fluid gives the surgeon a fair opportunity of ascertaining the diseased state of the testicle.

A hydrocele of the tunica vaginalis is sometimes divided into several distinct cells, or cavities, each of which requires to be opened to discharge its contents. In one case, recorded by Dupuytren, the fluid in one cavity was different from that in another, inasmuch as it coagulated on exposure to heat, while the latter was not coagulable by the same means. (See *Clin. Chir.* t. iv. p. 446.)

The complication of a hydrocele of the tunica vaginalis with an encysted one of the cord, may generally be known by the swellings having begun

at two different points, and by a kind of constriction between them. The latter symptom, however, is not infallible, because the tunica vaginalis of a common hydrocele is sometimes more or less contracted at the middle of the tumour, which is thus made to appear as if it consisted of two distinct pouches. While the two kinds of hydrocele have an interspace between them, they may readily be distinguished. The encysted hydrocele of the cord is above; that of the tunica vaginalis is below. The differences from hernia may be made out by carefully examining the tumours, while the patient is lying upon his back, and noticing the absence of the hernial impulse in them, when the patient is desired to cough. Their transparency and fluctuation also throw light on their nature. (See *Dupuytren, Clin. Chir.* t. iv. p. 438.)

When there are two swellings, and one admits of being pushed into the abdominal ring, the case is probably complicated with a rupture. (See *Hernia*.)

However, an encysted hydrocele of the upper part of the cord will sometimes admit of being pushed into the inguinal canal; and then the diagnosis is more obscure, though its circumscribed isolated form, its freedom from impulse when protruded, and perhaps a degree of transparency about it, will generally remove the doubt. (See *Case by Dupuytren, Clin. Chir.* t. iv. p. 440.)

Hydrocele, complicated with hernia, is chiefly seen in old subjects. The hydrocele is usually situated in front of the hernia (see *Sir A. Cooper on the Testis*, p. 175.); but now and then, though very rarely, it glides behind it. (See *Dupuytren, Clin. Chir.* t. iv. p. 450.) When the hernia lies in front of the hydrocele, a portion of intestine, or omentum, sometimes passes through rents in the tissues covering the tunica vaginalis, and projects into the midst of the fluid of the hydrocele. These secondary tumours are covered by the hernial sac, and by the serous coat of the testicle. M. Dupuytren met with six examples of this, and, in two of them, symptoms of strangulation were occasioned by the viscera being constricted in the new aperture. On dilating this opening, the hernia were reduced, without meddling with the abdominal ring. M. Dupuytren had never seen the tunica vaginalis project into a hernial sac. The combination of hydrocele with hernia should always be remembered in operations for this last disease, in a state of strangulation, and also in tapping a hydrocele, especially as their relative situation to one another is subject to variety. The surgeon will then avoid plunging a trocar into a hernial sac; cutting the coverings of a hydrocele, instead of those of a hernia; and dividing the ring, when the bowel is strangulated in a laceration of the tunica vaginalis of a hydrocele. (See *Dupuytren, Clin. Chir.* t. iv. p. 452.)

The size of a hydrocele, and the thickness of the tunica vaginalis, are generally in a ratio to the time which the disease has continued. In the beginning, that membrane is thin, transparent, and easily punctured; but, in cases of long standing, it (or rather the cellular tissue and the cremaster on the outside of it) frequently becomes greatly thickened, and almost as dense as cartilage. Then the transparency is usually lost; and after the fluid has been let out, the tunica vaginalis, instead of becoming flaccid, remains like a shell round the testicle. (See *Dupuytren, Clin. Chir.* t. iv.

p. 455.) In a few instances, even when the hydrocele is small, the tunica vaginalis is thickened, and presents internally a honeycomb appearance. Such a case will generally be found to have begun with inflammation. (Sir B. Brodie, *Lond. Med. Gaz.* for 1833-34, p. 89.) Portions of it have been found in an ossified state; and this, and the cartilaginous degeneration of it, are the only changes justifying the excision of any part of it. In many instances, hydrocele, with thickened indurated tunica vaginalis, has been mistaken for sarcocele, and the healthy testicle removed. Even Dupuytren once committed this serious blunder. (See *Clin. Chir.* t. iv. p. 460.)

The usual quantity of fluid in a hydrocele is from six to eight ounces; but the largest which Sir A. Cooper has ever heard of, and which was in Mr. Gibbon, the historian, contained six quarts. (*On the Testis*, p. 172.) A hydrocele has been seen of such a magnitude, that it hung down to the knees. (Sir B. Brodie, in *Lond. Med. Gaz.* vol. xiii. p. 89.)

TRE: F HYDROCELE OF THE VAGINAL COAT.

A hydrocele is by no means a dangerous complaint, though its weight and size are a disagreeable incumbrance, and the patient is always obliged to wear a bag-truss, in order to prevent a painful extension of the spermatic cord. Troublesome excoriations are also frequently caused by the friction of the tumour against the inside of the thigh; and when the swelling is very large, it draws over itself the integuments of the penis, which appears buried, as it were, in the tumour, and the genital functions are seriously interrupted. Hence, the greater number of patients are very anxious for relief.

Cases are sometimes met with, in which an accidental inflammation and sloughing of the scrotum are followed by the discharge of the fluid, an obliteration of the cavity in which it had collected, and a permanent cure. (Sir Astley Cooper on the *Testis*, p. 177.) The accidental rupture of a hydrocele by violence, however, does not always lead to a radical cure: one instance of this I have already cited from Sir B. Brodie; another is mentioned by Sir Astley Cooper, in which the fluid collected again, and another is quoted by him, in which the blow only changed the hydrocele into hæmatocele. (*On the Testis*, Op. cit. p. 177.)

It does not often happen that a hydrocele undergoes a spontaneous cure; yet every now and then, it occurs from inflammation of the tunica vaginalis accidentally taking place, of which Sir B. Brodie has mentioned two unequivocal instances. (See *Lond. Med. Gaz.* vol. xiii. p. 90.)

The surgical methods of cure, though various, are all reducible to two, viz. the *palliative* and the *radical*. One merely gives temporary relief by discharging the fluid, which commonly soon accumulates again. The other aims at bringing about a complete and permanent cure. In Pott's time, and, in fact, much later, it was the common belief, that hydrocele could not be radically cured, unless the cavity of the tunica vaginalis were obliterated by inflammation. We now know that, though the disease may be, and perhaps generally is, cured on this principle, yet in numerous instances the hydrocele does not return, though the cavity of

the tunica vaginalis remains. We have the authority of Ramsden, Wadd, Sir A. Cooper, Sir B. Brodie, and many other surgeons, for this last statement. It seems, then, that sometimes a change in the action of the secreting vessels leading to a cure, is brought about by the inflammation excited; and sometimes, according to Sir Benjamin Brodie's observations, a very slight degree of it will have this effect.

On the other hand, as the same very experienced surgeon remarks, a great degree of inflammation will by no means ensure the patient's cure. In proof of this, he mentions a case, in which a hydrocele was thrice tapped and injected, and once with port wine and brandy, a good deal of inflammation following each operation; yet the disease returned. The palliative method may be practised at all times of the patient's life, and in almost any state of health and habit: the radical method lies under some restraints and prohibitions; arising from the circumstances of age, constitution, state of the parts, &c. The operation, by which the fluid is let out, is a very simple one. The only circumstances requiring our attention in it, are, the instrument for its performance; and the place or part of the tumour into which such instrument should be passed. Sometimes a common lancet has been employed; but usually a trocar.

"The trocar, by means of its cannula," as Pott states, "secures the exit of the whole fluid without the possibility of prevention; the lancet cannot. And therefore it frequently happens, when this instrument is used, either, that some of the water is left behind; or, that some degree of handling and squeezing is required for its expulsion; or, that the introduction of a probe, or a director, or some such instrument, becomes necessary for the same purpose. The former of these may in some habits be productive of inflammation: the latter prolongs what would otherwise be a short operation, and multiplies the necessary instruments, which, in every operation in surgery, is wrong. To the lancet there is the yet greater objection of its being more liable to be followed by hæmatocele, as I have seen happen."

As the testicle is usually situated at the upper and back part of the cavity of the hydrocele, or, according to Sir Astley Cooper, about two thirds of the way downwards, at the posterior part of the swelling, the trocar should generally be introduced at the fore part of the tumour, and directed obliquely upwards. However, this rule is subject to all the difference, which must proceed from the variety sometimes met with in the position of the testicle, as already specified. Nothing can be more certain, than the truth of Sir Astley Cooper's remark, that the trocar can never be introduced with safety, unless the exact situation of that gland has been first ascertained. Whether the operation be done for the palliative or radical treatment, the trocar is to be withdrawn the instant the cannula enters the tunica vaginalis; but care must be taken to hinder the tube from slipping out, or rather to prevent the tunica vaginalis from slipping off it, which is best guarded against by holding the tube steadily within the puncture, and keeping the tunica vaginalis tense, by grasping the tumour at its back part, until the operation is finished. (See Sir Astley Cooper on the *Testis*, p. 180.)

After performing this operation, a bit of adhesive

or soap-plaster is generally applied; and the scrotum is suspended in a bag-truss.

In most people, the orifice heals in a few hours (like that made for blood-letting); but, in some habits and circumstances, it inflames and festers: this festering is generally superficial only, and is soon quieted by a simple dressing; but it sometimes is so considerable, and extends so deeply, as to affect the vaginal coat, and by accident produce a radical cure. A person, whose hydrocele had been tapped in the morning, travelled at night by the coach to Manchester, and had sufficient inflammation brought on to produce a cure. (See Sir Astley Cooper on the Structure, &c. of the Testis, p. 181.) Pott saw an instance, in which the consequences of the mere tapping proved more troublesome, and even fatal; but then the circumstances, both of the patient and of the case, were particular. Two examples are mentioned by Sir A. Cooper, in which gangrene arose from the puncture, and ended fatally: the patients were elderly persons, who had imprudently ventured to walk out the day after the operation. (On the Testis, p. 181.) Hence, the prudence of advising quietude in bed for a few days, when the patients are of advanced age, or of irritable constitutions.

When the inflammation is severe, an abscess may form within the tunica vaginalis. Sir Benjamin Brodie has seen, however, only three instances of it, and these were all in persons who had resided in the West Indies; a class of individuals very liable to hydrocele. If such an abscess form, relief is to be afforded by opening it, and discharging the matter.

"Wiseman and others have advised deferring the puncture, till a pint of fluid has collected. When there is a sufficient quantity, however, to keep the testicle from the instrument, there can be no reason for deferring the discharge; and Mr. Pott was inclined to believe, that if the operation were performed more early than it generally is, it might sometimes prevent the return of the disease.

This observation deserves notice, because it evidently implies a belief by Pott himself, that, under certain circumstances, a radical cure may be effected, though the cavity of the tunica vaginalis be not obliterated; an opinion since promulgated, as I have already said, by Ramsden, Wadd, Kinder Wood, Sir Astley Cooper, &c. Indeed, it appears probable, that generally, when a hydrocele is permanently cured, by means of such external applications as do not excite inflammation, but operate by quickening the action of the absorbent vessels, the cavity of the tunica vaginalis is not destroyed; and there can be but little doubt of the same thing, whenever what is termed a spontaneous cure happens, as it sometimes does in young subjects. It used also to be the doctrine of Desault, that injections did not obliterate the cavity of the hydrocele by adhesion, but only brought about a change in the vessels of the tunica vaginalis. This conclusion is reported by Boyer to be erroneous, who had an opportunity of dissecting the scrotum after a hydrocele had been radically cured, and the cavity was found obliterated. (See Dict. de Sciences Méd. t. xxii. p. 206.) Now, although our present information leads us to regard the latter as the common result, it does not authorize us to reject the inference made by Desault: in fact, Sir A. Cooper dissected a case, which he cured several years previously by an

injection; yet there were only a few adhesions, and the removal of the disease must be ascribed to some change effected in the vessels of the tunica vaginalis.

The palliative cure is sometimes deemed most eligible for very old persons. Its repetition will be necessary once every six months, or even much more frequently, if the fluid collect again very rapidly, and produce great distention, as sometimes happens. Sir James Earle recommended it to be performed at least once on those who determine to undergo a radical one, as it gives an opportunity of examining the state of the testis, and also of permitting the cavity to be filled again only to such a size, as may be thought to be best calculated to ensure success in any future operation. (On Hydrocele, p. 13. ed. 2.)

Upon the subject of performing the operation of tapping hydroceles, Scarpa offers some useful cautions. The analogy, which exists between large scrotal hernia and hydroceles of considerable size, led him to suspect, that, in the latter disease, the displacement and separation of the vessels of the spermatic cord from each other might also happen. Careful investigations, made upon the dead subject, fully justified the conjecture. In all considerable hydroceles, he found the spermatic vessels so displaced and separated, and that the artery and vas deferens were ordinarily situated on one side of the tumour, and the veins on the other. Sometimes these vessels all extended over the lateral parts of the tumour, as far as its anterior surface, principally towards the bottom.

It is well known, that, in many instances, the operation of puncturing a hydrocele has been followed by a large extravasation of blood within the tunica vaginalis; but Scarpa informs us, that, until lately, he was unacquainted with any case of this kind, which was well detailed, and authentic enough to be cited as an example of injury of the spermatic artery in the puncture of a hydrocele. This learned Professor, however, had such a fact recently communicated to him by Gasparoli, a distinguished surgeon of Palanza, who, in introducing the trocar into the lower part of the swelling, had the misfortune to injure the spermatic artery, and the patient was afterwards castrated. The wound of this vessel was most clearly proved by the particulars of the case, as detailed in Scarpa's work, to which I must refer the reader.

"From the accurate knowledge (says Scarpa) which we now have upon this pathological point, such an accident may be avoided, by observing the rules, which are elsewhere given, for opening the sac of a very large scrotal hernia. In this last operation, as well as that of puncturing an old and voluminous hydrocele, care must be taken to introduce the instrument at a considerable distance from the bottom of the tumour, that is to say, a little below its middle part, and on a line, which would divide the swelling longitudinally into two perfectly equal parts. Experience proves, that, for the purpose of completely emptying a hydrocele, it is unnecessary to make the puncture very near the bottom of the tumour. The corrugation of the scrotum, and a slight pressure made by the surgeon's hand, will suffice for discharging all the fluid contained in the tunica vaginalis, even when the puncture is

made at the middle part of the swelling." (*Scarpa, Traité des Hernies*, p. 64—68.) Our account of the lower situation of the testicle in the hydrocele of a child, than in that of a grown-up person, these directions of Scarpa will also be of value.

VARIOUS PLANS FOR THE RADICAL CURE.

External Applications.—The late Mr. Keate in 1788 recommended the application of a lotion of muriate of ammonia, vinegar and water, to the scrotum, and found it capable in some instances of dispersing a hydrocele. In children, this method will succeed in nine cases out of ten. (*Sir B. Brodie*.) But in adults it mostly fails. "If a child (says Sir Astley Cooper) be brought to me with hydrocele, I direct a dose of rhubarb and calomel occasionally, and order a suspensory bandage, which is to be kept wet with the muriate of ammonia, and liquor ammoniæ acet., in the proportion of ʒij. of the former, to six ounces of the latter. This, after a short time, produces excoriation, and causes the absorption of the fluid." If the fluid is not soon absorbed, he adds the fincture of cantharides, or applies the tincture of iodine. (*On the Testis*, &c. p. 178.)

Mr. Keate's plan has lately found an advocate in Baron Graefe, who applies either a lotion of the above kind, or the acetum scilliticum. M. Velpeau has seen two hydroceles cured by the muriate of ammonia lotion, and frictions with mercurial ointment. I believe with him, that in general such treatment will only succeed when the hydrocele is recent, and has arisen from an external injury (*Nouv. Elém. de Méd. Opér.* t. iii. p. 510.), or in children. When hydrocele is the result of inflammation of the testis, the plan will answer. (*Sir A. Cooper*.)

Besides the employment of external applications, wherewith a permanent cure has occasionally been accomplished, on the principle of absorption, various operations have been practised for the same purpose: viz. acupuncture, incision, excision, the application of caustic, the introduction of a tent, the employment of a seton, and the injection of a stimulating fluid into the cavity of the tunica vaginalis.

The principle on which the success of these plans depends has been already considered. Some of the methods are now exploded; some, which are still practised by a few, are generally successful, though severe, some are very uncertain in their effect, as well as painful; while others are recommended both by their mildness and general success.

Acupuncture.—Mr. Lewis has given an account of the success, with which a radical cure may be accomplished by acupuncture. He makes a puncture with a fine needle, and, on withdrawing it, a drop of fluid issues out. "In three days (says he) the hydrocele will completely disappear." In fifty cases, there was not a single failure. (*See Lancet*, vol. i. 1836 37, p. 559.) I tried this plan once in University College Hospital, but it required to be repeated several times, and the tumour was a long while in disappearing. I attended a clergyman who had a hydrocele, and, in attempting to introduce the trocar and cannula into the tunica vaginalis, the latter was stopped by its edge being too thick; and, on withdrawing the instrument, the serous

fluid passed into the cellular tissue. The fluid was absorbed, and did not collect again. Four or five years ago, the same accident occurred in a sailor, a patient of the Bloomsbury Dispensary; but the hydrocele returned. In Germany, as a gentleman, attending University College Hospital, informs me, acupuncture for the radical cure of hydrocele is followed up by the plan of making considerable but equable pressure on the scrotum, with compresses and a bandage, whereby the fluid is made to escape more certainly into the cellular tissue. The attempt to cure hydrocele by acupuncture is not new, my friend Mr. Robert Keate having proved in the *Medical Gazette*, for Feb. 1837, p. 789, that it was tried twenty years ago by a physician on himself, and with a perfectly successful result. At his suggestion, Mr. Keate frequently tried it both at the hospital and in private practice; "sometimes successfully, but more frequently the collection of fluid in the sac returned, and (says Mr. Keate) I generally found the patients impatient of the numerous punctures, and of the time required for the absorption." Mr. Travers, who began to try the practice in 1836, found it sometimes answer, and, in other instances, to be followed by relapse. (*Op. cit.*) It is perhaps the mildest plan of all, but uncertain. I suspect, that it would generally answer in children.

Incision.—Making an incision, so as to lay open the cavity containing the fluid, is the most ancient method, being described by Celsus. Paulus Ægineta says, the incision is to commence at the middle of the tumour, and be carried to the upper part of it, in a line parallel to the raphe. This incision is only to go through the integuments; the bag, which contains the water, is then to be opened, and part of the sides of the sac taken away. A director is next to be introduced, and a division of the tunica vaginalis made to the bottom of the swelling. The cavity is afterwards to be dressed with lint, and healed by granulations. Hildanus, Dodonæus, Wiseman, Cheselden, Heister, and Sharp, all coincide in stating the dangerous and even fatal consequences sometimes following this mode. Mr. B. Bell, who preferred this operation to every other one, acknowledges, that he had seen it produce great pain and tension of the abdomen, inflammation, and fever. Pott observes, that it can never be said to be totally void of danger; and that it bears the appearance of an operation of some severity. This eminent surgeon abandoned the method, during the last twenty-six years of his life. When obscurity hangs over the nature of the case, as to its being connected with hernia, or some disease of the testis, Sir Astley Cooper admits, that it is sometimes, though rarely, necessary to open the tunica vaginalis. He speaks of the severity of the operation, and of its sometimes proving fatal to elderly persons. (*On the Testis*, p. 192.)

Excision.—Albucasis gave the first clear account of this operation, though Celsus has certainly mentioned removing some of the sac. White and Douglas used to adopt this method. The latter advises making two incisions, so as to form an oval, from the upper to the lower part of the tumour; dissecting off the oval piece of the scrotum, and then making an opening into the sac, and enlarging it with scissors. The tunica va-

ginalis was next to be entirely cut away, close to where it was connected with the spermatic vessels. The cavity was afterwards filled with lint. Sir James Earle justly notices, that this plan must have been tedious, exquisitely painful in the performance, and, as subsequently treated, attended with violent and dangerous symptoms. Sir Astley Cooper concurs in this view; and he states that, in one example, he saw it produce gangrene of the scrotum and testicle. (*Op. cit.* p. 183.)

In modern days, excision is only sanctioned, when the tunica vaginalis is more or less in an ossified state; for a mere thickening of it does not prevent the success of milder plans of treatment. With respect to a mode of excision, recently proposed by Mr. Kinder Wood, it differs entirely from the ancient method, inasmuch as it is perhaps one of the mildest plans yet suggested for the radical cure, since it simply consists in puncturing the hydrocele with an abscess-lancet, drawing out a little bit of the sac with a tenaculum, and cutting it off. (See *Med. Chir. Trans.* vol. ix. p. 33.) I suspect, that this method, which is simple and mild, has not yet had a trial on a sufficiently extensive scale. Whether the cavity is always obliterated or not, as Mr. Kinder Wood himself believes, appears questionable.

Cautic.—Paulus Aegineta advises destroying the skin with a cautery of a particular form, dissecting off the eschar, and then cauterising the exposed membrane. Guido di Cauliaco is, perhaps, the first who described the application of caustic for the cure of hydrocele. Wiseman practised this method. Dionis advises it; but De la Faye and Garengot make objections to it. Mr. Else has left the best account of the manner of using caustic. He recommends laying "a small caustic upon the anterior and inferior part of the scrotum, which is intended to affect, and, if possible, penetrate through the tunica vaginalis."

The objections to the employment of caustic are, its causing an unnecessary destruction of parts, and producing a tedious painful sore. The action of caustic can never be so regulated as to make an opening with certainty through the tunica vaginalis, so that either its application must be sometimes repeated, or else a lancet, or trocar, used after all. Its success is also less sure than that of an injection. In one case, operated upon by Boyer, the disease returned; and in another example, in the practice of the same surgeon, the cure was accomplished at a great risk, as it was long dubious whether the testis would be saved. (*Dict. des Sciences Méd.* xii. p. 210.) Sir Astley Cooper bears testimony to the occasionally severe consequences of this method; and adds, "I have known it, in a diseased constitution, destroy life." There is a preparation in the collection of St. Thomas's Hospital, of a hydrocele, taken from a patient, who died from the effects of caustic. (*Sir Astley Cooper on the Structure, &c. of the Testis*, p. 183.)

Tent.—This was first mentioned by Franco. The operation consists in making an opening into the tunica vaginalis, and keeping the wound open with a tent of lint, linen, or sponge, so as to make the cavity separate, in which the water was contained. Paré, Guillemau, Covillard, Dupuytren, and Martin, have all described the plan with some variations, one of which consisted in stretching the tent with irritating sub-

stances. Dr. A. Monro, senior, devised the plan of keeping a cannula in the tunica vaginalis, so as to bring on a cohesion of the parts, without suppuration. Fabricius ab Aquapendente, however, has made allusion to some surgeons before his time, who used to keep the wound open a few days with a cannula. Mr. Pott tried the cannula, but found it very inconvenient, as its inflexibility hurt the testis whenever the patient moved with inattention, and, consequently, he preferred a tent, or bougie, though he speaks of the plan as a very uncertain one.

Of late, Baron Larrey, in consequence of having seen several instances, in which the symptoms, following the use of an injection, were violent, and one case, in which a fatal peritonitis was produced, has recommended exciting the necessary degree of inflammation by keeping a short piece of an elastic gum catheter in the puncture, which instrument also serves afterwards to let any fluid escape from the tunica vaginalis. (*Mém. de Chir. Militaire*, t. iii. p. 409. &c.) This author speaks of the plan as having fully answered his expectations; but, I doubt whether it has any particular superiority over several of the former methods of employing the tent; methods, which the wisdom, arising from experience, has long since rejected.

Seton was first mentioned by Guido di Cauliaco, in 1498, as a means of curing the hydrocele. In modern times, Pott preferred it to every other method, if we except injection, of which, according to Sir J. Earle, he expressed his approbation before his decease. When stimulating lotions fail, Sir A. Cooper still retains a preference to the seton for children, on account of its application being more easy in them, than the employment of injection. (*On the Testis*, p. 194.) Mr. Pott found, that the best mode of making the seton was as follows. He employed three instruments: the first was a trocar, the cannula of which was about one fourth of an inch broad. The second was what he called the seton-cannula, which was made of silver, was just small enough to pass with ease through the cannula of the trocar, and five inches long. The third instrument was a probe six inches and a half long, having at one end a fine steel trocar point, and, at the other, an eye, which carried the seton. The seton consisted of so much white sewing silk, as would just pass easily through the cannula, and yet fill it. The thickness of the seton, however, was not so great in the latter part of his practice. Having pierced the inferior and anterior part of the tumour with the trocar, withdrawn the perforator, and discharged the water, Mr. Pott used to pass the seton-cannula through that of the trocar, to the upper part of the tunica vaginalis, so as to be felt there. The probe, armed with the seton, was next conveyed through the latter cannula, and its point pushed through the upper part of the tunica vaginalis, and scrotum. The silk was then drawn through the cannula, until a sufficient quantity had been brought out of the upper orifice. The two cannulae being withdrawn, the operation was finished.

In the adult, Sir Astley Cooper sometimes uses the seton, when the injection has failed to excite sufficient inflammation; but he recommends it to be adopted before the inflammation, produced by the injection, has entirely subsided. (See *Sir A. Cooper on the Testis*, p. 194.)

Injection.—Dr. Monro erroneously attributed the first use of injections for the radical cure of hydroceles to an army surgeon of his own name, who employed spirits of wine. This produced a cure, but the inflammation was so violent, that he afterwards tried a milder injection, which consisted of wine. The plan is mentioned by Celsus, who recommends a solution of nitre to be injected, after the fluid has been discharged. Lambert, in his *Œuvres Chir.*, published at Marseilles in 1667, advised injecting a solution of sublimate in lime-water, and related examples of its success. Mr. S. Sharp also made trial of spirit of wine, which cured the hydrocele, but not without causing dangerous symptoms, and two subsequent abscesses in the scrotum. Douglas, Le Dran, and Pott, all disapprove of injections, in their works; though Sir James Earle informs us, that the latter lived to alter his opinion on the subject.

The violence of the inflammatory symptoms, consequent to the first employment of injections for the radical cure of hydroceles, arose from the fluids used being too irritating. Sir James Earle, at last, preferred wine for several reasons. He found that it had been used with success in France: its strength is never so great as to render it unsafe; and it may be readily weakened. However, as the strength and other qualities of port wine vary considerably, Sir A. Cooper prefers using a solution of the sulphate of zinc, ʒj. to a pint of water. (*On the Testis*.) M. Velpeau employs an injection, composed of ʒj. or ʒij. of spirituous tincture of iodine to each ounce of distilled water.

"I have commonly used (says Sir James Earle) about two thirds of wine to one third of water; if the parts appeared insensible, and no pain at all was produced by the first quantity thrown in, I have withdrawn the syringe, and added to the proportion of wine: on the contrary, if the complaint was recent, and the parts irritable, I have increased the proportion of water; so that I have hitherto been principally guided by the degree of sensation which the patient has expressed. I have lately used pure water mixed with wine, and found it answer as well as when astringents were added." (*On the Hydrocele*, p. 103. ed. 2.) In the preface, the author says, that he has long disused the pipe with a stop-cock, which he once employed, on account of not being well able to spare a hand, during the operation, to turn it, and its consequently being found awkward. A pipe, one end of which is made to fit into the annula of a trocar, the other adapted to receive the neck of an elastic bottle, with a valve, or ball, in the centre of the pipe, to permit the entrance, and prevent the exit of the injection, will be found infinitely more convenient and useful. (*Earle*.) I always make use of a brass syringe, in preference to one composed of elastic gum. When the hydrocele is very large, Sir James recommends simply letting out the fluid, and waiting till the tumour acquires a more moderate size, before attempting the radical cure by injection.

It appears from Sir James Earle's interesting cases, that a cure may be accomplished in this manner, even when the tunica vaginalis is considerably thickened. In the course of a month, Boyer cured a patient with an injection, even though the testicle was enlarged. (*See Dict. des Sciences Méd.* t. xxii. p. 214.) My own experience confirms the truth of both these obser-

ations. Sir Astley Cooper also informs us, that if, after draining off the water, he finds the testis somewhat enlarged, he does not let that circumstance prevent his going on with the operation, which will yet prove successful. (*On the Testis*, p. 187.) Similar cases are also reported in the *Parisian Chir. Journ.* The following is the common mode of operating: the hydrocele is to be tapped with a trocar at its anterior and inferior part, and when the whole of the fluid is evacuated, the cavity of the tunica vaginalis is to be moderately filled, but not distended to its former dimensions with the above injection. This is to be allowed to remain in the part about five minutes, upon the average, after which it is to be discharged through the cannula. The patient usually feels some pain in the groin, and about the kidneys, on the injection being introduced; tho' symptoms are rather desirable, as they evince, that the stimulus of the fluid is likely to have the wished-for effect of exciting the necessary degree of inflammation. Sometimes, however, great pain is followed by too little inflammation, and inconsiderable pain by too much; so that it is not an absolute test. This plan, which was brought to a high pitch of perfection by the late Sir James Earle, may be deemed almost a sure means of obtaining a permanent cure; and being, at the same time, mild, is mostly preferred in England, France, and Germany.

The treatment after the operation is exactly like that of common acute inflammation of the testicle (*see Testicle*), consisting of the use of fomentations, poultices, leeches, saline purges, and, above all, of a bag-truss for keeping up the scrotum. However, a strict antiphlogistic treatment need not be adopted, unless the inflammation become too violent, because a certain degree of it is necessary for the cure. I never put on a poultice till the inflammation has attained a sufficient height. Sir Astley Cooper directs the suspensory bandage to be discontinued. If there is great pain, he desires the patient to lie down; if there be but little suffering, he tells him to walk about; if the pain is severe, he advises him to eat very little, and drink only diluents; if he suffers but little, Sir Astley tells him to take his dinner, and two or three glasses of wine. If, on the following day, there should be considerable tenderness and some swelling, the suspensory bandage is to be worn. (*On the Testis*, p. 187.)

According to Boyer, the occasional failure of injections is owing to the premature discontinuance of spirituous applications, and the too quick substitution of emollients for them, as well as the plan of not letting the injection remain in the tunica vaginalis long enough. (*See Dict. des Sciences Méd.* t. xxii. p. 213.)

Ope caution it is necessary to offer before I take leave of this subject. It has sometimes happened, during the operation, that the cannula has slipped out of the tunica vaginalis, and its inner mouth become situated in the substance of the scrotum; in which event, the operator, if he persists in propelling out the injection, will fill the cellular texture of the part with a stimulating fluid, which may cause abscesses, sloughing, and other unpleasant symptoms, without entering the cavity of the tunica vaginalis, or producing a radical cure of the hydrocele, which, however, I have known happen from this cause. When such an accident has happened to a great extent, punctured

should be made to let the stimulating fluid pass out of the cellular tissue, and then fomentations and a dose of calomel and senna mixture had recourse to. Sometimes, when the injection is strong, and a great deal of it has passed into the cellular membrane, and the constitution is irritable, the mischief ends in the patient's death. Many such cases are on record, and the particulars of one, which terminated in death, are given by Sir A. Cooper. (*On the Testis*, p. 190.) This excellent surgeon takes care never to distend the tunica vaginalis with the injection, but throws in less than the quantity of the fluid of the hydrocele; and then moves it about so as to apply it to every part of the inner surface of the bag. "If much be injected, the cremastic muscle contracts, and forces a part of it, by the side of the cannula, into the cellular membrane of the scrotum, and sometimes produces inflammation and sloughing in that structure." (See Sir A. Cooper on the Testis, p. 186.)

Introducing into the tunica vaginalis air, cold water, or even the fluid discharged, has sometimes effected a radical cure. (See *Supplement to Plourquet*, p. 103. Tub. 1814.) Schreger did not find common air answer; but chlorine gas has been tried with success. (See *Bulletin Méd. Belge*, Janvier, 1836.)

A case is mentioned by Sir A. Cooper, in which milk was injected, on the supposition of its being a mild, unirritating fluid; however, severe inflammation followed, and an abscess in the tunica vaginalis. When an opening was made, the milk came out in curds.

CONGENITAL HYDROCELE.

There is a particular case, that has been called the *congenital hydrocele*, by which is implied a collection of water in the tunica vaginalis, with a communication between the cavity of this membrane and that of the peritoneum. When the patient is laid on his back, the fluid returns into the belly; but descends again when the body is erect. Pressure will also make the tumour recede; but this happens very gradually, and less quickly than the return of a hernia. The opening is frequently not of greater diameter than a common probe, and the fluid takes time to be squeezed through it. (See B. Brodie, in *Med. Gaz.* vol. xiii. p. 89.) The foregoing circumstances, together with fluctuation and transparency, make the nature of the case evident. Sometimes, it is complicated with a protrusion of the viscera, and always renders the patient, while it is uncured, liable to the latter accident. Desault used to cure this disease by a red wine injection. After the protruded viscera had been returned into the belly, and while the opening between that and the inside of the tunica vaginalis was carefully compressed and closed by a trusty assistant, Desault, after letting out the water in the common way, used to throw in the injection. The method, it is said, succeeded, without causing the serious consequence one might at first expect, viz. inflammation of the peritoneum. (See *Keeney* (*Chir.* t. ii. p. 442.)

The method, which I should recommend, is the constant application of a truss; by which means Sir A. Cooper has known a cure very successfully accomplished. (See *Lectures*, vol. ii, p. 91.) This, as well as injection, should not be adopted

if the hydrocele were accompanied by lodgment of the testis at or within the ring.

HYDROCELE IN WOMEN.

This disease is exceedingly rare. The researches of Sacchi, Paletta, Scarpa, Monteggia, and Regnoli, prove, that it is generally situated in the canal of Nuck, and may communicate with the abdomen, or not. In one encysted hydrocele of the round ligament, M. Regnoli accomplished a cure by incision. (See *Révue Méd.* Oct. 1834.)

Monro on the Tumours of the Scrotum, in the *Edinb. Med. Essays*, vol. v. *J. Douglas*, A Treatise on Hydrocele, 8vo. Lond. 1755; and Answer to Remarks on that Work, 8vo. Lond. 1758. *Pott* on the Hydrocele. *Euse* on the Hydrocele, 8vo. Lond. 1776; and the Works of *Joseph Euse*, 8vo. Lond. 1782. *W. Dacre* on the Different Kinds of Hydrocele, 8vo. London, 1798. *T. Keate*, Cases of Hydrocele, 8vo. 1788. *B. Bell* on Hydrocele, Sarcocoele, &c. 8vo. Edinb. 1794. *Loder* in *Med. Chir. Remerk.* th. i. cap. 7. *Theden's* Neue Remerk. th. ii. and iii. *Sir James Earle*, Treatise on the Hydrocele, 2^d ed. 8vo. Lond. 1803. *Schreger*, Chirurgische Versuche, b. i. 8vo. Nuremberg, 1811: a cure effected by the injection of air, p. 306. *Bertrandi*, in *Mém. de l'Acad. de Chir.* t. iii. and in *Trattato delle Operazioni di Chirurgia*. Nizza, 1763. *Desault*, Remarques, &c. sur Diverses Espèces d'Hydrocele; Œuvres Chir. t. ii. *S. Sharp's* Treatise on the Operations, and his Critical Inquiry. *J. Howard*, Obs. on the Method of curing the Hydrocele by means of a Seton, 8vo. Lond. 1783. *Sabatier*, Médecine Opératoire, t. i. ed. 2. *Scarpa*, Traité des Hernies, p. 64, &c. *LaFray*, Mémoires de Chir. Militaire, t. iii. p. 409. &c. *T. Ramsd.* n. Practical Observations on the Sarcocoele, &c. 8vo. Lond. 1811. *W. Wadd*, Cases of Diseased Bladder and Testicle, 4to. Lond. 1815. *Anders* n. Obs. on the Cure of the Hydrocele of the Tunica Vaginalis, without procuring an Obliteration of the Sac; in *Med. Chir. Trans.* vol. ix. p. 38. 8vo. Lond. 1818. *A. Scarpa*, Memoria sull' Hydrocele del Cordone Spermatico, 4to., Pavia, 1823. *A. Cooper*, Lectures on the Principles, &c. of Surgery, vol. ii. p. 86. 8vo. Lond. 1825; also Obs. on the Structure and Dis. of the Testis, 4to. Lond. 1830. *Sir Benjamin Brodie*, in *Lond. Med. Gaz.* vol. xlii. 8vo. 1833, 1834. *M. le Baron Dupuytren*, Leçons Orales de Clinique Chir. t. iv. art. 8. 8vo. Paris, 1834. *Alf. J. Lepeau*, Nouv. Elém. de Méd. Opér. t. iii. p. 507. 8vo. Paris, 1832.

HYDROCELE OF THE NECK.

A name given to a collection of fluid in a serous cyst in this part of the body. Professor Maunoir, Dr. O'Beirne, and Mr. Bransby Cooper, have particularly described it. (See *T. P. Maunoir*, *Mém. sur les Amputations*, Geneva, 1825; *Dublin Journ. of Med. Science*, vol. vi. p. 1; and *Guy's Hospital Reports*, vol. i.) It is sometimes cured by puncture and injection; but a seton, as originally recommended by M. Maunoir, seems the mildest and surest plan. Injections often fail.

HYDROPHOBIA. (From *ὕδωρ*, water, and *φῶβος*, fear. A dread of water.) This being, for the most part, a striking symptom of the fatal indisposition which results from the bite of a mad dog, and some other animals affected in the same way, the disease itself has been named *hydrophobia*. Some have used the more general term, *hydrophobia*, from *ὕδωρ*, liquid. But strong objection has been made to both these terms, because derived from a symptom, which does not exclusively belong to the disease, nor constantly exist in it.

The old writers, as we learn from Cælius Aurelianus, used the terms *acrophobia*, or a dread of air, and *panophobia*, or a fear of all things, since the impression of cold air sometimes excites terror, and the disorder is marked by a singular degree of general timidity and distrust. Others called it *phobadipsos* (δ-ψος, signifying thirst), because the patient is thirsty, yet fears to drink. Several modern authors, however, objecting to any appellation expressive only of one symptom, denominate

the disease *rabies*, and *rabies canina*, or canine madness. The French call it *la rage*.

With respect to hydrophobia, or the dreadful indisposition produced by the bite of a dog, or other animal, affected with rabies, or by the application of some of the secretions of such animal to a part of the body, the first clear mention of it is generally considered to be that made by Aristotle (*Hist. Animal*, lib. vii. cap. 22.); but he could have had but very erroneous notions upon the subject, since he sets down man as incapable of receiving the distemper from the bite of a rabid dog.

Concerning the antiquity of hydrophobia, however, I particularly refer to Dr. Hecker's Observations, who thinks the fact clearly proved, that the disease existed at least 400 years before Christ, and even in the most remote periods. (See *Journ. sur Chir. von C. F. Graefe*, &c. b. ii. p. 325, &c.)

With respect to a name for the disorder, as the patient does not commonly betray any tendency to fury, while the dread of water is really a customary attendant on the complaint, the terms *rabies* and *la rage* seem strictly even more exceptionable, than the word hydrophobia. At the same time, in order not to imbricate confused notions, whatever name be thought fittest for the illness arising in the human subject from the bite of a mad dog, and some other animals similarly affected, it is necessary to understand well, that hydrophobia, in the sense of a horror of water, or other liquids, is an occasional symptom of many diseases, and neither exclusively confined to the indisposition caused by the bite of a rabid dog, or certain other animals, nor even constantly attendant upon it. And with the same view of avoiding perplexity, all hydrophobic complaints may be arranged in two general divisions:

1. The first comprising all cases not ascribable to the bite of a rabid animal, or the application of some of its secretions to a part of the body.

2. The second comprehending the examples preceded by one of those occurrences.

The cases, included in the first of these divisions, are subdivided into the *symptomatic* and *idiopathic*, or *spontaneous*. By *symptomatic hydrophobia* is understood an aversion or dread of liquids, presenting itself as an occasional symptom of various diseases, as of certain inflammatory, febrile, and nervous disorders, hysteria, epilepsy, injuries of the brain. (*Treccurt in Recueil Périodique*, &c. t. vi.; *Acta Naturæ Curios.* vol. ii. obs. 205.), the operation of particular poisons (*Villermay, Traité des Mal. Nerveuses*, t. i. p. 90.; *Hurles, über die Hundswuth*, Frankf. 1809; *Schmiedel, Diss. de Hydrophobia ex Usu Fructuum Fugæ*, Erlan. 1762, &c.), gastritis, pneumonia, hepatitis, angina, &c. &c. In many of the instances of symptomatic hydrophobia, the aversion or dread of fluids occurs on the same day as the cause upon which it depends, or a few days afterwards; and, for the most part, may be cured with the disease which has given rise to it, or even independently of it. On the contrary, the hydrophobia from the bite or infection of a rabid animal, does not come on till a long time after the occurrence of the cause, and, when once formed, has hitherto proved incurable. Whatever analogy, therefore, may be imagined to exist, between symptomatic hydrophobia and rabies, they differ essentially in their causes, progress, degree of curability, and also in the treatment

required. (See *Dict. des Sciences Méd.* t. i. p. 38.)

Spontaneous or idiopathic hydrophobia denotes the questionable form of the complaint, sometimes supposed to be induced by violent mental commotion, anger, fright, &c. unpreceded by any other primary disease, to which it can be referred as a symptom.

Numerous facts upon record leave no doubt, concerning the reality of symptomatic hydrophobia; but, perhaps, none of the cases adduced by Raymond (*Mém. de la Soc. Royale de Méd.* t. ii. p. 457.), Roupe (*Nova Acta Physico-Med.* t. iv.), or Pouteau (*Essai sur la Rage*, Lyons, 1763.) in proof of the possibility of a spontaneous idiopathic form of the disease in the human subject, are sufficiently unequivocal to remove all suspicion, either that the complaint had been preceded by another primary disease (*Dict. des Sciences Méd.* t. xxii. p. 333.), or had been the result of an unobserved, or forgotten occasion, on which the infection was received from handling a dog, or cat, never suspected at the time to be affected with rabies. Here a wrong conclusion is the more apt to be made, in consequence of the disease being communicable without any bite to fix the patient's attention, and not commencing some times for months after the unnoticed receipt of the infection. Thus, Francis Stunniar died, in November, 1787, with symptoms of hydrophobia, though it was not known that he had ever been bitten by a mad dog. (*Lond. Med. Journ.* vol. ix. p. 256); yet, what safe inference can be drawn from this case, when the above-mentioned circumstances are recollected, and it is known that the man was often drunk, and in the streets at night? These and other considerations even throw a doubt upon a part of the cases recorded as instances of symptomatic tetanus, and they lead the generality of modern writers to incline to the sentiment of Dr. J. Hunter, that a disease, similar in its nature to what is produced by the bite of a mad dog, never arises spontaneously in the human subject. (See *Trans. of a Soc. for the Improvement of Med. and Chir. Knowledge*, vol. i. p. 299–303.) Many of the symptomatic cases, however, or those in which more or less aversion, or dread of liquids, is evinced as an effect of another disease, are too well authenticated to admit of doubt. In the *Dict. des. Sciences, Méd.* t. xxii. art. *Hydrophobie*, may be found a great deal of information, likely to interest such readers as wish to follow up the subject of the symptomatic forms of the disease. However, in looking over some of the cases there detailed, a suspicion will now and then arise in an intelligent mind, that the disorder was mistaken; for it will be noticed that sometimes pain shooting up the limbs preceded the general indisposition, while the rapidity of the disease, and the appearances found on dissection, corresponded precisely to what is usually remarked on hydrophobia. In particular, one patient is described as a man habituated to drinking, and as a sportsman to dogs also; he died on the third day, and on dissection, the stomach and intestines were found inflamed, and even gangrenous in several places, the œsophagus and lungs also participating in the inflammation. (*Commerc. Litter.* Noremb. 1743. hebd. 5.)

Animals of the dog kind, including the wolf and the fox, are most frequently the subject of rabies; and certain writers have maintained, that, it may be received and propagated by other

mals, yet it always originates in some of the canine race. (*Hillary on Diseases of Barbadoes*, p. 246.) However, it is asserted, that the disease sometimes originates spontaneously in cats, that is to say, without their having been previously bitten by another rabid animal; but the moderns do not incline to the belief, that it ever has been known to commence in this manner in other animals, though such an assertion is made by Cælius Aurelianus, Porphyrius, Avicenna, Valeriola, Vander Wiel, &c., not only with respect to man, but horses, asses, camels, hogs, bullocks, bears, monkeys, and even poultry. (See *Dict. des Sciences Méd.* t. xlvii. p. 45.)

It is interesting to inquire what animals are capable of communicating rabies, and what animals of receiving it? So far as our knowledge yet extends, it appears that animals of the canine species, with perhaps those of the feline race, are the only ones in which this disorder ever arises spontaneously: and they may transmit it to animals of their own kind, to other quadrupeds, and to man. The experiments made by Dr. Zincke, tend to prove also that birds, at least the common fowl, may have the disease communicated to them. (*Neue Ansichten der Hundswuth*, &c. 8vo. Jena, 1804.)

But, though it be well known, that animals of the dog and cat kinds can propagate the disorder, it is not settled whether it can be communicated by other animals. In a memoir, read to the French Institute, M. Huzard explained, that herbivorous quadrupeds, affected with rabies, are incapable of transmitting the disease; a position subsequently confirmed by additional experiments and observations made in the veterinary school at Alfort. M.M. Girard and Vatel inoculated with the saliva of a rabid sheep two other sheep, a young dog, and a horse; but none of these animals evinced any symptoms of the disease, and continued well ten months after the experiment. (*Magendie, in Journ. de Physiol. Expér.* t. viii. p. 326, &c. 8vo. Paris, 1828.) Professor Dupuy could never communicate the distemper to cows and sheep, by rubbing their wounds with a sponge, which animals of the same class, already labouring under the disease, had had in their mouths; though the same experiment, made with a sponge which had been bitten by a rabid dog, propagated rabies by a kind of inoculation. Dupuy has likewise seen, amongst several flocks, sheep affected with rabies, yet the distemper was never communicated by them to other sheep, notwithstanding the latter were bit in parts stripped of wool. Dr. Gillman inoculated two rabbits with the saliva of a rabid pig; but the disease was not communicated to them. (*On the Bite of a Rabid Animal*, p. 38.) On the other hand, Mr. King, of Clifton, is stated to have communicated rabies to a fowl, by inoculating it with the saliva of an ox, which had just fallen a victim to the disease. (*J. Ashburner, Diss. de Hydrophobia*, p. 29.) The author of the article *Rage* (*Dict. des Sciences Méd.*) observes, respecting this singular case, that, as it is accompanied with no details, doubts must remain whether the fowl actually died of rabies. A fatal instance of hydrophobia from the bite of a rabid badger has been lately recorded, though not with much precision as to leave no doubts about the nature of the case. (See *Huydon's Journ.* for 1821.)

As for some extraordinary cases, in which the

disease is alleged to have been communicated to the human subject by the bites of birds, or injuries done with the claws of animals, they are generally dismissed by modern writers with the inference, that the complaint thus transmitted, was not true hydrophobia or rabies. This conclusion is made, with respect to the cases of this kind reported by Cælius Aurelianus and Bader, and the notorious example mentioned by A. Baccius, of a gardener, who died of the bite of a cock, which, according to some, was rabid, according to others, merely enraged. Hildanus also details an instance, in which a young man was scratched on the great toe by a cat; and, some months afterwards, was attacked with hydrophobia (*Obs. Chir.* cent. i. obs. 16.); but, as a modern writer observes, if the patient were really affected with rabies, it is conceivable that the cat's claw, with which the scratch was made, might have been wet with the animal's saliva. (*Dict. des Sciences Méd.* t. xlvii. p. 47.)

Another question of considerable importance is, whether hydrophobia, that is to say, rabies, can be communicated from one human being to another? or, whether, in man, the disease is infectious or contagious? Many attempts have been made, in vain, to communicate the distemper to several kinds of animals, by inoculating them with the saliva of patients who had perished of the disease. These experiments were made in this country by Gauthier, Vaughan, Babington, &c.; but no infection was the consequence. In France, Giraud inoculated several dogs with saliva of a man in the convulsed stage of hydrophobia, but none of them afterwards took the distemper. (*Bosquillon, Mém. sur les Causes de l'Hydrophobie*, in *Mém. de la Soc. d'Emulation*, cinquième année.) M. Girard, of Lyons, collected some of the frothy saliva the instant it was discharged from a patient's mouth, and he inserted some of it into eight punctures, made on the inside of a dog's four legs; yet, six months after this inoculation, the animal had not suffered the slightest inconvenience. (*Essai sur le Tetanos Rabies*, p. 29.) A similar experiment was made on three dogs by M. Paroisse, who kept the animals between three and four months afterwards, during all which time they continued quite unaffected. (*Anal. Méd.* t. 43.)

Dr. Bezar published the following experiments: pieces of the flesh of a person who had died of hydrophobia, were smeared with his saliva, and given to a dog; another dog was suffered to eat the salivary glands; and a third, the sides of a wound. In three other dogs, incisions were made: the cut parts were then inoculated, and sewed up. Not one of these six animals became affected with rabies. (See *Mem. et Obs. lus à la Soc. Méd. Philanthropique*, première année, 1807, p. 17.)

The preceding experiments only furnish negative results; but one, to which we shall now advert, tends to establish a contrary opinion. On the 19th of June, 1813, in the Hôtel Dieu, at Paris, Magendie and Bruchet took some of the saliva of a man who died a few minutes afterwards of hydrophobia, and, by means of a bit of rag, they conveyed this saliva to the short distance of twenty paces from the patient's bed, and inoculated with it two healthy dogs. One of the dogs became rabid on the 27th July; and bit two others, one of which was attacked with complete rabies on the 26th of August. (*C. Baumout, see Collect. des Thèses*, in 4to. de la

Faculté de Paris, 1814.) It is remarked, in the work from which I have collected these particulars, that the foregoing is one of the best-authenticated experiments on the subject; for, in addition to the consideration of the talents and characters of the experimenters themselves, the facts were witnessed by numerous medical students. And, notwithstanding the objections which have been urged against the account (see *Journ. Gén. de Méd.* t. li. p. 13.), the main points are declared to be entitled to credit. (See *Dict. des Sciences Méd.* t. lxvii. p. 48.; also *Journ. de Physiologie*, par F. Magendie, t. i. p. 42.)

With these relations, it is proper to notice certain cases, too credulously promulgated as proofs of the possibility of the disease being communicated from one human being to another. Neither the instance of the maid servant, who died merely from seeing her mistress vomit, while labouring under hydrophobia (*Nich. Ettmüller, Op. Méd.* t. ii.); or the case of the peasant's children, *which all died on the seventh day*, as is alleged, from embracing their dying father; the example of a woman contracting hydrophobia from her husband, as detailed by Mangor (*Acta Soc. Reg. Hafniens.* vol. ii. obs. 32. p. 408.); nor other cases of a similar tenor; are now regarded as proving any thing more, than that the patients, supposed to have caught the disease by contagion, fell victims either to violent affections of the mind and nervous system, or illnesses accidentally taking place soon after the death of a near relation, or mistress. It is clear enough also, that some of the cases were, at most, only instances of symptomatic hydrophobia.

With regard to another opinion, that the bite of a man, or other animal, when merely enraged, may bring on hydrophobia, it is now entirely discarded as erroneous. The cases in support of it, recorded by Cl. Pouteau, Mangetus, Malpighi, Zuinger, Le Cat, &c. when critically examined, only prove, that the patients were affected with tetanus, or symptomatic hydrophobia, not arising from any infection; for, neither the mode of attack, nor the progress of the symptoms, in any of the examples which are related with sufficient minuteness, lead to the inference, that the patients actually died of rabies. (See *Dict. des Sciences Méd.* t. xlvii. p. 49.)

Wrong notions, of a dangerous tendency, have been generally entertained, in regard to the disease, as it appears in the canine race. The writer of the article *Dog*, in Dr. Rees's *Cyclopædia*, appears to have had extensive opportunities of observing the disorder in dogs: from his remarks, I have collected the following information.

The peculiar symptom, which often attends the complaint in the human subject, has been applied to the disease in the dog, and has occasioned it to be called by the same name, hydrophobia. This is a palpable misnomer; for, in no instance, does there ever exist any dread of water: on the contrary, dogs are in general very greedy of it. Neither have sheep, when rabid, any dread of water, but frequently take it with great freedom, as is proved by some experiments, of which an account is given in Magendie's *Journal*. (t. viii. p. 328.) Such unfounded supposition has often concluded to a very fatal error; for, it being the received opinion, that no dog is mad, who can lup water, many persons have been lulled into a dangerous security. Another equally false and fatal idea has prevailed, that every mad dog must be

wild and furious; but this is so far from being true, that in the greater number of instances, there is very little of that wild savage fury, that is expected by the generality of persons. "Hence," says this author, "as it is evident, that the term hydrophobia, characterising the affection in the dog, is a misnomer, so it is evident, that the term madness is equally so. In no instance, have I ever observed a total alienation of the mind; in very few, have the mental faculties been disturbed. The disposition to do mischief is rather an increased irritability, than absence of sense; for, in most instances, even those that are furious, acknowledge the master's voice, and are obedient." The symptom, which is most frequently first observable, in a rabid dog, is a certain peculiarity in his manner; some strange departure from his usual habits. In a very great number of instances, the peculiarity consists in a disposition to pick up straws, bits of paper, rags, threads, or the smallest objects which may happen to be on the floor. This is said to be particularly common in small dogs. "Others again show an early peculiarity by licking the parts of another dog. In one instance, the approach of the disease was foretold, by our observing a very uncommon attachment in a pug-puppy, towards a kitten, which he was constantly licking; and likewise the cold nose of a healthy pug, that was with him. An attachment to the sensation of cold appears in many cases, it being very common to observe them (the dogs) licking the cold iron, cold stones, &c. Some dogs, early in the disease, will eat their own excrement, and lap their own urine." An early antipathy to strange dogs and cats is very commonly observed, but particularly to cats. As the disease advances, the affected dogs bite those with which they are domesticated, and, lastly, the persons around; but, except in a moment of irritability, they seldom attack the human subject. The irritability, that induces them to bite, is very strong; but is devoid of wildness. It is more like peevishness than fury. A stick held up at them always excites their anger in a violent degree; and, throughout the disease, there is generally a wonderful impatience of control, and the animals are with great difficulty frightened." (See art. *Dog*, in *Rees's Cyclopædia*.) In sheep, as well as dogs, a peculiar change of the voice is regarded as one of the most unequivocal signs of the di-temper. (See *Magendie's Journ. de Physiol. Exp.* t. xiii. p. 330.)

Dr. John Hunter calculated, that out of every dozen of rabid dogs, about one evinces no particular tendency to bite. That these animals, and wolves also, have no particular dread of fluid, is proved by facts. Thus, a rabid wolf, at Frejus, swam across several rivers. (*Darluar, Récuil Périod. d'Observ.* vol. iv.) Duboueix has seen mad dogs drink without difficulty, and plentifully. (*Hist. de la Soc. de Méd.* an. 1783.) Rabid animals will sometimes eat as well as drink. Thus, the wolf which bit so many persons at Meyne, in 1718, was found in the morning devouring a shepherd's dog. And Dr. Gillman speaks of a dog, which was not deemed rabid, because it eat and drank well; but, as it seemed indisposed, it was killed, though not before it had bit a man, who fell a victim to hydrophobia. (*On the Bite of a Rabid Animal*, p. 15.)

When a dog bites a person, it should not be immediately killed, but merely chained up, because,

by destroying it at once; the possibility of ascertaining whether it was rabid is prevented, and great alarm is thus kept up in the minds of the wounded person and his friends. If the animal be affected with rabies, it will perish in a few days. At the veterinary school at Alfort, when a dog has been bit, it is usual to chain it up, for at least fifty days, before it is restored to its master, about six weeks being considered the period when a dog generally becomes rabid after being bitten.

My friend, Mr. St. Aubyn, had a large Newfoundland dog, however, which did not become rabid till seventy days had elapsed from the period when it was bitten by another dog. As I saw this case, and am minutely acquainted with the particulars, I consider it as furnishing an useful caution against placing too much confidence in the plan adopted at the veterinary school at Alfort.

For additional details, relating to the disease as it appears in the dog, I must refer to the above-mentioned paper. Enough, I hope, has been said to make the reader aware, that mad dogs are not particularly characterised by an inability to lap water, nor by any degree of fury. These animals, when actually affected with rabies, from their quiet manner, have even not been suspected of having the disorder, and have been allowed to run about, been fondled, and even slept with. (See *Mem. of Swedish Acad.* 1777.)

The causes of this peculiar distemper in dogs are at present unknown, and little more than conjecture prevails upon the subject. It is not positively known, whether rabies sometimes originates spontaneously in these animals, though I believe this opinion is at present gaining ground; or, whether, like small-pox in the human species, it is propagated only by contagion. That the disease is frequently imparted, in consequence of one dog biting another, every body well knows; yet, there are many instances, in which this mode of propagation cannot be suspected. Several facts render it probable, that among dogs, the disease is often communicated by contagion. It is observed, that in insular situations, dogs are seldom affected, and this circumstance is ascribed to such animals being in a kind of quarantine. The celebrated sportsman, Mr. Meynell, secured his dogs from the malady, by making every new hound perform a quarantine before he was suffered to join the pack. (See *Trans. for the Improvement of Med. and Chir. Knowledge*, vol. i. art. 17.) Great heat was very commonly supposed to be an exciting cause of the disease in dogs; but without much foundation.

A very hot climate, or one exposed to the extremes of heat and cold; a very hot and dry season; feeding upon putrid, stinking, and maggoty flesh; want of water; worms in the kidneys, intestines, brain, or cavities of the nose," are set down by Boerhaave as causes of the disease. (Aphorism 1134.) We learn from Dr. J. Hunter, that, in the hot island of Jamaica, where dogs are exceedingly numerous, not one was known to go mad during forty years. (*Trans. for the Improvement of Med. Knowledge*, loc. cit.) Cold weather has also been set down as conducive to rabies among the canine race, as is suggested, because, the ponds being frozen, these animals cannot quench their thirst. (*Id. ibid.*) That neither of these sentiments, about heat and cold being the cause of the origin of the disease in dogs, is correct, will be manifest enough to any body who has patience to

look over the volume of the *Mém. de la Soc. Royale de Méd.* devoted entirely to the consideration of rabies; and from the investigations of M. Andry (*Recherches sur la Rage*, 8vo. Paris, 1780.) it appears, that January, the coldest month in the year, and August, the hottest, are those which furnish the fewest instances of hydrophobia. On the contrary, the greatest number of rabid wolves is in March and April; and that of dogs, affected with spontaneous rabies, in May and September.

According to Savary, dogs never go mad in the Island of Cyprus, nor in that part of Syria, which is near the sea; and Volney assures us, that these animals enjoy the same fortunate exemption both in the latter country, and in Egypt. (*Voyage en Syrie*, t. i.) The traveller Brown also declares, that, in Egypt, they are never, or very rarely, attacked with rabies.

"Although (says Baron Larrey) hydrophobia is more frequent in warm, than temperate climates, it is not observed in Egypt; and the natives assured us, that they knew of no instance, in which this disease had manifested itself, either in man, or animals. No doubt, this is owing to the species and character of the dogs of this country, and their manner of living.

"It is remarked, that the Egyptian dogs are almost continually in a state of inaction: during the day, they lie down in the shade, near vessels, full of fresh water, prepared by the natives. They only run about in the night-time: they evince the signs and effects of their love but once a year, and only for a few instants. They are seldom seen coupled. On our arrival, there was a vast number of these animals in Egypt, because they were held, like many others, in great veneration, and were never put to death. They do not go into the houses: in the day-time, they remain at the sides of the streets; and they only wander into the country at night, in order to find any dead animals, which happen to be unburied. Their disposition is meek and peaceable, and they rarely fight with each other. Possibly, all these causes may exempt them from rabies." (*Larrey, in Mém. de Chir. Militaire*, t. ii. p. 226.)

This observation, about the exemption of the Egyptian dogs from rabies, is very ancient, having been made by Prosper Alpinus. (*Res. Egyptiarum*, lib. iv. cap. 8.) According to Barrow, the dogs in the vicinity of the Cape of Good Hope, and in Caffraria, very rarely go mad. (*Travels into the Interior of Africa*.) Several authors assert, that rabies never occurs in South America. (*Bibl. Raisonnée*, 1750. *Van Swieten, Comment. in Aphor.* 1129. *Portal*, &c.) L. Valentin declares, that it is exceedingly rare in the warm regions of America, but common in the northern part of that continent. (*Journ. Gén. de Méd.* t. xxx.) Dr. Thomas, who resided a good while in the West Indies, never saw, nor heard of a case of rabies there (*Practice of Physic*); and Dr. B. Moseley states, that the disorder was not known in those islands, down to 1783. On the other hand, the disease sometimes happens in the East Indies, though not with such frequency, as at all to justify the doctrine about heat being the cause of its production. The silence of Hippocrates proves, that in his days, hydrophobia must have been very rare in Greece; and, as the disorder is not mentioned in the Scriptures, an inference may be made, that it could not be so common in the hot tracts of the

globe, inhabited by the Hebrews, as in the temperate climates of Europe and America.

Neither can the sentiment be received as correct, that rabies is more frequent in the north, than in the temperate parts of Europe; for, De la Fontaine particularly notices how extremely rare it is in Poland. (*Chir. Med. Abhandl. Breslau*, 1792.) The disease is reported to be very common in Prussian Lithuania; but mad dogs are seldom or never heard of at Archangel, Tobolsk, or in the country north of St. Petersburg.

In Mr. Meynell's account, which was communicated to him by a physician, it is asserted, that the complaint never arises from hot weather, nor putrid provisions, nor from any cause except the bite; for, however dogs have been confined, however fed, or whatever may have been the heat of the season, the disorder never commences, without a possibility of tracing it to the preceding cause; nor was it ever introduced into the kennel, except by the bite of a mad dog. (See art. *Dog*, in *Rees's Cyclopaedia*.)

Dr. Gillman endeavours to prove, that the disease in dogs is probably excited independently of particular climates, of putrid aliment, of deficiency of water, of want of perspiration, or, of the worm under the tongue, to which causes it has been at different times ascribed; and he expresses his belief, that it originates somewhat like typhus in the human subject, and is not always produced by inoculation, or by means of a bite. He thinks, that it may be occasionally brought on by the confinement of dogs, without exercise, in close and filthy kennels; and that the success of Mr. Trevalyan, as related by Dr. Bardsley, in clearing his kennel of the disease, by changing even the pavement, after other means of purification had failed, affords presumptive evidence in favour of the opinion; and, consequently, this author thinks that the method of quarantine, adopted by Mr. Meynell, and recommended by Dr. Bardsley, on the supposition that the disease originates exclusively from contagion, will not be a sufficient preventive alone; and he infers, from some facts, reported by Mr. Daniel, that the poison sometimes lies dormant in dogs, four, five, and six months; and, consequently, that the period of two months is not a sufficient quarantine. (See *Gillman's Diss. on the Bite of a Rabid Animal*.)

In opposition, however, to some of the sentiments contained in the foregoing passage, it should be known, that Dupuytren, Magendie, and Breschet, have purposely kept many dogs for a long time in the most disgusting state of uncleanness, let them even die in this condition for want of food and water, or even devour each other, yet without exciting rabies. (*Dict. des Sciences Méd.* t. xlvii. p. 53.) Yet Professor Rossi, of Turin, is said to have produced this, or some similar disease, in cats, by keeping them shut up in a room. (*Mém. de l'Acad. Imp. de Turin*, 1805 à 1808, p. 93, *de la Notice des Travaux*.) On the whole, I consider it well proved, that neither long thirst, hunger, eating putrid flesh, nor filth, will occasion the disease in the canine race. At Aleppo, where these animals perish in great numbers from want of food and water, and the heat of the climate, the distemper is said to be unknown. Nor is rabies found to attack dogs and cats with particular frequency during the copulating season, and therefore, the *castrus veneris* cannot be admitted to have

any share in its production, as some writers have been disposed to believe. (See *Dict. des Sciences Méd.* t. xlvii. p. 55.)

Although most writers believe in the reality of a poison, or specific infectious principle, in cases of rabies, the fact has been questioned, or absolutely rejected, by others. Bosquillon considered the disease always as the effect of fear, or an impression upon the imagination. This view of the matter is far from being new, and has been ably refuted by many authors, and especially by M. Desault, of Bordeaux, who remarks that horses, asses, and mules, *quibus non est intellectus*, had died rabid the very year in which he wrote; and, it is observed by Dr. J. Vaughan, that an infant in the cradle is sometimes attacked, while many timorous children escape.

Another notion has partially prevailed, that rabies does not depend upon any virus, but upon the continuance of an irritation in the bitten parts, affecting the whole nervous system. (*Percival*; *J. Mease*; *Girard*, &c.) But this doctrine confounds rabies and tetanus together, and can only apply to the symptomatic non-infectious hydrophobia from an ordinary wound, or laceration.

The facts, in proof of the reality of a peculiar infectious principle in cases of rabies, are too numerous to leave any doubt upon the subject. Twenty-three individuals were bit one morning by a female wolf, of whom thirteen died in the course of a few months, besides several cows, which had been injured by the same animal. How could all these unfortunate persons have had similar symptoms, and especially a horror of fluids, had they not been all under the influence of some cause, besides the bites? The patients who died were bit on the naked skin; while in the others, who escaped infection, the bites happened through their clothes, which no doubt intercepted the saliva, the vehicle of the virus. In the Essay by Le Roux, mention is made of three persons, bit by a rabid wolf near Autun, in July 1781, and, notwithstanding mercurial frictions, they all died of hydrophobia. Of ten other individuals bit by a wolf, nine died rabid. (*Rey, Mém. de la Soc. Royale de Méd.* p. 147.) Twenty-four persons were injured in the same manner near Rochelle, and eighteen of them perished. (*Andry, Recherches sur la Rage*, ed. 3. p. 196.) On the 27th January, 1780, fifteen individuals were bit by a mad dog, and attended at Senlis by the Commissioners of the French Royal Society of Physic: ten had received the bites on the naked flesh, and five through their clothes. Of the first ten, only five lost their lives, three of them dying of decided rabies between the 27th of February, and the 3d of April; and the other two between the 29th of February, and the 18th of March. Unless the opinion be adopted, that the disease is caused by an infectious principle, a sort of inoculation, it would be impossible rationally to explain the cause of so many deaths from the bites of rabid animals. If the idea, that rabies originates from fear, or nervous irritation, were true, how could we account for there being such a difference between the usual consequences of the bite of a healthy dog, and those of the bite of one affected with rabies? Healthy dogs are incessantly quarrelling, and biting each other in the streets, yet their wounds are not followed by rabies, and, as a modern author remarks, if hydrophobia

were referrible to nervous irritation derived from the wounded part, how does it happen, that, amongst the thousands of wounded after a great battle, hydrophobia is not seen instead of tetanus? (*Dict. des Sciences Méd.* t. xlvii. p. 61.) But, if it were yet possible to entertain a doubt of an infectious principle in hydrophobia, this possibility would be removed by the reflection, that the disease may be communicated to healthy animals by inoculating them with the saliva of certain other rabid animals. In fact, as I have stated, the bites of such animals are in every point of view only an inoculation; and the same remark may be extended to the numerous instances on record, in which the disease arose in the human subject, as a consequence of a rabid dog or cat (not suspected to be in this state at the time) having been played with, fondled, or suffered to lick the naked skin, in which there was at the moment some slight scratch, entirely overlooked.

Many of the ancient writers not only believed in the hydrophobic virus, or infectious principle, but even in its diffusion through the blood, flesh, and secretions in general; and this hypothesis was professed by Boerhaave, Van Swieten, Sauvages, F. Hoffman, &c.; but, in proportion as the humoral pathology lost ground, the foregoing idea was abandoned, and the opinion adopted, that the infection is confined to the saliva, and wounded part, in which it has been inserted.

The tales of some old authors would lead one to think, that hydrophobia may be communicated by eating the flesh of a rabid animal. (*Fernelius, De Obs. Rer. Caus. et Morb. Epidem.* lib. ii. cap. 14.; *Schenckius, Mangetus, &c.*) But, respecting these accounts, it is remarked, that they are not entitled to much confidence; for, it is certain, that rabies never begins, as is stated with regard to some of the cases in question, a few hours after the application of its cause, and its early stage is never characterised by any fury, or disposition to bite. And, besides, how can such relations be reconciled with the practice of the ancients, who, according to Pliny, employed the liver of the mad dog, or wolf, as a remedy? Palmarius also fed his patients for three days with the dried blood of the rabid animal. (*Mém. de la Soc. de Méd.* p. 136.; et le No. 178.) The flesh of a bullock, which had been bit by a mad dog, and afterwards died rabid, was sold to the inhabitants of Medola near Mantua, yet none of them were attacked with hydrophobia. (*Andry, Recherches sur la Rage, &c.* p. 30.) Dr. le Camus informed Larrey, that he had eaten the flesh of animals, which died rabid, but he suffered no inconvenience from the experiment. And, it is stated in the letter of Dr. L. Valentin, that certain negroes in the United States of America had no illness from eating the flesh of pigs, which had died of rabies. (*Journ. Gén. de Méd.* t. xxx. p. 417.) As for the question, whether the blood is infected? it is generally considered to be settled in the negative, notwithstanding the account given by Lémery of a dog, which was attacked with rabies, as is said, from lapping the blood of a hydrophobic patient, who had been bled. (*Hist. de l'Acad. Royale des Sciences, 1707.* p. 25.) Dupuytren, Brachet, and Magendie, were never able to communicate rabies by rubbing wounds with blood taken from mad dogs; and they even several times injected such blood into the veins of other healthy dogs, yet none of these latter animals

were attacked with rabies, though they were kept for a sufficient length of time to leave no doubt upon the subject. (*See Dict. des Sciences Méd.* t. xlvii. p. 63.)

A point of greater practical interest, than the former, is, whether the drinking of the milk of an animal, labouring under rabies, is attended with any risk of communicating the disease? It is asserted by Timæus, that a peasant, his wife, children, and several other persons, were seized with hydrophobia, in consequence of drinking the milk of a rabid cow; and that the husband and eldest child were saved by medical treatment; but, that the wife and four of the children died. It is further stated, that three or four months afterwards, the maid and a neighbour, who had partaken of the milk of the same cow, also died of hydrophobia. (*Cons. vii. obs. 33.*) In opposition to this account, however, several facts, reported by other writers of greater credit, tend to prove, that hydrophobia cannot be communicated by the milk of a rabid animal. (*Nova Acta Nat. Cur.* vol. i. obs. 55. *Baudot, in Mém. de la Soc. Royale de Méd.* an. 1782, et 13. t. ii. p. 91.)

The cases; reported by F. Hoffman and Chabert, with the view of proving the possibility of infection, through the medium of the semen, are of no weight, because, on a critical examination of them, it will be found, that the infection of the women is stated to have taken place very soon after their husbands had been bit, which is quite at variance with the established character of the disease, as it never commences, and of course cannot be propagated in any manner, soon after the receipt of the bite. Besides, these histories are refuted by others of greater accuracy. (*See Baudot, in Mém. de la Soc. Royale de Méd.* an. 1782, &c. p. 92. *Rivallier, vol. cit.* p. 136. 211. *Routeille, p. 237.* *Boissière, in Journ. Gén. de Méd.* t. xvii. p. 296.)

Neither can hydrophobia be imparted by the breath, notwithstanding the statements of Calius Aurelianus, and some other old writers. A nurse, mentioned by Dr. J. Vaughan, repeatedly kissed a hydrophobic infant, which she had suckled, and exposed herself incessantly to its breath, but without the least ill effects. The fear which has also been entertained, of the disorder being receivable from the application of the patient's perspiration to the skin, is not founded upon any authentic facts.

Does the infectious principle of rabies reside in the salivary secretion, or in the mucus of the trachea and bronchi? The common belief is, that, in hydrophobia, the salivary glands are considerably affected. But, it has been remarked by a modern writer, that if these glands exhibit no morbid alteration during the whole course of the disorder; if they are found healthy after death; if the air-passages are the seat of inflammation; if the saliva does not constitute the frothy slaver about the lips; and if such slaver, wherewith the disease may be communicated by inoculation, is derived from the inflamed windpipe and bronchi, and consists of mucus converted into a kind of foam by the convulsive manner in which the patient breathes; there is some reason for questioning, whether the saliva, strictly so called, undergoes the alteration generally supposed? (*See Dict. des Sciences Méd.* t. xlvii. p. 66.) However, this writer is not exactly correct, when he describes the frothy secretion about the mouth, as being alto-

gether composed of mucus from the trachea, since a great part of it is unquestionably true saliva and mucus secreted in the fauces and mouth. In the stomachs of dogs, which died rabid, Dr. Gillman constantly observed traces of inflammation, and he once tried to communicate the disease to two rabbits, by inoculating them with matter taken from pustules found in the stomach of a rabid dog; but no infection took place. (*On the Bite of a Rabid Animal*, p. 32.)

According to professor Rossi, of Turin, the nerves, "before they grew cold, participated with the saliva in the property of communicating rabies." He asserts, that he once imparted the disease by inserting in a wound, a bit of the sciatic nerve, immediately after it had been taken from a living rabid cat. (See *Mém. de l'Acad. Imp. de Turin, Sciences, Phys. et Mathém.* de 1805 à 1808, part xciii. de la *Notice des Travaux*.)

After all which has been stated, concerning the hypothesis of the infectious principle of hydrophobia being more or less diffused through the solids and fluids of a rabid animal, and not being restricted to the saliva, perhaps the safest conclusion to be made is, not to reject the opinion altogether, but to consider it as at present requiring further proof. And from observations of what happens in the human subject, the same inferences should not always be drawn, as from experiments on animals, which are liable to be attacked with spontaneous rabies of a decidedly infectious character. (See *Dict. des Sciences Méd.* t. xlvii. p. 67.)

Although many cases are to be met with in the records of medicine and surgery, tending to convey an idea, that the mere application of the saliva of a rabid animal to the sound entire skin of the human subject, may give rise to hydrophobia, the assertion is contrary to general experience, and liable to a reflection which must overturn the hypothesis; viz. the slightest prick, scratch, abrasion, or broken pimple on the surface of the body, such as would not be likely in many instances to excite notice, may render the application of the saliva to the part a positive inoculation.

Instances are also reported, the tenor of which is to prove, that the hydrophobic virus may take effect through a sound mucous membrane. (*Palmarius, de Morbis Contag.*; *Portal, Obs. sur la Rage*, p. 131.; *Matthieu, in Mém. de la Soc. Royale de Méd.* p. 310, &c.) But, that this does not happen in the human subject is tolerably well proved by the consideration, that formerly a class of men made it their business to suck the wounds caused by the bites of rabid animals; yet none of them contracted hydrophobia from this bold employment. (*Bosquillon, Mém. de la Soc. d'Emulation*, t. v. p. 1.) The example of the nurse, who repeatedly kissed a child without the least ill effect, while it was dying of rabies, as recorded by Dr. J. Vaughan, has been already noticed. However, if hydrophobia were apparently to arise in any rare instance from the application of the saliva of a rabid animal to the inside of the lips, no positive inference could be drawn from the fact, unless the means were also possessed of ascertaining, that there were no slight abrasions about the gums, or within the mouth, previously to such application.

For the hydrophobic virus to take effect, there-

fore, it is generally, if not always necessary, that the infectious saliva be either applied to an abraded, wounded, or ulcerated surface. In the case of a bite, the teeth are the envenomed weapons which at once cause the solution of continuity, and deposit the infection in the part. But the mere abrasion of the cuticle, and the application of the infectious saliva to the denuded cutis, will often suffice for the future production of the disease. As the mode of communication, therefore, is a true inoculation, it follows, that the danger must depend very much upon the quantity of infectious matter conveyed into, or applied to the part, the effectual manner in which the saliva is lodged in the flesh, the extent and number of the wounds, and particularly the circumstance of the teeth of the rabid animal having passed through no clothes, by which the saliva might possibly be effectually prevented from entering the wound at all. Hence, bites on the hands and face are well known to be of the most dangerous description, especially those on the face, the hands being sometimes protected with gloves.

From what has been observed, however, it is not to be concluded, that the disease always follows, even when the animal, which inflicts the bite, is decidedly rabid, and some of its saliva is actually applied to the wounded, or abraded parts. On the contrary, experience fully proves, that out of the great number of individuals often bit by the same mad dog, and to whom no effectual prophylactic measure is extended, only a greater or lesser number are afterwards attacked with hydrophobia. When this difference in the fate of the individuals cannot be explained by the intervention of their clothes, the thickness of the cuticle at the injured part, the small size and superficial nature of the bite, the ablation of the part, or some other mode, in which any actual inoculation may have been rendered ineffectual, it can only be referred to some unknown peculiarities or differences in the constitutions of the several individuals. The latter conjecture seems more probable, when the fact is recollected, that some animals are more susceptible of rabies than others, and some appear to resist the infection altogether.

Dogs are more susceptible of the infection, than the human species. Four men, and twelve dogs, were bit by the same mad dog, and every one of the dogs died of the disease, while all the four men escaped, though they used no other means of prevention but such as we see every day fail. There is also an instance of twenty persons being bit by the same mad dog, of whom only one had the disease.

Dr. Heysham has defined hydrophobia to be an aversion and horror at liquids, exciting a painful convulsion of the pharynx, and occurring at an indeterminate period after the canine virus has been received into the system. Dr. Cullen places it in the class *neuroses*, and order *spasmi*; and defines it, a loathing, and great dread of drinking any liquids, from their creating a painful convulsion of the pharynx, occasioned most commonly by the bite of a mad animal. Others have suggested the following definition, as more complete:—melancholy, dread of cold air, of any thing shining, and particularly of water; often arising from the bite of a mad animal. (*Parr's Med. Dict.*) However, the latter definition is, perhaps, equally objectionable, because there is not invariably a dread of shining

bodies. (See *Dr. Powell's Case*, p. viii.) While some authors represent it as a nervous disorder, others, amongst whom is Boerhaave, consider it as one of an inflammatory nature. In many systems of surgery, hydrophobia is treated of with poisoned wounds, of one species of which it is strictly the effect.

With regard to the symptoms of hydrophobia, they are generally tardy in making their appearance, a considerable, but a very variable space of time usually elapsing between their commencement and the receipt of the bite. Out of a table of 131 cases, none of the patients became ill before the eleventh day after the bite, and only three before the eighteenth. It is pretended by Pouteau, that one patient was bit by a dog in the morning, and was attacked with hydrophobia at three o'clock in the afternoon. But, as this account was communicated to the author a long time after the occurrence, and not by a medical man, it deserves little confidence. Another case, adverted to by Mead, is deprived of all its importance by the same consideration. These examples, as well as another reported by Astruc, in which the patient is said to have had hydrophobia in less than three days, after being wounded on the temples, can at most be regarded only as specimens of symptomatic hydrophobia. (*Dict. des Sciences Méd.* t. xlvii. p. 74.) There appears to be no determinate period, at which the disorder makes its attack after the bite; but, it is calculated, that the symptoms most frequently commence between the 30th and 40th day, and that after this time the chances of escape increase. Of 15 patients, whose cases Trollet was acquainted with, seven were attacked between the 14th and 30th days; five between the 30th and 40th; two a little beyond the latter period; and one after 14 weeks. In May, 1784, 17 persons were bit by a rabid wolf near Brive, of whom 10 were afterwards attacked with hydrophobia; viz. one on the 15th day after the bite; one on the 18th; one on the 19th; one on the 28th; one on the 30th; one on the 33d; one on the 35th; one on the 44th; one on the 52d; and the last on the 68th day. (*Hist. de la Soc. Royale de Méd.* p. 209.) Fothergill and Mosely mention cases, in which the disease began four months after the bite; and M. Matthey, of Geneva, details an instance, in which the interval was 117 days. (*Journ. Gén.* t. liv. p. 275.) Haguenot knew of a case, in which the interval, between the bite and the commencement of the illness, was five months. (*Portal*, p. 183.) Dr. J. Vaughan mentions an interval of nine months; Mead of 11; Galen, Bauhin, and Boissière, of a year; Nourse of 19 months; and R. Lentilius of three years.

Dr. Bardsley, of Manchester, has recorded a case, in which the most careful inquiries tended to prove, that the patient had never suffered the least injury from any animal, except the bite, inflicted twelve years previously to the commencement of hydrophobia, by a dog apparently mad. (*Mém. of Liter. and Phil. Society of Manchester*, vol. iv. part ii. p. 431.)

A merchant of Montpellier is also stated to have been attacked with hydrophobia ten years after the bite of a rabid dog, which also bit the patient's brother, who died hydrophobic on the 40th day after the accident. (See *Dict. des Sciences Méd.* t. xvii. p. 18.) Here may also be found references to cases, in which the interval is alleged to have

been 18, 20, and even 30 years. It is certainly difficult to attach any credit to these very late periods of attack. Dr. J. Hunter considers 17 months, and Dr. Hamilton 19, the longest interval deserving belief. (*On Hydrophobia*, vol. i. p. 113.) Exposure to the heat of the sun, violent emotions of the mind, and fear, are believed to have considerable influence in accelerating the commencement of the symptoms. That mental alarm is also of itself sometimes capable of bringing on a simple hydrophobia, totally unconnected with infection, is incontestible; a case, which has not always been duly discriminated. A most convincing proof of this fact is recorded by Barbaudini, in the *Italian Journ. of Physic, Chemistry, &c.* for January and February, 1817. A young man was bit by a dog, which he fancied was mad, and on the 5th day he evinced symptoms of hydrophobia, of which he was nearly dying, when the dog, which had bit him was shown to him perfectly well, and the intelligence tranquillised him so effectually, that he was quite well four days afterwards. Mr. John Hunter is said to have mentioned in his Lectures a very similar case, in which he believed the patient would certainly have died, if the dog, which inflicted the bite, had not been found, and shown to the patient perfectly well. (See *Journ. Gén. de Méd.* t. xli. p. 215.) It is to the effects of terror, that several modern writers are disposed to refer the instances of very late attacks of hydrophobic symptoms after the period when the patients were bitten; though, unless the intellects be changed in the meantime by other causes, it is difficult to conceive, why the alarm should not have the greatest effect earlier, while the impression of the danger is undiminished by time. The idea, that the symptoms begin sooner, after the bite of a wolf, than that of a dog, is not adopted by a writer, who has taken great pains to collect information on the present interesting disorder. (See *Dict. des Sciences Méd.* t. xlvii. p. 77.)

Cullen has divided the disease into two stages, the hydrophobia *simplex* and *rabiosa*; or the *melancholy* and *raving* stages of some other writers. But, as the early stage is frequently unattended with any thing like melancholy, it is best merely to adopt the distinction of the *first* and *second* stages; one comprehending the effects of the disorder previously to the occurrence of a dread, or decided aversion of liquids; the other, the subsequent changes. The wound, if treated by common methods, usually heals up at first in a favourable manner. At some indefinite period, and, occasionally, long after the bitten part seems quite well, a slight pain begins to be felt in it, or the neighbouring parts, now and then attended with itching, but generally resembling a rheumatic pain. If the bite took place on the finger, the pain successively extends from the hand to the forearm, arm, and shoulder, without any redness or swelling in these parts, or any increase of suffering from pressure or motion of the limb. In a great number of instances, the trapezius muscle, and the neck, on the same side as the bite, are the points to which the pain principally shoots. The cicatrix, in the meanwhile, begins to swell, inflames, and often festers, and discharges an ichorous matter. These uneasy, painful sensations recur from time to time, and usually precede any dread of water several days; and, they are a just reason for apprehension. Sometimes, pains of a more flying, convulsive kind,

are felt in various parts of the body. As the disease advances, the patient complains of the pain shooting, from the situation of the bite, towards the region of the heart. Sometimes, instead of pain, there is rather a feeling of heat, a kind of tingling, or even a sensation of cold, extending up to the chest and throat. Occasionally no local symptoms take place: thus Sabatier, in giving an account of several cases, remarks it as worthy of notice, that the bitten parts did not become painful previously to the accession of the fatal symptoms: nor did any swelling, or festering occur. (See *Mém. de l'Institut. National*, t. ii. p. 249, &c.)

Dr. Marcet particularly observed, that the pain follows the course of the nerves, rather than that of the absorbents. In the case which he has related, as well as in one of the cases, detailed by Dr. Babington, there was pain in the arm and shoulder, but without any affection of the axillary glands; and in another case (see *Medical Communications*, vol. ii.), the pain, occasioned by a bite in the leg, was referred to the hip and loins, without any affection in the inguinal absorbents. (*Medico-Chir. Trans.* vol. i. p. 156.) Of the accuracy of the foregoing statement, by Dr. Marcet, there is no doubt: the observation, however, in regard to the irritation not affecting the absorbents, was long ago anticipated by several authors, who urged the freedom of the lymphatic glands from disease, as an argument, that the disorder did not depend upon the absorption of any virus. It is also noticed by others, who inclined to the belief in the absorption of the infectious principle. "*Resorptionem virus ope systematis lymphatici fieri veisimillimum videtur; neque tamen nec vasa lymphatica, nec glandulæ vicinæ stimulo morbozo, vel tumore adfici videntur; quod in aliis resorptionibus virulentis fieri solet.*" (*Callisen, Syst. Chirurgiae Hodiernæ*, vol. i. p. 595. Hafniæ, 1798.)

Pain and heaviness are felt in the head. Sometimes, the headache is at first very severe; sometimes but slight; but, in the latter case, it often becomes afterwards intense, general, and accompanied with a sense of pressure upon the temples. In certain instances, the patient's sleep lasts a good while, though disturbed by dreams; while, in other more frequent examples, he is continually restless. The intellectual functions generally seem increased; the memory stronger; the conception more ready; the imagination more fertile; and the conversation more animated. However, some patients are silent, and dejected, and when questions are put to them, the answers are short and peevish. But the greater number are active, lively, and talkative. At the same time, the organs of sense betray signs of increased sensibility; and the eyes, which are very open and bright, avoid a strong light. Sometimes, the pupil is found to be considerably dilated. Extraordinary pains are felt about the neck, trunk, and limbs. It is not uncommon, also, for the patient to evince great anxiety, or to fall into a state of dull despair and melancholy. These last symptoms, of which great notice is taken by writers, are particularly ascribable to the effect of fear. The disorder of the organs of digestion is sometimes manifested in various ways, though it is far from being so frequent and striking, as the affections of the head, which precede it. The disorder referred to, consists at first in loss of appetite, nausea, vomiting;

and afterwards constipation, and sometimes colic. In the first stage of the disease, the pulse is generally somewhat more frequent and strong, than in health, and the countenance appears more animated.

The above symptoms precede the second stage, or that of decided rabies, only by a few days, usually four or six, though sometimes, but two, or three. (*Dict. des Sciences Méd.* t. xlvii. p. 78.)

The second stage of hydrophobia commences with the first manifestation of the dread, or aversion of liquids. The ungovernable agitation and distressing sense of suffocation excited by the sight of liquids, the attempt to drink, or even the mere idea of drinking, is unquestionably the most remarkable symptom of the disorder. The patient is also frequently attacked with the same kind of commotion and suffering from other causes, such as the least agitation of the air, or exposure to a strong light. Indeed, some patients are so much affected by a blast of wind, that they have been known to endeavour to elude it by walking with their backs towards it. (*Hist. de la Soc. Roy. de Méd.* p. 157.) while others scream out whenever the window or door of their room is opened. (*Morgagni, De Sed. et Caus. Morb.* epist. viii. No. 28.)

Dr. Marcet, in relating the case of a patient affected with hydrophobia, observes, that "on our proposing to him to drink, he started up, and recovered his breath by a deep convulsive inspiration; yet, he expressed much regret that he could not drink, as he conceived it would give him great relief, his mouth being extremely parched and clammy. On being urged to try, however, he took up a cup of water in one hand, and a teaspoon in the other. The thought of drinking out of the cup appeared to him intolerable; but, he seemed determined to drink with the spoon. With an expression of terror, yet with great resolution, he filled the spoon, and proceeded to carry it to his lips; but before it reached his mouth, his courage forsook him, and he was forced to desist. He repeatedly renewed the attempt; but, with no more success. His arm became rigid and immovable, whenever he tried to raise it towards his mouth, and he struggled in vain against this spasmodic resistance. At last, shutting his eyes, and, with a kind of convulsive effort, he suddenly threw into his mouth a few drops of the fluid, which he actually swallowed. But, at the same instant, he jumped up from his chair, and flew to the end of the room panting for breath, and in a state of indescribable terror." (*See Méd. Chir. Trans.* vol. i. p. 158.) Even the splashing or running of any liquid causes a great deal of inconvenience. As the system becomes more and more affected, the patient loses his sleep entirely, and has frequent and violent fits of anxiety and loud screaming, from slight causes. The woman, whom Dr. Powell attended, was often attacked in this way, in consequence of so trivial a circumstance as a fly settling on her face. The noise of taccups, or the mention of any sort of drink, greatly disturbed her, though she was not at all agitated by the sound of her urine. The currents of air entering her room, whenever the door opened, became very distressing to her, and this more and more so. The pain in her neck became so great, that she could scarcely bear it to be touched; but

she made use of a looking-glass without the inconvenience, which hydrophobic patients usually suffer from the sight of shining bodies. Dr. Powell states, that the paroxysms, which this poor woman suffered, resembled those of hysteria, and increased in duration as the disorder lasted. "She described their commencement to be in the stomach, with a working and fullness there, and that a prickling substance passed up into her throat and choked her; she screamed suddenly, and grasped firmly hold of her attendants, as if voluntarily; and muscular convulsions came on, which were sometimes more, sometimes less, general and violent. The causes from which these paroxysms arose, were extremely slight; the passage of a fly near her face, the attempt to swallow a pill, a stream of air, the sight of oil or wine, or any other liquids, even the sound of water, and other such circumstances, were sufficient; she now also complained of inconvenience from light, which was accordingly moderated. The effect of sounds was peculiar; for, though in the subsequent stages their influence became more general, at this period the effect was rather proportionate to the ideas they excited in her mind, than to their violence. Bells, and other strong noises, did not agitate her, but the clatter of earthenware, the noise of a distant pump, or any thing connected with fluids, produced the paroxysms in all their violence." She could swallow frost, currents with less resistance than any thing else, taking care that they were perfectly dry. Her mind had, till now, been quite calm and composed, and her conversation and behaviour proper during the intervals of the convulsive attacks. But Dr. Powell was obliged to discontinue the pills of argemum nitratum, in consequence of the sufferings which the attempt to swallow them regularly brought on. Fifteen grains of this substance had been given without any sensible effect. The fits, and the irritability to external objects, increased. The pain shot from the back of the neck, round the angles of the jaws, the chin, and throat. At length, the paroxysms became more frequent, and, indeed, might be said to come on spontaneously: seven occurred in one hour. She looked pale and exhausted, and a tremor and blueness of her lips and fingers were observable; her pulse became weaker and more rapid, and her scalp so tender, that touching it brought on convulsions. She had, latterly, eructations of wind, and spit up some thick viscid saliva. Her urine now came away involuntarily, and she was more and more irritable and uncontrollable. Indeed, she passed two hours in almost constant convulsions; became extremely irritable and impatient of every thing about her; complained of failure of her sight; wished to be bled to death; her words were fewer and interrupted; she struck, and threatened to bite, her attendants, had copious eructations of air; discharged an increased quantity of viscid saliva with much convulsive effort; said the affection of her throat and stomach had quite left her; and continued in a general perspiration, with a weak pulse from 140 to 150. She afterwards bit some of the attendants, and was therefore confined with a waistcoat. From this period she had lost all control over her mind, and continued for almost four hours in a paroxysm of furious insanity. She now swallowed, with an effort, nearly half a pint of water; but this was, in a few seconds, vomited up, with some sanguis, and

a greenish fluid. In this violent raving state, she continued till within two hours of her death, which took place forty-seven hours after the first marked occurrence of hydrophobia. In the course of the case, she swallowed once, or twice, a little porter; and also some cinnamon-water, with tinct. opii; but they were always vomited up. (*Dr. Powell's Case of Hydrophobia.*)

It is by no means uncommon for a period to occur, when the horror of liquids undergoes a considerable diminution, or even entirely ceases; the patient quenching his thirst, and this sometimes as well as if he were in perfect health, and so as to raise doubts of the existence of rabies. But, after a few hours, the dread of fluids comes on again, and with it the convulsive paroxysms, which now become general, violent, and incessant. Dr. Cayol attended a girl, labouring under rabies, who was never affected with any very great dread of liquids, nor an absolute inability to swallow them, though she certainly disliked them, and swallowed them with difficulty. (*Journ. de Méd. Chir. &c. Août, 1811, p. 241.*) Nay, patients are sometimes seen who can manage to swallow red wine and broth, though their aversion to water is already beyond all control; and other patients can sometimes look at a liquid in a black pot without inconvenience; though any fluid offered to them in a glass will bring on a violent paroxysm of spasm and sense of suffocation. The sight of tears has even been enough to bring on the attack. (*See Dict. des Sciences Méd. t. xlvii. p. 79.*)

The question has sometimes been entertained, whether rabies can ever exist quite unattended throughout its course with a dread of liquids? The possibility of such a case was believed by Meud, and others; and an instance is recorded by Mignot, in which the patient died, without having manifested any sign of hydrophobia. (*See Hist. de la Soc. Roy. de Méd. an. 1783, 2^{me} part. p. 48.*) However, it is asserted, that a careful perusal of this case must produce a conviction, that the disorder was not rabies; and it is added, that when the histories of this disease on record are critically investigated, none will be found complete, which do not make mention of a more or less decided aversion to fluids. It also appears from facts, referred to, that the dread of liquids does not depend upon the pain, which the patient has already suffered from his attempts to drink, as it sometimes occurs before any such attempt has been actually made. (*Vol. cit. p. 80.*)

An inclination to bite was evinced in the case recorded by Dr. Powell; and also in another reported by Magendie. Yet, this disposition is far from being usual; and it never presented itself in any of the cases, which fell under the observation of the author of the article *Stage* in the foregoing publication, or of P. Desault, Duchoise, Dr. Vaughan, Sabatier, Dupuytren, &c. And, even when the patient's imagination is so disordered, that he cannot help biting, he commonly warns the bystanders to avoid the danger. The frothy slobber, which is voided with considerable and repeated efforts, is a symptom, which is said not to commence before the respiration begins to be convulsive. As the disease advances, there is no remission of the sputation, necessary to clear the throat of this viscous secretion; and, at the approach of death, when it cannot be expelled, it collects in the mouth, and covers the patient's lips.

The symptoms of what is termed cerebral excitement become stronger and more marked in the second stage of the disease. The eyes, the brightness of which is still further increased, appear, as it were, inflamed; the patient never shuts them again; and, as the daylight and brilliant colours are offensive, he prefers darkness. The hearing becomes very acute, and, as well as the sight, is troubled with hallucinations. The touch is extremely fine; the speech abrupt and rapid; and the conversation energetic, and often expressive of the most touching sentiments. (*Dict. des Sciences Méd. t. xlvii. p. 12.*)

Dr. Marshall made a very just distinction, between the real convulsions which came on towards the termination of the case in death, and the strong sudden action of the muscles excited in the course of the disorder by the light, the sight of liquids, and the feel of the air. (*The Morbid Anatomy of the Brain, &c. p. 88.*) Convulsions and hiccough, in fact, are the symptoms of dissolution.

Delirium is far from being a constant symptom, and only happens the last day of the disorder. Neither is it always without remissions; for the patients affected with it sometimes give rational replies. Every case upon record, where delirium is described as being one of the first symptoms, or as coming on with the dread of liquids, is set down on good authority, not as true rabies, but a symptomatic hydrophobia, attended with mania.

The dread of swallowing liquids, though the most singular symptom of the disease, constitutes but a small part of it. It is true, that none, or very few, recover who have this symptom, yet, they certainly do not die in consequence of the difficulty of swallowing liquids; for, the human body could easily exist double the time at the end of which the disease usually proves fatal, without food or drink. Besides, the sick can often swallow substances that are nourishing, in a pulpy state, without their lives being thereby at all prolonged. It is not, therefore, the difficulty, or impossibility of swallowing liquids: but the effects of the poison upon the constitution at large, which occasion death. (*Dr. J. Hunter, in Trans. for the Improvement of Med. Knowledge, vol. i. p. 305.*)

The extreme sensibility of the sick to all impressions, appears in the displeasure which they express at even the air blowing upon them; in their dislike to a strong light; in their aversion to new faces, or even the sight of their friends and relations; and in the terror they express at being touched, which throws them into convulsions. In a case related by Magendie, the slightest noise, and even merely touching the patient's hair, excited convulsions of incredible violence. As the disease advances, the mind is more and more filled with dreadful fears and apprehensions. (*Op. cit. p. 307.*)

In the second stage, the epigastrium, as well as the chest, is the seat of considerable pain; the patient is constipated, but the urine is plentiful and high-coloured. Before a certain period, the pulse is generally strong, regular, and a little accelerated; but, towards the end of the case, it becomes small, irregular, feeble, and rapid. (*See Dict. des Sciences Méd. t. xlvii. p. 83.*)

The duration of life, from the appearance of hydrophobia till death, varies from thirty-six hours

to four or five days: the most common period is from two to three days. (*Dr. J. Hunter, Op. cit. p. 308.*) The event is said to be directly caused by asphyxia, or the cessation of respiration. Of ten persons, who were bitten by the same animal, nine died on the second and third day, from the commencement of the horror of fluids, and only one on the fifth day. There is an account of a child at Senlis, who lived nine days, but the description of the case, and the circumstance of fourteen worms being found in the intestines, may raise doubts about the nature of the disease. (*See Hist. de la Soc. Roy. de Méd. p. 155. 209.*)

Whatever may be the resemblance found between tetanus and hydrophobia, with regard to the rapidity of their course, their causes, and some of their symptoms, the following considerations, as a modern writer observes, will always serve for the discrimination of one disorder from the other: tetanus attacks the muscles of the jaw, which remains motionless; while in rabies, the jaw is not only moveable, but incessantly moving, in consequence of the efforts unremittingly made by the patient to free his mouth from the thick saliva, with which it is obstructed. In this last disorder, the muscles are alternately contracted and relaxed; but, in tetanus, they always continue rigid. Tetanus is rarely attended with any aversion to liquids, and the patient may be kept for a long time in ^{the} bath without inconvenience; and the paroxysms are neither excited nor increased by a vivid light, a noise, the patient's being touched, or the sight of water, or shining surfaces. In addition to these differences, it is to be remembered, that tetanus is most frequent in warm climates, and that it mostly comes on a few days after the receipt of a local injury, and may occur as a complication of any kind of wound, even that which is made in a surgical operation. (*See Dict. des Sciences Méd. t. xlvii. p. 68.*)

On the subject of prognosis, with respect to the bite inflicted by a rabid animal, and its effects, as evinced in the decided form of rabies, there are several things worthy of attention. According to some writers, small wounds are not less dangerous than others, and an attempt is made to account for the fact, by the more copious hemorrhage from larger wounds, and the frequent neglect of lesser injuries. Perhaps, another reason is, that the virus is more likely to be confined in a wound with a small orifice, than in one which is ample, and admits of being more effectually washed. The more numerous the wounds are, the greater is the risk. If it be inquired, what is the average number of persons attacked with rabies, out of a given number who have received bites!—the question can only be answered by referring to the extir. Thus, Dr. J. Vaughan speaks of between twenty and thirty individuals, bit by a mad dog, of whom only one was afterwards attacked with rabies; and Dr. J. Hunter tells us of an instance, in which, out of twenty-one persons bit, only one became affected. (*See also Fothergill, in Med. Obs. and Inq. vol. v. p. 195.*) On the other hand, out of fifteen persons bit by a mad dog, and taken care of at Senlis, three at least were seized with the disorder. (*Hist. de la Soc. Roy. de Méd. p. 130.*) Of seventeen others bit by a wolf, ten were attacked (*ib. p. 130.*); and of twenty-three bit by a sho-wolf, thirteen died of rabies. (*L. F. Trollet, Nouveau Traité, de la Rage, &c. Obs. Chir., &c. No. 25.*)

Two important facts should always be recollected; viz., the disease may often be prevented; it can hardly ever be cured. Experience has fully proved, that when hydrophobia once begins, it generally pursues its dreadful course to a fatal termination, the records of medicine furnishing very few unequivocal and well authenticated cases to the contrary. Hence, the imperious necessity of using every possible means for the prevention of the disorder.

Probably, however, many things which possess the character of being preventive of hydrophobia, have no real claim to such reputation. I would extend this observation to all internal medicines, mercurial frictions, and plunging the patient for a considerable time under water.

The instances, in which a prevention is inferred to have taken place by different writers, in consequence of such means, may all be very rationally ascribed to other circumstances. Facts already cited sufficiently prove, that, out of the great number of persons frequently bitten by the same dog, only a limited proportion is commonly affected. The hydrophobic poison is known to reside in the saliva of the animal; consequently, the chance of being affected must greatly depend upon the quantity of this fluid which is insinuated into the wound; and, if the teeth of the animal should have previously pierced a thick boot, or other clothing, before entering the skin, the danger must obviously be much diminished. Many patients wash and suck the wound, immediately after its occurrence, and thus, no doubt, very often get rid of the poison. Even when it is lodged in the wound, it may not be directly absorbed, but be thrown off with the discharge. All prudent patients submit to excision of the bitten part. Now, under each of the above circumstances, escapes have frequently occurred, while internal medicines, half-drowning, or salivating the patients, had also not been neglected, so that all the efficacy of preventives has too often been most unjustly ascribed to means, which probably never yet had, and never will have, any beneficial effect whatever. What confirms the truth of the preceding statement is these facts: that, persons bitten by the same animal, have sometimes been treated exactly on the same plan; some of them escaped the disease; others had it, and, of course, perished: on other occasions, some of the patients, bitten by the same animal, have been treated in a particular way, and have escaped hydrophobia; while others, bitten at the same time by the animal, also never had any constitutional effects, although they took no medicines, nor followed any other particular plan.

If to these reflections be added the consideration, that it is frequently doubtful whether the bite has actually been inflicted by a truly rabid animal, and that the mental alarm will sometimes bring on a symptomatic hydrophobia, it is easily conceivable how mistaken a person may be, who believes that he has prevented the disorder, and how unmerited is the reputation of the means which he has employed for the purpose.

The bite of a naturally ferocious beast has often been thought to be attended with more risk than that of an animal naturally tame; and hence, the bite of a wolf is said to be more frequently followed by rabies than that of a dog. This proposition is admitted to be true; but the explanation is erroneous. The true reason of the difference is,

that a wolf usually seizes the face, and inflicts a deeper bite; while a dog only snaps as he runs along, and mostly bites through the clothes. (See *Dict. des Sciences Méd.* t. xlviii. p. 88.) The bite of a rabid animal may be rendered much more dangerous by being situated near a part, or an organ, which increases the difficulty or risk of adopting an effectual mode of removing the whole of the flesh in which the virus may be lodged. Thus, bites near the large arteries, the eyes, the joints, &c. are of a more serious description than others. Dr. J. Hunter rated the hazard in some degree by the vascularity of the bitten parts. The prognosis will always be more unfavourable, when no proper measures have been applied to the bitesoon after its infliction, and perhaps the risk may be increased by certain causes not having been duly avoided, which, as already stated, are thought to have a tendency to accelerate the attack of rabies. The exact time after a bite, when the prevention of rabies is no longer practicable, is quite an undetermined point: but every fact, known upon the subject, evinces, in an urgent manner, the necessity of adopting preservative measures without the least delay.

In almost all the dissections of patients, who have died of rabies, certain indications of inflammation have been perceptible, more frequently, in some part of the space between the pharynx and the cardiac orifice of the stomach, in the stomach itself, in the lungs, the choroid plexus, and membranes of the brain. (See *Med. Repository*, vol. iii. p. 51.) M. Trollet opened, with the greatest care, six bodies of persons, destroyed by this disease. The mouth and fauces in each subject were first examined, and found of a pale grayish colour, scarcely lubricated with mucus, and quite free from all frothy matter. All the salivary glands seemed perfectly healthy. When the larynx, trachea, and bronchi were opened, they appeared to have been the seat of inflammation, the traces of which were the most marked low down, where the mucous membrane was of the colour of wine-lees. In four of the bodies, frothy mucus was perceived in the bronchi, larynx, and trachea. Trollet infers from these appearances, that the frothy matter, seen about the mouth and lips of patients affected with rabies, is secreted by the inflamed mucous membrane of the bronchi, and that it is this secretion, and not the real saliva, which contains the hydrophobic poison. (*Nouveau Traité de la Rage*, &c.) In giving an account of a dissection, Faure also long ago remarked, that the frothy matter was only met with in the air-passages, that the salivary organs were unaffected, and that the saliva itself did not contribute to the formation of the thick slaver, which appeared to have issued from the chest. (*Hist. de la Soc. Roy. de Méd.* ann. 1783, p. 93.) From the preceding observations, and those of Mignot de Genety (vol. cit. p. 54.), Morgagni (*De Sedib. et Caus. Morb.* Epist. viii. art. 20. 25. 30.), Darlue (*Journ. de Méd. de Vandermonde*, t. iv. p. 270.), B. Rush, and Dupsey (*Obs. Inédites*, No. 138.), it would appear:—

1. That the mouth, strictly so called, and the salivary glands are without any alteration.

2. The mucous membrane of the air-passages is affected with inflammation, which, in its highest degree, extends from the division of the bronchi to the pharynx. When the inflammation is of less extent, the pharynx appears sound; and when yet more limited, it is usually not to be traced in the

larynx. The point, where it seems to commence, and is most strongly marked, is at the lower part of the trachea, or in the bronchi. Lastly, when none of these parts are found inflamed, the lungs themselves present vestiges of inflammation.

With respect to the theory of Trollet, wherein the hydrophobic poison is said to be contained in the mucous secretion voided from the lungs, and to be the product of inflammation of the membrane of the bronchi, and not derived from the salivary glands, the question requires the confirmation of experiment; for, though the salivary glands are not the seat of pain, swelling, &c., it by no means follows, that their secreting process may not have been subject to some peculiar modification, on which the production of the hydrophobic virus depended. Thus, severe and obstinate ptyalism is often occur, and yet there is no manifest change in the state of the salivary glands. According to Van Swieten and Mead, there are sometimes no morbid appearances either in the head, fauces, chest, or stomach. (*Comment. in Boerh. t. iii. p. 562.*)

The dissections of two rabid sheep have been lately published in France, and it is particularly noticed, that in these animals the lungs were sound (*Magendie's Journ. t. viii. p. 330, &c.*); a fact that is very repugnant to the hypothesis adopted by Trollet.

In three cases out of six, the lungs were found emphysematous, that is to say, their interlobular substance was distended with air, and the pleura pulmonalis raised into a great number of transparent vesicles on the surface of the lungs. In a fourth instance, the emphysema was not observed in the lungs themselves, but in the cellular substance between the two layers of the mediastinum, and under the muscles of the neck. Morgagni also noticed vesicles of air on the surface of the lungs of a person that died of hydrophobia. (*De Sed. et Caus. Morb. epist. viii. art. 30.*); M. Trollet presumes, that this emphysema is occasioned by the rupture of one of the air cells, in the convulsive efforts of respiration, as sometimes happens when a foreign body is lodged in the larynx. (See *Cases by Louis and Lescure in Mém. de l'Acad. de Chir. t. iv. p. 538. : t. v. p. 527.*)

The lungs were of a deep red colour in all the six subjects dissected by Trollet, and they were observed to be gorged with blood in cases reported by numerous writers: as Bonet (see *Van Swieten, t. iii. § 1140.*); Boerhaave (*Op. Omn. p. 215.*); Morgagni (*De Sedibus et Caus. Morb. ep. viii. art. 23, &c.*); Mead, Darlue (*Recueil Périod. &c. t. iii. and iv.*); Faure (*Hist. de la Soc. Roy. de Méd. p. 33.*); De la Caze (*ib. p. 69.*); Portal, Oldknow, Ballingall (*Edinb. Med. and Surg. Journ.*); Marshall (*Morbid Anatomy of the Brain, &c., p. 69.*); Gorey (*Journ. de Méd. Chir. t. xiii. p. 83.*); Ferriar (*Med. Hist. and Reflections, &c.*), "Pulmones in quinque nigri ex toto, aut magna parte (says Morgagni) in quatuor magna item ex parte sanguine pleui." In a case examined by M. Ribes, the larynx, trachea, and bronchi, besides presenting traces of inflammation, were every where lined with a thick white frothy mucus. (*Magendie's Journ. t. viii. p. 232.*) With respect to the state of the organs of the circulation, in three of the cases dissected by Trollet, a good deal of air escaped from the heart and aorta. Morgagni is supposed to be the only other writer, who has noticed a similar occurrence (*Epist. viii. No. 30.*),

and who also in another case saw air escape from beneath the dura mater. (*ib., No. 23.*) In two of Trollet's cases, some gelatinous clots were found in the heart and large vessels; but the great mass of blood was black, and very fluid in the heart, arteries, and veins, as in subjects who have died of asphyxia. In all the six cases, traces of inflammation were noticed in the brain, or its membranes. The sinuses were filled with a dark-coloured fluid blood; and the pia mater was much injected, and of a brownish hue. The same appearances were found upon the cerebellum, and the vessels on the investment of the medulla spinalis were considerably enlarged. The surface of the cerebrum was also studded with scarlet spots, which appeared to arise from blood effused from the small vessels of the pia mater into its cellular substance. In two subjects, blood was extravasated towards the base of the brain in larger quantity. The plexus choroideus was gorged with blood, and of a brown colour. Besides these and other changes, Trollet, remarked, in two of the cases, a thickening of the pia mater. The substance of the brain was generally softer than usual; but the fluid in the lateral ventricles was not in large quantity, though, in two cases, it had a bloody tinge. The late Dr. Marshall believed that, in rabies, the brain was the part principally affected. (*Op. cit. p. 145.*)

Hufeland conjectured, that, in hydrophobia, the medulla spinalis is the part originally affected, whence the effects of the disease are propagated to the nerves of the trunk. (*Bibl. Méd. t. lv. p. 395, &c.*) Dr. R. Read believed, that an alteration of the spinal marrow was essentially concerned in the disease. (*On the Nature, &c. of Tetanus, and Hydrophobia, 8vo. Dublin, 1817.*) A case was also published by M. Matthiey, of Geneva, in which a quantity of serum was found within the spinal canal. (*Journ. Gén. de Méd. t. liv. p. 279.*) See on this subject some observations by Dr. Abercrombie. (*Edinb. Med. and Surg. Journ. vol. xiv. p. 66.*) In one instance, dissected by M. Ribes, the vessels of the pia mater, brain, and medulla spinalis, were gorged with dark blood, but without any appearance of inflammation. (See *Magendie's Journ. t. viii. p. 232.*)

According to Trollet, the traces of inflammation in the digestive organs are not so constant as in the lungs and brain. In none of the six cases dissected by him was there any appearance of inflammation in the pharynx, though some parts of the alimentary canal were affected in this manner. The cases recorded, however, in which the digestive organs presented considerable morbid appearances are very numerous. Thus Joseph de Aromatarius, Darlue (*Recueil Périod. t. iii. p. 189. et t. iv. p. 270.*), Sauvages (p. 107.), Professor Rossi, M. Gorci (*Journ. de Méd. Chir. &c. t. xiii.*), and Dr. Powell, (*Case of Hydrophobia*), found inflammation either in the pharynx, or œsophagus, or both these tubes. Dr. Powell's words are, "The œsophagus was rather redder than natural, and covered with a thin layer of coagulable lymph." A similar coat of lymph was also found by Oldknow (*Edinb. Med. and Surg. Journ. vol. v. p. 280.*), Ballingall (*Op. cit. vol. xi. p. 76.*), Dr. Ferriar (*Med. Hist. &c., vol. iii. p. 27.*) In dogs, Dr. Gillman found the pharynx and œsophagus in a state of inflammation. (*On the Bite of a Rabid Animal, p. 13. 23. 26. 44.*) M. Ribes found the pharynx and soft palate slightly inflamed. It is conjectured,

that, in many of these instances, the inflammation extended to the œsophagus from the trachea and bronchi. (*Dict. des Sciences Méd.* t. xlvii. p. 98.) Inflammation of the mucous membrane of the stomach, and small intestines, has likewise been very generally noticed, as may be seen by referring to the accounts published by Morgagni, Powell, Oldknow, Ferriar, Ballingall, Marshall, &c. In dogs, the same fact was remarked by Dr. Gillman (p. 13. 31. 44.); sometimes, however, according to this last author, no vestiges of inflammation, nor any other morbid appearances, are discoverable in the examination of animals, that have died of rabies. (P. 83.) Dupuytren is stated to have found the mucous membrane of the stomach and bowels inflamed in several places, and even almost gangrenous. (*Dict. des Sciences Méd.* t. 47. p. 98.) By M. Ribes, the gall-bladder was found empty; the mucous coat of the stomach, jejunum, and ileum inflamed; and these organs much contracted. (See *Magendie's Journ.* t. viii. p. 233.)

From recent investigations, made at the veterinary school, at Alfort, by Professor Dupuy, the following are the usual morbid appearances, noticed in the dissection of dogs, horses, cows, and sheep, destroyed by rabies:—1. The lungs and brain universally gorged with blood. 2. Greater or lesser marks of inflammation in the mucous membrane of the bronchi, trachea, larynx, throat, œsophagus, stomach, and frequently even in that of the bowels, vagina, uterus, and bladder. Yet, in two dissections more recently recorded, no particular changes were discoverable in the pharynx and œsophagus. (*Magendie's Journ.* t. viii. p. 331, 332.) 3. The air passages filled with frothy mucus. 4. A collection of serum in the ventricles of the brain, and sometimes even between the membranes covering the spinal marrow. 5. An unusual redness of the investment of the pneumogastric and trisplanchnic nerves. (See *Dict. des Sciences Méd.* t. xlvii. p. 99.)

Happily, surgery possesses one tolerably certain means of preventing hydrophobia; when it is practised in time, and in a complete manner. Every reader will know, that the excision of the bitten parts is the operation to which I allude. Indeed, as hydrophobia is often several months before it begins, the wounded parts should, perhaps, always be cut out, even though they are healed, and some weeks have elapsed since the accident, provided no symptoms of hydrophobia have actually commenced. The operation should be done completely; for a timorous surgeon, afraid of cutting deeply enough, or of removing a sufficient quantity of the surrounding flesh, would be a most dangerous one for the patient. All hopes of life depend on the prevention of the disorder; for, in the present state of medical knowledge, none can rest upon the efficacy of any plan, except the extirpation of the part. For this purpose, caustics have sometimes been employed. However, as their action can never be regulated with the same precision as that of the knife, and, consequently, they may not destroy the flesh to a sufficient depth, excision should always be preferred. The latter method is also the safest, for another important reason; viz., the part and poison lodged in it, are removed from the body at once; but, when the cautery or caustic is used, the slough must remain a certain time undetached. Some surgeons are not content with cutting out the part; but, after the operation, fill the wound with

the liquor ammoniac, or cauterize its surface, for the sake of greater security. How late excision may be done with any prospect of utility I am not prepared to say; but there are practitioners, who deem excision right, even when heat, irritation, or inflammation is observed in the bitten part. (See *Med. Repository*, vol. iii. p. 54.)

Cases present themselves, in which it is even preferable to amputate the limb, than attempt to extirpate; either with the knife or cautery, the whole of the bitten parts; an endeavour, which could not be accomplished with any degree of certainty. Thus, as Delpoch observes, when the hand, or foot, has been deeply bitten in several places, it is obvious, that it would be impossible to make caustic (or the cautery) certainly reach every part, which the saliva of the rabid animal may have touched. Besides, the mischief resulting both from the injury, and the other proceedings together, might be such as to afford no prospect of saving the limb, or at least, of preserving it in a useful state. (See *Précis Élém. des Mat. Chir.* t. ii. p. 133.) I have known of one or two cases, in which the patients lost their lives, in consequence of the excision, or destruction of the bitten parts not having been attempted, on account of the surgeon's reluctance to cut tendons, or wound a large artery, as one of those at the wrist. In such cases, however, the fear of rendering a muscle useless, or of wounding an artery, is no justification of leaving the patient exposed to a danger, so surely fatal, as that of the hydrophobic virus, if it once affect the constitution. The artery should be exposed for a sufficient length, and secured with two ligatures, when the requisite extirpation of the parts between them may be safely performed.

When once the hydrophobic symptoms have commenced, there is little or no hope of saving the patient, the disease having almost invariably baffled every plan of treatment, which the united talents of numerous medical generations have suggested. All the most powerful medicines of every class have been tried again and again; mercury; opium; musk; camphor; arsenic; the nitrate of silver; cantharides; belladonna; ammonia; plunging the patient in the sea; bleeding; &c., &c.

The inefficacy of opium is now generally acknowledged: in the space of fourteen hours, Dr. J. Vaughan gave one patient fifty-seven grains of opium, and also half an ounce of laudanum in a glyster, but the fatal termination of the disease was not prevented. Dr. Babington even prescribed the enormous quantity of 180 grains in eleven hours, without the least amendment, or even any narcotic effect. (*Med. Records and Researches*, p. 121.) On the very first day, that rabies decidedly showed itself in a man, who had been bit by a mad dog, Dupuytren injected into the vena saphæna, by means of Anel's syringe, two grains of the extract of opium dissolved in distilled water, and as a degree of calm appeared to be the result, four grains more were thrown into the cephalic vein. The patient remained perfectly tranquil three hours longer; but the symptoms afterwards recurred with increased violence. The next morning, about six or eight grains more were dissolved, and thrown into the circulation; but, all was in vain, as the patient died in three quarters of an hour after the last injection. (See *Dict. des Sciences Méd.* t. xlvii. p. 131.) By Dr. Brandreth, a solution of the acetate of morphia has been more

recently tried, without success. (See *Edinb. Med. Journ.* No. lxxxii. p. 76.)

As for belladonna, its employment for the prevention and cure of hydrophobia is very ancient, its external use for this purpose having been mentioned by Pliny, and its internal exhibition, with the same view, by Theod. Turquetus, in a posthumous work published in 1696. (See *Præcos Medica Syntagma*, &c.) In 1763, belladonna was recommended by Schmidt, as a remedy for hydrophobia; and in 1779 by J. H. Munch. (See *Richter's Chir. Bibl.*) It has so frequently failed, that, in this country, very little confidence is now put in it; but, in Italy, it is still employed, and some cases, published by Brera, where it was exhibited in very powerful doses, in conjunction with the warm bath, and mercurial friction, tend to show that it will sometimes arrest the disease, in its incipient state. (*Mém. Soc. Ital. Scienza Modena*, t. xvii.)

A few years ago, the public hope was raised by the accounts given of hydro-chlorine, or oxymuriatic acid. Wendelstadt even published the story of an Englishman, who allowed himself to be bit several times by a mad dog, and then saved himself by washing the bites with this acid. And, still more recently, Brugnattelli, in the *Italian Journal of Physic, Chemistry, &c.* (t. ix. p. 324.) has published some observations tending to prove its efficacy. The bites are washed with it, and then covered with charpie, wet with it. And, when the symptoms commence, if it cannot be swallowed in a fluid form, Brugnattelli gives bread pills imbued with it. For a child eight years old, the dose is ℥ij., four or five times a day, but gradually increased. According to Orfila, hydro-chlorine was long since recommended by Cluzel, as an internal remedy for hydrophobia. (*Séances à donner aux Personnes empoisonnées, &c.*, 8vo. Paris, 1818, p. 153.) With regard to Brugnattelli's cases, they are said to be so destitute of precision, that no inference can be drawn from them. (*Dict. des Sciences Méd.* t. xlvii. p. 119.) In order to give hydro-chlorine a fair trial, it was used internally and externally on seven patients in the *Hôtel Dieu*, at Lyons, in 1817. The bites were washed and bathed with it, and some of them also cauterised; and each patient took daily a drachm of the acid, made into an agreeable sweetened drink. All these unfortunate individuals afterwards died of rabies, though the treatment was begun the day after the receipt of the wounds. (*Le F. Trollet, Nouveau Traité de la Rage, &c.*) The excision of the bites seventy hours after their infliction, and washing the wound with oxymuriatic acid, did not, in Dr. Johnson's case, prevent the disease. (See *Edinb. Med. and Surg. Journ.* vol. xv. p. 212.) In America, the plant *scutellaria laterifolia* has been greatly extolled as a certain specific for hydrophobia. (See *A History of Scutellaria Laterifolia, as a Remedy for preventing and curing Hydrophobia*, by Lyman Spalding, M. D., New York, 1819.) And, M. Marochetti, of Moscow, has described a new treatment, which consists in giving large doses of *genista tinctoria*, or butcher's broom, and pricking with a lancet, and then cauterising with a hot needle some little pustules said by him to form at the orifices of the sub-maxillary glands, between the third and ninth day from the period of the bite, the mouth being afterwards well washed out with the decoct. *genistæ*.

M. Magendie, West, and various English practitioners, however, have not been able to discern these sublingual pustules, possibly, in consequence of their having looked for them too late, that is, after the accession of the constitutional disorder; for it appears, that M. Magistel, of Saintes, has noticed such pustules in several patients. Some arose on the sixth day, others later, and the latest on the 32d day. Of ten persons bitten, whom M. Magistel attended, five died, notwithstanding the strict adoption of Marochetti's treatment. (See *Journ. Gén. de Méd.*) M. Villermé also observed a transparent pustule under the left side of the tongue, in the case of a female, on the eighth day from the bite. (*Revue Méd., Anderson's Quarterly Journ.* vol. i. p. 124.) In relation to this part of the subject, it merits notice, that the vesicles were particularly sought for in two rabid sheep at the Veterinary School of Alfort, but could not be detected. (*Magendie's Journ.* t. viii. p. 328.) The prussic or hydrocyanic acid has likewise been proposed, on account of its reputed anti-spasmodic properties; but, some experiments made with it on dogs by Dupuytren, Magendie, and Breschet, furnish no results in favour of its being likely to prove useful in the present disorder. (See *Dict. des Sciences Méd.* t. xlvii. p. 132.) Indeed, the following statement, if correct, leaves little hope, that any effectual medicine for hydrophobia will ever be discovered:—"The most active substances, the most powerful narcotics (says M. Magendie), have no effect upon man, or animals attacked with rabies. I do not merely speak of substances introduced into the stomach, and the operation of which may be prevented or diminished by so many circumstances; I speak of substances injected into the veins, and the effects of which must be equally prompt and energetic. For instance, I have several times introduced into the veins of rabid dogs very strong doses of opium (10 grains) without producing the least narcotic effect, while a single grain of the watery extract, injected into the veins of a healthy dog, immediately makes him fall asleep, and often continue so eight or ten hours. The same phenomena are remarked in our own species. M. Dupuytren and I injected into the radial vein of a young man labouring under hydrophobia, about eight grains of the gummy extract of opium, without any apparent result. We have also seen mad dogs bear the introduction of prussic acid into their veins, without an instant's remission in the progress of their disorder." (*Journ. de Physiologie*, t. i. p. 41.) M. Magendie frequently noticed in his experiments, that an artificial aqueous plethora manifestly enfeebles all the functions of the animals subjected to it, and especially those of the nervous system. Hence, he was led to think that some benefit might arise from it in a case, where the activity of the nervous system is at its greatest height. His idea received encouragement also from considering, that, in hydrophobia, the patient takes no drink to replace the fluid separated from the circulation by the cutaneous and pulmonary perspiration, and that after venesection, the blood seems as if it hardly contained any serum. The experiment was first tried on a rabid dog, from which about a pound of blood was drawn, and then 60 oz. of water injected into the left jugular vein, about 10 or 12 oz. of blood, mixed with water, however, being purposely allowed to flow out, during the latter part of the operation. The

animal, which had previously been quite furious, now became tranquil; but, five hours afterwards, it was attacked with difficulty of breathing, which ended fatally in half an hour. (Vol. cit. p. 44. &c.) On the 15th of October, 1823, M. Magendie injected a Paris pint of water, heated to 30 deg. Reaumur, into the veins of a man's arm, who was labouring under hydrophobia in an advanced and violent form. Directly after the operation, the patient, from being furious, became tranquil; the pulse fell from 150 to 120, then to 100, and, in twenty minutes, to 80. The convulsive motions ceased, and the patient drank a glass of water without any difficulty. Notwithstanding a hemorrhage from the bowels, he continued to improve till the 5th day, when he was seized with acute pains and swelling of the wrists, knees, and elbows, and threatened with an extensive abscess of the leg, the consequence of the lodgment in the foot of two pieces of lancets, broken in the attempt to bleed him, while he was suffering violent paroxysms in a previous stage of the disorder. Despondency and mental agitation again came on, and he died early on the 9th day from the experiment. On dissection, the swelled joints were found filled with pus; the mucous membrane of a part of the small intestines reddened by the expansion of veins; several small ulcerations in the ileum where it joins the cæcum; the blood in a decidedly putrefied state; the heart and large vessels distended with gas; air under the peritoneal coat of the lungs and intestines; posterior part of the lungs a little swelled; trachea sound, but the bronchæ red. Magendie considers this case on the whole very favourable to the practice; and when it is reflected, that the patient underwent, directly after the experiment, a great and sudden change for the better, lived eight days after the injection, and then possibly died rather from other accidental complaints, it must be acknowledged, that the method seemed well deserving of further trials. I would also particularly recommend its adoption in an earlier stage, and while the patient is less reduced, than the one on whom the experiment was made and failed, in one of the Borough hospitals.

By Dr. Rossi, of Turin, the trial of galvanism was suggested. (*Alibert, Nouveaux Elémens de Thérapeutique*, t. ii. p. 436. ed. 4.); yet, the only fact brought forward, as an encouragement to persevere with the last means, appears to a modern author, from its symptoms and progress, not to have been a case of true rabies. (*Dict. cit. t. xlvii. p. 126.*) The rapid and powerful effects of the bite of a viper on the whole system, and perhaps the idea, that the operation of this animal's venom might counteract that of the hydrophobic virus, led some experimenters to try what would be the result of subjecting patients, affected with rabies, to the bite of that kind of snake. The project, however, was attended with no success. Three cases of this description were communicated to the Royal Society of Medicine (*Hist. p. 201.*); two additional ones were recorded by Dr. Gilbert, physician to the Hôtel Dieu at Lyons (*Advers. Méd. Pract. p. 257.*); and Viricel, surgeon of the same hospital, repeated the experiment on a child, which yet fell a victim to hydrophobia. Other trials are also said to have been made in France and Germany with no better success. Dr. de Mathias, in the year 1783, let a viper bite a rabid dog on the throat. The dog's head was swelled with considerable swelling, the

hydrophobia ceased, and, according to some accounts, the animal perfectly recovered; but, according to other statements, though it drank freely as soon as its head had swelled, it only survived the experiment a few hours. (*See Dict. des Sciences Méd. t. xlvii. p. 126.*)

Some facts, which occurred, a few years ago, in the East Indies, tended for a time to raise an expectation, that a copious abstraction of blood might be the means of preserving patients actually attacked with this fatal disorder. Mr. Tymon, assistant surgeon of the 22d light dragoons, tried successfully the method of taking away at once an immense quantity of blood from the patient. "I began by bleeding him (says Mr. Tymon) until scarcely a pulsation could be felt in either arm." Opium was afterwards given, and the patient salivated with mercury. (*See Madras Gazette of Nov. 23. 1811.*)

Although in the observations annexed to this case by Dr. Berry, there are some circumstances, which render it probable, that the case was really hydrophobia: yet, as the successful termination of it is an event so extraordinary, I much regret that some desirable information is omitted. For instance, we have no account of any pain or changes in the bitten part, or limb, at the first coming on of the indisposition. The early constitutional symptoms are not described, and the violent spasms, screaming, &c., are the first things mentioned. Some particulars of the dog would also have been interesting.

Such information, indeed, becomes still more essential, when we find it stated, that another man, Sergeant Jackson, was also bitten by the same dog, and had hydrophobia in a mild form, from which he recovered under the use of mercury, blisters to the head, and cathartic injections, without any recourse to bleeding at all. This last case is even more contrary than the former, to what general experience teaches; because mercury, blisters, and injections, have been tried a thousand times unavailingly; while, perhaps, blood-letting, in the manner practised by Mr. Tymon, is a new treatment. Dr. Shoolbred, of Calcutta, published a second case of hydrophobia cured by bleeding ad deliquium animi, and afterwards exhibiting calomel and opium. The patient being threatened with a relapse, was largely bled again. The whole of the success is imputed by Dr. Shoolbred to the venesection. But this gentleman is not so sanguine as to believe, that bleeding will cure every case of hydrophobia. It is probable, that there is a period, beyond which its curative effect cannot extend, and, therefore, it is upon the first appearance of unequivocal symptoms of the disease, that he thinks copious bleeding affords a prospect of success, while the delay of only a few hours may prove fatal. He observes, that the medical profession, taught by numerous disappointments, admit very cautiously the claims of any new practice to general adoption. If several patients in hydrophobia, therefore, should happen to be bled in an advanced stage of the disease, and die (as they inevitably would do, whether they had been bled or not), such cases would be quoted against the new practice, as failures. But Dr. Shoolbred argues, that numerous failures in an advanced stage of the disease can form no just ground for the rejection of a remedy, which has effected a cure in an earlier stage. He insists upon the necessity of making a

large orifice in the vein, so as to evacuate the blood quickly, which must be allowed to flow, without regard to quantity, ad deliquium animi.

Dr. Shoolbred was well aware, that bleeding had often been tried in hydrophobia; but, says he, owing probably to the evacuation not having been pushed far enough, when used in the early stage of the disease; or to the period for its beneficial employment having elapsed; the cases in which it was tried, afforded little or no encouragement to the continuance of the practice.

Since the preceding cases, the effect of bleeding has had the fairest trials made of it, and some of the reports are in favour of its occasional utility. (See *Particulars of the successful Treatment of a Case of Hydrophobia*, by R. Wynne, 8vo. Shrewsbury, 1813; also, *Edinb. Med. Rep.*, vol. iii. p. 93.) In almost every instance, however, it fails in hindering the usual melancholy event. (See *Kerrison's Case and Obs. in Med. Repository*, vol. ii. p. 197.) This unpleasant truth, I think, receives confirmation from the fact, that the practice is far from being new.

Dr. Mead, who was very confident that he had found an infallible preventive of the disease in a little *liverwort* and *black pepper*, aided by bleeding and cold bathing before the commencement of the course of medicine, says, "As to all other ways of curing the hydrophobia, I own, I have not been so happy as to find any success from the many I have tried. Bathing at this time is ineffectual. I have taken away large quantities of blood; have given opiates, volatile salts, &c. All has been in vain because too late." Notwithstanding his disappointment, he concludes, "If any relief could be expected in this desperate state, I think it would be from bleeding, even ad animi deliquium," &c.

The doctrines of Boerhaave also led him and his pupils to recommend and practise bleeding in hydrophobia. "The distemper (says he) is to be treated as one highly inflammatory, upon the first appearance of the signs which denote its invasion, by blood-letting from a large orifice, continued till the patient faints away; and soon after by enemata of warm water and vinegar," &c.; and he adds, "that this practice is supported by some small number of trials." But the particulars of the success alluded to, are not given.

Dr. Shoolbred finds, that a trial of it was made at Edinburgh, more than sixty years ago, by Dr. Rutherford, who took away gradually sixty ounces of blood from a patient, who had already been bled the same morning. As the patient lived forty-eight hours after the large bleeding, the method was probably tried somewhat early in the disease; and the case may therefore be set down as a fair instance of the failure of the practice. The trials, which have been made in this country of the practice of bleeding, in cases of hydrophobia, since the receipt of the above reports from India, I am sorry to say, have not confirmed its efficacy.

Bleeding was also recommended in cases of hydrophobia, by Poupert. (See *Hist. de l'Acad. Royale des Sciences, pour l'année 1699*, p. 48.) The practice is likewise mentioned in the *Medical Essays of Edinburgh*, vol. v. part ii. § 5; and in the writings of Dr. Rush. See also Dr. Burton's Case, *Phil. Mag.*, August 1805.)

Early excision, or amputation of the bitten parts, the application of cupping-glasses to the wound, or the removal of atmospheric pressure,

as recommended by Dr. Barry (see *Experimental Researches*, &c. Lond. 1826); the injection of warm water into the veins, and bleeding ad deliquium in the early stage, are the plans which have most evidence in their favour. The investigations of Sir David Barry make the application of a cupping-glass to the wound, inflicted by the bite of a rabid animal, or to any other poisoned wound, appear one of the most efficacious measures which can be adopted, with the view of preventing the entrance of the poison into the system. The removal of the atmospheric pressure from the part, not only has the effect of drawing the blood and a portion of the poison out of orifices of the vessels, but suspends the function of absorption. Hence, Sir David Barry was an advocate for the practice both before and after the excision of the wounded part. See WOUNDS.

It was observed by a critical writer before the experiment of injecting after had been made "That experience authorises placing confidence in bleeding ad deliquium; on vomiting; and perhaps on the use of atropa belladonna; and on tobacco, exhibited as a glyster. That it is probable, advantage would result from the combined employment of bleeding, vomiting (see Dr. Satterly's *Obs. in Medical Trans.*, vol. iv.), and purging in the early part of the disease. That analogy recommends the trial of spirit of turpentine in the convulsive stage of the disease." (*Med. Repository*, vol. iii. p. 54.) In one case, in which oil of turpentine was copiously given both in electuary and glysters, the patient died on the fourth day. (*Same work*; No. for October 1822.)

According to Dr. Marochetti, of Moscow, the existence of the hydrophobic poison in an individual is denoted by the appearance of two small tumours, one on each side of the trachea of the tongue, within six weeks after the bite. As the tumours only continue twenty-four hours, they are to be looked for twice a day during this space of time. If they have disappeared, without treatment, he represents the case as sure to end fatally. His plan, as already stated, is to open the tumours, and cauterise them, as soon as discovered. A lymph escapes, which the patient is to spit out, and then wash his mouth with a decoction of the tops and flowers of *genista tinctoria*. A pint and a half of this decoction is also to be drunk daily for six weeks. The tumours, referred to by Dr. Marochetti, have been often sought for in Great Britain, without success. Here, the proposal has gained no confidence.

Jos. de Aronatus, De Rabie Contag. Francof. 1626. Sauvages sur la Rage, 12mo. Paris, 1771. *James, On Canine Madness*, 8vo. Lond. 1780. *Mead, On the Bite of a Mad Dog*. *Jos. S. Dalby, The Virtues of Cinabar and Musk, against the Bite of a Mad Dog*, 4to. Birmingham, 1764. *J. Heysham, De Rabie Canina*, Edinb. 1777. *B. F. Münch, De Belladonna*, Frank. Del. op. 1. *D. P. Lagard, Essay on the Bite of a Mad Dog*, 2d edit. 1763. *R. Hamn, Remarks on Hydrophobia*, 2d edit. 2 vols. 8vo. Lond. 1798. *Medical Museum*, vol. II. Lond. Med. Trans. vols. II. and IV. ed. 2. *Med. Obs. and Inq.* vol. III.; and *Fothergill*, in vol. V. of the same work. *C. Nugent, Essay on Hydrophobia*; to which is prefixed, the Case of a Person cured, 8vo. Lond. 1753. *Le Roux, Sur la Rage*, 8vo. Dijon, 1780. *Idem, Traite-ment local de la Rage*, 8vo. Paris, 1783. *Edinb. Med. Comment.* vol. V. p. 42. *J. Faughan's Cases and Obs. on Hydrophobia*, 8vo. Lond. 1778. *Dr. Powell's Case of Hydrophobia*. *Latta's System of Surgery*, vol. III. *Cullen's First Lines*, vol. IV. *Enaur et Chausier, Méthode de Traiter les Morsures des Animaux enragés*, &c. 12mo. Dijon, 1780. *Memoirs of the Med. Society of London*, vol. I. p. 243. *Medical Communications*, vol. I. *J. Menzies, An Essay on the Disease produced by the Bite of a Mad Dog*, with a Preface &c., by *J. C. Lettsom*, 8vo. Philadel.

phia, 1793. *Mém. de la Société Royale de Médecine de Paris*, pour l'an. 1782 et 1783. *Perriar's Med. Facts and Observations*, and his *Med. Histories*, &c., 2d ed. 8vo. Lond. 1810. *Callien's Systema Chirurgiæ Hodiernæ*, t. i. p. 503. Hafniae, 1798. *Marcel*, in *Med. Chir. Trans.* vol. i. p. 132, &c. *Jesse Foote*, An Essay on the Bite of a Mad Dog, 8vo. Lond. 1788. *Lasus*, *Pathologie Chir.* t. ii. p. 226, &c., ed. 1809. A valuable Paper by *Dr. J. Hunter*, in *Trans. of a Society for the Improvement of Med. and Chir. Knowledge*, vol. i. art. 17. *James Gillman's Dissertation on the Bite of a Rabid Animal*, 8vo. Lond. 1812. *S. Bardesley*, in *Memoirs of the Literary and Philosophical Society of Manchester*, vol. iv. part 2. Medical Reports, &c.; to which are added, An Inquiry into the Origin of Canine Madness, and Thoughts on a Plau for its Extirpation from the British Isles, 8vo. Lond. 1807. *Babington*, in the *Medical Records and Researches*, Lond. 1798. *R. Pearson*, Arguments in favour of an Inflammatory Diathesis in Hydrophobia misidered, Birmingham, 1798. Art. Hydrophobia in *Rees's Cycl. pædia*. *M. Ward*, Facts establishing the Efficacy of the Opiate Friction in Spasmodic and Febrile Diseases; also an Attempt to investigate the Nature, Causes, and Method of Cure of Hydrophobia and Tetanus, 8vo. Manchester, 1809. Cases and Cures of Hydrophobia, selected from the Gentleman's Magazine, 8vo. Lond. 1807. *G. Pinckard*, Case of Hydrophobia, 8vo. Lond. 1808. *B. Mosely*, On Hydrophobia, its Prevention and Cure, 8vo. Lond. 1809. *J. P. A. Lalouette*, Essai sur la Rage, 8vo. Paris, 1812. *A. Portal*, Mémoires sur la Nature, &c., des plusieurs Maladies, t. ii. p. 31. 8vo. Paris, 1800. *G. C. Reich*, De la Fièvre en général, de la Rage, &c. 8vo. Metz, 1800. *Raspail*, *Mém. sur les Causes de l'Hydrophobie*, 8vo. Paris, 1808. *S. V. Sæter*, Esperienze (Mediche stinorina la Cura del Idrophobia, ossia della Malattia proveniente dal Morso del Cane rabbioso, 8vo. Bologna, 1806. *Dr. Berry's Obs.* and *Mr. Tynnon's Case* cured, by large blood-letting, as detailed in the *Madras Gazette*: of November 23. 1814; and *Dr. Shoolbrod's Case* successfully treated by copious bleeding, is related in one of the Asiatic Mirrors for May, 1812. *O'Donnell's Case* of Hydrophobia, 1813. *T. Arnold*, Case of Hydrophobia successfully treated, 8vo. Lond. 1793. *R. Wymie*, Particulars of the successful Treatment of a case of Hydrophobia, 8vo. Shrewsb. 1803. *Boyer*, *Traité des Mal. Chir.* t. i. p. 435, &c. Paris, 1811. *C. H. Barry*, Cases of Tetanus and Rabies Contagiosa, or Canine Hydrophobia, 8vo. Lond. 1814. *A. Marshall*, The Morbid Anatomy of the Brain in Mania and Hydrophobia, with the Pathology of these two Diseases, &c. 8vo. Lond. 1815. *R. Reid*, On the Nature and Treatment of Tetanus and Hydrophobia, 8vo. Dublin, 1817. *Autenrieth*, Diss. de hactenus prætervisa Nervorum Lustratione. In *Sectionibus Hydrophoborum*, 4to. Tub. 1802. *Goltz*, *Zinke*, Neue Ansichten der Hundswuth, 8vo. Jena, 1804. *Dict. des Sciences Méd.* t. xxii., art. Hydrophobie, et t. xvii. art. Rage. *G. Lipscombe*, Cautions and Reflections on Canine Madness, 8vo. Lond. 1807. *C. Hüber*, *Pract. Abhandl. über die Vorbeugung, &c. der Hundswuth*, 8vo. Wien, 1814; this author has confidence in the powder of meloe malalis. *C. F. Hæstles*, über die Behandlung der Hundswuth, 4to. Frankf. 1809; Stramonium recommended. *Breca*, *Comm. Clinico per la Cura del Idrophobia*, in *Mem. Soc. Ital. Scienz.* Modena, t. xvii. *J. M. Aler*, *Nouv. Bibl. German.* Med. Chir. 1821; Cautarides, a preventive. *Marochetti* in *Petersburgh Miscellanies* of Med. Science. *Magenthi*, *Journ. de Physiologie Experimentale*, t. i., &c. *J. Booth*, On Hydrophobia, 8vo. Lond. 1824. *Quarterly Journ. of Foreign Med.* vols. iii. and iv. *David Barry*, Exp. Researches on the Influence of Atmospheric Pressure upon the Progression of the Blood in the Veins, upon Absorption, &c. 8vo. Lond. 1826.

HYDROPHthalmia (from ὕδωρ water, and ὀφθαλμός the eye.) *Dropsy of the Eye.* *Hydrophthalmus*; *Hydrophthalmos*. In the eye, as in other organs, dropsy arises from a disproportion taking place between the action of the seerning arteries, by which the fluid is deposited in the part, and the action of the absorbent vessels, by which it is taken up, and returned to the circulation; and according to this principle, the disease may be supposed to depend, either upon secretion being too rapid, or absorption slower, than is proportionate to the natural activity of the vessels by which the secretion of the humours of the eye is effected.

According to Beer, dropsy of the eye is seldom entirely a local disease, but at least is generally combined with an unhealthy constitution, or is a mere symptomatic effect of some other dis-

dropsical affection, anasarca, hydrocephalus, &c. Sometimes, it appears as a symptom of chlorosis. On the other hand, Mr. Lawrence informs us, that the facts, which have come under his observation, have not afforded the slightest support to the doctrine, that the disease owes its origin to a morbid state of constitution, or requires the use of antihydrotic remedies. (*On Dis. of the Eye*, p. 653.) Dropsy of the eyeball seems also to Mr. Middlemore to be a local defect, not arising from constitutional causes, or metastasis. (*On Dis. of the Eye*, vol. ii. p. 475.)

The disease may originate either from a preternatural accumulation of the aqueous humour; from that of the vitreous humour; or from an immoderate accumulation of both these humours together. (*Lehre, von den Augenkr.* b. iii. p. 616. Wein, 1817.) When the vitreous humour collects in this manner, it usually loses its natural consistence, and becomes thinner and more watery. (*Richter, Anfangsgr.* b. iii. p. 392.)

It is sometimes conceived, however, that in general dropsical affections of the eye "depend entirely on some local cause, which has operated, not so much in directly increasing the fluid contents, as in weakening the resisting power of the tunics of the eye-ball, and especially of the cornea and scleroticæ." (See Mackenzie, *On Dis. of the Eye*, p. 627. ed. 2.)

Beer states, that in the case proceeding from a morbid quantity of the aqueous humour, the first indication of the disease is an increase in the dimensions of the cornea, attended with a manifest enlargement of the anterior chamber. The cornea may become, in this manner, two, three, or even four times wider, than natural, without bursting, or losing its transparency; for, though a turbid appearance is discernible, this depends rather upon the state of the aqueous humour itself. The iris, which, in the very commencement of the disease, begins to lose its mobility, soon becomes completely motionless, and acquires a dull colour; the pupil always remaining in the mid-state between contraction and dilatation. In the eyeball an annoying sense of pressure, tension, and heaviness is felt, rather than actual pain. In the beginning of the disease, there is a considerable degree of far-sightedness, or presbyopia, which soon changes into a true amauiotic weakness of sight, but never terminates in perfect anaurosis. The free motions of the eyeball are more and more interrupted, in proportion as the organ grows larger, and it has invariably a hard feel, while the scleroticæ, to the distance of two lines from the margin of the cornea, is as bluish as it is in the new-born infant.

Respecting the precise cause of the accumulation of the aqueous humour Beer offers no observation worthy of repetition, excepting perhaps that in which he reminds us, that a similar collection happens apparently as an effect of the conical staphyloma of the whole cornea. (See also *Wardrop's Essays on the Morbid Anatomy of the Eye*, vol. v. p. 19.) Mr. Lawrence has seen dropsy of the anterior chamber, remain as an effect of internal acute inflammation which had destroyed sight. Long-continued strumous inflammation of the cornea, he observes, is attended with increased secretion of the aqueous humour. After the termination of the inflammation, near-sightedness is produced; there may be, however, a cloudy state of the cornea, and a corresponding imperfection of vision. Mr.

Lawrence is unable to state whether this dropsy of the aqueous humour from scrofulous cornæitis is ever removed. (*On Dis. of Eye*, p. 655.)

Perhaps, so far as our knowledge yet extends, it is impossible to say, whether the changes of the cornea are, in the present disease, to be regarded as the cause, or the effect, of the increased quantity of the aqueous humour, or, whether, as seems to me most probable, both phenomena are only effects of one and the same cause. The examples, somewhat repugnant to this idea, are those referred to by Beer, as symptomatic of other dropsical affections. On the other hand, Mr. Wardrop has never seen a preternatural collection of the aqueous humour, without its being accompanied with disease of the coats of the eye. (Vol. cit. p. 20.)

In hydrophthalmia, the prognosis is generally unfavourable; and, when the sight is nearly or quite lost, scarcely any hope can be entertained, either of restoring vision, or preserving the shape of the eye. Yet, according to Beer, things are not always quite so unpromising in the preceding form of the disease, especially when the surgeon is consulted in time, and the patient's constitution is not exceedingly impaired. He had never seen any instance in which the eye spontaneously burst; on the contrary, when the habit was decidedly bad, and the treatment ineffectual, the disease became gradually conjoined with the second species of dropsy of the eye, and terminated in a frightful disfigurement of the whole organ, and death. On dissection, the innermost textures of the part were found spoiled and disorganised, and sometimes even the orbit itself carious. (Vol. cit. p. 619.)

With respect to the treatment, Beer thinks, that this must depend very much upon the nature of the primary disease, to which the dropsical affection is ascribable. He has known great benefit sometimes produced by the submuriate of mercury, combined with digitalis, and a drink containing supertertrate of potassa, and borax. This practice is manifestly connected with the notion, that this affection of the eye may depend upon the same causes as dropsy in general; a view, at present renounced. Now, as a modern writer remarks, we do not "expect any material benefit from the adoption of any plan of treatment, which does not include the evacuation of a certain part of the augmented contents of the globe, or some other surgical proceeding, having for its object the production of a diminished plenitude of the eyeball." (*See Middlemore on Dis. of the Eye*, vol. ii. p. 476.) When the disease has been preceded by the sudden cure of any cutaneous disease, Beer has faith in the practice of stimulating the surface of the skin with antimonial ointment, or making an issue. This plan is to be aided with alterative medicines, sulphur auratum antimonii, and flowers of sulphur, &c. The parts about the eyebrow should be rubbed sometimes with mercurial ointment, sometimes with a mixture of æther and liquor ammoniac. But, when the disease has made considerable progress, and vision is either weak, or nearly lost, while the sclerotica near the cornea is not much discoloured, and there are no appearances of a varicose affection of the blood-vessels of the organ, Beer recommends making a puncture with a small lancet, in the lowest part of the cornea, half a line from the sclerotica, so as to discharge the aqueous humour. The anterior chamber is then to be kept empty for several days, or weeks, if possible, by reopening the small wound

every day with the point of the lancet. (*See also Richter's Anfangsgr.* b. iii. p. 403.) After the operation, the eye is to be dressed in the same way, as after the extraction of a cataract. (*See CATARACT*) Previously to paracentesis, Beer has often seen every general and local means perfectly useless, but highly beneficial, as soon as that operation had been practised. Even when the paracentesis fails in bringing about a permanent cure, it may still be resorted to as a palliative with great advantage, and be often beneficially repeated, if care be taken not to make the puncture too large. However, when the blood-vessels are generally varicose, and the constitution very bad, such operation is apt to excite violent inflammation, suppuration, and even sloughing of the organ, attended with imminent danger to the patient's life. (*Beer*, vol. cit. p. 620. 622.)

With regard to the second species of hydrophthalmia, or that depending upon a preternatural accumulation of the vitreous humour, Beer states, that, in this case, it is chiefly the posterior part of the eyeball which is enlarged, so that the whole organ acquires a conical shape, in which the cornea very much participates. The latter membrane remains unaltered in regard to its diameter; but, it is more convex than natural, and its transparency is perfect. It is observed by Mr. Wardrop (*On Morbid Anatomy of the Eye*, vol. ii. p. 126.), that an increase in the quantity of the vitreous humour happens not unfrequently in staphyloma, in which disease, he says, the enlargement of the eyeball will generally be found to arise more from an increase in the quantity of the vitreous, than of the aqueous humour. One character of staphyloma, is often absent in hydrophthalmia; 1 mean, opacity of the cornea. In the case, which consists in an immoderate collection of the aqueous humour, the anterior chamber is always enlarged: on the contrary, in the present form of the disease, that cavity is manifestly lessened, for the motionless iris is gradually forced so much towards the cornea, that at length the chamber in question almost completely disappears. However, the colour of the iris undergoes no change, and the pupil is always rather diminutive. Around the cornea, the sclerotica is rendered bluish by distention, with a somewhat smutty tinge. In the early stage, the patient is affected with shortsightedness, *myopia*; but his power of vision is always seriously diminished, and, at last, is so totally destroyed, that not a ray of light can be perceived. The motions of the globe of the eye and eyelids are lessened, or impeded, at a still earlier period, than in the first species of hydrophthalmia, and to the touch, the organ seems like an egg-shaped stone. The very commencement of the disease is attended with pain, which daily becomes more and more severe, and, at length, is not confined to the eye and its vicinity, but affects all the side of the head, the teeth, and neck, being sometimes so violent as almost to bereave the patient of his senses, who urgently begs the surgeon to puncture the eye, or even is driven by desperation to do it himself, as Beer once knew happen. Even while the pain is less afflicting, the patient is deprived of his sleep and appetite. (*Beer*, vol. cit. p. 623.) Though an increase in the quantity of the vitreous or aqueous humour has generally been treated of as a distinct disease, and denominated hydrophthalmia, Mr. Wardrop has never seen a dropsy of the eye, without an accompanying disease

of the sclerotic coat, or cornea. (*Morbid Anatomy of the Eye*, vol. ii. p. 126.) Beer offers no valuable remark on the causes of the preceding form of hydrophthalmia, his account of the connection with scrofula and syphilis being more conjecture, though delivered as a positive matter of fact. However, another position, offered in the paragraph concerning the prognosis, seems more correct, viz. that there can be scarcely any hope of a radical cure. Beer's opinion is, that, when the disease has made such progress that not a ray of light can be discerned, and the pain in the eye and head is so violent, by day and night, that the sleep, appetite, and even the senses are lost; it is fortunate, if only the most perilous symptoms can be obviated by palliative treatment; for the preservation of a good-shaped eye is then quite out of the question. And even in the most favourable cases, the utmost which can be expected, is to stop the further advance of the disease, a perfect cure being extremely rare.

According to Beer, the first indication is to improve the state of the health by medicines and regimen. For this purpose, a long time will be requisite; and as for local treatment, in this case, little or nothing can be accomplished by it. Hence, the disease often continues to grow worse and worse; and, when the pain becomes violent, the best thing which the surgeon can do, both with the view to the functions of the organ and its form, is to let out the aqueous humour. But, Beer reprobates, in the strongest terms, the plan sometimes recommended, of plunging a trocar through the sclerotica into the vitreous humour, and keeping the tube introduced until a certain quantity of that humour is discharged. The method preferred by him, is that which is mentioned by Richter (*Anfangsg.* b. iii. p. 400.), and consists in opening the cornea and capsule of the lens, as in the extraction of the cataract, discharging the lens and vitreous humour, and letting the coats of the eye collapse; but, in order to prevent any re-accumulation of fluid, he afterwards cuts away a little bit of the flap of the cornea. The eye is then to be dressed in the same manner as after the extraction of the cataract. (See CATARACT.)

In one case from injury, where the lens was opaque and displaced, Dr. Mackenzie succeeded in curing the vitreous dropsy by repeatedly tapping through the cornea. (*On Dis. of the Eye*, p. 632. ed. 2.)

The third species of hydrophthalmia, or that produced by an accumulation both of the aqueous and vitreous humours together, is excellently described by Scarpa. He observes, that in every case on which he has performed the operation, and in other examinations of the different stages of the disease, made on the dead subject, he has constantly found the vitreous humour, more or less, altered in its organisation, liquified, and converted into water, according as the disease was ancient, or recent. In some instances, he could not distinguish whether the increased quantity of the vitreous, or aqueous humour, had most share in the formation of the disease.

In every eye, affected with dropsy of the vitreous humour, which Mr. Middlemore has had an opportunity of examining, the reticular arrangement of the hyaloid membrane was destroyed. (*On Dis. of the Eye*, vol. ii. p. 482.)

The eyeball at first assumes an oval shape, ending at the point of the cornea; it enlarges in all

dimensions; and in the end, projects from the orbit in such a manner, that it cannot be covered by the eyelids, disfiguring the patient's face as much as if an ox's eye were placed in the orbit.

This disease (says Scarpa) is sometimes preceded by blows on the eye, or temple; sometimes by an obstinate internal ophthalmia. In other instances, it is preceded by no inconvenience, except an uneasy sensation of tumefaction and distension in the orbit, a difficulty of moving the eyeball, and a considerable impairment of sight. Lastly, it is sometimes preceded by none of these causes, or no other obvious one whatever, especially when the complaint occurs in children of very tender age, from whom no information can be obtained. As soon as the eye has assumed an oval form, and the anterior chamber has become preternaturally capacious, the iris seems situated further backward than usual, and tremulates in a very singular way, on the slightest motion of the eyeball. The pupil remains dilated in every degree of light, while the crystalline is sometimes brownish from the very beginning of the disease; and sometimes it does not become cloudy till the affection has arrived at its highest pitch. The complaint then becomes stationary; and as the crystalline is not deeply opaque, the patient can distinguish light from darkness, and, in some degree, the outlines of objects, and brilliant colours. But when the eye has acquired a larger volume, and the whole crystalline lens has become opaque, the retina at last remains in a state of complete paralysis.

In the last stage of the disease, to which the term *buphthalmos*, or ox-eye, is properly applicable, when the dropsical eye projects from the orbit, so as not to admit of being covered by the eyelids, with the inconveniences already enumerated, says Scarpa, others associate them—elves, arising from the friction of the ciliae, the secretion of gum, the flux of tears, the ulceration of the lower eyelid, on which the eye rests, and the excoriation of the eye itself. Hence, the dropsical eye is gradually attacked with violent ophthalmias, attended with intolerable pains in the part affected, and the whole head. The ulceration, also, does not always confine itself within certain limits, but continues to spread; first, depriving the cornea of its transparency; next, consuming the sclerotica; and, lastly, destroying progressively the other component parts of the eyeball.

At the first appearance of dropsy of the eye, many surgeons recommend mercurials, and cicuta; astringent collyria; a seton in the nape of the neck; and compression of the eye. However, Scarpa has never yet met with a single well-detailed history of a dropsy of the eye, cured by these means. With regard to externals, he has learned, from his own experience, that when the disorder is manifest, astringent, and corroborant collyria, as well as compression of the protuberant eye, are highly prejudicial. In such circumstances, making a seton in the nape of the neck, frequently bathing the eye in a lotion of mallows, and applying to it a poultice, composed of the same plant, have enabled him to calm, for a time, that disagreeable sense of distention in the orbit, and over the forehead and temple of the same side, of which patients in this state make so much complaint, especially when they are affected with a recurrence of ophthalmia. But, as soon as the eyeball begins

to protrude from the orbit, and project beyond the eyelids, he thinks there is no means of opposing the very grievous dangers, which the dropsy of the eye threatens, except an operation, which consists in evacuating, by an incision, the superabundant humours, then exciting gentle inflammation of the membranes, and suppuration within this organ.

Beer's prognosis in the third species of hydrophthalmia is at least as discouraging as that made by Scarpa; for the rapidity of the disease is said to be such as leaves scarcely a possibility of benefit being effected by any mode of treatment, and the case usually terminates in a carcinomatous exophthalmia, and death. These melancholy events are said, by Beer, to be accelerated by paracentesis of the eye, however executed; and he thinks, that the sole chance of stopping the progress of the disease, depends upon an endeavour being made in its very commencement to improve the general health, though he owns, that success is to be regarded as a rare occurrence. The same author has no faith in any local treatment; and when the disease is advanced, he considers the extirpation of the eye the only rational expedient, though precarious in its result. (*Lehre von dem Augenk. b. ii. p. 628, 629.*)

The main point, on which Scarpa differs from Beer, is that respecting the effects of discharging the humours of the eye; a practice, which the former represents as useful, even in cases where the hydrophthalmia combines an accumulation both of the aqueous and vitreous humours. In former times, says Scarpa, paracentesis of the eyeball was greatly extolled. Nuck, one of the promoters of this operation, punctured the eye with a trocar, exactly in the centre of the cornea. (*De Duct. Ocul. Aquos. p. 120.*) It has since been thought better to puncture the sclerótica about two lines from the junction of this membrane with the cornea, that such a small quantity of the vitreous humour may be more easily discharged at the same time with the aqueous, as may be deemed adequate to effect a diminution of the eyeball.

According to Scarpa, paracentesis of the eye, performed so as merely to discharge the humours, can never be a means of curing dropsy of the eye, unless the puncture, made with the trocar, excite inflammation and suppuration, and afterwards a concretion of the membranes composing the eyeball.

Scarpa condemns the plan of making a circular incision through the sclerótica, as being constantly followed by the most aggravated symptoms, particularly frequent hemorrhages, an accumulation of grumous blood at the bottom of the eyeball, vehement inflammation of the eye, eyelids, and head, obstinate vomitings, convulsions, delirium, and the most imminent danger. Such modern surgeons, as have faithfully published the results of their practice on this point, namely, M. Louis (*Mém. de l'Acad. de Chir. t. xiii. p. 289, 290.*); Marchan (*Journal de Méd. de Paris, Janvier, 1770; Sur deux Exophthalmies, ou Grosseurs contre Nature du Globe de l'Œil*); and Terras (*Ibidem, Mars, 1776; Sur l'Hydrophthalmie*); have ingenuously declared that, after performing the circular resection of dropsical eyes in the sclerótica, they had the greatest motives for repenting of what they had done. Scarpa prefers making a circular section, about three lines in breadth, at

the summit or centre of the cornea of the dropsical eye, as directed by Celsus for staphyloma.

Whether the cornea be transparent or not, as sight is irrevocably lost, the surgeon must introduce a small bistoury across the apex, or middle of the cornea, at one line and a half from its central point; and then, by pushing the instrument from one towards the other canthus of the eye, he will cut the lower part of the cornea in a semi-circular manner. The segment of the cornea being next elevated with the forceps, the operator is to turn the edge of the knife upward, and complete the work by a circular removal of as much of the centre of the cornea as is equal to three lines in diameter. Through this circular opening, made in the centre of the cornea, the surgeon may, by means of gentle pressure, discharge as much of the superabundant humours of the eye, as is requisite to make the eyeball diminish, and return into the orbit, so as to be covered by the eyelids. As for the rest of the humours lodged in the eye, it will gradually escape of itself.

Until the appearance of inflammation, that is, until the third or fifth day after the operation, the dressings are to consist of the application of a compress of dry lint, supported by a bandage. As soon as inflammation and tumefaction invade the eye and eyelids, internal remedies, calculated to moderate the progress of inflammation, are to be employed, and the eyelids covered with a bread and milk poultice, which must be renewed every two hours. When the interior of the eye begins to suppurate, the swelling of the eyelids decreases, and the eyeball diminishes in size, and returns gradually into the orbit. After the wound is healed, an artificial eye may be placed between the eyelids and the remains of the eyeball.

If a mild inflammation and suppuration in the interior of the eye should not take place on the fifth day, Scarpa exposes the eye to the air, or removes a circular portion of the cornea, half a line in breadth, or little more, by means of the forceps and curved scissors. The foregoing practice is certainly preferable to that advised by Richter, who, when the eyesight was lost, and the object was merely to discharge the humours, and let the eye collapse, sometimes made a crucial division of the cornea, and removed the four flaps or angles, or even cut away the whole of the anterior part of the eyeball through the sclerótica. (*Anfangsgr. b. iii. p. 404.*) In order to lessen the bulk of the eye, the late Mr. Ford, in one instance, passed a seton through the front of the organ, with apparent success. (*See Med. Communications, vol. i.*)

Consult *Mauchart, De Paracentesi Oculi*; Tub. 1744. *Conradi, Handbuch der Pathol. Anat. p. 523. Feliz, in Hufeland's Journ. iv. b. p. 208. Flajani, Collezione d'Osservazioni, t. i. obs. 43. Goudron, Mal des Yeux, t. ii. Louis, in Mém. de l'Acad. de Chir. t. v. 4to. Marchan, in Journ. de Méd. t. xxii. p. 65. Terras, Op. cit. vol. xiv. p. 289. Scarpa, Sulle principali Malattie degli Occhi, cap. 13. C. P. Beger, De Hydrophthalmia, Haller, Disp. i. 575. A. Sarcey, De Paracentesi Oculi in Hydrophthalmia et Amblyopia Senum. Haller, Disp. Chir. i. 887. Tab. 1744. *Berwick, De Morbis Humoris Vitrei. Luke, Diss. de Hydrophthalmia; Jen. 1803. Richter, Anfangsgr. b. iii. p. 392. &c. Götz, 1795. Beer, Lehre von den Augenkr. b. ii. Wien, 1817. J. Wardrop, Essays on the Morbid Anatomy of the Human Eye, chap. 18, and 40. vol. ii. 8vo. Lond. 1818. A. Smith, in Edinb. Med. Journ. No. 73. B. Travers, Synopsis of the Diseases of the Eye, p. 195. p. 200. &c. 8vo. Lond. 1820. W. Lawrence, On Dis. of the Eye, p. 658. 8vo. Lond. 1823. E. Middlemore, On Dis. of the Eye, vol. ii. p. 475. 8vo. Lond. 1835. and W. Mackenzie, On Dis. of the Eye, ed. 2. p. 627—633. 8vo. Lond. 1836.**

HYDROPS. (from ὕδωρ, water.) A dropsy, or morbid accumulation of water. For *hydrops articuli*, refer to **JOINTS, DISEASES OF**; for *hydrops oculi*, see the foregoing article. With regard to *hydrops pectoris*, *hydrothorax*, or dropsy of the chest, as it is altogether a medical case, an account of its symptoms and treatment will hardly be expected in this Dictionary. The only concern, which a surgeon has with the disease, is being occasionally required to make an opening for the discharge of the water. (See *Paracentesis Thoracis*.)

HYDROSARCOCELE. (from ὕδωρ, water; σὰρξ, flesh; and κύημα, a tumour.) A sarcocele, attended with a collection of fluid in the tunica vaginalis.

HYMEN, IMPERFORATE. The inconveniences, brought on by such a cause, and the mode of relief, are explained in the article **VAGINA**.

A continuation of the hymen over a part of the orifice of the meatus urinarius may produce great pain and difficulty in making water, and symptoms, which may give rise to suspicion of stone. For a case illustrating the truth of this observation, see *Warner's Cases in Surgery*, p. 276. ed. 4.

HYPERTROPHY. (from ὑπέρ, and τροφή, signifying an excess of nutrition.) This term ought to be restricted to cases, in which a part, though increased in bulk, retains its natural organisation and structure. It is one of the most common effects of increased activity in the nutrition of textures and organs; and likewise one, which may give rise to the most diversified functional disturbance. It cannot always, however, be regarded as a disease. The mere increase of size of a part, unattended with change of structure, or the interruption or disorder of any function by such hypertrophy, cannot be considered as a morbid affection. Thus, hypertrophy in a muscle of animal life is not a disease; but, in the heart, it becomes one of the most serious. (See *Andral, Anat. Pathol.* t. i. p. 166.) It can hardly come under the denomination of a disease, until it interferes with the regular and complete accomplishment of a function. As one of the most distinguished of modern pathologists observes, "That the increased anomalous development of an organ, or tissue, denominated hypertrophy, depends essentially on an excess of the nutritive function, appears to be sufficiently demonstrated by the presence, on the one hand, of an increase of bulk, and the absence, on the other, of any adventitious solid, or fluid substance. The organisation and structure remaining unaltered, is also further evidence, that the increase of bulk is owing to a superabundant deposition of the natural solid constituents of the affected organ from an excess of the nutritive function." (See *R. Carswell's Illustrations of the Elementary Forms of Disease*, fasciculus ix.)

1. Many hypertrophies seem to arise altogether from augmentation in the habitual activity of the functions of organs. "The prodigious development and power of the muscles of the superior extremities of the blacksmith, and of the inferior extremities of the stage-dancer, are striking examples of hypertrophy occurring under the influence of the frequent and increased exercise of a function, the effect of which is a corresponding increase of nutrition and of development of the muscular tissue. The anomalous development of the muscles of involuntary motion, as those of the

heart, bladder, and intestines, is likewise often precisely of a similar nature, an increased exercise of the muscular power of these organs having been excited and kept up to overcome a mechanical obstacle to the free passage of their respective contents." (*Carswell, lb.*)

2. Some hypertrophies take place as the unequivocal result of what Andral calls active *hyperæmia*, either acute or chronic, or, in other words, of a great determination, or of a copious afflux of blood to parts, for a greater or lesser time.

3. Others proceed from some physiological or pathological stimulus, some irritation of the nutritive function, creating an excess of it. (See *Andral, Précis d'Anat. Pathol.* t. i. p. 182.)

HYPOPIUM, or HYPOPYON. (from ὑπό, under; and πύον, pus.) An accumulation of a glutinous, yellowish fluid, like pus, in the anterior chamber of the aqueous humour, and, frequently, also in the posterior one. This viscid matter of hypopyum, though commonly called pus, is found to be coagulating lymph, or fibrine, secreted, either by the lining of the cornea, the iris, the capsule of the lens, or the ciliary processes. (See *MacKenzie, On Dis. of the Eye*, p. 572. ed. 2.) The symptoms, portending such an extravasation in the eye, or an hypopyum, are the same as those which occur in the highest stage of acute ophthalmia: viz., prodigious tumefaction of the eyelids; the same redness and swelling of the conjunctiva, as in chemo-sis; burning heat and pain in the eye; pains in the eyebrow and nape of the neck; fever, restlessness, aversion to the faintest light, and a contracted state of the pupil.

As soon as the hypopyum begins to form, says Scarpa, a yellowish semilunar streak makes its appearance at the bottom of the anterior chamber, and, regularly, as the glutinous fluid is secreted from the inflamed internal membranes of the eye, so as to pass through the pupil, and fall into the aqueous humour, it increases in all dimensions, and gradually obscures the iris; first at its inferior part, next where it forms the pupil, and lastly, the whole circumference of this membrane. So long as the inflammatory stage of violent ophthalmia lasts, the hypopyum never fails to enlarge; but, immediately this stage ceases, and the ophthalmia enters its second period, or that dependent on local weakness, the quantity of coagulating lymph, forming the hypopyum, leaves off increasing, and, from that moment, is disposed to diminish.

Scarpa states, that persons, little versed in the treatment of diseases of the eyes, would fancy, that the most expeditious and efficacious mode of curing an hypopyum, after it has become stationary in the second stage of acute ophthalmia, would be that of opening the cornea at its most depending part, in order to procure a speedy exit for the matter collected in the chambers of the aqueous humour; especially as this was once the common doctrine. But experience shows, that dividing the cornea, in such circumstances, is seldom successful; and most frequently gives rise to evils, worse than the hypopyum itself, notwithstanding the modification suggested by Richter (*Obs. Chir.* fasc. 1. chap. 12.) not to evacuate the whole of the matter at once, nor to promote its discharge by repeated pressure and injections, but to allow it to flow slowly out of itself. The wound made at the lower part of the cornea, for evacuating the matter of the hypopyum, small as the incision may

be, most commonly reproduces severe inflammation, and a greater effusion of coagulating lymph in the chamber of the aqueous humour. It might even convert the hypopium into an ulcer of the cornea, attended with prolapsus of the iris, and occasionally of the lens itself.

There seems to Scarpa to be only one case, in which dividing the cornea is, not only useful, but indispensable; this is, when there is such an immense quantity of coagulating lymph, extravasated in the eye, that the excessive distention which it produces of all the coats of this organ, occasions symptoms so vehement, as not only threaten the entire destruction of the eye, but even endanger the life of the patient.

The dispersion of hypopium, by means of absorption, forms the primary indication, at which the surgeon should aim. In order to stop its progress, the most efficacious method is to subdue the first violence of the inflammation, and to shorten its acute stage, by the free employment of antiphlogistic treatment, and the use of emollient, topical applications. And, in conjunction with these means, there can now be no doubt, that the practice of Briél, published in 1809, ought to be followed: I mean, the quick exhibition of the submuriate of mercury, so as to affect the mouth, which was also found many years ago, at the London Ophthalmic Infirmary, to be the most powerful means of checking effusion of lymph in the eye. (See *Saunders's Work on the Eye*, ed. 2.; and *A Synopsis of the Diseases of the Eye*, by B. Travers, p. 135.) The efficacy of this practice, combined with the external use of belladonna, to make the pupil expand, will be hereafter noticed. (See *Ornithomy*.) The acute stage having been checked, a seton, or a blister on the nape of the neck, as recommended by Scarpa, should be applied.

Mr. Lawrence strongly disapproves of the practice of puncturing the cornea in hypopium. "I lay it down (says he) as an invariable rule, not to puncture the cornea in hypopion. Inflammation must be arrested by suitable means, and the effusion will be rapidly absorbed." (*On Dis. of the Eye*, p. 279.) The only exception made is, the case of general suppuration of the globe, where the eyesight is already lost, and relief of suffering may be obtained by giving exit to the matter. Mr. Middlemore takes a similar view, believing, that the treatment of hypopium should be directed against the inflammation, which is the cause of it. On the other hand, Dr. Mackenzie is partly in favour of the practice, which, in the hands of Dr. Montearth, was even repeated from time to time with advantage.

In bad cases, hypopium may lead to ulceration, opacity, and bursting of the cornea. The ulceration takes place with great celerity, and as soon as an aperture has been formed, an abundance of coagulating lymph begins to escape, and a degree of relief is experienced. But, this is not of long continuance; for, scarcely is the glutinous fluid evacuated, that distended the whole eye, and especially the cornea, when it is followed by a portion of the iris, which glides through the ulcerated aperture, and protrudes externally. (See *IRIS, PROLAPSUS OF*.) But, if in such an emergency, the cornea, already ulcerated, opaque, and greatly deranged in its organisation, should not immediately burst, the surgeon is then constrained by the violence of the symptoms, depending on the pro-

digious distention of the eyeball, to make an opening in this membrane.

Were there the least chance of restoring, in any degree, the transparency of the cornea, and the functions of the organ of vision, after opening the cornea, Scarpa acknowledges, that it would be more prudent to make the opening at the lower part of this membrane. But, in the case now considered, in which the cornea is universally menaced with ulceration and opacity, and seems ready to slough, there can be no hope of its resuming its transparency at any point, and he therefore deems it the best, and most expeditious method of relief, to divide its centre with a small bistoury, to the extent of a line and a half; and then to raise the little flap, with a pair of forceps and cut it away all round with one stroke of the scissors, so as to let the humours escape without any pressure. The eye is to be covered with a bread and milk poultice, which is to be renewed every two hours; such general remedies, as are calculated to check the progress of acute inflammation, and to quiet the nervous system, not being omitted. In proportion as the interior of the eye suppurates, the eyeball gradually diminishes, shrinks into the orbit, and at length cicatrises, leaving things in a favourable state for the application of an artificial eye.

When Scarpa delivers his opinion, that in the above aggravated form of hypopium, there can be no chance of the cornea resuming its transparency at any point, I think his assertion rather imprudent. Nor, admitting its general truth, does it follow, as a matter of course, that it is necessary and right to cut away a piece of the centre of the cornea, and absolutely destroy whatever little chance may yet be left of saving the eye. In support of this remark, let me contrast what Mr. Travers has said, with the advice of Scarpa:—"When the hypopium is so large as to rise towards the pupil, and the ulceration of the cornea is extending, I think its discharge by *section near the margin* advisable. If not too long delayed, the ulcerative process is checked by it, which would otherwise run into sloughing, and the cornea recover with only partial opacity and disfigurement." (*Synopsis of the Diseases of the Eye*, p. 280.)

Mauchart, De Hypopio; Tubingæ, 1742. C.P. Leporia, De Hypopio; 4to. Göt. 1778. Goiddin, Diss. de Hypopio; Erlang. 1810. Walther, Merkwürdige, Heilung eines Enterauges, &c. 8vo. Landshut, 1819. I observe, that in Hufeland and Himley's Journal for October 1809, p. 93. there is an account of the treatment of an hypopium, or case of effused lymph in the chambers of the eye, by exhibiting from 12 to 18 grains of the submuriate of mercury, in the space of 12 hours, and then giving bark, while as an external application the tinct. opii crocat. was employed. Thus we see, that the efficacy of mercury in checking the effusion of lymph in the eye, and promoting its absorption, has been known many years in Germany. A. Scarpa, Saggio di Caservazioli e d'Esperienze, sulle Principali Malattie degli Occhi; Venezia, 1802. Richter, Anfangsgründe der Wundarzneikunst, b. iii. 1795. J. Wardrop, Essays on the Morbid Anatomy of the Human Eye, chap. 6. Edinb. 1809. W. Lawrence, On Dis. of the Eye, p. 279. 8vo. Lond. 1833. R. Middlemore, On Dis. of the Eye, vol. 1. p. 606. 8vo. Lond. 1833. W. Mackenzie, On Dis. of the Eye, p. 372. 8vo. Lond. 1835.

HYPOSPADIAS, or HYPOSPADIÆOS, (from *hypo*, under, and *σπας*, to draw). The congenital imperfection, in which the urethra terminates at the under part of the penis, and does not extend sufficiently far forwards to reach the right situation of its orifice in the glans. Sometimes there is a vestige of this orifice; sometimes none. Half an inch, or more, of the urethra may be de-

ficient. About two years ago, I was consulted by Mr. Baker, of Staines, for a case of hypospadias, in a young child. In this instance, I cut a new passage through the glans, and having established a communication between it and the urethra, introduced a silver tube. This was worn for some time, and, the little opening having been touched with caustic, a complete cure was brought about. The management of the case was attended with some difficulty, and would not have answered with a piece of elastic gum catheter, which was at first tried; and it was necessary to get Messrs. Weiss to fabricate, at a short notice, a silver tube for the purpose, furnished with a rim, and apertures by which it could be conveniently fixed. Mr. Liston has sometimes succeeded in completing the passage by turning back a portion of the prepuce, and uniting it without any twist, i. e. with the lining membrane outwards. (*On Practical Surgery*, p. 476.)

HYSTEROTOMIA. (from *hystera*, the womb, and *tomos*, to cut.) See **CESAREAN OPERATION**.

IMPERFORATE HYMEN. See **VAGINA**.

INCARCERATION. This term is sometimes applied to cases of hernia, in the same sense as strangulation. (See **HERNIA**.) According to Professor Scarpa, however, an *incarcerated*, and a *strangulated* hernia, do not imply exactly the same thing. In the first case, says he, the course of the intestinal matter is interrupted, without any considerable impairment of the texture, or vitality of the bowel. On the contrary, in *strangulated* hernia, besides the obstruction to the course of the fecal matter, there is organic injury of the coats of the intestine, with loss of its vitality. The bowel, that is merely incarcerated, resumes its functions immediately it is replaced in the abdomen; while that, which is truly strangulated, never returns to its natural state. (*Des Hernies*, p. 251.) In England this distinction is not generally recognised.

INCONTINENCE OF URINE. (See **URINE**, **INCONTINENCE OF**.)

INFLAMMATION. (from *inflammo*, to burn.) Inflammation is the most common disorder with which surgeons have to deal. it is itself the occasion of many diseases, the number of which might be much reduced, if they were understood in their early stage, and properly treated. Inflammation follows every operation; and, if it attain a high degree, frequently prevents a successful issue. Yet, in some cases, the process is absolutely necessary for the cure; and hence, the surgeon intentionally uses such means as are calculated to excite it. (See *Langenbeck, Nosologie*, &c. b. i. c. 1.) By the term, *inflammation*, is generally understood, the state of a part, in which it is painful, hotter, redder, and more swollen and turgid than natural; which symptoms, when present in any considerable degree, or when they affect very sensible parts, are attended with fever, or a general disturbance of the system. (*Burns*.) It is more easy, however, to explain the treatment, than to say what is the essence of inflammation, or what is a satisfactory definition of it. The solution of these problems is peculiarly difficult; for, as *Langenbeck* remarks, when we describe it as that form of disease, which is characterised by pain, redness, heat, and swelling, associated with fever, this is only one view of the manner in which the affection presents itself — or, at most, only an enumeration of its appearances; and the questions, Where is the seat of the

disorder? and what is the cause of those appearances? remain unanswered. The determination of these points is the more important and necessary, because the appearances of inflammation are subject to great variety; and it is not every inflamed part that is red, and the pain is likewise attended with differences. Neither are these symptoms present in an equal degree; and one or the other may be entirely absent. Inflammation, therefore, is liable to numerous modifications, according to the organisation of the parts affected; and yet the essence of the disorder is constantly the same. In all the old works on surgery, the account of the nature of inflammation is nothing more than a notice of its symptoms. (*Langenbeck, Nosol.* b. i. p. 3.)

The susceptibility of the body for inflammation is of two kinds: the one *original*, constituting a part of the animal economy, and beyond the reach of human investigation; the other *acquired* from the influence of climate, habits of life, and state of the mind over the constitution. (*Hunter*.) The first kind of susceptibility, being innate, cannot be diminished by art; the second may be lessened by the mere avoidance of the particular causes upon which it depends.

Inflammation may, with great propriety, be divided into *healthy* and *unhealthy*. Of the first, there can only be one kind, though divisible into different stages; of the second, there must be an infinite number of species, according to the peculiarities of different constitutions, and the nature of diseases, which are numberless. (*Hunter*.) Another general division is into *common* and *specific* inflammation; the latter term implying, that the affection has some strongly marked particularity about it, rendering it, in some degree, independent of such circumstances as would controul and regulate the progress of common inflammation. Such are *venereal*, *variolous*, *vaccine*, *erysipelatos*, *gouty*, and *rheumatic* inflammations, &c. Inflammation may also be divided into the *acute* and *chronic*. This division of the subject is one of the most ancient, and seems to have obtained the sanction of all the best surgical writers. Healthy inflammation is invariably quick in its progress; for which reason, it must always rank as an *acute* species of the affection. However, there are numerous inflammations, controlled by a diseased principle, which are quick in their progress, and are, therefore, to be considered as *acute*. Chronic inflammation, which, in some of its forms, seems to be principally a perversion of the nutritive function of parts, or of the function of secretion from mucous surfaces, is always accompanied with diseased action.

My friend, Mr. James, of Exeter, justly impressed with the utility which would result from a good nosological arrangement of inflammation, has attempted to supply what must generally be allowed to be a great desideratum. To the division of inflammation into the *acute*, *sub-acute*, or *chronic*, he objects, that in many instances, these are merely different stages of the same disease. The arrangement into the *adhesive*, *suppurative*, *ulcerative*, or *gangrenous* inflammation, he does not altogether approve, because it is merely founded on the modes in which either different, or, in some instances, the same kinds of inflammation, terminate. Under the heads of *phlegmonous*, *erysipelatos*, and *gangrenous* inflammation, he argues, that diseases of the most opposite nature have been indiscrimi-

minutely brought together. The disposition to terminate in gangrene, he admits, will afford a basis for subdivision, but not for primary separation. Mr. James makes some judicious observations on the arrangement of the kinds of inflammation, according to the elementary tissue in which they occur, as proposed by Dr. Carmichael Smyth, Pinel, and Bichat. The tissues in question are five; and the doctrine supposes that the inflammation of each is essentially different. The first is phlegmonous inflammation, which affects the membrane, including the parenchyma of viscera. The second is inflammation of mucous membranes. The third, which is named erysipellatous, is of the skin: and the fifth, termed rheumatic, belongs to fibrous structure. That inflammations differ materially from the circumstance of their affecting one of these elementary tissues, rather than another, Mr. James freely admits: but he makes the following objections to this system:—1. Different kinds of inflammation are liable to occur in the same tissue. 2. The same kind of inflammation is often met with in different tissues. 3. The same inflammation may be transferred from one to another: an argument, however, on which he lays less stress, as being difficult of direct proof. (See *Obs. on the different Species of Inflammation*, p. 3—7. 8vo. Lond. 1821.) Although difference of structure accounts for some of the varieties in the appearance and character of inflammation, it has been objected to as the foundation of a nosological arrangement; not only for the reasons pointed out by Mr. James, but because the common distinctions of inflammation at present in vogue, (and some of which at least are striking), cannot be solved by reference merely to texture. Nor did this theory satisfy Mr. Hunter; who observed, that, if it were true, “we should soon be made acquainted with all the different inflammations in the same person, at the same time, and even in the same wound. For instance, in an amputation of a leg, where we cut through the skin, cellular membrane, muscle, tendon, periosteum, bone, and marrow, the skin should give us inflammation of its kind, the cellular membrane of its kind; the muscles of theirs, &c. &c.; but, we find it is the same inflammation in them all.” However, though Mr. Hunter did not admit the possibility of referring the different kinds of inflammation to peculiarities of texture, his doctrines assign to this cause considerable influence over every form of the disorder.

But, subsequently to the time of this distinguished man, a great deal has been made out in regard to the peculiarities, and different course and effects of inflammation, as it presents itself in the various textures of the body. “Even in its acute, and still more in its chronic form, inflammation frequently spreads, extensively, lasts long, and produces decided lesions in one texture, without in the slightest degree affecting others in its immediate neighbourhood. Repeated observations on the bodies of those who have died of pleurisy, of bronchitis, of peritonitis, and of dysentery, as well as of more external inflammation, leave no room for doubt on this point. Formerly, the diagnosis of different inflammatory diseases seldom extended further than the *organs* chiefly affected, and the functions of which were deranged; but we now consider the *texture* primarily affected to be one

of the most important objects of inquiry, and to be frequently within the reach of careful scrutiny.” (*Alison, in Cyclop. of Pract. Med. art. Hist. of Medicine.*) In no case is the truth of these observations more beautifully illustrated than in the varieties of inflammation to which the eye is subject. (See OPTHALMY.) But this eminent pathologist further remarks, “Not only have the effects of inflammation in the various textures been ascertained by dissection, the characteristic symptoms resulting during life from these consequences of inflammation in several parts of the body, not open to inspection, have been clearly pointed out. Thus the usual effects of inflammation of the pleura and bronchi may almost always be recognised and distinguished by percussion and auscultation. The existence of inflammation of the mucous membrane of the great intestines in all cases of dysentery, and of inflammation of the same membrane of the small intestines, in a certain class of cases of diarrhoea; the diagnosis of inflammations of this membrane from those of the peritoneum; its remarkable tendency to ulceration; its frequent (though by no means uniform) combination with inflammation of the liver, particularly in hot climates, and with continued fever in this climate, and the indications of its degree, and of its stage, to be drawn from examination of the stools, are important additions to our knowledge of abdominal inflammations,” which we owe to the labours of Somers, Ballingall, Johnson, Robertson, Abercrombie, Cheyne, Harty, Petit, Serres Andral, Chomel, and Billard. (See *Alison, Op. cit.*)

Enough, I think, has been stated to prove the practical use of attending to the effects of inflammation, as determined by texture.

The mode of reasoning, adopted by Mr. James, leads him to propose; 1st. The division of inflammations into two great classes, according to their disposition either to be limited by the effusion of organisable coagulable lymph, or to spread. 2dly. The orders are established on the principle of the degree of connection of the organ with the vital functions of the animal; another cause, which exerts a predominant influence over the character of the inflammation, acts invariably, and, *ceteris paribus*, in the same degree, the constitutional sympathy being in proportion to the danger, the difficulty of resisting that danger, and of repairing the mischief done. 3dly. The genera are founded on the original disposition of inflammations to have particular modes of termination: thus, says Mr. James, in boil and whitlow, it is to suppurate; in carbuncle, to slough; and in mumps, to resolve; and this disposition is so strong that it is very difficult to procure any other termination. It may happen, however, that there shall be more than one mode in which the inflammation is disposed to terminate, as in either resolution, or suppuration, in sphacelus, or ulceration, &c. (*Op. cit.* p. 13—16.) Mr. James conceives, “That these general principles will perhaps afford a sufficient basis for such an arrangement, as shall be both natural and useful in its application to all kinds of common inflammation; gout, rheumatism, and scrofula having peculiarities, which require them to be separated. Also with respect to inflammations, arising from external injuries, as they are more simple in their nature, may take place in sound constitutions, and are accompanied with disorganisations, which do not

exist in other cases, Mr. James considers them as materially different. He purposely excludes from his classification inflammations of the organs of sense, and of the bones, the peculiarities in their structure and functions rendering them fit subjects for separate description. Mr. James's nosological table of inflammation is certainly ingenious: I may say this, without at all involving myself in the hypothesis, that the limitation, or spreading of the generality of inflammations, is a circumstance entirely dependent upon their disposition, or indisposition to effuse organisable lymph. Mr. Hunter was well acquainted with the frequent usefulness of the adhesive inflammation in setting limits to disease, yet he did not venture to refer the circumscription of every inflammation to this cause, or the spreading of the disorder entirely to its absence. Nor, indeed, does it seem essential to Mr. James's classification, that any cause should be assigned for the disposition of one class of inflammations to be limited, and of another to spread; the two facts themselves being sufficient for the basis of the division.

There is much foundation for believing, that healthy inflammation is invariably a homogeneous process, obedient to ordained principles; and, that in similar structures, situations, and constitutions it uniformly assumes the same features. If experience reveals to us, that *here* it is commonly productive of certain effects, and *there* of different ones, the same unbounded source of wisdom communicates to the mind a knowledge that there is some difference in the tone of the constitution, or in the structure or situation of the parts affected, assignable as the cause of this variety. Dr. Carmichael Smyth (See *Med. Communications*, vol. ii.) makes the nature of the exciting cause one principal ground of the specific distinctions in inflammation; and with good reason, when he takes into the account the action of morbid poisons, and the qualities of disease in general. In burns and chilblains, the inflammation is unquestionably attended with great peculiarity, requiring different treatment from that of common inflammation in general. But, when the exciting cause is strictly mechanical, its violence and extent may cause difference in the degree and quantity of inflammation; but, with respect to its quality, this must be accounted for by constitution, or other circumstances.

It was the doctrine of John Hunter, that parts, which from their vicinity to the source of the circulation, enjoy a vigorous circulation of blood through them, undergo inflammation more favourably, and resist disease better, than other parts, of similar structure, more remote from the heart. The lower extremities are more prone to inflammation, and disease in general, than parts about the chest; when inflamed, they are longer in getting well; and the circumstance of their being depending parts, which retards the return of blood through the veins, must also increase their backwardness in any salutary process.

Common inflammation, when situated in highly organised and vascular parts, is generally more disposed to take a prosperous course, and is more governable by art, than in parts of an opposite texture. Hence, common inflammation of the skin, cellular tissue, muscles, &c. more frequently ends favourably than the same affection of bones, tendons, fasciæ, ligaments, &c. But inflammation of vital parts, though they may be exceedingly

vascular, is less likely to go on favourably than in other parts of resembling structure, but of different functions; because the natural operations of universal health depend so much upon the sound condition of such organs. (*Hunter*.)

All new-formed parts, not constituting any portion of the original structure of the body, as tumours, both of the encysted and sarcomatous kinds, excrescences, &c. cannot endure the disturbance of inflammation long, nor in a great degree. The vital powers of such parts are weak, and when irritated by the presence of inflammation these adventitious substances are sometimes removed by the lymphatics, but more commonly mortify. This remark applies also to substances generated as substitutes for the original matter of the body; for instance, the substance of a cicatrix, or of callus. The knowledge of this fact, leads us to a rational principle of cure in the treatment of several surgical diseases. Do we not here perceive the cause, why large wens are occasionally dispersed by the application of urine, brine, and similar things, which are now in great repute on this account with almost every one out of the profession?—How many verrucæ, wrongly suspected to originate from a syphilitic cause, are diminished and cured by a course of mercury! It is the stimulus of this mineral upon the whole system that accomplishes the destruction of these adventitious substances—not its antivenereal quality; and topical stimulants would fulfil the same object, not only with greater expedition, but with no injury to the general health.

Inflammation, *ceteris paribus*, always proceeds more favourably in strong than in weak constitutions; for, when there is much strength, there is little irritability. In weak constitutions, the operations of inflammation are backward, notwithstanding the part in which it is seated, may, comparatively speaking, possess considerable organisation and powers of life. (*Hunter*.)

Healthy inflammation, wherever situated, is disposed to be most violent on that side of the point of inflammation which is next to the external surface of the body. When inflammation attacks the socket of a tooth, it prevails in the greatest degree, not at the inner side of the alveolar process, but towards the cheek. When inflammation attacks the cellular substance, surrounding the rectum, near the anus, the affection mostly extends itself to the skin of the buttock, leaving the intestine perfectly sound, though in contact with the inflamed part. (*Hunter*.)

We may observe the influence of this law in the diseases of the lachrymal sac and duct, in those of the frontal sinus, and antrum, and particularly in gunshot wounds. Suppose a ball were to pass into the thigh, to within an inch of the opposite side of the limb, we should not find that inflammation would be excited along the track of the ball, but on the side next the skin which had not been hurt. If a ball were to pass quite through a limb, and carry into the wound a piece of cloth, which lodged in the middle, equidistant from the two orifices, the skin immediately over the extraneous body would inflame, provided the passage of the ball were superficial. Mr. Hunter compared this law with the principle, by which vegetables approach the surface of the earth; but the solution of it was too arduous even for his strong genius and penetration.

We see three remarkable effects often follow common inflammation; viz., adhesions of parts of the body to each other; the formation of pus, or suppuration; and ulceration, a process in which the lymphatics are sometimes thought to be more actively concerned than the blood-vessels. Hence, Mr. Hunter termed the different stages of inflammation, the *adhesive*, the *suppurative*, and the *ulcerative*. But all parts of the body are not equally liable to each of these consequences.

In the cellular texture, and in the circumscribed cavities, or those lined by a serous membrane, the adhesive stage takes place more readily than the others; suppuration may be said to follow next in order of frequency; and lastly ulceration. This statement, however, must be received with the understanding that the inflammation is healthy, and not excessive; for, when it is erysipelatous, carbuncular, or influenced by unfavourable conditions of the general health, or marked by violence of degree, no texture suffers injury and even destruction, so frequently, or to so great an extent as the cellular tissue. And, where it does not actually mortify under these circumstances, it becomes a frequent seat of abscesses and sinuses.

In internal canals, on the inner surfaces of the eyelids, nose, mouth, and trachea, in the air-cells of the lungs, in the œsophagus, stomach, intestines, pelvis of the kidney, ureters, bladder, urethra, and in all the ducts and outlets of the organs of secretion, being what are termed *mucous membranes*, the suppurative inflammation comes on more readily, than either the adhesive or the ulcerative. Adhesions, which originate from the slightest degree of inflammation in other situations and structures, can only be produced by a violent kind in the above-mentioned parts. Ulceration is more frequently met with upon mucous surfaces, than adhesions. The cellular tissue appears to be much more susceptible of the adhesive inflammation, than the adipose, and much more readily passes into the suppurative. Thus we see the cellular tissue connecting the muscles together, and the adipose substance to the muscles, inflaming, suppurating, and the matter separating the muscles from their lateral connections, and even the fat from the muscles, while the latter substance and the skin are only highly inflamed. (Hunter.) With respect to the fat being highly inflamed, however, the expression is not strictly true. Fat has no vessels, principle of life, nor action of its own; consequently, we cannot suppose that it can itself either inflame, or suppurate. We know, that it is itself a secretion; and when an abscess forms in it, we understand, that the mode of action in the vessels, naturally destined to deposit fat, has been altered to that adapted to the formation of pus. When therefore the fat is said to be inflamed, it is only meant, that the membranous cells, in which it is contained, and by which it is secreted, are thus affected.

The deeply-situated parts of the body, more especially the vital, readily admit of the adhesive stage of inflammation. The circumstance of deeply-seated parts not so readily taking on the suppurative stage of inflammation, as the superficial ones do, is strikingly illustrated in cases of smooth extraneous bodies, which, if deeply lodged, only produce the adhesive inflammation. By this process a cyst is formed, in which they lie without much inconvenience; and they may even gradually change their situation, without disturbing the parts, through

which they pass. But no sooner do these same bodies approach the skin, than abscesses immediately arise.

All inflammations, attended with disease, partake of some specific quality, from which simple inflammation is entirely free. When the constitution allows the true adhesive and suppurative stages to occur, it is to be regarded as the most healthy. Were it in an opposite state, we should see the very same irritation excite some other kind of inflammation, such as the erysipelatous, scrofulous, &c. (Hunter.)

In specific inflammations, the position, structure, and distance of the part affected from the source of the circulation, as well as from the surface of the body, seem also to have much influence. Upon this point, I feel conscious of being at variance with what Mr. Hunter has stated; but, the undecided manner in which he expresses himself, not less than the following reflections, encourages me not to desert my own ideas. We see, that venereal eruptions sooner make their appearance upon the chest and face, than upon the extremities. No organised part can be deemed exempt from the attack of common inflammation; many appear to be totally insusceptible of the venereal. We know, that scrofulous diseases of the superior extremities take a more favourable course, require amputation less frequently, and get well oftener, than those of the inferior limbs. The venereal disease make more rapid advances in the skin and throat, than in the bones and tendons; we often see it producing a specific inflammation, and an enlargement of the superficial parts of the tibia, ulna, clavicle, cranium, &c., while other bones, covered by a considerable quantity of flesh, are but rarely affected. Gouty inflammation is most prone to invade the small joints; rheumatic the large.

SYMPTOMS, NATURE, AND CAUSES OF INFLAMMATION.

Redness, swelling, heat, and pain, the four principal symptoms of phlegmonous inflammation, have been accurately noticed by Celsus, *Nota vero inflammationis sunt quatuor, rubor, et tumor, cum calore et dolore* (b. iii. cap. 10.). If we refer to any writer on this interesting part of surgery, we shall find the above symptoms enumerated as characterising phlegmon. In short, this term is usually applied to a circumscribed tumour, attended with heat, redness, tension, and a throbbing pain. These are the appearances first observed; and when they are slight, and the inflammation is of no great extent, they have commonly very little, and sometimes no apparent, influence on the general system. But, when they are more considerable, and the inflammation becomes extensive, a full, quick, and generally a hard pulse, takes place, and the patient, at the same time, complains of universal heat, thirst, and other symptoms of fever. While the inflamed part becomes red, painful, and swelled, its functions are also impaired. The same degree of inflammation produces more swelling in soft parts, and less in those of a harder structure. (Burns.) Of textures naturally transparent, inflammation usually produces opacity. Most commonly it thickens parts, and renders them more solid; but in certain instances it may occasion the opposite effect—a softening of them; as in the brain and medulla spinalis. The softening of some textures is regarded by Professor

Carswell, as a variety of gangrene. (See his *Illustrations of the Elem. Forms of Disease*.)

As the constitutional disturbance, arising from inflammation has been already noticed in the article *FEVER*, I shall not dwell upon it at present. I may observe, however, that inflammation of small extent, particularly if not implicating organs of great importance in the economy, frequently commences, runs their course, and terminate, without the action of the heart being in the least affected. In the *Hunertian* language, the constitution does not sympathise with this minor degree of inflammation. Hence, as a modern writer observes, since the action of the heart is not increased, except when a considerable extent of inflammation exists, or, I would add, a more limited inflammation of highly important and sensible organs, the increased action of the heart cannot be regarded as a necessary constituent of inflammation. Consequently (says he) no argument in favour of an increased action of the heart, or of the larger vessels, as causes of inflammation, can be drawn from extensive inflammations, in which the heart is affected secondarily, can apply to those which are small and circumscribed, and during the whole course of which the heart may not beat even once oftener in a minute, than it did before the local disease existed. (See *J. W. Earle*, in *Lond. Med. Gaz.* vol. xvi. p. 107.)

Though the redness, swelling, throbbing, tension, and other symptoms of inflammation, are less manifest, when the affection is deeply situated, yet their existence is undoubted. When persons die of peripneumony, or inflammation of the lungs, the air-cells of these organs are found crowded with a larger number of turgid blood-vessels, than in the healthy state, and, of course, the parts must appear preternaturally red. Coagulating lymph, or a mixture of fibrine and serum, and even blood, are extravasated in the substance of these viscera, which become heavier, and feel more solid. (*Baillie*.)

The extravasation of coagulating lymph, which is one of the chief causes of the swelling, is also one of the most characteristic signs of phlegmonous inflammation.

Some writers (*Smyth*, in *Med. Commun.* vol. ii.) restrict the seat of phlegmon to the cellular tissue; but, this is erroneous. Had such authors duly discriminated the nature of common inflammation, they would have allowed, that this affection existed, wherever the capillaries appeared to be more numerous, and enlarged, than in the natural state, accompanied with an effusion of coagulating lymph, whether upon the surface of a membrane, or a bone, or in the interstices of the cellular substance, and attended with acute pain, and a throbbing pulsation in the part.

As Dr. Thomson has observed, the epithet *remote*, as applied to the causes of inflammation, does not appear to be happily chosen; for under this term, are comprehended all those agents, events, and states, which contribute immediately, as well as remotely, directly as well as indirectly, to the production of the affection. (*Lectures on Inflammation*, p. 50.)

The remote causes of inflammation are infinite in number, but, easy of comprehension, because divisible into two general classes. The first includes all such agents as operate by their stimulant or chemical qualities; for instance, cantharides, heat, the action of concentrated acids, alkalies,

metallic oxides, and metallic salts, acrid vapours, such as ammoniacal gas, the nitrous, sulphureous, muriatic gases, &c., alcohol, æther, and all acrid, vegetable essential oils, animal poisons, and the whole of that class of substances, known by the name of rubefacients. (*Thomson*, *On Inflammation*, p. 55.) The second class of causes are those which act mechanically, such as bruises, wounds, pressure, friction, &c.

Fevers often seem to become the remote causes of local inflammation. In other instances, inflammation appears to arise spontaneously, or, as I should rather say, without any perceptible exciting cause.

The principle, on which the application of cold to a part becomes the remote cause of inflammation, is not decidedly known. "No subject (says a distinguished professor) is more deserving of your study, than the effects, which are produced in the human body by the operation of cold applied to its surface; but the subject is, at the same time, exceedingly extensive, complicated, and difficult. These effects differ according to the degree, in which the cold is applied, the state of the system, the part of the body to which it is applied, and the mode of its application. So diversified, indeed, are these effects, that it requires no mean confidence in theoretical reasoning to believe, that the operation of cold in producing them is explicable upon any single general principle." (See *Thomson*, *On Inflammation*, p. 58.) And in the preceding page, he observes:—"The operation of cold upon the human body affords the best example, which I can suggest to you, of the production of inflammation from the operation of a power acting upon a part at a distance from that, in which the inflammation takes place. The instances formerly mentioned of inflammation of the throat, chest, or belly, from the application of cold to the feet, are daily occurrences in these climates, of which it is impossible for us, in the present state of our knowledge of the animal economy, to give any thing like a satisfactory explanation.

"In some instances, cold, or a diminution of temperature, seems to act more directly upon the parts, with which it comes into contact. We have examples of this in the inflammation of the mucous membranes of the nose, fauces, trachea, and bronchiæ, from the inhalation of cold air; and in the production of rheumatic inflammation from the accidental exposure of some part or other of the body to cold. The application of cold, in the instances I have mentioned, seems to have somewhat of a directly exciting effect; and perhaps the same remark is still more applicable to the local effects of cold in the production of the inflammation accompanying the state, which is usually denominated frost-bite. Touching a solid body, as a piece of metal, the temperature of which has been greatly reduced, produces a sensation like that of burning, and may be followed, like the application of fire, by a blister." (*Op. cit.*)

Numerous opinions have been entertained, respecting the proximate cause of inflammation; but almost every theory has been built upon the supposition of some kind of obstruction in the inflamed part.

While the circulation of the blood was unknown, the opinion prevailed, that the liver was the centre of the vascular system, from which the blood went forth by day to the extremities, and returned again.

by night. If then any peccant matter irritated the liver, the blood was sent out more forcibly; and if at the same time any part of the body were weakened, or otherwise disposed to receive a greater quantity of fluid than the rest, then a swelling was produced by the flow of humours to this place. Fluxions, or flows of humour to a part might happen either from weakness of it which allowed the humours to enter more abundantly, or from its attracting the humours, in consequence of the application of heat or other agents. The peculiar nature of the swelling was supposed to depend upon the kind of humour. Blood produces the true phlegmon; bile, erysipelas, &c. An idea was also entertained, that the blood and humours might slowly stagnate in a part, from a want of expulsive power, and this affection was termed a *congestion*, while the expression *fluxion* or *defluxion* was used to denote any swelling arising from the sudden flow of humours from a distant part. (*J. Burns, Dissertations on Inflammation.*)

From the theories of *fluxion* and *congestion*, which were quite incompatible with the laws of the circulation of the blood, we turn our attention to the doctrine of *obstruction*.

Boerhaave inculcated, (*Aph.* 375. *et seq.*) that inflammation was caused by an obstruction to the free circulation of the blood in the minute vessels, and this obstruction, he supposed, might be caused by heat, diarrhoea, too copious flow of urine, and sweat, or whatever could dissipate the thinner parts of the blood, and produce a thickness or viscosity of that fluid. When the lensor did not exist before the production of inflammation, he imagined that the larger globules of the blood passed into the small vessels, and thus plugged them up. This circumstance was termed an *error loci*. The obstruction, whether caused by *viscosity*, or an *error loci*, was imagined to occasion a resistance to the circulation in the part affected; and hence, an increase of the flow of the blood in the other vessels, an irritation of the heart, and augmentation of the force or attraction of the blood in that part of the vessel which was behind the obstruction. This caused heat and pain, while the accumulation of the blood produced redness. Boerhaave also brought into the account an *acrimonious state of the fluids*, which rendered resolution out of the question, and gangrene likely to follow. (*Aph.* 388.)

Boerhaave's theory of obstruction was too circumscribed, and too mechanical; it reduced all inflammations to one species; the only distinctions which could have arisen, must have proceeded from the nature of the obstruction itself; and it was a doctrine that never could account for the action of many specific diseases and morbid poisons. (*Hunter.*)

The decided impossibility of giving a rational explanation of the immediate cause of inflammation by any supposed state of the blood alone, led pathologists to investigate how far a change in the blood-vessels themselves might account for the process. It belongs more properly to a physiological, than a surgical work, to explain the various facts and experiments in support of the opinion, that the arterial tubes, and especially the capillaries, possess a high degree of vital contractility, whereby the motion of the fluids in them, the process of secretion, and other local phenomena, may be importantly affected, in a manner not at all explicable, by reference only to the action and

power of the heart. For such information, I would particularly advise the reader to consult the publications of Dr. Wilson Philip and Dr. Hastings. According to the latter gentleman, the actual agency of the capillary vessels, "is not only supported by such experiments as those related, it is also countenanced by an extensive series of phenomena presented during the disease in the human subject. Of these may be mentioned, irregular determinations of blood, the growth of tumours, increased pulsation of arteries leading to inflamed parts, of which the following is a well-marked example, the accuracy of which may be entirely relied upon:—The carotids, when the person alluded to is in health, beat equally as to strength and frequency; but, when he is attacked with inflammation in the right tonsil, to which he is particularly subject, and which proceeds sometimes so far as nearly to prevent deglutition, each pulsation of the artery gives a throbbing sensation on the right side of the head. On the application of the hand at this time to each carotid, the right is found to beat much stronger and fuller, than the left. This diversity of action in these two arteries cannot arise from any impulse given by the blood to the heart; it must be derived from some modification of the contractile power of the artery." And Dr. Hastings expresses his belief in this explanation, notwithstanding Dr. C. H. Parry wishes to attribute to the remote influence of the heart, some of the phenomena of local congestion, and motion, and to show, that the different states of vascular dilatation are still more conspicuously connected with the different degrees of action of the heart, and the consequent momentum of the blood, than with local circumstances; and that the proneness to local dilatation, or, as it is called, action, is a consequence of slowly succeeding, but continued impulse.

The blood-vessels, through every part of the system, are commonly believed to possess a considerable share of irritability, by which they contract, and propel forward their contents. Hence the blood, by the action of the vessels, receives a new impulse in the most minute tubes, and a well-regulated momentum is preserved in every part of its course. But, of all parts of the sanguiferous system, the capillaries seem most eminently endowed with this faculty, and are least indebted to the presiding influence of the heart. Yet even, in these vessels, the action of the heart is of high importance in sustaining the healthy circulation, inasmuch as it gives the first impulse to the blood, and preserves the harmony of the sanguiferous system.

The vessels are endowed with this vital property, in order that each organ in the body may receive such a supply of blood, as will enable it duly to exercise its functions. Hence, a healthy state of this property is absolutely necessary for the preservation of the animal functions; for, if the vital contraction of the blood-vessels be either increased or diminished, irregular distribution of the blood inevitably follows, and from this source numerous diseases arise, and none more frequently, than inflammation. However, though these sentiments, delivered by Dr. Hastings, may be generally correct, I am not prepared to join in the opinion, that inflammation is ever produced simply by an inequality in the distribution of the blood; a statement, which this gentleman probably does not

mean to make himself, as he confesses, that some of the phenomena of this disease depend upon sympathy between the sanguiferous and nervous systems. (See *Hastings, On Inflammation of the Mucous Membrane of the Lungs, &c.* p. 32. 64. 65. 8vo. Lond. 1820; and *C. H. Parry, Additional Experiments, On the Arteries, &c.* p. 112. 114.; also *Whytt, On the Motion of the Fluids in the small Vessels; Verschuir de Arteriarum et Venarum Vi irritabili; Zimmerman, de Irritabilitate*, p. 24.; *Hunter, On the Blood, &c.*; and *J. Cloquet, Pathologie Chir.* p. 13. 4to. Paris, 1831.)

Dr. Cullen attributed the proximate cause of inflammation to a "spasm of the extreme arteries supporting an increased action in the course of them." This theory only differs from that of Boerhaave in the cause which is assigned for the obstruction. Dr. Cullen conceived, however, that some causes of inequality in the distribution of the blood, might throw an unusual quantity of it into particular vessels, to which it must necessarily prove a stimulus; and, that in order to relieve the congestion, the vis medicatrix nature increases still more the action of the vessels; which, as in all other febrile diseases, it effects by the formation of a spasm on their extremities. "A spasm of the extreme arteries, supporting an increased action in the course of them, may, therefore, be considered as the proximate cause of inflammation; at least, in all cases not arising from direct stimuli applied; and, even in this case, the stimuli may be supposed to produce a spasm of the extreme vessels." (*Cullen.*)

The inconsistencies in Cullen's theory are glaring. The congestion, or accumulation of blood, which is only an effect or consequence of inflammation, is set down as the cause of the spasm of the vessels, to which spasmodic constriction, Cullen, strangely enough, assigns the name of proximate cause. The spasmodic contraction of the extremities of the vessels, instead of propelling the accumulated quantity of blood, would render the passage of the blood from the arterial into the venous system still more difficult. (*Burns.*)

We shall now notice the celebrated, and very original opinions, promulgated on this subject by John Hunter. According to him, inflammation is to be considered only as a disturbed state of parts, which requires a new, but salutary mode of action, to restore them to that state, wherein a natural mode of action alone is necessary. From such a view of the subject, therefore, inflammation in itself is not to be considered as a disease, but as a salutary operation, consequent either to some violence or some disease. Elsewhere, the author remarks, the act of inflammation is to be considered as an increased action of the vessels, which, at first, consists simply in an increase or distention beyond their natural size. This increase seems to depend upon a diminution of the muscular power of the vessels, at the same time that the elastic power of the artery must be dilated in the same proportion. This is, therefore, something more than simply a common relaxation: we must suppose it an action in the parts to produce an increase of size for particular purposes; and this Mr. Hunter would call an act of dilatation. The whole is to be considered as a necessary operation of nature. Owing to this dilatation, there is a greater quantity of blood circulating in the part, which is according to the common rules of the animal economy; for,

whenever a part has more to do than simply to support itself, the blood is there collected in larger quantity. The swelling is produced by an extravasation of coagulable lymph, with some serum: but this lymph differs from the common lymph, in consequence of passing through inflamed vessels. It is this lymph which becomes the uniting medium of inflamed parts; vessels shoot into it; and it has even the power of becoming vascular itself. The pain proceeds from spasm. The redness is produced either by the arteries being more dilated than the veins, or because the blood is not changed in the veins. "As the vessels become larger, and the part becomes more of the colour of blood, it is to be supposed there is more blood in the part; and as the true inflammatory colour is scarlet, or that colour which the blood has when in the arteries, one would from hence conclude, either that the arteries were principally dilated, or, at least, if the veins are equally distended, that the blood undergoes no change in such inflammation in its passage from the arteries into the veins, which I think (says Mr. Hunter) most probably the case; and this may arise from the quickness of its passage through those vessels. When a part cannot be restored to health, after injury, by inflammation alone, or by adhesion, then suppuration, as a preparatory step to the formation of granulations, and the consequent restoration of the part, takes place. The vessels are nearly in the same state as in inflammation; but they are more quiescent, and have acquired a new mode of action." (*Hunter.*)

With respect to Mr. Hunter's theory, which has deservedly had vast influence in regulating the judgment of professional men in this country on the nature of the process called inflammation, it cannot be received in the present state of knowledge, without some limitation. The hypothesis, that the blood-vessels possess an active power of dilatation, independently of their elasticity, as Dr. Hastings observes, must as yet be regarded, as devoid of proof, and therefore should not be assumed as a basis, on which any theory of inflammation can be founded. (*On Inflammation of the Mucous Membrane of the Lungs, &c.*, p. 70.) And, as another intelligent writer remarks, how different would have been Mr. Hunter's inferences, if, instead of trusting to the unassisted eye, he had viewed the inflamed vessels through the microscope! He would then have seen the blood moving; and found, that, "instead of its passage being quickened in the inflamed vessels, it is uniformly rendered slower in proportion to the degree of inflammation, and, in the most inflamed parts, stands still altogether." (*On the Vital Functions*, p. 288. ed. 2.) And, in another part of his writings, Dr. Philip has endeavoured to prove, from several facts respecting the colour of the blood, that, within certain limits, the accumulation of this fluid in the debilitated vessels of the inflamed part necessarily causes the blood to retain the florid colour. (*On Fevers*, part 2. Introd.)

In modern times, the vague, but convenient expression, increased action of the vessels, has been very generally used as an adequate explanation of the proximate cause of inflammation. The doctrine, it is said, derives support from a review of the several exciting causes of the affection, which, being in general of an irritating nature, must, when applied to any living or sensible parts, occasion such increased action of the vessels; while

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the method of cure also tends to confirm the opinion. But, before one can judge, whether this doctrine is correct, and supported by facts and observation, it is necessary to understand precisely what is implied by increased action of vessels; for it is not every affection of the vessels, capable of being thus denominated, which will of itself constitute inflammation. In gestation, the arteries of the womb are enlarged, and a greater quantity of blood is sent into them; yet this organ is not inflamed. The carotids are in a similar state during the growth of the stag's horn; but no inflammation exists. If, then, the proximate cause of inflammation is to be called an increased action of the vessels, we must first be informed not only what is meant by the term, but what particular vessels are spoken of, whether the arterial trunks, branches, or capillaries. Because, if the phrase is intended to signify increased alternate expansions and contractions of all the arteries of the inflamed part, it is an hypothesis entirely destitute of foundation. If it be meant to denote an increased velocity of the motion of the blood in the part affected, the doctrine is rather contradicted, than confirmed, by the latest and most carefully instituted microscopical experiments. But if the expression only refers to the dilated state of the capillaries, the throbbing of the arteries leading to the seat of inflammation, the effusion of lymph, &c., less fault can be found with the language, though yet requiring much further explanation ere it can communicate any very precise information.

"There are (says a learned professor) two hypotheses, which at present divide the opinions of pathologists, respecting the state of the capillary vessels affected with inflammation. According to the first of these hypotheses, the inflamed vessels are in a state of increased action; according to the second, they act with less force than the trunks from which they are derived." (See Thomson, *On Inflammation*, p. 64.)

The first of these opinions, according to Dr. Thomson, was suggested by the views which Stahl took of the animal economy, and his ideas respecting the tonic, or vital action of the capillary vessels. The doctrine, however, was more particularly insisted upon by his disciples and followers, especially De Gorter, who, in one place, expressly states: "That the proximate cause of inflammation consists in an increased vital action of some particular artery, or arteries, by which the blood is propelled with greater force than usual, into the communicating lymphatic and colourless vessels. (See his *Compendium Medicinæ*, and *Chirurgia Repurgata*.)

The doctrine, which supposes the action of the inflamed vessels to be diminished, or to be proportionally less than that of the trunk, or trunks, from which they are derived, was, as far as Dr. Thomson can learn, first stated by Vacca, an Italian physician, in a small treatise on inflammation, published at Florence, in 1765, entitled, "*Libro de Inflammationis Morbosæ, quæ in humano corpore fit Naturâ, Causis, Affectibus, et Curatione.*"

For an account of the arguments, with which Vacca supports his hypothesis, my limits oblige me to refer to the work of Dr. Thomson. (P. 68. &c.)

There are certain points, in which the two doctrines agree, as well as others in which they differ.

"The advocates for each hypothesis agree in admitting, 1st. that inflammation has its seat in the capillary vessels; and 2dly. that the redness in inflammation is owing to an unusual quantity of blood in the vessels of the inflamed part, and consequently that the capillary arteries are much dilated during the state of inflammation. The contractions of these vessels, indeed, it has been said, are increased also in a ratio proportional to the dilatations; but this is an assertion, which has not yet been proved, either in the way of experiment, or of observation.

"The sense of throbbing, which the advocates for the hypothesis of increased capillary action regard as the strongest proof of that action, Mr. Allen is disposed to attribute to the difficulty which the blood meets with in passing from the trunk into the capillary branches. This sensation of throbbing, and appearance of increased action, may be produced in an instant, by applying a ligature to an uninflamed finger, so as to obstruct the motion of the blood through its point. Besides, this throbbing, or pulsatory motion, can afford us no criterion, by which to judge of the force, with which the artery contracts; for it is produced in the dilatation of the artery, and by a power foreign to the artery itself." (Thomson, *On Inflammation*, p. 73.)

Dr. Wilson Philip, many years ago, endeavoured to ascertain, by means of the microscope, the state of the vessels in the various stages of inflammation, both in the warm and cold blooded animal. I have put the epithet warm in italics, because it has been observed by my friend, Mr. James, "That analogies between the higher and lower orders of animals, the chief subjects of these experiments, cannot be deemed conclusive," (*On Some of the General Principles of Inflammation*, p. 29. 8vo. Lond. 1821) as if it had escaped attention, that many of the experiments were really made on the more perfect animals. From the valuable observations, to which I here allude, (see Philip, *On Febrile Diseases*, part. 2. Introd.) it appears, that the state of the smaller vessels in an inflamed part is that of preternatural distension and debility. As for the larger vessels, whose state may be ascertained, without the aid of the microscope, "they do not undergo a similar distension, and the increased pulsation of the arteries, sufficiently evinces their increased action. In inflammatory affections of the jaw and the head, for example, a greatly increased action of the maxillary and temporal arteries is readily perceived by the finger. It is to be observed, however, that although inflammation, as was evident from the foregoing experiments, begins in the capillaries, if it continues, the circulation in the smallest vessels becoming very languid, those immediately preceding them in the course of the circulation begin to be distended, and consequently debilitated." Dr. Philip adds, that such distension and debility of the vessels, which immediately precede the capillaries, cannot go far because when the former lose their power, the circulation in the latter is not supported, and gangrene soon ensues. "In short (says Dr. Philip), inflammation seems to consist in the debility of the capillaries, followed by an increased action of the larger arteries," and is terminated by resolution, when the capillaries are so far excited, and the larger arteries so far weakened, by the preternatural action of the latter, that the power of the

capillaries is again in due proportion to the *vis à tergo*.

"Thus far (says Dr. Philip) I cannot help thinking the nature of inflammation appears sufficiently evident. The motion of the blood is retarded in the capillaries, in consequence of the debility induced in them; an unusual obstacle is thus opposed to its motion in the arteries preceding them in the course of the circulation, which are thus excited to increased action. Several difficulties, however, remain, on which the experiments just related throw no light. Why does a failure of power, of small extent in the capillaries of a vital part, strongly excite, not only the larger arteries of the part affected, but those of the whole system; while a more extensive debility of the capillaries of an external part excites less increased action in the larger arteries of that part, and often none at all in those of the system in general? Why does inflammation often move suddenly from one part to another, when we see no cause, either increasing the action of the capillaries of the inflamed part, or weakening those of the part now affected? Why does inflammation often arise in parts only sympathetically affected, and consequently far removed from the offending cause? Why is inflammation often as apt to spread to neighbouring parts, between which, and the part first affected, there is no direct communication of vessels, as to parts in continuation with that part?

"These phenomena, it is evident (says Dr. Philip), are referrible to the agency of the nervous system, and seem readily explained by the experiments, which prove, that the effects of both stimuli and sedatives, acting through this system, are felt by the vessels, and that independently of the intervention of any effect produced on the heart. (Exp. 27, 28.) Thus, the irritation of the nerves of the inflamed part may excite the larger arteries of this part, or of distant parts, or of the whole sanguiferous system. It will, of course, be most apt to do so, where the irritation excited by the inflammation is greatest, and consequently in the more important vital parts. It cannot appear surprising, that inflammation should suddenly cease in one part and attack another, when we know, that the nerves are capable of exciting to due action the capillaries of the one part, and in the other of impairing the vigour of those which have not suffered. In the same way, we account for parts only sympathetically affected becoming inflamed, and for inflammation readily spreading to neighbouring parts, which always sympathise, although there is no direct communication between them, either of vessels or nerves." (*On the Vital Functions*, p. 279. &c. ed. 2.)

Respecting the inference, made by Dr. Philip from his experiments, that the circulation is slower in inflamed, than uninfamed arteries, Dr. J. Thomson conceives, that its truth "is not necessary to the establishment of Mr. Allen's hypothesis; and from a number of experiments which I have at different times made upon frogs, I am inclined to believe, that a diminished velocity of the blood, in the capillary branches, is by no means a necessary, constant, nor even the most common effect of incipient and moderate degrees of inflammation." (P. 75.)

In order to reconcile this difference in the statements made by the only two writers, who had then treated this subject by experiment, Dr. Hastings

repeated their mode of investigation with the aid of the microscope. His conclusions are, "that certain stimuli, applied to living parts, produce an increased velocity of the blood's motion, and a contraction of the blood-vessels. During this state of excitement, the part affected is so far from giving any thing like the appearances of inflammation, that the size of the vessels is diminished, and the part paler. But, if the stimulus be long continued, or increased in power, the small vessels, which, in the natural state, admit only of one series of globules, become so dilated, as to allow an accumulation of a much less fluid and redder blood in them, which loses its globular appearance, and moves much more slowly, than that which previously passed through the vessels. The part now appears inflamed. If the stimulus be removed, the vessels do not soon regain their original state; time is necessary to allow them to recover their contractile power, so as to prevent the impetus, with which the blood is propelled by the heat and larger arteries, from keeping up the dilated state of the capillaries. Here then we are obliged to admit, with Boerhaave, that there is an error loci; for a denser and redder blood passes into small vessels, which before carried much more fluid contents: but the error loci does not cause the inflammation, but results from the previously weakened state of the capillaries. In this manner, the blood may occasionally be extravasated in inflammation, without any actual rupture of a vessel, for the exhalents may be so weakened and dilated, as to allow globules to pass through them."

"If the stimulus, which produces the inflammation be of a very acrid nature, debility of the vessels is frequently induced without any previous excitement. The blood in all the smaller vessels becomes very red, circulates very slowly, and in some vessels stagnates."

"The application of a stimulus, different from that which produced inflammation, will sometimes bring on resolution. When this occurs, the dilated vessels contract; they no longer contain a red, dense, homogeneous fluid, but again receive blood, consisting of small, nearly colourless globules, which float in a colourless fluid; and the motion of these globules at length becomes as quick as before the inflammation took place. If, however, the inflammation proceed, the blood becomes nearly stagnant; it continues very red, and the vessels are much dilated."

"When this high degree of inflammation is not relieved, sphacelus ensues. The part then feels softer to the finger, and gives way with less force. The vessels are much dilated, the blood does not move, it loses its red colour, and becomes of a yellowish brown hue. The separation of the dead from the living part takes place soon after this change in the colour of the blood."

"Whilst the ulceration, produced by this separation of the dead from the living part of the web is healing, the capillary vessels, distributed on the ulcerated surface, and the contiguous parts, are much distended with arterial red blood, which is moved very slowly. When the ulceration is healed, the vessels become contracted, and circulate the fluid, with the same degree of velocity as before the inflammation was excited."

"With respect to the seat of inflammation, it may be observed, that the capillaries are first affected; but even the small arteries of the web are

also occasionally distended." (*Hastings, On Inflammation of the Mucous Membrane of the Lungs*, &c. p. 90—92.)

With respect to the doctrine, espoused by some pathologists, that the smaller branches of veins are the exclusive seat of inflammation, the same author observes, that the microscope shows us that the most minute arterial branches, though far less numerous, are equally affected with weakness and distention. But, as Mr. Lawrence has remarked on this part of the subject, how can we tell whether the arteries, or the veins are exclusively affected? Is the distinction even practicable? If we trace the vessels of a part, we soon come to the points at which we can no longer distinguish between arteries and veins; we find a minute network of vascular ramifications, which cannot be unravelled, or distinguished.

In the course of Dr. Hastings's inquiry, it is proved, that the healthy circulation of the blood essentially depends upon a due degree of action in the vessels throughout the system; that the application of stimuli, whilst it increases the action of the vessels, produces none of the symptoms of inflammation. When, however, the excessive action of these stimuli has impaired the excitability of the small vessels, the phenomena of inflammation are fully manifested; and when their excitability is restored, the inflammation subsides. It may be logically inferred, therefore, says this writer, that *inflammation consists in a weakened action of the capillaries, by which the equilibrium between the larger and smaller vessels is destroyed, and the latter become distended.* And, with respect to the conclusion, drawn by Dr. Thomson from his experiments, that inflammation, in moderate degrees, consists in an increased action of the vessels, Dr. Hastings argues, that the writer's belief in the excitement of the capillaries, in some cases of inflammation, arises from his having denominated that a state of inflammation, which ought not to be so called. "The application of the salt (says Dr. Thomson) produced an increased velocity in the dilated larger and smaller arteries and capillary vessels, to which it was more immediately applied. In nine experiments, the phenomena of which I have minutely recorded, the application of the salt was not only followed by a bright red colour, visible to the naked eye, and a sensible enlargement of the arterial and venous branches, but with an increased rapidity of circulation in the capillary vessels; the globules becoming less distinct, than before the application of the salt, and obviously less distinct, from the rapidity of their motion, than the globules in the capillary vessels in the uninfamed part of the web in the same animal. The repeated application, however, of the salt to the same vessels, was always sooner or later followed by retarded capillary circulation, or even by complete stagnation." (See *Thomson's Lectures*, p. 68.) The results of other experiments, made by this gentleman, and which coincide with the sentiments of Dr. W. Philips and Dr. Hastings, need not here be cited.

Now, with regard to those experiments, which seemed to Dr. Thomson to justify the inference, that moderate degrees of inflammation may be attended with an increased velocity of the blood in the inflamed vessels, Dr. Hastings, as I have already said, objects, that the appearances seen, while such velocity of the circulation presented

itself in the vessels affected, ought not to have been denominated inflammation; because "it constantly happened in his own experiments, that when inflammation commenced, no globules could be seen even in the blood of the affected vessels. It was universally converted into a bright red homogeneous fluid. So that *globules could never be seen in the capillaries of a really inflamed part, much less moving with great velocity.*" He argues, that the state alluded to by Dr. Thomson, is only that temporary excitement of the capillaries, generally preceding their debility, which is inseparable from inflammation. (See *Hastings, On Inflammation*, &c. p. 98. 101.)

Mr. J. W. Earle adopts nearly the same view, as that taken by Dr. Hastings. He asks, whether either of the variations in the state of the capillaries, and in the flow of the blood, which have been described by Dr. Thomson, was accompanied with an effusion of lymph, or by mortification, which are the usual attendants upon the state of inflammation, and by which the existence of that condition might have been distinctly recognised. "To this question (he observes), as far as I am capable of judging, there appears to be but one answer, which is, that, although that state of parts, which was induced by the application of salt, viz. retardation and stagnation of the blood, prevented the strongest resemblance to inflammation, yet, in no one instance, did either state continue for a sufficient length of time to allow any one of the usual accompaniments of inflammation being produced, since each variation terminated more or less speedily in the restoration of the natural current." (See *Lond. Med. Gaz.* vol. xvi. p. 40.) The same gentleman deems the evidence adduced by Dr. Philip a complete proof, that *no sign of inflammation can be detected, while the velocity of the blood's motion is increased, but that inflammation is immediately recognised, when it is retarded; and disappears as the healthy current is restored.*

Mr. J. W. Earle quotes, from the valuable work of M. Gendrin, the following interesting particulars respecting the nature of the process of inflammation:—"If (says M. Gendrin) we continue the irritation of the tissue, whether of the mesentery, or of the web of the foot, the blood flows towards the point irritated. The best method of observing this phenomenon, is to concentrate the rays of the sun, by means of a convex glass, upon the part placed in the focus of the microscope. The globules of the blood are then seen crowding into the capillaries, which are dilated, and which all carry the blood towards the point irritated. This movement is so evident, that one need only place a red-hot needle upon the course of the minute vessel, in which the flow of the globules has been distinctly noticed, in order to see them *instantly retrograde* towards the point irritated. The capillaries around this point dilate, and seem to multiply themselves; because a greater number is perceived, on account of the presence of the red blood, which, in colouring them, renders them more visible. The globules arrive; they are crowded together; their motion is retarded; and at length suspended. They *revolve* upon themselves, and at last remain entirely at rest. The capillary circulation is then evidently suspended in the point irritated. For some distance around, the *retardation of the circulation and dilatation of the capil-*

laries are plainly seen; a little farther off, the circulation is more rapid, the capillaries being still dilated, and the globules of the blood less distinct. Finally, at the limits of the inflamed areola, the circulation is, on the contrary, accelerated, the capillaries dilated, and the blood contains a greater number of globules." (See Gendrin, *Hist. Anat. des Inflammations*.)

Here, then, we find, as Mr. J. W. Earle has remarked, a notice of the increased velocity of the capillary circulation in the immediate vicinity of the inflamed part, and "which should not be lost sight of, since it clearly shows, that more blood may pass through the circumferential channels during the stagnation in the focus of the inflammation, than through the whole part before the stagnation existed; and consequently reconciles this fact with one apparently contradictory, which was ascertained by Mr. Lawrence." (See *Lond. Med. Gaz.* vol. xvi. p. 42.) In a case of inflamed hand and forearm, the latter gentleman tried the experiment of opening a vein in each arm at the same time. Three times more blood flowed from the vein of the inflamed limb, than from that of the sound one in the same time. (*On Dis. of the Eye*, p. 64.) In such an experiment, of course due care would be taken to make the opening in two veins of equal magnitude, the puncture in each vein of the same size, and to apply the bleeding fillet with the same degree of tightness to each arm.

It thus appears, that all the vessels of an inflamed part are dilated; and that while the motion of the blood is retarded, or arrested, in some, a greater quantity than usual is forced through others. Hence, as Mr. J. W. Earle very judiciously observes, the term *hyperæmie*, which is proposed by M. Andral to be substituted for *inflammation* (*Anat. Pathol.* t. i. p. 9.), has no reference to these opposite states, but merely to the quantity of blood in an inflamed part. He proposes, therefore, a change, which would be no improvement; and I think with Mr. J. W. Earle, that it is much more easy for those who employ the term *inflammation*, to understand the real nature of the process, to which it refers, than it is to find a term, which properly expresses the co-existence in the same part of two states of the blood, so opposed to each other as those accompanying inflammation. (See *Lond. Med. Gaz.* vol. xvi. p. 109.)

Of course, such writers as believe, that the blood in the capillaries is not propelled by these vessels themselves, but by the impulse received from the heart, cannot assent to any view, in which the proximate cause of the inflammation is ascribed to debility of those vessels. Dr. Parry argues, that the theory which represents this process as consisting in an increased momentum of the blood in the part affected, is not invalidated, were it even proved, according to the opinion of Dr. Philip, that the velocity of the blood in the vessels of an inflamed part is diminished, unless it be also proved, that the velocity is diminished in a greater proportion, than the quantity is increased. (*Elements of Pathology*, vol. i. p. 84.) So far, however, as I can judge, the arguments are in favour of Dr. Philip's doctrine: for, with respect to quantity making up for loss of velocity, if the supposition were to be adopted, surely it could not be retained after the inflammation had arrived at that state, in which the fluid in the capillaries is seen with the microscope to be nearly or quite stagnant.

It must be confessed at the same time, that the question about the proximate cause of inflammation is still a topic of endless controversy, into which I consider it perfectly absurd to enter any further without prosecuting the inquiry by experiments. In one sense, both Dr. Philip and Dr. Hastings admit, that an increased action of the vessels may exist in inflammation; but then this excitement, or increased action, is not in the capillaries, but the larger arteries; and Dr. Philip even suggests, that the presence or absence of such excitement may make the difference between acute and chronic inflammation. The considerations in support of the side of the question, to which I do not myself incline, may be found in the writings of Dr. Parry, Dr. C. H. Parry, and Mr. James. From this remark, I would not have it inferred, that I am at all convinced of the propriety of referring the proximate cause of inflammation to debility of the capillaries, though the retarded circulation in them, like their dilatation, is now a fact placed out of all doubt. The points, however, on which I should not assent to Dr. Philip's doctrine, will be best understood, when the treatment is considered. On the whole, we may conclude, I think, with Mr. J. W. Earle, from all the evidence and experiments hitherto brought forward, that "inflammation consists in a retardation and stagnation of the blood in the capillaries, which is subsequently attended with an enlargement of the vessels, which directly supply the obstructed part, and also with an enlargement of the circumferential vessels and channels; and, of course, the veins must be proportionally enlarged." (See *Lond. Med. Gaz.* vol. xvi. p. 44.)

As it is elsewhere noticed by the same gentleman, the experiments of Hastings, Kaltenbrunner, Gendrin, and of all the best modern authorities, prove, that an obstruction first occurs in the most minute capillaries; whereas, if inflammation were caused by any action of the larger vessels, the order of these occurrences would be reversed (P. 73.) Instead of attributing the variations in the flow of blood through the capillaries to any positive action of the vessels themselves, Mr. J. W. Earle, rejecting the Hunterian doctrine on this point, refers such variations to what is termed the *secretory function of the nerves*. (P. 76.) Whatever may be thought of this hypothesis, which still leaves the secretory function of the minute vessels unsettled, it is certain, that the influence of the nerves upon the earliest changes perceptible in inflammation, has been too much disregarded; and it is now generally admitted, that the blood-vessels, the nerves, and the blood itself, are essentially concerned in this process.

It cannot be doubted, that the varied and important functions of the extreme vessels are under the immediate and powerful influence of the nervous system, and more especially of the ganglionic nerves of the great sympathetic. "The activity of the circulation in these vessels, and the various changes, which the circulating fluid undergoes in the process of nutrition, secretion, &c., are accelerated, retarded, or otherwise altered, according to various modifications of sensibility." (See Wilson Philip, *On the Vital Functions*, c. v. p. 119.; and Tweedie, in *Cyclop. of Pract. Med.* art. *Inflammation*.) Barthez even maintained, that a direct influence was exercised by the nervous system over the blood; an idea, unfounded, as

M. Andral justly observes, with reference to the blood, as it is in its great vessels; but, "in the capillaries, where it comes into contact with the solids, and is even confounded with them, where it manifests signs of vitality, and where, in conjunction with the nerves, it gives life to the organs it traverses; in these, who will venture to deny the influence of the nerves over it?" (See *Andral, Pathol. Anat.* t. i. p. 660.) On the other hand, the nervous system is immediately dependent on the blood for the preservation of its power, which is completely destroyed the moment the nervous centres are deprived of arterial blood. This intimate connection; and mutual influence of the vascular and nervous systems on each other, are of considerable importance to be recollected in the investigation of disease, as the various morbid conditions of sensibility constitute one of the essential features of the process of inflammation. (See *Tweedie*, vol. cit.) Indeed, I think, that we must allow, with the latter writer, that until a very recent period, sufficient attention had not been paid to the influence of the nerves in this affection; the changes of the blood; or the modifications in the structure and functions of the part, which characterise inflammation. In fact, when a stimulus is applied to a living part, the first effect produced is an *excitement of its sensibility*, and, with some exceptions, a consequent degree of pain. If the stimulation be severe, or prolonged, a more rapid flow of blood to the part ensues; and, not being carried off as quickly as it arrives, it soon accumulates. The strength and action of the smaller vessels, according to Kaltenbrunner, diminish as their distention increases. The circulation, which was at first accelerated, now becomes gradually slower, and may continue languid for a considerable time, without being completely interrupted. Under these circumstances, the healthy functions of the part are necessarily more or less impeded; the blood ceases to undergo its usual change from arterial to venous; the red globules, which were before confined to the arteries, are now seen circulating in the small veins; these globules are more numerous and of a more vivid red; the viscosity and coagulability of the blood seem to be augmented by a decrease in the proportion of its serum; and the globules, having a tendency to unite together, become less distinct; and the functions of nutrition and secretion are partially, or wholly suspended. (*Kaltenbrunner*, in *Repert. Gén. d'Anat.* t. iv.; and *Tweedie*, in *Cyclop. of Pract. Med.* art. *Inflammation*.)

This is Kaltenbrunner's period of *congestion*, characterised; first, by an increased activity of the vessels and influx of blood; various degrees of turgescence, swelling, heat, redness, and pain; interruption of the healthy functions of the part; and, secondly, as the congestion increases, a laboured slow circulation, arising from the overdistention of the vessels, and increased thickness and viscosity of the blood. There is yet, however, no change of structure in the part, nor formation of new products. The circulation, although slow, is still only partially interrupted.

The period of *true inflammation* seems to Kaltenbrunner to be characterised by complete interruption of the circulation: the blood coagulates, clogs the vessels, and stagnates in several points of the inflamed part; some of the vessels give way, and blood or fibrine is effused in the parenchyma;

serum also exudes; and a decided change of structure is produced. The functions of the part are completely suspended. These changes are attended with increase of the swelling, heat, redness, and pain.

As Dr. Tweedie observes, however, it may often be extremely difficult to draw an exact line of demarcation between congestion and inflammation. "The stagnation of the blood, effusion of blood, lymph, or serum, either by exudation or rupture of vessels, the changes in the structure of the part, and formation of new products, may generally be considered, however, as the pathognomonic signs of inflammation," (See *Cyclop. of Pract. Med.* art. *Inflammation*.)

Redness.—Healthy inflammation is of a pale red; when less healthy, it is of a darker shade; but, according to John Hunter, the inflamed parts, in every constitution, will partake more of the healthy red, the nearer they are to the source of the circulation. The redness is manifestly owing in a great measure to the increased quantity of blood in the inflamed part. More blood must necessarily be contained there, because the vessels, which previously conveyed this fluid, are preternaturally distended, and the small vessels, which naturally contained only lymph, are now so enlarged as to be capable of receiving red blood. "I froze (says Mr. Hunter) the ear of a rabbit, and thawed it again; this occasioned a considerable inflammation, an increased heat, and thickening of the part. This rabbit was killed when the ear was in the height of inflammation, and the head being injected, the two ears were removed and dried. The uninflamed ear dried clear and transparent; the vessels were distinctly seen ramifying through its substance; but, the inflamed ear dried thicker and more opaque, and its arteries were considerably larger."

There is also reason to suspect, from the investigations of Kaltenbrunner and others, that the redness of inflamed parts may, in some measure, depend upon the blood in them ceasing to undergo its usual change from arterial to venous.

Many have supposed, that the redness of common inflammation is partly occasioned by the generation of new vessels. This doctrine, however, is losing ground. When coagulated lymph is extravasated upon the surface of a wound, or an inflamed membrane, unquestionably it often becomes vascular, in other words, furnished with new vessels. But, in the extravasated lymph of a phlegmonous tumour, we have no evidence, that there is any formation of new vessels. Were the lymph to be rendered organised and vascular, the swelling and redness would probably be more permanent, and at least not admit so easily of resolution. When adhesions are formed between two inflamed surfaces, the organised substance forming the connection, lives after the subsidence of the inflammation, and is a permanent effect. In the experiments detailed by Dr. Hastings, when the inflammation began and terminated, without any lesion of the part affected, new vessels were never formed. (*On Inflammation*, &c. p. 93.) At the same time, it must be confessed, that great obscurity prevails on this very difficult part of the subject; for when suppuration happens in a phlegmonous tumour, the cavity is lined by a kind of cyst, or membranous layer of lymph, which is unquestionably furnished both with secreting vessels and absorbents; for, otherwise,

how could the continued secretion of pus, or its occasional sudden disappearance, be at all explicable? It was probably the enlargement of the small vessels, and the circumstance of their being filled with red blood, that led to the theory of new vessels being usually formed in inflammation. It has, however, been justly observed, that the supposition easily admits of refutation; for heat, and many other causes of inflammation, operate so quickly, that there can be no time for the formation of any new vessels; and yet the redness is as great, and the inflammation as perfect, in a minute, as in an hour, or a day, after the application of the exciting cause. (*Burns.*) Mr. Hunter, it is well known, believed, that a coagulum or layer of lymph might produce vessels within itself.—(*On the Blood*, p. 92. &c.) Others, however, distrust this hypothesis, and incline to the opinion, which refers the derivation of vessels for the organisation of deposits to parent branches. (*Travers, Synopsis of Diseases of the Eye*, p. 113.) The latter sentiment is corroborated by the appearances noticed by Dr. Hastings, in his experiments, who describes the small vessels first seen in the lymph upon the surface of a wound, as even then communicating with the inflamed capillaries. (*On Inflammation*, p. 94.) Another reason, assigned for the redness of inflammation, is, that the blood, after it has become venous, retains, more or less, its bright scarlet colour. (*Hunter.*) And, in some late very carefully conducted experiments, it was remarked, that the weakened action of the smaller vessel was always accompanied with an alteration in the appearance of the blood. In the natural state of this fluid, globules can be distinctly seen; but, after inflammation has commenced, the globular structure disappears, the blood becomes redder, and the most minute capillaries are distended with it. (*Hastings, On Inflammation*, &c. p. 95.)

Swelling.—This effect arises from several causes:—1. The increased quantity of blood in the vessels. 2. The effusion of coagulating lymph, and serum, and deposition of new matter. 3. The interruption of absorption, particularly noticed by Sömmerring. (*De Morb. Vas. Absorb.*)

Pain.—This is observed to be the greatest during the diastole of the arteries. The affection is probably owing to the unnatural state of the nerves, and not to mere distension, as many have asserted. Were the latter cause a real one, the pain would always be proportioned to it.

"Parts, which in the sound state have little or no sensibility (as Dr. Thomson remarks), become exquisitely sensible in the inflamed. That this is the case with tendon, ligament, cartilage, bone, and membrane, seems to be fully established by Dr. Whytt in the very instructive controversy carried on between him and Haller, respecting the sensibility and irritability of the different parts of man, and other animals." (*Lectures on Inflammation*, p. 45.)

Heat.—The heat or real increase of temperature in an inflamed part, when judged of by the thermometer, is generally much less than might be supposed from the patient's sensations. It is said never to exceed the heat of the blood at the heart. Thus, in health, is usually about 100° Fahrenheit's thermometer; but sometimes in disease it rises to 106° or even 107°. Mr. Hunter artificially excited inflammation in the

chest of a dog, and in the abdomen, rectum, and vagina of an ass, without being able to discover any obvious rise of temperature in these parts. In a patient, however, on whom he operated for hydrocele, the thermometer, introduced into the tunica vaginalis, and kept for some time close to the side of the testicle, was only 92°; but rose the following day, when inflammation had come on, to 98½°. As Dr. Hastings observes, the advocates for excited action of the vessels in an inflamed part have thought, that the increase of temperature favours their hypothesis, and have called to their aid the ingenious calculations of Dr. Crawford. They have even gone so far as to say, what state of the arteries enables the blood to give out most caloric. They tell us, that, in consequence of excitement of the vessels, more blood is transmitted into the minute arteries; the capacity of a greater quantity of this fluid for heat is of course diminished, and more caloric is evolved in the inflamed part. (*Hastings, On Inflammation*, p. 110.) Yet, this theory, besides involving the contradicted hypothesis of an increased and accelerated flow of blood through the vessels of the inflamed part, cannot be reconciled to various other considerations. "Daily experience convinces us (says the above writer), that the temperature is not always proportional to the velocity of the circulation. In fevers, the author has several times ascertained, with the thermometer, that the heat was 101°, when the pulse beat only 45 times in a minute. In hydrocephalus, with a pulse from 60° to 70°, the heat is often above the degree it reaches in health. In these cases, according to the theory of Dr. Crawford, the heat should rather be under, than above, the natural standard." (*Op. cit.* p. 112.) And, as another judicious writer has noticed, although the former mode of explaining the production of animal heat has been held adequate to account for the phenomena by such philosophers as Black, Crawford, Lavoisier, and Laplace, the evidence on which it rests is not so clear, as to have commanded universal assent, or entirely set aside objections. It has indeed been generally allowed, that respiration and the changes it produces in the air and animal fluids, are essential conditions of the evolution of caloric in animals; but, it has been thought, that there are other circumstances, hitherto, perhaps, not well understood, which influence the phenomena. In external appearance, the blood is the same in all the vessels of the fetus: is this any proof, that its temperature is owing to the conversion of oxygen gas into carbonic acid? Is the uniformity of temperature in the higher animals, under varying states of respiration and circulation, and the consumption of various quantities of oxygen, whether in the same, or different individuals, consistent with the theory? And can local variations of temperature be explained by it? (*Rees's Cyclopædia*, art. *Respiration*.) Doubts must also spring from the recollection of the discordance of the experiments related by Dr. Crawford, Dr. John Davy, De la Roche, and Berard. In fact, the determinations of the specific heats of oxygen gas and carbonic acid by the two latter experimenters are conceived to be very much against the probability of Dr. Crawford's theory. Other stronger grounds for scepticism in this subject are the results of Sir Benjamin Brodie's investigations. Having

pithed, or decapitated animals, he kept up artificial respiration, and thus maintained their circulation. The blood continued to be changed in the lungs from venous to arterial, and from arterial to venous, in the general circulation. The respective colours of the two kinds of blood could not be distinguished from those, which they exhibit in living and healthy animals. Yet the temperature of an animal, thus heated, sunk faster, than that of another animal simply killed and left to itself; and the former was supposed to be more quickly cooled by the air conveyed into its chest. Other experiments, detailed by Sir B. Brodie, tend to prove, that the oxygen of the air, employed in artificial respiration, underwent its usual conversion into carbonic acid. A living rabbit formed 50 or 56 cubic inches of carbonic acid in an hour. A decapitated animal, in which artificial respiration was kept up, emitted 40 to 48 inches in the same time. The thermometer in the rectum of the latter had fallen from 97 to 90, while, in another rabbit left to itself, but similarly treated in all other respects, it had fallen only to 91. In a rabbit, poisoned with woorara, or the essential oil of bitter almonds, not decapitated, and, in which artificial breathing was kept up, 51 cubic inches of carbonic acid were emitted in an hour. The thermometer in the rectum had sunk to 91 in 30 minutes; while it stood at 92 in another animal, treated exactly in the same way, with the omission of the artificial breathing. From these experiments, Sir B. Brodie infers, "that, in an animal in which the brain has ceased to exercise its functions, although respiration continues to be performed, and the circulation of the blood is kept up to the natural standard, although the usual changes in the sensible qualities of the blood take place in the two capillary systems, and the same quantity of carbonic acid is formed as under ordinary circumstances; no heat is generated, and (in consequence of the cold air thrown into the lungs) the animal cools more rapidly than one which is actually dead." (See *Phil. Trans.* for 1811, p. 36.; and for 1812, p. 378.) It appears certain, therefore, that the generation of animal heat, either in an inflamed, or an uninfamed part, can never be satisfactorily explained by any reference merely to chemical principles, and that the process is essentially connected with, and influenced by, the state of the functions of the brain and nervous system, and no doubt also by the principle of life itself. At the same time, I think that any hypothesis, suggested without due reference to the connexion, which respiration has with this curious and interesting process, will never be established. Neither would I venture so far as Dr. Philip, who believes, that animal heat is evolved by the same means, by which the formation of the secreted fluids is effected, viz. the action of nervous influence on the blood, and that the production of such heat is to be regarded as a secretion. (On the *Vital Functions*, p. 169.) However, the influence of the nervous system over this process must be allowed to be very great, and may afford a more probable explanation of the cause of the local change of temperature in inflammation, than Dr. Crawford's theory, combined with the doctrine of increased action, and an accelerated circulation in the vessels of the part affected.

Buffy coat.—The blood, when taken out of the living vessels, spontaneously separates into two distinct parts, the serum and the crassamentum. The last is a compound substance, consisting chiefly of coagulating lymph, or fibrine, and red globules, the most heavy ingredients in the blood. Blood taken away from persons affected with a degree of inflammation sufficient to disturb the constitution, was believed by John Hunter to be longer in coagulating, and to coagulate more firmly, than in other instances. Hence, the red globules, not being so soon entangled in the lymph, he supposed, descended by their gravity, more deeply from its surface, which being more or less divested of the red colouring matter, is from its appearance termed the *buffy coat*, or *inflammatory crust*. Sometimes, however, it is of a dull greenish colour, or like glue; hence, the phrase *sizey blood*. The *buffy coat* consists, indeed, of pure fibrine, and it may form a layer, varying in thickness from that of a single line to that of one or two inches. Blood, taken away from persons labouring under inflammation, is usually found to contain a larger proportion of fibrine than healthy blood. The firmer and more compact coagulation of the lymph compresses out an unusual quantity of serum from it, and the surface of the sizey blood is often formed into a hollow, the edges being drawn inward. (Hunter.) Such blood is said to be *cupped*. In some cases, these changes in the blood are deemed a more unequivocal proof of the existence of inflammation, than the state of the pulse itself. In peritonæal inflammation, the patient sometimes seems to be in the most feeble state, and the pulse, abstractedly considered, would rather induce the practitioner to employ tonics, and stimulants, than evacuations; but, should the continuance or exasperation of the disorder, or any other reason, lead him to use the lancet, then the *buffy coat*, and the *concave surface*, of the blood, materially obviate any doubt of the existence of inflammation.

The cupped appearance, and the firmness both of the *buffy coat*, and of the entire crassamentum, are in general proportionate to the strength of the patient, and the severity of the inflammation: they are also greater in the inflammation of certain textures, particularly serous membranes, and fibrous structures, than in that of others.

The serum of inflammatory blood has been proved by the researches of Dr. Trail, and M. Gendrin, to contain nearly twice as much albumen as in the healthy state. (See *Dowler*, in *Med. Chir. Trans.* vol. xii.; *Gendrin*, *Hist. Anat. des Inflammations*, vol. ii.; *Tweedie*, in *Cyclop. of Pract. Med.* part xii.)

Every surgeon should remember, that the blood may present the *buffy coat*, and cupped appearance, though no inflammation may exist. The blood of individuals, labouring under plethora, and of those accustomed to be bled, at certain periods of the year, is often in this state. *Buffy blood* seems occasionally to be rather a criterion of some unusual operation going on in the system, than a positive test of the existence of inflammation; for the blood taken from pregnant women usually exhibits the same phenomena.

As Dr. Tweedie observes, the presence of the *buffy coat* may generally be considered as a correct indication, either of the actual existence of inflammation, or of a strong predisposition to it;

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and when the obscurity of the other symptoms leaves any doubt respecting the inflammatory nature of the case, a buff and cupped appearance of the blood will tend greatly to confirm us in the opinion of the disease being inflammatory. The degree of buffness is not, however, in proportion to the danger of the inflammation; for, in the inflammation of fibrous tissues, the blood is, in general, more intensely buffed and cupped, than in that of vital organs. On the other hand, the absence of the buffy coat is not to be taken as conclusive evidence of the non-existence of inflammation. In what is sometimes termed subacute inflammation, it is often not observable. In some inflammations of mucous membranes, the blood is frequently neither buffy, nor cupped. And, as Andral has particularly noted, in debilitated and typhoid states of the constitution, or where inflammation has advanced rapidly to mortification, the blood will not exhibit those appearances. Hence, when the symptoms of inflammation are well marked, too much weight should not be attached to the fact of the blood not being sized or cupped. (See Tweedie, in *Cyclop. of Pract. Med. art. Inflammation.*) John Hunter and Hewson represent the blood, in inflammation, as coagulating more slowly than in health, and that more time was thus afforded for the subsidence of the red globules, and hence the production of the buffy coat. This view, however, is controverted by Dr. Davy, and M. Gendrin. The latter maintains, as the result of many experiments, that the coagulation of inflammatory blood commences sooner, and is completed more quickly, than that of healthy blood. Indeed, it has been long known, that the slow coagulation of the blood will not account for the formation of the buffy coat; and I noticed the fact thirty years ago, that, though the blood may not coagulate at all, the globules will not always descend from the surface, and leave it with a sized appearance. The same fact has been exemplified in experiments detailed by Dr. Stokes in his *Pathological Observations*. But, as Dr. Tweedie remarks, although the comparatively slower coagulation of inflamed than of healthy blood, cannot be admitted as the cause of its buffy appearance, it is nevertheless certain, that every circumstance, favourable to its unusually rapid coagulation, has the effect of preventing the formation of the buffy coat. A small opening in the vein, so that the blood trickles down slowly, and becomes exposed to the cooling influence of the air, will make it coagulate directly it reaches the basin, without any time being afforded for the separation of its constituent parts. We may sometimes account in this manner for the first cup not exhibiting any buffiness, while, if the blood is made to flow afterwards more freely, the buff may form in the second cup, in consequence of its coagulating more slowly. The reception of the blood in a flat vessel, especially a cold one, may also interfere with the production of the buffy coat; and so will letting the blood fall into the basin from a height of three or four feet, or keeping it for some time in a state of agitation.

The following facts tend to prove, that, though the buffy and cupped appearance of blood during inflammation; may be affected by various accidental circumstances, this property of it is connected with some peculiar influence exercised by the vital powers over the mass of blood. The

first cup of blood is often buffy, when the second is much less so, and the last one not at all. Now, bleeding is frequently attended with an immediate diminution of the violence of the inflammatory symptoms, even while the blood is flowing; and the rapid change in the appearance of the blood may therefore be justly attributed to the amendment of the state of the patient. If, at the end of some hours, the inflammatory symptoms increase, and blood be again drawn, it will be buffy. Gendrin has observed, on several occasions, that, if blood is taken away immediately after recovery from syncope, it not only has lost its inflammatory character, but the clot is softer; and the effect of syncope in subduing inflammation is well known. The relief, afforded by bleeding, is also attended with an immediate change in the proportions of the constituent parts of the blood. (See Tweedie, in *Cyclop. of Pract. Med. art. Inflammation.*)

Terminations.—Inflammation is said to have several different terminations; or, in more correct language, we may say, that, after this process has continued a certain time; it either subsides entirely, occasions the formation of pus, with or without ulceration, or completely destroys the vitality of the part.

Before the inflammation has reached its greatest height, and any considerable change of structure has taken place, it may gradually subside. The quickness of the circulation begins to decrease at the circumference, and there is a reflux of blood toward the centre. A thin serous, or sanguineous fluid, is poured out on the surface, of in the cellular texture of the part; and from secreting surfaces there may be a profuse exhalation of fluids. The small coagula of lymph and blood, contained within the vessels, or deposited in the parenchyma, are softened and removed. (See Kaltenbrunner, *Op. cit.*; and Tweedie, in *Cyclop. of Pract. Med. art. Inflammation.*)

When inflammation is to end in this manner, the pain, heat, redness, and swelling subside, the fever, and every other symptom gradually abate, till at last the part is wholly restored to its natural size and colour. There is no formation of pus, nor any permanent injury of structure; and, if Dr. Philip's theory of inflammation be correct, the debilitated capillaries are excited to due action by the increased action of the larger arteries. (*On the Vital Functions*, p. 298.) This termination of inflammation, which is fortunately the most common, is termed *resolution*.

If, however, notwithstanding the application of the usual remedies, the several symptoms of heat, pain, and redness, instead of diminishing, rather increase; if the febrile symptoms are likewise augmented, and the tumour gradually acquires a larger size, turns soft, somewhat prominent in the middle, or towards its most depending part; if it should next acquire a clear shining appearance, and become less painful, the different symptoms of fever being at the same time diminished, and a fluctuation perceptible in the tumour; the inflammation has ended in *suppuration*, the fluid, termed pus, having now been formed. The qualities of pus, and the nature of the process by which it is produced, will be hereafter considered. (See *Suppuration.*)

The worst, but happily, the least frequent consequence of common inflammation, is the death, or *mortification*, of the part affected. In the

microscopical experiments of Dr. Hastings, it was observed, that, on the approach of gangrene, the blood entirely loses its red colour, and acquires a yellowish brown tinge. (*On Inflammation*, p. 97.) The part, which was of a bright red, becomes of a livid hue; small vesicles, filled with a thin fetid serum, arise on its surface, and air is plainly felt within the cellular membrane. The pain is indeed diminished; but the pulse sinks, while the tumour is gradually changed into a black, fibrous mass.

In old books, scirrhus will be found enumerated as one of the terminations of inflammation. The best modern surgeons, however, do not regard scirrhus as one of the usual effects of ordinary inflammation: "the term scirrhus, as used by the older medical writers, is extremely indefinite, having been sometimes used to express every kind of induration, which remained after an attack of inflammation, as well as the malignant hardness that precedes cancer. Surgeons now usually limit the use of the term to the last of these significations." (*Thomson on Inflammation*, p. 126.) Common inflammation, particularly when it affects glandular parts, is often followed by induration, which may continue for a greater or lesser time. Thus, when the testis has been inflamed, a hardness of the epididymis frequently remains during life. Such induration, however, is not malignant, and, consequently, very different from what is now implied by scirrhus.

The adhesion of contiguous surfaces to one another, so often exemplified in the serous membranes of the chest and abdomen, is also sometimes spoken of as another termination of inflammation.

Uses of Inflammation.—In numerous instances inflammation is a salutary process, inasmuch as it acts in preventing, repairing, or removing the consequences of injury or disease. Frequently, however, it becomes hurtful, dangerous, and even fatal, either from excessive violence, its complication with disease, or the inability of the constitution to bear the great disturbance of functions, excited by inflammation of vital organs. The salutary effects of inflammation, in preventing more serious, and even fatal mischief, is often exemplified by the process of adhesion. When an opening is made in any of the hollow viscera, either by ulceration, or violence, the escape of their contents into the cavity of the peritoneum, which would be sure to excite a fatal attack of peritonitis, is frequently prevented by a slight inflammation taking place round the opening, followed by a close adhesion of the margins of such opening to the contiguous parts. Abscesses and foreign bodies, seem often to become bounded, and separated, as it were, from the rest of the system by the adhesive inflammation. Ulceration appears to stop, only when a process analogous to it is established. The same observation applies to mortification; the line of demarcation, denoting that it has ceased to spread, being a sign of the adhesive inflammation having bounded and stopped the extension of the disorder. What is it that retards the destruction of the patient by hæmorrhage, when an aneurism makes its way in succession through a series of textures? Is it not the adhesions which form between such textures, and still confine the blood within one cavity? Inflammation, by first producing adhesions, and then ulceration, is often of material service in

bringing collections of matter, or foreign bodies, to the surface with a degree of safety not otherwise conceivable. Thus, in cases of hepatic abscess, firm adhesions may take place between the liver and the colon, and then, by an ulcerative process, a communication may be formed between the abscess and the bowel, at once insuring the discharge of the matter, and hindering all risk of its effusion in the abdomen, which would prove fatal. But, the examples, in which the process of inflammation has a salutary effect, are so numerous cited in different parts of this work, that I shall not here expatiate upon the subject. In a vast number of other instances, inflammation proves, from its violence, or peculiar character, a source of the utmost danger to life itself, or of destruction to some of the structures and organs implicated. In fact, at least two thirds of the mortality of the human race begin with, end with, or are connected with, the effects of inflammation in some manner or another.

TREATMENT OF INFLAMMATION.

One principal difficulty in believing the fact of the retardation of the circulation in the capillaries of an inflamed part, and a strong argument against the supposition of their being in a state of debility, is, that the most effectual treatment of common inflammation consists of means, which are generally of a debilitating nature, as bleeding, purging, &c. And surgeons are still further attached to the theory of increased velocity of the blood's motion, in the part affected, by the recollection of the local augmentation of temperature, the throbbing, and the instantaneous return of the red colour, after the discontinuance of any pressure, by which the redness has been momentarily removed at some point of the inflamed surface. These, too, are all so many facts, which, as far as I can judge, are admitted by the generality of reasoners, whatever may be their particular theory. At the same time, it appears equally well proved by careful microscopical experiments, that in the capillaries of the part, which is directly the seat of inflammation, there is a retardation, and sometimes even a stagnation, of the circulation. But, this is not all: it is further manifested, that the capillaries are considerably dilated, the blood in them materially altered, and that these phenomena are followed by an increased action of the larger arteries leading to the part affected. Now, I think, if we remain contented with these obvious circumstances, and dismiss the hypothesis of debility of the capillaries, not only the necessity for venturesome conjectures may be avoided, but a more rational account delivered of the principles of the efficacy of the usual mode of treatment. Thus, I would not presume to offer any supposition, why the capillaries are dilated, and why the motion of the fluid in them is retarded, but would be satisfied with a knowledge of the facts, so as to elude a source of endless controversy, viz. the question, whether these changes proceed from debility of the said vessels, or other causes? In the view which I take of the nature of phlegmonous inflammation, I consider the following circumstances proved:—1. The dilated state of the capillaries in the immediate seat of inflammation. 2. The retardation, or even stagnation of the circulation in them. 3. The increased action, or excitement of the larger arteries leading

to the inflamed part. All these three main points seem to me to be fully established by the investigations and experiments both of Dr. Wilson Philip, and Dr. Hastings; and I may make the observation, though aware, that the latter gentleman does not regard increased action of the larger arteries, as a constituent and necessary part of inflammation, because cases occur, in which no such excitement can be detected (*On Inflammation*, p. 104.); for, I here put out of consideration chronic inflammation, which I believe is entirely a different process, bearing no resemblance to the acute forms of the disorder, either in the state of the capillaries, or of the larger arteries. Assuming the above points, as proved, it is to be inquired, whether other facts, such as the heat and throbbing in the inflamed part, the instantaneous return of redness to the spot, which has been touched, and the efficacy of common treatment, are reconcilable with them, or not. I am disposed to think they are: for, it is only asserted, that the passage of the blood is more or less obstructed in the capillaries in the seat of the inflammation; and the larger arteries, leading to them, are, for the most part, obviously in a state of increased action, whereby a greater quantity of blood must be supposed to be determined towards the part. Now, as this augmented quantity of blood cannot pass freely through the smaller vessels, in the immediate place of inflammation, it must be thrown into such arteries in the neighbourhood, as are capable of receiving it, so that, in fact, the theory of obstruction of the capillaries may not be altogether incompatible, both with increased action, and quickened circulation, in the arteries directly around the parts, in which there is a retarded circulation in the capillaries. This view of the subject, I think, is not liable to greater perplexity in the explanation of the heat, throbbing, &c., than former doctrines, involving the contradicted notion of there being an increased action, and an augmented velocity of the blood's motion, in all the arteries of the part affected.

Resolution being the most favourable termination of common inflammation, it is of course, the object at which the surgeon generally aims in the treatment. Dr. Philip's very ingenious view of inflammation leads him to suppose, that resolution arises from the debilitated capillaries being excited to due action by the increased action of the larger arteries. (*On the Vital Functions*, p. 298.) But, I am of opinion, that the doctrine of debility of the capillaries, and the hypothesis of their being strengthened by the excitement or increased action of the larger vessels, are by no means satisfactory, and perhaps not very intelligible. On the contrary, if the capillaries are already so weak as to be distended by the ordinary impulse of the blood, how are they to be restored to their natural dimensions and functions by any increased action of the larger arteries? the effect of which, I should conceive, would be to gorge them still more with blood, and produce even a greater dilatation of them. Were the above reasoning correct, it would follow that a principal indication in the treatment would be to promote the increased action of the larger arteries, whereby so much supposed benefit is communicated to the debilitated capillaries. Yet such practice is contrary to the dictates of experience, and is even inconsistent with the principles, on which Dr. Philip himself thinks the treatment should be founded. Indeed, the fol-

lowing directions are such, as I imagine will be perfectly approved of by practitioners, who, far from looking upon the increased action of the arteries, as a means of relief, are accustomed to do every thing in their power to lessen and resist it. "All the local means (says Dr. Philip) are calculated either to lessen the contents of the morbidly distended vessels, or to excite these vessels to expel them. The general means are regulated by the effects, produced by the disease on the more distant vessels, through the medium of the nervous system; the objects of this part of the treatment being, neither to allow the action of these vessels to fall so low, that it is incapable of supporting any degree of circulation in the debilitated vessels, nor to become so powerful, as farther to distend by gorging them with blood. Thus, when the symptoms of active inflammation run high, we lessen the vis à tergo; when gangrene is threatened, we increase it." (*W. Philip on the Vital Functions*, p. 285, ed. 2.) In short, as soon as the fact is established, that a strong flow of blood towards an inflamed part tends to aggravate the disorder, all difficulty ceases in reconciling the usual means of relief to that theory of inflammation, which takes into the account a retarded state of the circulation in the distended capillaries.

Let us now devote a few pages to the consideration of the means to be employed for the relief of inflammation.

Removal of exciting causes.—In all cases, the first circumstance to be attended to, is the removal of all such exciting causes as may happen to present themselves. If the irritation of a splinter were to excite pleurmonous inflammation, who would not of his own accord directly take away the extraneous body? In wounds, foreign substances frequently excite inflammation, and ought to be taken away as speedily as possible; splintered pieces of bone often give rise to the affection, and require removal; the head of a bone being out of its place, may press and inflame the part on which it lies; and who does not immediately see the propriety of putting it back into its natural situation? These and other similar exciting causes may often be detected and removed at once, and this is doing a great deal towards the cure and even the prevention of inflammation. However, many of the exciting causes of this affection are only of momentary application; yet, though their action is thus short, the process of inflammation must follow, as a kind of salutary operation, without which, the injured organisation, and tone of the parts, still remaining, could not be rectified again. Hence, besides taking away the remote cause, whenever this can be done, it is proper to moderate, by other means, the increased action of the larger arteries, and lessen the velocity of the blood's motion towards the inflamed part.

Bleeding.—As there is reason to believe, that, in common inflammation, a greater quantity of blood is impelled towards the inflamed part, than in the natural state, and experience proves, that nothing has a more powerful effect in checking the disorder, than diminishing the determination of blood to the part, bleeding must be a principal means of relieving inflammation: it lessens the action of the whole sanguiferous system, and, of course, of that part of it, which is directly concerned in regulating the quantity of blood transmitted to the part affected. On the principle also

of lessening the whole mass of blood in the circulation, it must have a similar effect.

Bleeding, however, is often misemployed, especially when regarded as the only remedy for inflammation, and other steps are neglected. The general obstinacy and vehemence of the process in weak constitutions prove, that bleeding is not invariably proper, and in such individuals it often appears, as if their general irritability and the difficulty of curing the inflammation, were in a ratio to their weakness. It is a common notion, that when inflammation is complicated with disorder of the chylopoietic organs, blood should be taken away with great circumspection; but, for its correctness, I cannot vouch, any more than I can vouch for the truth of a common supposition, that cases of inflammation in London do not require bleeding to the same extent as similar cases in the country. The hypothesis is beginning to be doubted by the sagacious part of the profession, and has now less influence than formerly upon practitioners, who are getting into the wise custom of examining things with their own senses, and thinking for themselves.

A great deal of induration, with little pain and heat in the inflamed part; the probability of a long and copious suppuration, as is the case in many compound fractures; and the connection of the inflammation, with a want of tone in the part; are particular instances, in which the practitioner should be sparing of this evacuation. Bleeding is sometimes quite unnecessary, when the local inflammation and symptomatic fever are trivial, when the patient is feeble or very old, and when the cause of the affection can be entirely removed. (*Richter's Anfangsgr.* b. i.) However, bleeding is as necessary in old as in young persons, if the general and local effects of genuine phlegmonous inflammation be severe. Also, as Langenbeck has explained, even in feeble individuals, the inflammation may depend upon occasional causes, which are so powerful in their operation, as to be followed by great reaction. Sometimes, after having amputated the limbs of patients, already labouring under hectic symptoms, he assures us, he has practised bleeding, in consequence of such inflammatory reaction, with the best effect. (*Nosologie*, &c. b. i. p. 261, 262.)

On the other hand, bleeding is highly beneficial where the inflammation is uncomplicated with any previously existing disorder of the gastric system, while it is considerable in extent and degree, and attended with a good deal of febrile disturbance. The same practice is also strongly indicated, when the part affected is very sensible, and highly important, in regard to its office in the system. Thus the lancet must be freely employed in acute ophthalmia, or inflammation of the eye, which is a most sensible part; and, in inflammation of the lungs, brain, or stomach; organs, the sound state of which is essential to the regular continuance of all the various operations in the animal machine; and if a successful effort be not promptly made to stop such inflammation by the most vigorous means, death itself will be the result.

In general, bleeding may be said to be indicated, when the patient is young, robust, and plethoric; when the local and constitutional symptoms are severe; when the patient has been living well and eating a great deal of animal food, so as to have a decidedly inflammatory diathesis (see Langenbeck's

Nosologie, &c. b. i. p. 261.); when the cause of the disorder can neither be removed nor diminished; and when there is a strong motive for wishing to avoid the formation of matter. Inflammation of the eye is a case, illustrative of the truth of the last observation; for, if suppuration take place in this organ, the common consequence is so serious a destruction of its internal structure and organisation, that the future restoration of sight is totally impossible. In the examples, falling under the conditions specified as requiring blood to be taken away, it is sometimes necessary frequently to repeat the evacuation.

The efficacy of bleeding is greater, the sooner it is practised, and the more suddenly the blood is evacuated. Bleeding near the part affected is usually more effectual, than when done in a remote situation. Hence, in inflammation of the eye, or brain, it is often considered most advantageous to take blood from the temporal artery, or by cupping from the temples.

"In many inflammations, particularly those of the parts contained in the three great cavities of the head, chest, and belly, general blood-letting (says a judicious writer) if not the only, is the principal remedy, to which we can trust for a cure. The quantity of blood, which, in these inflammations, it is necessary to take away, varies according to the violence of the inflammation, the temperament, strength, and habits of the patient, and according to the structure, functions, and situation of the organ in which it occurs. From twelve to twenty ounces, or even more, ought generally to be drawn every time we have occasion to use the lancet in the cure of inflammation, and bleeding to this extent may be repeated two or three times in the course of the first twenty-four hours, according to the effects, which it seems to produce, as well as according to the violence and urgency of the symptoms. In inflammation of internal parts, we judge of the effect of bleeding, and of the necessity of a repetition, from the feeling and continuance of pain, from the state of the pulse, and also from the appearance of the blood, which has been last drawn.

"A partial, and in some instances, an almost complete cessation of pain takes place even during the operation of blood-letting. This is always a favourable symptom, and indicates, that the inflammation has made no great, nor very alarming progress. In other instances, the relief from pain, though inconsiderable, at the time of bleeding, becomes afterwards more sensible, and the other symptoms of inflammation abate in nearly the same proportion; while, in other instances again, the pain is either not relieved by the bleeding, or, if relieved, the relief is but of short duration. These last are cases, in which, the other symptoms of inflammation continuing unabated, recourse must be had again to the use of the lancet, and as much blood drawn, as can be done with safety to the patient.

"The changes which take place in the state of the pulse, either with regard to its frequency, or strength, during, or soon after the abstraction of blood, though they afford criterion, by which we may judge of the state of the inflammation, and of the effects of the bleeding, are by no means marks so sure of the advantage, which has been obtained, as that derived from the cessation of pain.

"In some inflammations of the head, for example, the pulse is slower than natural, though it

beats with its accustomed, or even with an increased degree of strength. In inflammations also of the peritoneum, and of the intestinal canal, we find the pulse not much quicker than natural, small, and contracted. We should deceive ourselves, therefore, were we to infer, that an increase of inflammation had taken place, because, in the first instance, the pulse had become quicker, and in the second, fuller and stronger, during, or soon after the abstraction of a quantity of blood.

"The pulse, it may be remarked, has often a contracted, cord-like feel in inflammation, and it may always be regarded as a favourable event, when it becomes softer, fuller, and slower, during, or soon after blood-letting." (See *Thomson on Inflammation*, p. 166. 168.)

Although Langenbeck, in common with other practitioners, deems the change of the pulse and the abatement of pain, as important considerations for determining how much blood should be taken away, he advises the surgeon never to forget, that when certain organs are inflamed, bleeding is always followed by a rise of the pulse. This reason leads him to regard the cessation, or continuance of pain, as a better criterion. (*Nosologie*, &c. b. i. p. 265.)

With respect to the buffy coat of the blood, Dr. Thomson is of opinion, that it is not by the buffy coat alone, but by the buffy coat in conjunction with the quantity and firmness of the coagulum, that we must judge of the propriety of any further detraction. When the buffy coat has a firm and tenacious consistence, and when the pain continues unabated, we may conclude, that the inflammation is not subdued. But when the coagulum is soft and easily broken, and when the colour of the buffy coat is changed from a yellowish to a greenish hue, Dr. Thomson thinks, that little or no benefit can be derived from bleeding. But, as already mentioned, every practitioner should remember, that, in particular constitutions, and in pregnancy, blood taken away naturally exhibits a buffy appearance, independently of inflammation.

The following observations appear judicious:

In all cases of active inflammation, but more especially, when the constitutional symptoms are severe, general bleeding is to be employed, with the object of diminishing the quantity of blood and, at the same time, of abating the force and frequency of the action of the heart and arteries. The abstraction of blood from the system is more especially necessary in inflammation of important organs, as of the brain, pulmonary and abdominal viscera, in which disease it forms the principal means of cure.

"It is generally found, that inflammation of serous membranes requires larger losses of blood, than when the parenchyma, or substance of an organ is inflamed, and that on the other hand, inflammation of mucous surfaces is less under the control of general bleeding. In such cases, the local is preferable to the general abstraction of blood.

"The propriety or necessity for general blood-letting being determined, the question as to quantity requires consideration. For this, there cannot obviously be any fixed, or determinate rule, as it must depend on the importance of the organ inflamed, the intensity of the inflammation, its duration, and the peculiar circumstances which each case presents. When an organ, important to life is inflamed, and if there be no special circum-

stances to forbid copious blood-letting, the effect produced on the symptoms is a matter of greater moment, than the quantity of blood abstracted.

"The too common practice of prescribing a certain number of ounces of blood to be drawn from a vein in an acute disorder is most reprehensible. The disease may yield to the abstraction of a few ounces of blood, or a much larger quantity than was at first anticipated may be necessary." After the relation of an interesting case illustrative of these circumstances, the same writer notices the impression on inflammation by the blood being taken from a large orifice, or a vein being opened in each arm, and allowing the blood to flow till there is an approach to syncope, which may be promoted by placing the patient in the erect position. The effect of blood-letting, more especially if continued nearly to syncope, in lessening inflammation, may be plainly seen in inflammation of the conjunctiva. The distended and tortuous vessels are no longer visible, and that membrane actually returns to its naturally pale colour. The same effects take place in internal organs and structures not visible. (See Dr. A. Crawford, in *Cyclop. of Pract. Med.* vol. ii. p. 797.)

It is always a point highly worthy of consideration, whether bleeding in or near the part, that is local, or topical bleeding, will answer better, than taking blood from the general habit; for, certainly less may be removed in this way, so as to have equal effect upon the part inflamed, and probably, upon every other disease that is relieved by bleeding with less injury to the constitution. Although, in many cases the general habit is relieved by bleeding, it is the part affected which most requires this evacuation. Hence, it is not always necessary to take blood from the system, the topical abstraction being often sufficient to accomplish a cure. Cases also frequently occur, in which the loss of even a small quantity of blood from the system is followed by considerable inconvenience and exhaustion though the same amount of blood, abstracted locally, is followed by excellent effects. This mode of blood-letting, therefore, may be employed — 1. When the amount of inflammation is trivial; 2. When the powers of the patient are too weak to admit of general blood-letting; 3. When the active stage of inflammation is past; 4. As an auxiliary to general blood-letting. (See Crawford, in *Cyclop. of Pract. Med.* vol. ii. p. 800.)

Topical bleeding is sometimes so conducted as to have the effect of a general bleeding. Thus, if a great many leeches are applied, or more than a certain quantity of blood is taken away at once by cupping, the same impression is produced on the whole system, as if the lancet had been employed. When blood is taken from the temporal artery, or external jugular vein for the relief of inflammation of the brain, the practice is chosen on the principle of its combining the advantages both of general and local bleeding. This idea, however, is certainly not correct in relation to the vein.

Cupping is often deemed preferable to the application of leeches, because thus the blood is more rapidly taken away, and its quantity may be more nicely regulated. On the other hand, leeches may be applied to some parts, which will not admit of being cupped; and where the patient is weak, or the active stage of inflammation past, or the degree and extent of the disorder moderate; they are frequently preferred. (See ARTERIOTOMY, CUPPING, LEECHES, SCARIFICATION, and VENESECTION.)

Purging.—The exhibition of purgatives is another principal means of diminishing inflammation. Purgative medicines not only remove accumulated secretions, but, according to the class of these medicines prescribed, produce by their action on the intestinal exhalants a powerful derivation from the circulating system. Purging does not produce such lasting weakness as is the consequence of bleeding, and, therefore, it is scarcely ever omitted, even when the abstraction of blood is deemed improper. Saline purges must lessen the quantity of circulating blood, inasmuch as they increase the secretion from the intestinal arteries; and, therefore, they probably operate beneficially in the cure of local inflammation, much upon the same principle as bleeding. Mr. Hunter was of opinion, that purging lowers action, without diminishing strength, by which we are probably to understand without producing a very lasting or permanent loss of strength. With respect to mild laxative medicines, none are superior to manna, rhubarb, oleum ricini, and the like; and of the saline purgatives, the best are, the sulphate of soda, tartrate of potassa, phosphate of soda, and sulphate of magnesia. It may here be remarked, that, besides the benefit, which local inflammation derives from the judicious administration of purgatives, the costiveness and heat, which usually attend the symptomatic fever, are also removed by the same means.

“Purgatives (says Dr. Thomson) are more or less required in almost every species of inflammation; but they are more peculiarly necessary in those which are accompanied with a high degree of fever, or with derangement of the digestive, or biliary organs. In cases of inflammation, which have a tendency to spontaneous resolution, they are almost always the best, and often the only remedies that are required.” (*Lectures on Inflammation*, p. 171.)

However, as Dr. A. Crawford judiciously observes, purgatives are more applicable to some forms of inflammation than others. The circulation in the brain is readily affected by purgatives, as is evident from the paleness of the countenance and the syncope produced by active cathartics. Hence, in all cases of cerebral inflammation, purgatives ought never, unless under special circumstances, to be omitted. In thoracic inflammation purgatives are indicated, but they are less efficacious in this, than in some other forms of inflammatory disease; and more reliance is to be placed on general and local bleeding than on them. In the treatment of abdominal inflammation, purgatives are to be employed with more caution. In the commencement, except when the mucous membrane is the seat of inflammation, the bowels may be cleared out once or twice with an active aperient. On the whole, however, in peritonitis, the lancet is to be preferred, inasmuch as all irritation of the bowels, with cathartics in this case, has pernicious effects. When peritoneal inflammation is subdued, the bowels are readily opened by comparatively mild aperients. If it be necessary to be cautious with purgatives in peritonitis, it is particularly so in inflammation of the mucous membrane of the intestines. (See *Cyclop. of Pract. Med.* vol. ii. p. 801.)

Mercury is frequently prescribed for the purpose of stopping inflammation, either in conjunction with blood-letting, or without it, when this evacu-

ation is deemed inadvisable. In iritis, the power of mercury in controlling inflammation, preventing the effusion of fibrine, or lymph, and bringing about its absorption when effused, may be said to be perfectly demonstrated. Its efficacy in inflammations of the larynx, trachea, testicle, synovial membranes, and various internal organs, is daily exemplified. When inflammation is chronic, and blood-letting can no longer be continued, mercury is often employed with decided advantage. When inflammation is situated in parts where it is likely soon either to destroy the functions of the organ, or life itself, mercury should be freely and quickly exhibited directly after general and local bleeding. In such cases, from two to four grains of calomel may be given every other hour, till salivation has been excited, or the inflammation arrested. In less urgent examples, two grains of calomel, five of blue pill, or ten of hydrargyrum cum creta, may be given every four, six, or eight hours, according to circumstances. When mercury disturbs the bowels, it should be combined with opium; and in this form it is generally found to be more successful than when given alone, especially if there be much pain. Whatever may be the power of mercury over inflammation, it is universally acknowledged that this power is not such as to supersede the necessity for blood-letting in all cases of acute inflammation of a certain extent, or of important organs. In fact, the exhibition of mercury should generally be preceded by bleeding.

Diaphoretic and nauseating Medicines.—Medicines, which have the power of producing sickness, lessen, for a time, every action in the system, and even the general powers of life. This is in consequence of every part of the body sympathising with the stomach; and the effect may be very quickly excited. Sickness lowers the pulse, makes the small vessels contract, and rather disposes the skin to perspiration. But nothing more than nausea should be caused; for vomiting rather rouses than depresses. (*Hunter*.) Nauseating medicines, employed after bleeding has been practised once or twice, are often productive of considerable benefit; but there are some affections, in which they cannot be used, such as inflammation of the stomach and intestines. In all superficial inflammations, however, they may be safely and advantageously exhibited, as well as in most inflammatory affections internally situated. In inflammation of the dura mater and brain, and, indeed, in every instance, in which there is an urgent reason for putting as sudden a check as possible to the continuance of the affection, the employment of nauseating doses of tartrate of antimony is strongly indicated. Upon this preparation of antimony practitioners place the greatest reliance, and it is to be prescribed for the purpose of exciting nausea, as follows:—*R* Antimonii tartratis grana duo; *Aqua* distillatæ uncias quatuor. *Misce et cola*. *Dosis*, *Uncia dimidia quartâ vel sextâ quâque horâ*.

The safest diaphoretics are citrate of potass, acetate of ammonia, tartrate of antimony, and James's powder. The two latter, from their effects in producing nausea, and weakening the pulse, are most efficacious, as already stated.

“The warm bath seems to act not only by increasing the tendency to perspiration, but also by occasioning a determination of blood to those parts of the body to which it is more immediately applied.

It is in this way that bathing the feet seems to relieve inflammatory affections of the head and throat. I have not seen any experiments, nor am I acquainted with any, which have been made with a view to ascertain its use in the inflammations of the chest; but, in all inflammations of the belly, and of the viscera contained within that cavity, there are no other means of cure, blood-letting excepted, which afford such sudden and permanent relief as that which is obtained from hot fomentations and warm bathing." (See *Thomson on Inflammation*, p. 173.)

Opium.—The majority of surgeons entertain an objection to opium in the generality of cases of inflammation, on account of its being a powerful stimulant. The plan, however, has its advocates. One of its strongest partisans tells us, that opium particularly lessens the disturbance of inflammation, and allays pain, which is at once a principal symptom of the process, and a cause of its augmentation, as well as that of the fever. It quiets the inordinate action of the solids, the mental agitation and restlessness so powerfully, that it well deserves the name of the grand *antiphlogistic remedy*. It likewise occasions a moisture on the surface of the body, which experience shows is eminently serviceable. When given with this view, it is usually conjoined with antimony, calomel, or ipecacuanha. The administration of opium is a general practice in all painful inflammations arising from external causes, and, it is attended with perfect safety when evacuations from the bowels and bleeding have been previously put in practice. In cases of external injuries, it is to be given the two first days, immediately after bleeding. It is to be given as soon after the accident as possible, in order to tranquillise the mental alarm, and, if convenient, towards the evening, for the sake of procuring a quiet night. (*Richter*.) In large wounds, especially from amputations, and other capital operations, and in punctures of all kinds, large doses of opium are attended with good effects. In all such cases, however, opium in order to have a proper influence, should be administered in liberal doses. Morphia being the principle in opium which tranquillises without producing the irritation arising from other constituents of this medicine, the preparations of it are better adapted to cases of inflammation than laudanum or pure opium.

Many practitioners find, that, in active inflammation, the administration of opium alone, after a full bleeding, is followed by the most happy effects, especially in irritable habits. After a patient has been bled nearly to syncope, the reaction, which generally follows, may often be prevented by two grains of solid opium, or a draught containing one grain of acetate or muriate of morphia, administered when the faintness is disappearing. The heart's action is thus controlled, while the nervous system is tranquillised; so that the patient enjoys an interval of refreshing sleep, from which he often awakes with a moist skin and freedom from pain.

In many cases, this practice, with a cathartic, is sufficient to arrest inflammation. If, however, after three or four hours, the symptoms return, with hot skin, and wiry pulse, the blood-letting is repeated, and the opium, with three or four grains of calomel repeated. Afterwards, these medicines may be continued in smaller doses.

(See *Hamilton, Armstrong, Adair, Crawford, Stokes, &c.*)

On the contrary, those who are averse to opium, remark, that, in acute inflammation daily experience proves, that its exhibition increases the fever, and aggravates the local action. Even given as a preventive of inflammation, after operations, they allege that it is hurtful, producing restlessness, heat, thirst, and afterwards headach, sickness, and frequently troublesome vomiting. (*A. Burns*.)

According to Dr. Thomson, "those diaphoretics, into the composition of which opium enters, seem to be better adapted for inflammation attended with fever of a typhoid character, or for cases where the inflammation has existed for a considerable time before diaphoretics are employed. Given at an early period in acute inflammatory diseases, opium never fails to excite vascular action, and to aggravate all the symptoms of fever. Opium, therefore, is not to be used, unless to allay the pain and irritation from a surgical operation, or from the recent infliction of an external injury. Indeed, unless when the patient is very nervous, and complains much of pain, its use, even after surgical operations, had, I believe, in general, better be abstained from, as it almost never fails to add to the violence of the symptomatic fever which is the necessary consequence of the operation. Its effects are often very beneficial, when the period of this fever has passed over." (See *Lectures on Inflammation*, p. 172.) Upon the whole, candour obliges me to own, that the majority of surgeons are decidedly against the general use of opium in inflammation; but after the performance of severe operations, and in all instances attended with excessive pain, truth, I believe, will justify my saying, that they are in favour of the exhibition of this remedy; and, no doubt, the preparations of morphia, or those from which the stimulating principles of the drug have been removed while the anodyne are retained, ought to be preferred.

Diet and Regimen.—In all cases, the surgeon is to forbid the use of wine and spirits; and, when the inflammation is at all considerable, or seated in an important organ, the same prohibition is to be made in regard to animal food. Watery, cooling, mucilaginous drinks are proper; for they keep off thirst and heat, promote perspiration, and tend to soothe the increased action of the arterial system. For this purpose, whey, buttermilk, barley-water, decoctions of dried fruits, water-gruel, &c. may be given.

When diluent drinks "are intended to allay thirst, as well as to promote perspiration, the addition of some vegetable acid, such as lemon-juice, or cream of tartar, renders them in general very palatable to patients. In the earlier stages of inflammation, and where the object is to induce a moisture on the skin, the mineral acids, though they might serve to quench thirst, are not to be employed, as they tend rather to check, than promote the flow of sweat." (*Thomson on Inflammation*, p. 172.)

The chamber in which the patient lies should not be warmer than his comfort requires, for heat tends powerfully to keep up an increased action of the sanguiferous system. For the same reason, the patient should not be covered with a superfluous quantity of bed-clothes.

The whole body, but more especially the in-

flamed part, should be preserved in as complete a state of rest as possible. Every one knows, that all motion, exercise, and muscular exertion, accelerate the circulation, and hence, must have a pernicious effect on inflammation, by determining a larger quantity of blood to the part affected.

For the relief of gouty and rheumatic inflammation, *colchicum* is an efficacious medicine. The wine may be prescribed in doses of from xx . to xxx drops, three or four times a day, with or without the carbonate of magnesia, and such other medicines as may be indicated. Or a pill, containing one grain of the acetic extract of *colchicum*, and three grains of the extract of *hyoscyamus*, may be ordered to be taken every eight hours. (See *Adair Crawford*, in *Cyclop. of Pract. Med.* vol. ii. p. 804.)

Applications.—With the exception of what has been stated, concerning topical bleeding, all the foregoing remarks relate to the general treatment of inflammation: the local means remain for consideration.

It has been already observed, that phlegmon is attended with an increase of heat in the part, and it is an acknowledged fact, that the action of the arteries, as well as every other operation in the animal economy, is promoted and increased by the influence of heat. For this reason, an obvious indication arises, viz. to reduce the temperature of the inflamed part, by the topical application of cold, and in particular, by continually abstracting the heat from the part, by keeping up a constant evaporation from its surface.

“Of the local remedies, applied directly to inflamed parts, (says Dr. Thomson) cold is undoubtedly one of the most powerful. In reducing the temperature, cold diminishes the morbid sensibility and pain of inflamed parts; and, probably, in consequence of this, the action also of the vessels by which the inflamed parts are supplied with blood. The most common mode of employing cold is by the application to the part inflamed of cloths, which have been dipped in cold water. These are to be repeated, as often as they become warm, or any relief is experienced by the patient from their use. When the inflammation is seated in the remote parts of either the upper or lower extremities of the body, the inflamed part itself may be immersed in water. This immersion, as I shall afterwards have occasion to mention, has often been found useful in superficial burns. In order to increase the effect produced by cold, it has been proposed to reduce the temperature of the water below that of the surrounding atmosphere, by a proper mixture of saline bodies, as some of these are known to produce cold during their solution in water, or even in very urgent cases to apply ice or snow. The ice, however, must not be applied too long, nor in too large a quantity; for it very quickly reduces the temperature of the part to which it is applied, and, in some instances, has been known to occasion gangrene, &c.” (On *Inflammation*, p. 180.)

With the cold water applied to phlegmonous inflammation, it is usual to blend some remedies, which are astringent, and supposed to have also a sedative quality. The acetate of lead, and sulphate of zinc, seem now, indeed, to have acquired permanent celebrity for their efficacy in resolving inflammation.

“The manner in which the acetate of lead

operates in curing inflammation (as Dr. Thomson observes) is not known to us, nor is it at all times easy to distinguish between the share which the lead has in allaying inflammation, and that which is to be attributed to the coldness of the water in which it is dissolved. No one, however, will doubt of the efficacy of this remedy, who has ever felt it in his own body, or witnessed in others the soothing and agreeable effects, which it produces in excoriations of the skin, or in inflammation of mucous membranes. Lead is a remedy which is often highly useful in excoriations from friction, in punctured wounds with inflammation of absorbent vessels, veins, nerves, &c., in slight burns, in cutaneous heat, eruptions of the face, in fractures and dislocations, in the inflammation attending scirrhus and cancer, syphilis and gonorrhoea, in wounds accompanied with excoriation from the discharges they emit, and in wounds attended with a burning sensation of pain.” (P. 182.)

From the poisonous qualities of lead, when taken into the system, and from the possibility of this mineral being absorbed from the surface of the body, objections have arisen against the free use of its preparations, even as external applications. Certain it is, however, that, though the possibility of such absorption is proved by the occurrence of the disorder called the *colica pictorum*, which originates in painters from the white lead absorbed into the system, yet, any ill effects from the use of lead, as an application to inflamed parts, are so rare, that they can hardly form a serious objection to the practice. In inflamed parts there is an impediment to absorption, and this circumstance must tend to render the employment of lead a matter of safety. Mr. B. Bell observes, that in all the experience which he had had of the external application of lead and its preparations, and in many cases, particularly of burns, where he had known the greater part of the surface of the body covered with applications of this description for days, nay, for weeks together, he did not recollect a single instance of any disagreeable symptom being ever produced by them. Nor has Dr. Thomson ever seen the *colica pictorum* follow the use of Goulard. (See *Lectures on Inflammation*, p. 183.)

A lotion composed of acetate of lead, vinegar, and water, is very commonly employed. R Plumbi Acetatis ℥ss . Solve in Aret. pur. ℥iv ., et adde Aq. Fontanæ distill. ℥ij . The vinegar makes the solution more complete. In all common cases a teaspoonful of the liquor plumbi acetatis, blended with a pint of water, to which an ounce or two of camphorated spirit has been added, will be found an eligible lotion. Occasionally, bread-crum is moistened in the fluid, and applied in the form of a poultice; but linen dipped in the lotion, and kept constantly wet with it, is mostly preferred. Thus a continual evaporation is maintained, and of course a regular abstraction of heat from the part.

After the acute stage of inflammation is past, and the pain and redness slight, though the swelling is considerable, it is an indication to rouse the action of the absorbents, in order that they may remove the extravasated fluid. With this view a more powerful discutient lotion may be employed than in other cases, and sometimes it is even better to use embrocations and liniments than any sort of lotion. The following discutient lotions are often employed:— R Ammonie Murialis ℥ss . Aceti; Spiritus Vini rectificati; sing. ℥ij . M . R Liq.

Ammon. Acet.; Spir. Vini rectif.; Aq. distillatæ; sing. ℥iv. M.

When the part affected with inflammation is not very tender, or when it lies deep, a poultice, made with vinegar and crum of bread, is sometimes used.

Warm Applications.—The impossibility of reconciling every useful practice with a philosophical theory, is in no instance more strikingly exemplified, than in the opposite sorts of local applications, which are of service in inflammation. Many cases receive most relief from cold sedative lotions; but many others derive the greatest service from warm emollient applications.

Were I to endeavour to define the particular instances in which the latter avail most, I should take upon me a task, which has baffled all the most able surgical writers. The first stage of some forms of acute ophthalmia, and common inflammation of the testicle, may be specified, as examples in which, generally speaking, warm applications are better than cold. Yet, even with respect to inflammation of the testicle, there is some difference of opinion about the superiority of cold or of warm applications. Mr. James's sentiments are as follows: in the treatment it is of importance to consider the differences of the cause: thus, in mumps and rheumatism, the constitution is chiefly to be attended to, and cold applications are certainly improper. When it (the inflammation of the testis) arises from a blow, after leeches have been freely employed, fomentations are the best remedy. But Mr. James thinks, that this is not the case, in many instances of inflamed testicle from gonorrhœa, where cold applications are preferable; but, he owns, that the feelings of the patient will best determine the point. (*James on Inflammation*, p. 164.)

“Fomentations, or embrocations with warm water (as a judicious writer has remarked), are often a very powerful means of abating internal inflammation. This effect is very apparent in some of the deeper-seated inflammations, as in the inflammation of the urinary bladder, intestines, or other viscera contained within the cavity of the abdomen. The warmth, in this case, may be applied to the surface of the abdomen, by bath or fomentation, or, in the way of injection, by the anus, &c. In some inflammations of the joints, warmth also is found to be very useful. These, however, are inflammations which have a tendency to the chronic state.” (*See Thomson on Inflammation*, p. 188.)

If we may judge by the feelings of certain patients, there are undoubtedly particular constitutions, in which the local use of warm remedies produces greater relief, than that of cold ones. This circumstance, however, does not generally happen; and, as warm emollient applications, of all kinds, have the most powerful influence in promoting suppuration, a fact admitted by every experienced practitioner, the use of such remedies, while the resolution of inflammation is practicable, may not be advisable. But, I am ready to grant, that in all cases of inflammation, which manifestly cannot be cured without suppuration, the emollient plan ought to be at once adopted; for the sooner the matter is formed, the sooner the inflammation itself is stopped. The inflammation attending contused and gun-shot wounds, and that accompanying boils and carbuncles, are of this description. The inflammation, originating in

fevers, commonly ends in suppuration, and, in such instances, perhaps, it may be advantageous to resort at once to emollient treatment.

Warmth and moisture together, in other words, fomentations, are commonly had recourse to; but, it is observed by Mr. Hunter, that when the warmth is as much as the sensitive principle can bear, it excites action. Whether it is the action of inflammation, or the action of the contraction of the vessels, is unknown. We see that many patients cannot bear warmth, and, therefore, it may be supposed to increase the action of dilatation, and do harm. But, if the pain should arise from the contraction of the inflamed vessels, benefit would be the result; though we must doubt, that this change is produced, as making the vessels contract would probably give ease. (*Hunter.*)

From the preceding observations, we must perceive how vain it is to theorise on this subject, which even puzzled the genius and penetration of a Hunter. In addition to what has been already observed, I feel totally incapable of giving any useful practical advice, with respect to those cases, in which warm emollient applications should be used in preference to cold astringent ones. I can, however, with confidence remark, that the surgeon who consults the feelings and comfort of the patient on this point, will seldom commit any serious error. Hence, in all cases in which the first kind of topical applications seem not to produce the wanted degree of relief, let the second sort be tried. From the opportunity of comparison, a right judgment may then be easily formed.

The poultice, made of the powder of linseed, is so easily prepared, that the old bread and milk poultice is now seldom employed. As much hot water is to be put into a basin, as the size of the poultice requires, and then the linseed powder is to be gradually mixed with the water, till the mass is of a proper consistence. Frequently a little sweet oil is also added, to keep the application longer soft and moist.

Fomentations are only to be considered as temporary applications, while the emollient poultices are the permanent ones. The former are, at most, never used more than three times a day, for the space of about half an hour each time. Two of the best are the following:—℞ Lini contusi ℥j.; Chamæmeli ℥ij.; Aq. distill. lbvj. Paulisper coque et cola. Or, ℞ Papaveris albi exsiccati ℥iv.; Aq. puræ lbvj. Coque usque remaneant lbij., et cola.

Some practitioners, however, are inclined to think warm water alone quite as efficacious as the decoctions of particular herbs. Thus Dr. Thomson observes, “herbs are now seldom used in the way of fomentation, unless in compliance with ancient custom, or with the prejudices of particular individuals. The discutient power of the warm water may be increased by the addition of various substances, such as vinegar, spirits of wine, saline substances, such as common salt, acetate and muriate of ammonia. But, these warm and stimulating embrocations are used chiefly in the passive, chronic, or more indolent species of inflammation.” (*See Lectures on Inflammation*, p. 189.)

By pursuing the above treatment, the resolution of inflammation will, in general, begin to take place, either in the course of three or four days, or in a shorter space of time. At all events, it may usually be known before the expiration of this period, how the disorder will terminate. If

the heat, pain, and other attending symptoms abate; and, especially, if the tumour begin to decrease, without the occurrence of any gangrenous appearances; we may then be almost certain, that, by a continuance of the same plan, a total resolution will in time be effected.

On the other hand, when all the different symptoms increase, and particularly when the tumour becomes larger, and softish, attended with a more violent throbbing pain, we may conclude, that the case will proceed to suppuration. Hence, an immediate change of treatment is indicated, and such applications as were proper, while resolution seemed practicable, are to be left off, and others substituted. This remark relates to the employment of cold astringent lotions, which, when suppuration is inevitable, only do harm, by retarding what cannot be avoided, and affording no relief of the pain and other symptoms. If the inflammation, however, should already be treated with emollients, no alteration of the topical applications is requisite, in consequence of the inevitability of the formation of matter. Indeed, emollient poultices and fomentations are the chief local means both of promoting suppuration, and diminishing the pain, violent throbbing, &c. which always precede this termination of phlegmonous inflammation.

But, besides the substitution of warm emollient applications for cold astringent lotions, practitioners have decided, that it is also prudent, as soon as the certainty of suppuration is manifest, to relinquish the free employment of evacuations, particularly blood-letting, and to allow the patient a more generous diet. When the system is too much reduced by the injudicious continuance of rigorous antiphlogistic treatment, the progress of the ensuing suppuration is always retarded in a disadvantageous manner, and the patient is rendered too weak to support either a long continued, or a profuse discharge, which it may not be possible to avoid.

I shall conclude this article with briefly noticing blisters, the external use of nitrate of silver, rubefacients, issues, and synapisms, as means often employed for the relief of particular cases of inflammation. "Blisters (says Dr. Thomson) are never applied to a part which is actually inflamed. They seem to be chiefly useful by exciting inflammation in a contiguous part. It is from this tendency, which blisters have to produce inflammation, and of course a certain degree of fever, that they are seldom to be employed in acute inflammatory cases, till the constitutional symptoms are by other means in some measure subdued." (P. 187.)

"Of the same nature, though milder in their operation than blisters, are the whole class of rubefacients. They produce a determination of blood to the parts to which they are applied, and in a manner not yet well understood, occasion a diminution in the action of the vessels, and consequently in the quantity of blood with which the inflamed parts are supplied. This influence is exerted more or less directly in different instances. The extremities of the intercostal arteries may open both on the pleura lining the chest, and on the surface of the skin covering it, and whatever excites an increased flow of blood into one of these textures, may be conceived to be attended with a proportionally diminished flow into the other texture. But, blisters are found by experience to be efficacious in removing inflammation, where no

communication whatever can be traced between the blood-vessels of the inflamed part, and that to which the blister is applied. We have examples of this mode of action in the beneficial effects obtained from the application of blisters in inflammation of the brain and the membranes immediately covering it, of the lungs and intestines, or of any of the viscera contained in the cavity of the abdomen. The nearer in such instances the blister or rubefacient can be applied to the part inflamed, the greater is the relief obtained; and in general, I believe, it may be laid down as a rule, that the relief which they afford will be proportional to the degree of inflammation which they excite." (See *Thomson on Inflammation*, p. 187. 189.)

Blackening the skin with the nitrate of silver, appears to have, in some cases, considerable power in checking inflammation. In whtlowes, and scrofulous inflammation of the lymphatic glands, I have found this plan sometimes capable of preventing suppuration. For a full account, however, of the uses of nitrate of silver, as a means of controlling inflammation, I must refer to a modern publication. (See *John Higginbottom on Lunar Caustic*, 8vo. Lond. 1826; or the later ed.) See SILVER, NITRATE OF.

Synapisms, blisters, and issues, are in many instances applied in situations, which are so remote from and unconnected by vessels with the inflamed parts, that it is impossible to explain their mode of operation, except through the medium of the nervous system. "The irritation of a synapism applied to the foot (says Dr. Thomson) may relieve an attack of gout in the head, or stomach. Bathing the feet and legs gives relief in inflammation of the bowels; and the application of a blister, or caustic, to the neck, may cure an inflammation of the eyes, &c. (P. 189.) Here counter-irritation is the principle, by which an explanation is usually attempted. (See BLISTERS.)

Gorter's Compendium Medicinæ, 4to. Lugd. 1731; and *Chirurgia Repurgata*, 4to. Lugd. 1742. *Vacca, Liber de Inflammationis morbosæ, quæ in humano Corpore fit, Naturâ, Causis, Effectibus, et Curatione*, 1765. *D. Magensie, the Doctrine of Inflammations*, founded upon reason and experience; and entirely cleared from the contradictory systems of Boerhaave, Van Swieten, and others, 8vo. Lond. 1768. *Cullen's First Lines of the Practice of Physic*, vol. 1. *John Hunter, on the Blood, Inflammation*, &c. 4to. London, 1794. *J. Burn's Dissertations*, 8vo. Glasgow, 1800. *Thomson's Lectures on Inflammation*, Edin. 1813. *Boyer, Traité des Maladies Chir. t. 1. Delpsch, Précis Élém. de Mal. Chir. t. 1. chap. 1. Paris, 1816. John Herdman, Diss. on White Swelling and the Doctrine of Inflammation*, 8vo. Edin. 1802. *F. J. V. Broussais, Hist. des Phlegmasies, ou Inflammations Chroniques*, &c. ii. tom. 8vo. Paris, 1808. *C. Wenzel, über die Induration und das Geschwür in indurirten Theilen*, 8vo. Mainz, 1815. *Wilson Philip, on Febrile Diseases*, part 2. Introduction, ex. 3; and an *Experimental Inquiry into the Laws of the Vital Functions*, ed. 8vo. Lond. 1818. *Calch B. Parry, Elements of Pathology and Therapeutics*, 8vo. Lond. 1815. Also, an *Experimental Inquiry into the Nature, &c. of the Arterial Pulse*, 8vo. Lond. 1816. *Charles H. Parry, Additional Experiments on the Arteries of Warm-blooded Animals*, &c. 8vo. Lond. 1819. *James Wilson, Lectures on the Blood, and on the Anatomy, Physiology, and Surgical Pathology of the Vascular System*, 8vo. Lond. 1819. *C. H. Ronnefeld, Animadversiones nonnullæ ad Doctrinam de Inflammatione*, 4to. Lips. 1817. *C. Hastings, a Treatise on Inflammation of the Mucous Membrane of the Lungs*, &c. 8vo. Lond. 1820. *J. H. James, Obs. on some of the General Principles, and on the particular Nature and Treatment of the different Species of Inflammation*, 8vo. Lond. 1821. *C. J. M. Langenbeck, Nosologie, &c. de Chir. Krankheiten*, 1. b. Güt. 1822. *J. Syme, on the Nature of Inflammation*, in *Ed. Med. Journ.* No. 97. p. 316. *A. N. Gendrin, Histoire Anatomique des Inflammations*, 2 t. 8vo. 1826. one of the best works on the subject. *M. G. Kallenbrunner, Recherches Expérimentales sur l'Inflammation*, in *Répertoire Générale*

d'Anatomie et de Physiologie Pathologique, t. iv. *J. W. Earle*, on the Nature of Inflammation, in Lond. Med. Gaz. vol. xvi. 8vo. 1835.

INJECTION. A fluid intended to be thrown against, or into a part of, the body by means of a syringe. Thus port wine and water form an injection, which is often used by surgeons for radically curing the hydrocele, and, for this purpose, it is introduced into the cavity of the tunica vaginalis, where it excites the requisite degree of inflammation.

Thus many fluid remedies are introduced into the urethra and vagina for the cure of gonorrhœa. See GONORRHOEA, and HYDROCELE.

INJECTIO ALUMINIS.—R Alum. 5j.; Aq. pur. ʒvij. Misce. Successfully employed by Dr. Cheston, in affections of the rectum, either when the internal coat was simply relaxed and disposed to prolapsus, or when it was studded with loose fungated tumours.

INJECTIO FERRI MURIATIS.—R Tinct. Ferri Muriatis 5j.; Aquæ puræ lbj. An eligible injection in some cases of prolapsus ani, prolapsus vaginae, &c.

INJECTIO QUERCUS. R Decocti Quercus lbj.; Aluminis purificat. ʒss. Misce. Sometimes used, when the rectum, or vagina, is disposed to prolapsus from relaxation.

INOSCUATION denotes the union of vessels by conjunction of their extremities. It is generally synonymous with *anastomosis*, though sometimes a distinction is made, *anastomosis* signifying the union of vessels by minute ramifications, and *inosculation* a direct communication by trunks. The great use of inosculations is to facilitate and ensure the continuance of the circulation, when the large trunks of vessels are obstructed by pressure, disease, &c. Thus, in cases of aneurism, when the main artery of a limb is tied, the inosculations of the branches, given off above the ligature, with other branches arising below it, form at once a channel, through which the lower part of the limb is supplied with blood. Were there no such arrangement in the human body as inosculations, aneurisms could never be cured by a surgical operation. So infinitely numerous indeed are these inosculations that they do the office of the subclavian, carotid, and external and internal iliac arteries, when these vessels are tied, and upon this fact is founded the success of some of the most brilliant operations in modern surgery. (See ANEURISM.) Even the aorta itself may be perfectly obstructed, the circulation go on, and every part be fully supplied with blood. (See AORTA.) In dogs, the abdominal aorta has been tied without the circulation in the hinder extremities being stopped (see the *Experiments of Sir A. Cooper*, in *Med. Chir. Trans.* vol. ii. p. 258.); and the operation performed a few years ago, in Guy's Hospital, tends to prove that the same thing is possible in the human subject. (See AORTA.) From the observations of the same distinguished surgeon it appears, that the arteries which form the new-circulation in a limb, after the obliteration of the principal artery, are not only enlarged but tortuous. Any great increase, however, in the diameter of the anastomosing vessels is but slowly produced; for Sir A. Cooper has injected a limb several weeks after the operation for popliteal aneurism, without being able to force the injection through communicating vessels into the parts below. The limb must have active exer-

cise before the vessels enlarge much. On account of the arteries not very readily enlarging, the limbs of persons who have undergone the operation for aneurism, are for a considerable time weaker than natural. They feel the influence of cold more, and are more disposed to ulcerate from slight causes. Hence, the utility of covering them with flannel, or fleecy hosiery. Hence, the rashness of applying cold washes, bandages, &c. (See vol. cit. p. 249. et seq.)

In another place, the same gentleman has published an interesting description of the anastomoses of the arteries of the groin. "Hypothesis (says he) would lead to a belief, that anastomosing vessels would be numerous in proportion to the time which had elapsed from the operation; but the reverse of this is the fact; for, at first, many vessels convey the blood originally conducted by the principal artery. But, gradually, the number of these channels becomes diminished, and, after a length of time, a few vessels, conveniently situated for the new circulation, become so much enlarged, as to be capable of conveying an equal portion of blood to that which passed through the original trunk."

The experience of Sir A. Cooper also tends to confirm the important fact, that "it is desirable in femoral aneurism, if not, indeed, in all others, to perform the operation in an early state of the disease," as the patient then recovers the use of the limb much more quickly, than when the tumour has been suffered to attain a large size. (See *Med. Chir. Trans.* vol. iv. p. 425. et seq.)

INTERRUPTED SUTURE. See SUTURES.

INTESTINAL CONCRETIONS. *Gastro-Intestinal Concretions.* Comprehending under this head both gall-stones and intestinal concretions, an interesting subject presents itself, certain parts of which have been chiefly elucidated in modern times. When the concretions voided are numerous, they are generally gall-stones. Thus, Dr. Coe relates an instance in which seventy were discharged in one day. In the same short time, Petermann knew of seventy-two being voided from one individual; Birch, one hundred; Barbet, Sloane, and Vogel, two hundred; and Russell, four hundred. A patient, under the care of Van Swieten, had voided two hundred, and was still continuing to expel others. Riverius speaks of another patient who had voided calculi from the bowels for several years whenever he went to stool. Fernelius likewise adverts to cases in which the concretions evacuated were innumerable. (*Pathol. lib. vi. cap. 9.*) Alvine concretions are of various sizes. Most of them are not larger than a pea or nut; but others are as large as an orange, and weigh four pounds. (See *Morbo's Morbid Anat. of the Human Gall, &c.*; and *Medico Chir. Journ.* vol. iv. p. 188.) Morgagni saw one which equalled in size a moderate finger, and Gooch, Guettard, Huermann, Maréchal (*Mém. de l'Acad. Royale de Chir.* t. iii. p. 55.), and others, have seen concretions of this nature, which were too bulky to pass out of the rectum without surgical aid. In certain examples recorded by Huermann and Maréchal, the passage of the concretion outward lacerated the sphincter ani. Horstius speaks of one concretion, which was as large as an apple (*Epist. l. ii. sect. 2. Opp. ii. p. 237.*); and Marcellus Donatus, Schwind (*Schmucker's Verm. Schriften*, b. ii. p. 129.), Hooke, Vennette, and Hequet,

give the particulars of other examples, in which the concretions discharged were as large as a hen's egg. Mr. C. White extracted two from the rectum, which were nearly as big as the fist (*Cases in Surgery*, p. 18.) ; and in a boy, who had died in an emaciated state, after continued pain in the abdomen, attended with frequent attacks of ileus, Mr. Hey found in the transverse arch of the colon so large a concretion, that it could not pass any further along the bowel, and appeared to have been the sole cause of death. (*Practical Obs. in Surgery*, p. 509. ed. 2.) An analogous case is reported by White (p. 28.) Duhamel saw a concretion which had been discharged, and was two inches and a half in length, one inch and a half in diameter, three inches and a half in circumference, and weighed three drachms and a half. But, judging by their weight, how much larger those must have been which were seen by Schroekius and Lettsom, and weighed ten drachms ; that reported by Dolaus, which weighed two ounces ; that recorded by Orteschi, which, besides weighing two ounces, two drachms and a half, was eight inches in circumference, and taken out by force ; that recorded by Scharschmidt, which weighed four ounces ; and lastly, the specimen cited by Plouquet (*Literatura Med. Dig.* vol. i. p. 171.), the weight of which is alleged to have been half a pound. (*Namnl. Med. Wahrnehm.* b. ix. p. 231.) It is observed by Rubini, that although examples of alvine concretions being discharged by vomiting are not so frequent as the foregoing cases, yet they are tolerably numerous. Many of them have been collected by Schenck, and others are collected by Breyh (*Phil. Trans.* No. 479.) ; by Orteschi in his journal ; by Moreali (*Dell' Uscita di una Pietra, per la Via del Esophago*, Modena, 1781) ; by Borseri ; and by a long list of other writers, whose names and publications are specified by Plouquet. (*Lit. Med. Dig.* art. *Calculus Vomitus*, &c.) With this class of substances may also be arranged those concretions, which are found upon dissection either in the intestines or stomach, whence, probably, in time they might have been expelled. Facts of this description are recorded by Portal, Vicq d'Azyr, Jacquemelle, Chaudron, &c. The cases recited by White and Hey, in which the colon was completely obstructed, I have already mentioned ; and to these may be added the instance quoted by Rubini, in which Meckel found the jejunum entirely blocked up by a similar substance. (*See Pensieri sulla varia origine e natura de corpi calcolosi, che vengono talvolta espulsi dal tubo gastrico*, Memoria, p. 5. and 6. 4to. Verona, 1808.)

With respect to the origin of alvine concretions, whether discharged from the alimentary canal upwards or downwards, some of them appear to be formed in that canal itself, while others pass into it from other situations : and they all admit of being distinguished according to the place of their origin and formation into three kinds : 1. *hepatic*, or *biliary* ; 2. *gastric*, or *intestinal* ; and 3. (what Rubini terms) *mixed*, or *hepatico-gastric*. *Hepatic alvine concretions*, as the name implies, are derived from some point of the hepatic system : the *gastric*, or *intestinal*, are formed within the alimentary canal ; and the *mixed* commence in the hepatic organs, but afterwards get into the bowels, where they acquire an increased size.

The accuracy of the preceding statement is but

trivially affected by the observation of the late Dr. Marcet, that he once found a stone in the alimentary canal, which came from the urinary passages : a communication existed between them, the rectum being imperforate. Here also, it should likewise be remembered, that some concretions are formed of substances swallowed, and afterwards cemented together and accumulated in such masses as obstruct the bowels, and create dangerous effects, as, for instance, mustard seed, chalk, magnesia, and carbonate of iron.

If, when carbonate of iron is prescribed, the bowels are not kept open, large masses of it are apt to collect in the large intestines. Dr. Elliotson attended a man, who took two pounds of it every day for several days, when labouring under tetanus, and large lumps of it were regularly discharged, covered with mucus, and without any pain, because their passage was facilitated with clysters. If a person do not attend to his bowels, a great accumulation may take place in the rectum, and he may be obliged to pick it out. The patient under Dr. Elliotson, who took carbonate of iron, if he neglected to keep his bowels open, used to find his rectum become dry and distended ; and, on one occasion, a shovelful was found in his bed, which he had amused himself day and night in removing. (*See Elliotson's Lectures, Med. Gaz.* for 1832-33, p. 598.)

Some hepatic concretions cannot pass from the place of their origin into the intestines, but only such as are situated in the ductus hepaticus, or its main branches, in the gall-bladder, the ductus cysticus, or the ductus choledocus. When their size is not disproportionate to the diameter of the ducts, they pass with facility, but, when their dimensions are larger than those ducts can naturally admit, the latter become stretched and dilated, whence arise the sharp pains and colic which attend the disorder, analogous to the sufferings produced by the descent of large calculi from the kidneys to the bladder. The reality of these dilatations of the hepatic ducts is proved by dissection. Heister found the orifice of the ductus choledocus, which is usually very small, so much enlarged that it could receive a finger ; and Vicq d'Azyr saw this duct enlarged through its whole extent in a similar degree. (*Hist. de la Société Royale de Médecine*, an. 1779, p. 229.) Calanuzzi, in dissecting a body, found the ductus choledocus so dilated, that it resembled a kind of bag, in which several calculi were included. Mr. Thomas has likewise seen two cases, in which the point of the forefinger readily passed from the duodenum into the gall-bladder. (*See Med. Chir. Trans.* vol. vi. p. 105.) Morgagni saw this duct in one instance large enough to hold a couple of fingers, and he quotes many similar instances from Bezold, Trew, Verney, and others. We may conceive how dilated this tube must have been in a case recorded by Richter, where, though it was not completely obstructed, a calculus weighing three ounces and a half was lodged within it. (*Rubini, Op. cit.* p. 7—10.)

With regard to those concretions which are distinguished by the epithet *gastric*, or *intestinal*, some are formed in the stomach ; the rest in one or other of the intestines. Some are only partly formed in the digestive tube, having a nucleus, which is usually some substance which has been swallowed, round which certain matters acqui-

mulate and crystallize, though, without the accidental introduction of the nucleus, no concretion at all would have been formed. Other intestinal concretions are entirely produced in the intestinal canal. (*Andral, Précis Elém. d'Anat. Pathol.* t. ii. p. 162.) They remain for a greater or lesser period in the place of their formation, according as they happen to be lighter or heavier, smoother or rougher, more or less adherent, or as local, or general circumstances, are more or less favourable to their retention or expulsion. Sometimes, they continue undischarged, until they have attained a very considerable size. In particular instances, instead of remaining constantly in one place, they successively pass through the whole intestinal tube, lodging at different points for a greater or a lesser time. The alvine concretion, of which Maréchal has given an account, was some years in traversing all the convolutions of the bowels. These gastric or alvine concretions, which are very common in animals, are less frequent in the human subject, as is proved by the observations of Fourcroy and Vauquelin, inserted in their valuable essay on this subject in the *Annales du Muséum Nationale d'Histoire Naturelle de Paris*. In the horse, they are sometimes of an enormous size, as we may learn from an instance on record, in which the concretion weighed thirteen pounds. (*Voigt, Magazin für das Neueste der Naturkunde*, b. iii. p. 578.)

As for the third species, which Rubini names *mixed*, or *hepatico-gastric*, they have their beginning in the hepatic organs, and augment in the intestinal tube. Here, if the extraneous body be detained, and the contents of the bowels have a disposition to become thickened and condensed round it, as a nucleus, it may be rendered larger by additional strata of matter, and would increase *sine fine*, if a stop were not put to the augmentation by the narrowness of the canal, or an effort made for the expulsion of the concretion. The crystallized appearance of alvine concretions is generally so conspicuous, that it did not escape the attention of several of the old writers, as we may convince ourselves by referring to the works of Corn. Gemma, Greisel, Baglivi, Scultetus, &c. It was noticed by Haller in his *Elementa Physiologia*; vol. vi., and by Morgagni in his *Epist.* 37. *de Sedibus et Causis*, &c. If, says Rubini, these crystallizations are not always plainly visible, distinct, and regular, this depends either upon their imperfection; the heterogeneous nature of the accumulated matter; or particularly unfavourable circumstances, which would equally affect the process of crystallization out of the body.

Now, as all crystallizations depend upon the fluids, in which they form, and from which they receive their crystallizing elements, it must be evident that, inasmuch as the fluids of the hepatic organs differ in their constituent principles from the fluids contained in the intestinal canal, the concretions, produced in the first system, must differ from those originating in the second; whilst the hepatico-gastric calculi will combine the nature and properties of both together.

The fluid, from which hepatic concretions are formed, is unquestionably the bile, either some or all its ingredients entering into their composition. Indeed, previously to the new chemical doctrines, hepatic concretions were generally considered as being simply condensed indurated bile.

From investigations made, in more modern times, however, when the art of analysis has attained a precision, of which the old chemistry was not susceptible, it appears, that, although human biliary calculi yield the same products as the bile, there is contained in them more or less of a peculiar substance, which was considered by the celebrated Fourcroy to be *adipocire* (*Mém. de l'Acad. des Sciences*, 1789, p. 323.), or a substance very similar to spermaceti; but which has since been proved to be cholesteroline. This differs from spermaceti in requiring a temperature of 278° Fahr. for fusion, and by not being convertible into soap, when digested in a solution of potash. The presence of this substance in the concretion is of such importance, that, when it is abundant, and in large proportion, the calculus is regular, and the crystallization well finished; and, when it is in small quantities, the crystallization is confused and disordered, the calculus only exhibiting an irregular misshapen concretion, more like a clot, than true crystals. According to Chevreul, biliary concretions in general are composed of the yellow colouring matter of the bile, and cholesteroline, the latter predominating, and being sometimes in a state of purity; "and," says Dr. Turner, "I have had frequent opportunities of satisfying myself of the accuracy of this observation." (*See Turner's Elem. of Chemistry*, p. 922. ed. 4.)

While the hepatic system contains a fluid which is always nearly of the same quality, viz. the bile, the alimentary canal, as Rubini observes, contains a hundred different fluids, and is continually occupied by substances, of various natures, kinds, and properties, consisting of food, drink, and diverse secretions. All the principles, which are to serve for the formation and renewal of the different species of living solids, and of the many kinds of fluids, at first remain more or less time in the alimentary canal, and there undergo peculiar changes. All the principles, which, under different circumstances, may contribute to the production of morbid concretions, either in the gall-bladder, the urinary bladder, the kidneys, or in any other part of the body, where they ever occur, pass at first into the intestinal canal, where they continue for some time. Such a multiplicity of principles, disposed to crystallize, and be converted into calculi, would, almost daily, produce these concretions in the bowels, were there not many circumstances which counteract this tendency, as, for instance, exercise, the incessant motion of the matter itself along the intestinal tube, the variety of these elements, whereby their natural tendency to unite is disturbed, and the decomposing and recomposing influence of the gastric secretions, whereby parts are united, disposed of, dissolved, and analogous matter kept divided, &c. But, whenever these circumstances are not actively operating, as may be the case in a noose, or fold of the bowels, or in some preternatural cyst belonging to them; whenever the intestinal fluids undergo such an alteration, that the production of these concretions cannot be prevented; or, lastly, whenever some favourable circumstance, such as an extraneous nucleus, forms a centre of reunion for particular elements; then the saline matter, which is most disposed to crystallize, and the earthy and mucilaginous substances, &c. are attracted together, and produce more or less perfect crystallizations.

Some specimens, contained in the Edinburgh museum, were carefully examined by Dr. T. Thomson; they at first swam in water, but afterwards sunk; the specific gravity varying from 1.376 to 1.540. Cold water acquired from them a brownish tinge, and took up albumen, which separated in white flakes by boiling. There was also a peculiar brown substance, at first dissolving in water, but rendered nearly insoluble by slow evaporation: soluble in alcohol; and most nearly resembling vegetable extract. The specimens likewise contained muriate of soda, crystallizing on spontaneous evaporation of the water; phosphate of lime, precipitated by ammonia; sulphate of soda in minute proportion; and, perhaps, sulphate of lime. Alcohol dissolved the peculiar brown matter and some of the salts; caustic potash, the albumen brown matter, and perhaps some of the salts; and muriatic acid a proportion of phosphate of lime. After all, there remained a peculiar substance, having the colour and texture of the calculus; in very short threads, light, resembling cork, or rather agaric; tasteless, insoluble in water, alcohol, ether potash-ley, and muriatic acid; being blackened, and partly reduced to charcoal by sulphuric acid; slowly dissolving by heat without effervescence, in nitric acid; and leaving on evaporation a whitish residue, of bitter taste, and imperfectly soluble in water; burning with a bright flame; but differing from all other animal and vegetable substances hitherto examined, and distinguishable from wood, by its insolubility in potash-ley. The calculi consisted of alternate layers, or intimate mixtures of this substance and phosphate of lime, to which the albumen and brown matter served as a cement, the other substances being in small proportions. Phosphate of lime, mixed with a brown animal matter, formed the external crust of some of the specimens. On the surface of a few were noticed crystals of phosphate of ammonia and magnesia. The presence of neither potash, ammonia, carbonate of lime, uric acid, nor urea, could be detected.

Varieties have also been found by Dr. Henry and Mr. Brande, exclusively composed of magnesia, of which the patient had been in the habit of taking vast quantities. (See *Thomson's Obs.*, in *Monro's Morbid Anatomy of the Human Gullet*, &c. p. 36., or in *Medico Chir. Journ.* vol. iv. p. 188, 189.)

From observations made by Dr. Wollaston, it appears probable, that the above fibrous, light, thready substance is derived from oats, which are so commonly taken as food in Scotland. "If the oat-seed be divested of its husk, minute needles or beards, forming a small brush, are seen planted at one of its ends. Dr. Wollaston, on examining these needles and comparing them with similar ones detached from the calculi, and forming the velvet substance in question, satisfied himself beyond all doubt, of their perfect identity." (*Marcel on Calculous Disorders*, p. 130, 8vo. London, 1817.)

Those composed of carbonate of iron, chalk, &c. have already been noticed. In cows, concretions are often found in the alimentary canal, consisting of their hairs which they have licked off and swallowed. Millers' horses are likewise subject to alvine concretions, formed of collections of the grit of the stone dust in the mills, taken into their stomachs when they are fed with bran.

The specimen, analysed by Dr. Ure, he inferred

to be a modification of ambergris. (*Dict. of Chemistry*, art. *Intestinal Concretions*.)

As for the mixed, or hepatico-gastric calculi, they have for their nucleus a biliary concretion, round which other substances contained in the bowels adhere: hence it is evident, that as they are formed at two distinct periods in two different situations, and amongst various fluids, two distinct compositions must be the result. Although, says Rubini, there has hitherto been no scientific analysis of this species of calculus, excepting the very imperfect one by Moreali, reason shows clearly enough, that, if two separate analyses were made, one of the nucleus, the other of the surrounding matter, there would be obtained from the nucleus the same elements, as those of an hepatic calculus, and from the rest those of an intestinal concretion. (See *Pensieri sulla Varia Origine, &c. de' Corpi calcolosi che vengono espulsi dal tubo gastrico*, p. 15—17.)

As the same author remarks, the foregoing principles will enable us to determine with greater precision, than formerly, the characters which appertain to the several classes of calculi, liable to be voided from the intestinal canal; characters, by means of which there can be no difficulty in deciding, from the appearance of one of these concretions, the place of its origin, and its peculiar nature. The hepatic calculus being composed of bile, and also of adipocire, or cholesteroline, its characters will be such as indicate the predominance of an uniform, oleaginous, and (what Rubini terms) a well animalised principle. The gastric or intestinal calculus, arising from the union of various salts, earths and other principles, which happen to be in the alimentary canal, will have very different characters, generally indicating its earthy, saline composition. Lastly: the hepatico-gastric calculus will present an union of the different characters, viz. in the centre, the characters of the hepatic calculus; more externally, those of the gastric.

The criteria for distinguishing the several kinds of calculi from each other may be divided into such as may be termed *external*, being derived from accidental circumstances attending the foreign body; and others, which may be called *internal*, being deduced from the inherent characters, belonging to the composition and nature of these concretions.

The first of these external criteria is the age of the patient. C. Stephanus, Hoffmann, Durande, and Morgagni all agree, that biliary calculi seldom occur, except in subjects of advanced age, and never in youth. And Haller writes, "*Juniores et pueros, quantum novi, nunquam affligit morbus.*" Morgagni met with sixty-one old persons who had alvine concretions, but with only eight young persons, not one of whom was a child, the youngest being twelve years of age, and the eldest twenty-nine. To these I may add the instance reported by Saye, in which a stone, as large as a hen's egg, was found in the gall-bladder of a girl only twelve years of age. (See *Journ. des Savans*, September, 1697.) The cause of this difference is attempted to be explained by Morgagni; but, probably, a more rational explanation, than that suggested by him, will be found in the analysis of the bile of old and young subjects, as made by Fourcroy, and other modern chemists. From these and other observations, collected by Rubini, it is rational to conclude, that when an alvine concre-

tion is discharged from a young subject, the chances are, that it is not a biliary one; though, if the patient be of advanced age, it is not to be inferred, that the foreign substance expelled must certainly be hepatic, because gastric or intestinal concretions are common to individuals of every age. (*Rubini, Op. cit. p. 18.*) Indeed; with the latter kind of calculi, men of advanced age, and women are said to be most frequently afflicted; children and young persons rarely suffering, unless the formation of such bodies has been produced by the presence of fruit-stones, or other indigestible substances, which serve as nuclei. (*Richerand, Nosographie Chir. t. iii. p. 433. ed. 4.*) These concretions are also sometimes formed in patients, who have been confined by disease a long while in a recumbent posture.

The second criterion is drawn from the symptoms, which precede or accompany the expulsion of the calculus. Sense of heaviness, irritation, and pain in the region of the liver, pain about the ensiform cartilage and navel, bilious vomiting, jaundice, and either looseness of the bowels or constipation, are the symptoms, which (especially when they frequently occur) indicate the hepatic origin of the calculus, and proceed from its passing through the narrow ducts of the liver or gall-bladder towards the intestines. The most careful observations have proved, however, that these symptoms are only to be depended upon when taken collectively, and that no single one gives any certain information. Also, if their presence be sufficient to prove the hepatic origin of the calculus, their absence can by no means be regarded as a proof of the concretion being of the intestinal kind. (*Rubini, p. 19.*)

Third criterion. A calculus voided may be set down as undoubtedly hepatic, if accompanied by others unequivocally of this nature. In a case recorded by Brunner, and in another by Vater, the absence of certain symptoms in the first, and the magnitude of the calculus in the second, created doubts whether the concretions were not more likely to be of the intestinal kind than of the hepatic. At length, the bodies having been opened, the presence of other similar calculi in the gall bladders afforded an adequate criterion.

Morgagni lays down a fourth criterion, deduced from the number of the calculi voided; which, if very numerous, are to be considered as biliary. Rubini points out, however, the fallacy of this test; both hepatic and gastric concretions being sometimes single, sometimes in various numbers even up to a thousand; and he refers to a case where a very large number of concretions of the gastric description were voided, as reported by König. The test, here suggested, however, may be considered as generally valid; for, the number of intestinal concretions is rarely more than two, though sometimes very considerable. (*T. Thomson. See Med. Chir. Journ. vol. iv. p. 189.*)

I shall now follow Rubini, and notice those characters of alvine concretions, which he calls *internal*, and are deduced from their quality and composition, beginning with the criterion furnished by the size of the extraneous substance voided. As the biliary ducts are narrow, it is obvious that, if the calculus be above a certain size, it cannot have passed in this state suddenly through those narrow tubes, and, consequently, must be either of the gastric description, or mixed, having quitted

the hepatic system while small, and afterwards increased within the alimentary canal. Unquestionably, as Rubini admits, this criterion has considerable weight, especially when the discharge of the calculus has not been preceded by pain, or other symptoms indicating such violent distension, as the above ducts must have suffered from the passage of the foreign body. These are certainly capable of being dilated in a remarkable degree, as some facts already noticed in this article, sufficiently prove; but, such dilatation can never happen without pain, irritation, and a serious train of sympathetic effects. As Rubini remarks, this criterion will only apply to large, and not to diminutive concretions. A biliary calculus, of prodigious size, was found by Mr. Brynne, of Banbury, to have passed by ulceration directly from the cavity of the gall-bladder into that of the duodenum, whence it made its way through the rest of the bowels, and was voided from the anus. (*See Med. Chir. Trans. vol. xii.*)

A second criterion is the colour of the calculus; a test admitted by Moreau, who asserts, that biliary calculi are yellow, or green, and intestinal ones greyish brown, or black. But, says Rubini, one need only look at various specimens of alvine concretions, and read the statements of authors who have seen a great many of them, particularly Morgagni and Soemmering, to comprehend, that any criterion deduced from their colour is most fallacious, every species of them presenting great variety in this particular. And it is to be remembered, that the bile and the intestinal fluids, whence these concretions are formed, differ in colour in different individuals, according to a variety of circumstances, in health and disease. One species of hepatic calculus has a white colour, but is sometimes yellow or greenish. Another is of a round or polygonal shape, and often of a grey colour externally, and brown within. A third is of a deep brown or green colour. (*See Ure's Dict. of Chemistry, art. Gall-stones.*) The smaller intestinal concretions, examined by Dr. T. Thomson, destitute of coating, resembled bad yellow ochre, the larger were encrusted with an earthy matter, of a coffee colour, and purple, or sometimes white. (*See Memoir on the Human Gall, &c.; and Med. Chir. Journ. vol. iv. p. 188.*)

Third criterion. The presence or absence of a nucleus will enable one to judge whether a calculus be gastric or hepatic. A biliary concretion has no nucleus, properly so called; that is to say, it has no foreign body in its centre. When a transverse section is made of such a calculus, one finds either a cavity in its middle, or else nothing by which this part of its substance can be distinguished from the rest; or, if a nucleus, different from the other part of the concretion, be apparent there, it consists merely of bile, either grumous, differently coloured, or more or less fluid than the rest of the calculus, but which is nevertheless invariably bile. On the contrary, every gastric concretion has, as it were, an extraneous nucleus, as Fourcroy and Vauquelin have explained in their essay upon the intestinal calculi met with in animals. Ruysch, in the *Phil. Trans.* gives an account of some alvine concretions, which were formed round grains of seed. Birch records an example of a crystallized calculus, formed round a leaden bullet. Haller met with a calcu-

lus, in the centre of which was an iron nail. Concretions, formed upon fruit-stones, are recorded by Clarke, White, and Hey, and also in the *Edin. Med. Essays*. Instances in which the nucleus was a small portion of bone, are related in the latter work, and also by Hooke and Coe. Homberg and others describe alvine concretions, formed round indurated excrementitious matter: and many similar cases are specified by Vallisnieri, Van Swieten, and others. In the hepatico-gastric calculus, the biliary concretions serve as a nucleus for the gastric. According to Dr. T. Thomson, the nucleus is commonly a cherry-stone, a small piece of bone, or a biliary calculus. (See *Méd. Chir. Journ.* vol. iv. p. 188.; *Cruveilhier, Anat. Pathol.* livr. xxvi.) In the work last referred to, the nuclei were cherry-stones, retained in the colon by an obstruction of it from cancerous disease.

A fourth criterion is deduced from a certain unctuousity, which belongs to biliary calculi, but not to those of the gastric class. This character is more palpable, when the calculus has been recently voided, or when it is handled with warm fingers. The unctuousity is still more evident, when the concretion is cut, or sawn, as then the knife, saw, or fingers, become smeared with saponaceous particles which adhere to them. In order to denote an hepatic calculus, however, the unctuousity must pervade its whole substance, and not merely appear towards its outside; for a gastric, earthy, saline concretion, may by accident become coated, as it passes through the bowels, with a stratum of bile, or saponaceous matter. When the unctuousity is deficient externally, or in the outer laminae of a calculus, but is found in its interior, it is a clear indication of the hepatico-gastric formation of the concretion.

Fifth criterion. The specific gravity of a calculus, the property which it has of floating or sinking in water, has been long considered as a test of its species. The hepatic calculus is generally specifically lighter than water, as most oily substances are: on the contrary, gastric calculi are specifically heavier than water, like all earthy saline matter, and of course sink in that fluid. This criterion was often employed by Reverhorst, Fernellius, and others, for distinguishing various concretions. But it is by no means regular, as many biliary calculi swim only a little while and then sink. The specific gravity of that analysed by Dr. Ure of Glasgow, was 1.0135. (See *Méd. Chir. Journ.* vol. iv. p. 179.) As Rubini observes, this test will not answer for hepatico-gastric calculi, which are subject to great anomalies. (*Pensieri, &c.* p. 22.) Nevertheless, the most correct modern examinations prove, that gastric concretions have a specific gravity, varying from 1.376 to 1.640 (*Dr. T. Thomson, in Monro's Morb. Anat. &c.*); and, consequently, their general character is to be heavier than biliary calculi.

A sixth criterion is that proposed by Vicq d'Azyr in the *Mém. de l'Acad. Royale de Méd.* and deduced from the figure of the crystallisation. According to this writer, intestinal concretions crystallise in concentric laminae, shaped like a cock's comb, while the crystallisations of biliary calculi are radiated and needle-shaped. Although this criterion is ingeniously founded upon the known laws by which every crystallised substance assumes a peculiar and determinate shape, yet it may be generally observed, with respect to the

mark of distinction here proposed, that the concretions of which we are now speaking, are usually too compound, and too much disturbed in their crystallisation, to exhibit a regularity, for which simplicity and quietude are indispensable. Hence, many of these concretions do not present the slightest vestige of crystallisation, while others scarcely show a trace of it, in the midst of a large misshapen mass. The white-coloured hepatic calculus, when broken, is said to present crystalline plates, or striae, brilliant and white like mica. The round, or polygonal one, which is often of a gray colour externally, and brown within, is described as consisting of concentric layers of inspissated bile, usually with a nucleus of the white crystalline matter in the centre. Lastly, the hepatic calculi, of a deep brown, or green colour, when broken, are said to exhibit a number of crystals of the substance resembling spermaceti, mixed with the inspissated bile. (See *Ure's Dict. art. Gall-stones.*) With respect to the special shape, assigned by Vicq d'Azyr to the two classes of alvine concretions, it may be observed, that his specimens were taken from animals, and that, consequently, the inferences made from them are not applicable to substances of an analogous nature, discharged from the human body; because, as the bile varies in different animals, so must the formative principles of the calculous crystallisations. It is further remarked by Rubini, that the substance termed *adipocire*, which is the basis of biliary concretions, was not found by Poulletier in hepatic calculi taken from horned cattle.

A seventh criterion is founded upon the inflammability of an alvine calculus. A biliary concretion, being commonly made up altogether of unctuous matter, liquefies, when subjected to heat, smokes, emits a flame, and burns. When this experiment is made in close vessels, the products are hydrogen, carbonic acid gas, oil, and ammonia: some carbon and earth remaining behind. An intestinal concretion, on the other hand, decrepitates, or turns black, but generally does not burn. One specimen, examined by Dr. Ure, when heated to the temperature of 400 Ft., fused into a black mass, and exhaled a copious white smoke, in the odour of which was recognised that of ambergris, mixed with the smell of burning fat. Exposed in a platina capsule to a dull red heat, it burned with much flame and smoke, leaving no appreciable residuum. (See *Ure's Dict. of Chemistry, art. Intestinal Concretions.*)

The eighth criterion depends upon the solubility of calculi in an oily menstruum. Haller dissolved biliary calculi in oil of turpentine; Dietrick found them soluble in oil of sweet almonds; and Gren in oils in general. But intestinal calculi are not so readily dissolved by any of these menstrua.

The ninth criterion is founded upon the consideration that, while hepatic concretions are almost always more or less dissolved by alcohol, those of the gastric kind resist this menstruum.

Though the above criteria are interesting, as tending to establish distinctions betwixt the different species of alvine concretions, it merits attention, that not one of them, taken separately, is at all certain and pathognomonic. It may happen that some peculiarity in the biliary secretion, and an irregularity in the crystallisation, and

accumulation of the matter, may cause salts and earths to predominate in hepatic concretions, in which circumstance, their usually oily quality will be defective. On the other hand, in the formation of an intestinal concretion, oily adipose matter may accidentally adhere to it, so as to disguise its wonted character. If uniformity of characters and physical properties depend upon uniformity of elementary constituent principles, it can hardly happen even in the natural healthy state of the secretions, because age, sex, and other particular circumstances of the individual, will always make a difference in the proportions of those principles. How then can identity of results be expected in a diseased state of the process of secretion?—Such reflections may explain, how Morgagni, amongst others, met with many biliary calculi which were not inflammable; while others, which did not give a yellow tinge to water; and with some which floated, or sunk in water, according as they had been recently or long discharged; while Gren found some of these calculi insoluble in alcohol, &c. (*Rubini*, p. 24, 25.)

Moreali put a piece of the outer part of an alvine concretion into nitrous acid, when a considerable effervescence took place, and the substance afterwards completely dissolved. Now, as this calculus had a nucleus, it must have been of the hepatico-gastric kind, and the experiment was therefore made only with the intestinal part of it. Should the experiment be often repeated with the same result, says Rubini, it would furnish another criterion for distinguishing the two species of calculi: those being intestinal, which effervesce; and others being hepatic, which do not effervesce, but yield globules of wax-like oily matter. (P. 28.)

With respect to the treatment of cases of biliary calculi, the subject not being generally one for which any surgical proceeding is advisable, I may be brief. The medicine, which was alleged by Durande, a physician at Dijon, to be the best solvent for them, consists of three parts of sulphuric æther, and two parts of oil of turpentine. It is to be given in the dose of ʒij every morning; purgatives being previously exhibited for a few days. The efficacy of this medicine is also corroborated by Soemmering and Richter. To these statements, however, some doubts must be attached, because, what symptoms and circumstances will ever unequivocally prove, that there were biliary calculi in the bowels; and that they have been dissolved by this medicine? And how can the product of such solution be got at and examined? But, admitting the authenticity of the cases, doubts must exist of the solvent action of the remedy, since, at a temperature below that of the human body, the æther separates from the turpentine and is volatilised. (*See Dict. des Sciences Méd.* t. iii. p. 464, 465.)

A calculus in the gall-bladder, or one of the biliary ducts, sometimes produces so much irritation, that inflammation and suppuration take place; and, if the abscess point outwardly, the stone may escape externally, and a termination be put to the patient's sufferings. Heberden records a case of this description; and another is given by Blagden. (*See Méd. Trans. of the College of Physicians*, vol. v., and *H. L. Thomas in Med. Trans.*, vol. vi. p. 106; *Acret, Diss. de Calculis*, Lugd., 1788, p. 204; *Act. Natur.*

Cur. vol. vi. obs. 69.; *Bartholinus, Act. Hafn.* iv. obs. 46.; *Block, Med. Bemerk.* p. 27.; *Gooche's Works*, vol. ii. 157—161.; *Johnston in Phil. Trans.* vol. i. p. 2. 548.; *Petit, Mém. de l'Acad. de Chir.* i. p. 182—185.; *Sandifort, Tab. Anat. Fasc. 3.*; *Haller, Collect. Diss. Pract.* iii. No. 107.)

J. L. Petit first suggested the bold practice of making, under certain circumstances, an incision into the gall-bladder, in order to extract biliary calculi. This proceeding, however, is liable to serious objections, arising not only from the usual difficulty of knowing positively whether there is a calculus in the gall-bladder, but also from the difficulty of ascertaining whether this viscus is adherent to the peritoneum, without which state of things, the operation would cause an extravasation of bile, enteritis, and death. Petit himself, indeed, mentions three cases, in which distension of the gall-bladder was mistaken for an abscess, and punctured. In two of these examples the consequences were fatal, there having been no adhesion between that organ and the peritoneum to prevent the bile from getting amongst the bowels: the other patient was saved by this fortunate circumstance. (*See Traité des Mal. Chir.* t. i. 262, &c.) However, if a case were to present itself, in which an abscess had formed, and broken, leaving an aperture, in which the calculus could be plainly felt, the surgeon would be justified in attempting to make a sufficient opening for its extraction.

The symptoms, induced by the lodgment of large concretions in the bowels, are of a formidable description: severe pains in the stomach and bowel, diarrhoea, violent vomitings of blood and mucus, a discharge of thin fetid matter from the rectum, a difficulty of voiding the excrement, an afflicting tenesmus, extreme emaciation, and debility. That the foregoing account is not exaggerated may be seen by a perusal of the cases, and remarks published by Mr. C. White, and the late Mr. Hey.

In cases like that reported by Mr. Hey (*Pract. Obs.* p. 509. ed. 2.), where the colon was entirely obstructed, surgeons have been advised to cut into that bowel, and extract the foreign body. Let the inexperienced admirer of curious feats with the scalpel, however, pause a little, before he ventures to make up his mind upon this matter; and, at all events, let him know, that some serious mistakes have nearly been made: “upon the very bold operation of cutting out these concretions, when lodged in the colon, proposed by Dr. Monro, senior (*see Monro's Morbid Anatomy of the Human Gullet*, &c. p. 63.), we think it our duty to state, that the diagnosis is so difficult, that, in one case, where the operation was strongly advised, it turned out, upon dissection, that the disease was a *scirrhus pylorus*.” (*See Edinb. Med. and Surg. Journ.* No. xxxiii. p. 112.)

Sometimes patients ultimately get well by voiding the concretions either by vomiting or stool. Mr. C. White gives us an account of some instances of this kind: in one, fourteen concretions on plum-stones were discharged from the anus; in another, twenty-one similar bodies were ejected from the stomach.

When such concretions are not particularly large and indurated, they sometimes admit of expulsion by castor oil, oleaginous clysters, &c.

But, in other instances, their extraction must be attempted, if their situation in the rectum will permit. It may be done with a pair of lithotomy forceps, or with a sort of scoop used for taking fragments of stone out of the bladder. In this manner Mr. C. White succeeded in removing two alvine concretions from the rectum, nearly as big as his fist. When the sphincter ani will not allow the concretion to be taken out, the muscle should be divided at its posterior angle. According to Richerand, such a division does not permanently weaken its fibres in a perceptible degree, and its paralysis never originates from this cause. (*Nosogr. Chir.* t. iii. p. 434. *édit.* 4.) Maréchal, after a proper dilatation with a scalpel, extracted from the rectum an alvine concretion, which weighed two ounces and a half, and was of an oval form; its greater diameter being two inches eight lines, and its smaller, one inch seven lines. (See *Mém. de l'Acad. de Chir.*)

Alb. Haller, De Calculis Felleis frequentioribus, 4to. Gott. 1749. *Walther, De Concrementis Terrestribus in variis partibus corporis humani reperiis*. Fol. Acol. 1775. *Fag d'Azur, Hist. de la Société Royale de Méd.* 1779. *Dumas, Mémoires sur les pierres biliaires, et sur l'efficacité du mélange d'éther vitriolique et d'esprit de térbenthine dans la colique hépatique produite par ces concrets*, vol. i. des *Mém. de l'Acad. de Dijon*, svo. p. 159. an. 1783. *S. T. Sacmeyer, De Concrementis biliaris Corporis humani*, svo. Traj. ad Rhen. 1795. *B. Brucé, Essai sur les Calculs biliaires*, 4to. Paris, 1803. *Pourcroy, Mém. de l'Acad. des Sciences*, 1789, et *Syst. de Connoissances Chim.* t. x. p. 53. - 60. *Dr. Bostock, in Nicholson's Journal*, vol. iv. p. 137. *Marcel's Chemical History and Medical Treatment of Calculous Disorders*, svo. Lond. 1817. *J. F. Meckel, Handbuch der Pathol. Anat.* b. ii. p. 455. et seq. Leipzig. 1818. *P. Rubini, Pensieri sulla varia Origine e Natura de' Corpi calcinosi che vengono talvolta espulsi dal Tubo Gastrico*, Memoria, 4to. Verona. 1808. *James Kennedy, An Account of a Morbid Concretion discharged from the Rectum, and in its Chemical Characters closely resembling Ambergris*; see *Medico-Chir. Journal*, vol. iv. p. 177. et seq. 1817. *Mourio's Morbid Anatomy of the Human Gullet, Stomach, and Intestines*, svo. Edinb. 1811. *F. Sandfort, Mus. Anat. Lugd. Bat.* t. clide, Nov. 1793. *Muscovitus, Diss. de Calculorum Animalium, eorumque imprimis biliosorum origine et natura*. Berol. 1812. Cases in Surgery, by C. White, svo. Lond. 1770. p. 17. *Philos. Trans.* abridg'd. vol. v. p. 256. et seq. Edinb. *Med. Essays and Obs.* vol. i. p. 301. *Ibid.* vol. v. p. 431. *Essays, Phys. and Literary*, vol. ii. p. 345. *Lewy's Natural History of Lancashire*, plate 1. fig. 4. *V. Hey's Practical Obs. in Surgery*, p. 507. ed. 2. *Thomas, in Med. Chir. Transactions*, vol. vi. p. 88. *T. Bragay, An Account of Two Cases of Biliary Calculi of extraordinary Dimensions*; *Med. Chir. Trans.* vol. xii. *Lie's Chemical Diet.*, articles *Intestinal Concretions* and *Gall-stones*. *G. Andrak, Précis d'Anatomie Pathologique*, t. ii. p. 163. svo. Paris. 1820. *Idem, Lancet*, vol. i. 1835-36. p. 955. *Craweiller, in Anat. Pathol.* b. xvi. fol. Paris, 1837. For an account of adipocirous and fatty concretions in intestines, see Elliottson's *Lectures*, and his papers in *Med. Chir. Trans.*; also Good's *Study of Medicine*, vol. i. p. 251. ed. 4.

INTESTINES WOUNDED. See *Wounds of the Abdomen*.

INTROSUSCEPTION, or *Intussusception*. Called also *Volvulus*. A disease, produced by the passing of one portion of an intestine into another, commonly the upper into the lower part. (*J. Hunter*.) On this subject, Mr. Langstaff remarks, that the small intestines of children are so often affected with intussusception, in a slight degree, that most practitioners must have had opportunities of observing the form of the complaint. The greatest part of three hundred children, who died either of worms, or during dentition, at the Hôpital de la Salpêtrière, and came under the examination of M. Louis, had two, three, four, and even more volvuli, without any inflammation of the parts, or any circumstances leading to a

suspicion, that these affections had been injurious during life. "These cases (says M. Louis) seem to prove, that intussusception may be formed, and destroyed again by the mere action of the intestines." (*Mém. de l'Acad. de Chirurg.* 4to. t. iv. p. 222.) This opinion is confirmed by the authority of Dr. Baillie (*Morbid Anatomy*, 2d edit. p. 162.), who observes, that "in opening bodies, particularly of infants, an intussusception is not unfrequently found, which had been attended with no mischief; the parts appear perfectly free from inflammation, and they would probably have been easily disentangled from each other by their natural peristaltic motion." A rare example is on record, where the displacement existed at birth. (*Barrel, De Intestinis se intussuscipientibus*, &c. *Heimst.* 1769.)

According to Mr. Langstaff, the disease assumes a more dangerous, and, indeed, generally a fatal form, when it occurs at the termination of the small intestines in the cæcum. A contracted state of that part to be intussuscepted, and a dilatation of that portion of the canal, into which this part must pass, are essential conditions to the formation of a volvulus; and they exist nowhere so completely as in this situation. The extent to which the affection here proceeds would appear almost incredible, if it were not proved by well-authenticated facts. A person, who considered the natural situation and connexion of the parts, would of course require the strongest evidence, before he would believe, that the ileum, cæcum, ascending and transverse portions of the colon, may descend into the sigmoid flexure of the latter intestine; nay, more, that they may pass through the rectum, and be protruded in the form of a procidentia ani. Such cases, however, are recorded. (See *Lettsom's Case in Phil. Trans.* vol. lxxvi.; and *Langstaff, in Edin. Med. and Surg. Journal*, No. xi.)

Mr. Langstaff relates the case of a child three months old, the body of which he inspected after death, and found to confirm the truth of the preceding account. The example was particular, in there being, in addition to an extensive intussusception in the usual way, a smaller invagination in the opposite direction, like what probably occurred in the case related by Mr. Spry. (*Med. and Physical Journal*, No. xi.) Sir E. Home mentions a retrograde intussusception, in which a worm was found coiled up round the intussuscepted part. The disease took place in a boy who had swallowed arsenic. (See *Trans. for the Improvement of Med. and Chir. Knowledge*, vol. i.)

If the following mode of accounting for intussusception be just, it will most frequently happen downwards, although there is no reason why it may not take place in a contrary direction; in which case, the chance of a cure will be increased by the natural actions of the intestinal canal tending to replace the intestine; and, probably, from this circumstance, it may oftener occur than commonly appears.

When the intussusception is downwards, it may be called *progressive*, and when it happens upwards, *retrograde*. The manner in which it may take place is, by one portion of a loose intestine being contracted, and the part immediately below relaxed and dilated; under which circumstances, it may very readily happen by the contracted portion slipping a little way into that which is

dilated, not from any action in either portion of intestine, but from some additional weight in the gut above. How far the peristaltic motion, by pushing the contents on to the contracted parts, might force these into the relaxed, Mr. Hunter could not determine, but he was inclined to suppose that it did not have this effect.

By this mode of accounting for an accidental introsusception, it may take place either upwards or downwards; but if a continuance or an increase of it arises from the action of the intestines, it must be when it is downwards, as we actually find to be the case; yet this does not explain those in which a considerable portion of intestine appears to have been carried into the gut below: to understand these, we must consider the different parts which form the introsusception. It is made up of three folds of intestine; the inner, which passes down, and, being reflected upwards, forms the second or inverted position, which being reflected down again, makes the third or containing part, that is, the outermost, which is always in the natural position. (*J. Hunter.*)

The outward fold is the only one which is active, the inverted portion being perfectly passive, and squeezed down by the other, which inverts more of itself, so that the angle of inversion in this case is always at the angle of reflection of the outer into the middle portion or inverted one, while the innermost is drawn in. From this we can readily see how an introsusception, once begun, may have any length of gut drawn into it.

The external portion, acting upon the other folds in the same way as upon any extraneous matter, will by its peristaltic motion urge them further; and, if any extraneous substance is detained in the cavity of the inner portion, that part will become a fixed point for the outer or containing intestine to act upon. Thus it will be squeezed on, till at last the mesentery preventing more of the innermost part from being drawn in will act as a kind of stay, yet without entirely hindering the inverted outer fold from going still further. For it being the middle fold that is acted upon by the outer, and this action continuing after the inner portion becomes fixed, the gut is thrown into folds upon itself; so that a foot in length of intestine shall form an introsusception not more than three inches long.

The outer portion of intestine is alone active in augmenting the disease when once begun; but if the inner one were capable of equal action in its natural direction, the effect would be the same, that of endeavouring to invert itself, as in a prolapsus ani; and the outer and inner portions, by their action, would tend to draw in more of the gut, while the intermediate part only would, by its action, have a contrary tendency.

The action of the abdominal muscles cannot assist in either forming, or continuing this disease, as it must compress equally both above and below, although it is capable of producing the prolapsus ani.

When an introsusception begins at the valve of the colon, and inverts that intestine, we find the ileum is not at all affected; which proves that the mesentery, by acting as a stay, prevents its inversion. (*J. Hunter.*)

From the natural attachment of the mesentery to the intestines, one would, at the first view of the subject, conceive it impossible for any one portion

of gut to get far within another; as the greater extent of mesentery, that is carried in along with it, would render its further entrance more and more difficult, and we should expect this difficulty to be greater in the large intestines than in the small, as being more closely confined to their situation; yet one of the largest introsusceptions of any known was in the colon, as related by Mr. Whately. (*See Phil. Trans. vol. lxxvi. p. 305.*)

The introsusception appeared to have begun at the insertion of the ileum into the colon, and to have carried along with it the cæcum and its appendix. The ileum passed on into the colon, till the whole of the ascending colon, the transverse arch, and descending colon, were carried into the sigmoid flexure and rectum. The valve of the colon being the leading part, it at last got as low as the anus; and when the person went to stool, he only emptied the ileum; for one half of the large intestines being filled up by the other, the ileum alone, which passed through the centre, discharged its contents. (*J. Hunter.*)

Two questions of considerable importance present themselves to the mind in considering this subject; whether there are any symptoms, by which the existence of the affection can be ascertained during life? and whether we possess any means of relieving it, supposing that its existence could be discovered? The symptoms, attending an introsusception, are common to inflammation of the intestines, hernia, and obstruction of the canal from whatever cause, and a volvulus is the least frequent cause of such symptoms. In the case published by the above gentleman, and in those related by Mr. Hunter, Mr. Thomas Blizard (*Med. Chir. Trans. vol. i. p. 170.*), and Mr. Spry, the seat of the disease was clearly denoted by a hard tumour on the left side of the abdomen. This circumstance, together with the impossibility of throwing up more than a very small quantity of fluid in gylsters (*Hevin, Spry, Langstaff*), and the presence of the other symptoms would lead us to suspect the nature of the disorder. If the invaginated portion descended so low as to protrude through the anus, and we could ascertain that it was not an inversion of the gut, the case might be considered as clear, and we should have no hesitation in delivering a prognosis, which, by preparing the friends for the fatal termination, would exonerate us from all blame on its occurrence. (*Langstaff.*)

Mr. Bullin, of Farringdon-street, attended a man, who died of an introsusception of the ileum and cæcum into the colon, in which latter bowel there was a very close stricture by which the further descent of the other intestines had been impeded. The chief symptoms were suppression of stools, and violent pain in the abdomen, quite unattended with vomiting, and at first without any remarkable change in the pulse. The preparation, which is in Mr. Bullin's possession, is interesting. It is to be presumed, that, in this example, the disease and stricture of the colon had been the original complaint.

In the treatment of Introsusception, bleeding, to lessen the inflammation that might be brought on, and quicksilver, to remove the cause, have been recommended.

Quicksilver would have little effect either in one way or the other, if the introsusception were downward; for it is to be supposed that it would easily

make its way through the innermost contained gut, and if it should be stopped in its passage, it would, by increasing its size, become a cause (as before observed) of assisting the disease. In cases of the retrograde kind, quicksilver, assisted by the peristaltic motion, might be expected to press the intromusception back; but even under such circumstances it might get between the containing and inverted gut into the angle of reflection, and, by pushing it farther on, increase the disease it is intended to cure. (*J. Hunter.*)

Everything that can increase the action of the intestine downwards is to be particularly avoided, as tending to increase the peristaltic motion of the outer containing gut, and thus to continue the disease. Medicines can never come into contact with the outer fold; and, having passed the inner, can only act on the outer further down, and therefore cannot immediately affect that portion of the outer which contains the intromusception; but we must suppose that whatever affects or comes into contact with the larger portion of the canal, so as to throw it into action, will also affect by sympathy any part that may escape such application. Mr. Hunter, therefore, recommends emetics, with the view of inverting the peristaltic motion of the containing gut, which will have a tendency to bring the intestines into their natural situation.

If this practice should not succeed, it might be proper to consider it as a retrograde intromusception, and, by administering purges, endeavour to increase the peristaltic motion downwards. (*J. Hunter.*)

I cannot agree with Mr. Langstaff, that it is to be regretted, Hunter's name should be affixed to the foregoing proposal, or that it is an absurd one; for purgatives and emetics were only recommended to increase the peristaltic action, the former downward, the latter upward, according as the supposed nature of the case might require; and this effect they certainly would have, notwithstanding vomiting is an early and constant symptom of the disease, and an insuperable constipation an equally invariable attendant. The method, I allow, however, is not very hopeful, and may sometimes be frustrated by the formation of adhesions. According to Mr. Langstaff, the *Récherches Historiques sur la Gastrotomie dans le Cas de Volvulus*, par M. Hevin, contain many interesting facts, and a great deal of sound reasoning. There we find a very ample discussion of the question, concerning the propriety of opening the abdomen, in order to disentangle the intromuscepted intestine; a proposal which M. Hevin very properly condemns.

If the equivocal and uncertain nature of the symptoms of volvulus were not sufficient to deter us from undertaking an operation, which, under the most favourable circumstances, could not fail to be extremely difficult, and imminently hazardous to the patient, the state of the invaginated parts would entirely banish all thoughts of such an imprudent attempt; for the different folds of the intestine often become agglutinated to each other, so that they can hardly be withdrawn after death (*Simpson's Edin. Med. Essays*, vol. vi.; *Hevin's 4th Obs.*; *Malcolm's Physical and Lit. Essays*, vol. ii. p. 360.; *Hunter, Med. and Chir. Trans.*; and *Soemmering in Transl. of Baillie's Morb. Anat.*); nay, the stricture on the intromuscepted part may cause it to inflame, and even mortify. (*Soemmering. T. Blizard, Case in Med. Chir. Trans.* vol. i. p. 170.) It is very clear, that in this state of

parts, the operation of gastrotomy would be totally inadmissible, even if the symptoms could clearly indicate the nature of the case, and the affected part could be easily reached and examined.

However, in the *Transylvania Journal of Medicine* may be found a case, in which Dr. John R. Wilson undertook the operation with success. The patient was a young negro, who had laboured for seventeen days under bilious, colic, and stercoraceous vomiting, in defiance of every remedy. An incision, five inches in length was made in the direction of the linea alba. The portion of intestine involved in the stricture, was found to be in the ileum. The bowel was grasped above and below the obstruction, and after several efforts, the adhesion gave way. The patient soon afterwards voided the mercury which he had taken on the previous day, and rapidly recovered.

The forcible injection of glysters was found useless by Dr. Monro; and the agglutination of the parts must produce an insuperable obstacle to the bowels being pushed back by this means. Some have proposed the employment of a long bougie, or a piece of whalebone, to push back the intestine; and this proposal may be adopted, when we are furnished with an instrument adapted to follow the windings of the large intestine to its origin in the right ileum, without any risk of perforating the gut in its course. (*Langstaff.*)

It must be confessed, that both surgery and medicine are almost totally unavailing in the present disease; yet here, as in many other instances, the resources of nature are exhibited in a most wonderful and astonishing manner, while those of art completely fail. The invaginated portion of intestine sometimes sloughs, and is discharged *per anum*, while the agglutination of the parts preserves the continuity of the intestinal canal. The annals of medicine furnish numerous instances, in which long pieces of gut have been discharged in this manner, and the patient has recovered. Hence, some hope may be allowed under the most unpromising circumstances. In a case related in *Duncan's Commentaries*, eighteen inches of small intestine were voided *per anum*; vol. ix. p. 278. Three similar instances occur in M. Hevin's *Memoir*; twenty-three inches of colon came away in one of these, and twenty-eight of small intestines in another. Other cases occur in the *Physical and Literary Essays*, vol. ii. p. 361.; in *Duncan's Annals*, vol. vi. p. 298.; in the *Med. Chir. Trans.* vol. ii., where Dr. Baillie states, that a yard of intestine was voided. The patients did not, however, ultimately survive in every one of these instances. (*Langstaff in Edinb. Med. and Surg. Journal.*) A very interesting case, in which a recovery was effected on this principle, and in which from 15 to 18 inches of the ileum were discharged from the anus, was recorded by Mr. Bush (1823), in the *Med. and Phys. Journ.*

Langenbeck has recorded an instance, in which a prolapsus of the large intestines protruded half an ell out of the anus. The disease had lasted thirty weeks. Langenbeck made an incision into, or rather through, the protruded inverted bowel, immediately below the sphincter ani. He first divided the inner vascular coat, then the muscular, and lastly the outer coat with great caution. He now discovered, within the protruded inverted bowel which he had opened, another part of the intestinal canal, which was not yet inverted. He

remarked upon it the appendices epiploicæ, and the white shining peritoneal coat. This last portion would also have become inverted, had the disease continued. He next reduced the latter, uninverted part, and afterwards succeeded in replacing the rest of the protrusion; which did not fall down again when the boy had stools. No bad symptoms immediately followed; but, the lad being very weak, survived only eight days. (See *Bibl. für die Chir.* b. iii. p. 756. Gött. 1811.)

In the example recorded by Mr. Thomas Blizard, the lower part of the ileum, immediately above the intussusception, was a little inflamed; "but otherwise the effects of the derangement of parts were so strictly confined to the intussuscepted bowel, that had the child's constitution been able to sustain its separation, the inflammation necessarily accompanying this process would, no doubt, have produced an union of the ileum with the lower part of the colon; the continuity of the canal would thus have been maintained, the separated part might have passed, and the child have recovered." (*T. Blizard, in Med. Chir. Trans.* vol. i. p. 170.)

Hæm., in *Mém. de l'Acad. de Chir.* vol. iv. 4to. *Hunter*, in *Trans. for the Improvement of Medical and Chir. Knowledge*, vol. i. p. 103. et seq. *L'Encyclopédie Méthodique*, partie Chir. art. Gastroënie. *A. Vater*, *De Invaginatione Intestini*. (*Haller*, *Disp. Anat.* 1. 481.) *C. H. Felse*, *De Mutuo Intestini Ingressu*. &c. Lugd. 1742. (*Haller*, *Disp. Anat.* 7. 37.) *J. C. Lettsom*, *The History of an Extraordinary Intussusception*, with an account of the dissection by Mr. T. Whately. &c. Lond. 1780. *Baillie's Series of Engravings*, p. 1. pl. 6. *Langstaff*, in the *Edinb. Med. and Surgical Journal*, No. xi. *T. Blizard*, in *Med. Chir. Trans.* vol. i. p. 167. *Hall*, in *Med. Journ.* for 1802.

INVERSION OF THE UTERUS. (See UTERUS, INVERSION OF.)

IODINE. The following are the formulae recommended by Brera:—1. *Tincture of iodine* made by dissolving 48 grains of pure iodine in an ounce of alcohol. The dose for adults is from 5 to 20 drops, three times a day. The tincture is subject to decomposition, and should therefore be used fresh. Dr. Manson's tincture contains one drachm of iodine in 5 iiss. of rectified spirit. Of this he commonly prescribes thirty minims thrice a day. Mr. Buchanan puts 5j. of iodine to 3 iij. of rectified spirit, and prefers the external to the internal use of the medicine, as more efficacious and less likely to create nausea and other unpleasant symptoms. He has often observed, that when desquamation of the cuticle and great itching followed the external application of the tincture, the parts received more benefit than when the cuticle retained its natural appearance. (*On Diseased Joints*, p. 86.) 2. *Pills of iodine*, made by forming one grain of iodine into two pills, with elder-rob and liquorice-root; one to be taken every morning and evening. 3. *Iodine ointment*, made by mixing a drachm of pure iodine with an ounce of lard, or half a drachm of hydriodate of potash with an ounce and a half of lard; of the former, about a scruple, of the latter, a bit, about as large as a filbert, may be rubbed on the part, to which it is intended to be applied. Dr. Manson's ointment has 3ss. of the hydriodate to an ounce of lard. 4. *Solution of the ioduretted hydriodate of potash*, made by dissolving 36 grs. of the hydriodate and 10 grains of pure iodine in 10 drachms of water. The dose should not, at first, be more than five or six drops, three times a day. In administering iodine, care must be taken

not to combine it with substances calculated to decompose it. The liquid preparations are generally given by Dr. Coindet in syrup and water. When ill effects arise from its too violent operation, such as pains in the stomach, chest, bowels, defective vision, loss of sleep, palpitations, tremors, convulsions, &c., or even inconveniences of a less dangerous kind, the medicine should be immediately discontinued. A strict regimen, copious mucilaginous drinks, the tepid bath, and sometimes bleeding, are necessary. It is hardly necessary to observe, that the use of iodine requires great caution, as several cases have happened in which the patients were poisoned by it. (See *Ed. Med. Journ.* vol. xxiii. p. 225. &c.) When bronchocele, or any other tumour, is in a state of irritation from the stimulation of iodine, fomentations, poultices, and leeches, are indicated. The several formulæ of iodine, employed by M. Lugol, will be noticed under the head of *Serofula*.

Iodine has obtained considerable reputation for its efficacy in bronchocele, serofula, various chronic tumours, diseased joints, enlargements of the breast, bursa mucosa, testicle, &c.

(See Brera, *Saggio Clinico sull' Iodio*, e sulle differenti sue combinazioni; Padua, 1822; *J. R. Coindet*, on the Effects of Iodine in Bronchocele and Serofula; a translation of his three Memoirs, by Dr. J. R. Johnson, Lond. 1821. *Magnaldi's* Formulary, ed. 2. Lond. 1824. *Medical Researches on the Effects of Iodine*, by Alex. Manson, 8vo. Lond. 1825. *T. Buchanan*, Essay on a New Mode of Treatment of Diseased Joints, 8vo. Lond. 1828. *J. G. A. Lugol*, *Mém. sur l'Emploi de l'Iode dans les Maladies Scrofuleuses*, 8vo. Paris, 1829; and Professor A. T. Thomson's *Materia Medica and Therapeutics*, ed. 2. 8vo. Lond. 1835.

IRIS, PROLAPSUS OF. A small tumor, formed by the protrusion of a portion of the iris through an opening in the cornea. It is sometimes named *staphyloma of the iris*. The protrusion of the whole iris, after the destruction of the entire cornea by sloughing, is termed *staphyloma racemosum*. A small prolapsus, forming a brownish tumour, compared to a fly's head, is called *myocephalon*.

The causes of this complaint are such wounds and ulcers of the cornea, as make an opening of a certain extent into the anterior chamber of the aqueous humour, and violent contusions of the eyeball, occasioning a rupture of the cornea. If the edges of a wound in this situation, whether accidental, made for the purpose of extracting the cataract, or evacuating the matter of hypopygium, be not brought immediately afterwards into reciprocal contact, or continue not sufficiently agglutinated together to prevent the escape of the aqueous humour from the anterior chamber, regularly as this fluid is reproduced; the iris, drawn by its continual flux towards the cornea, glides between the lips of the wound, becomes elongated, and a portion of it gradually protrudes beyond the cornea, in the form of a small tumour. The same thing takes place, whenever the eyeball unfortunately receives a blow, or is too much compressed by bandages, during the existence of a recent wound of the cornea. Also if the patient should be affected, in this circumstance, with a spasm of the muscles of the eye, with violent and repeated vomiting, or with strong and frequent coughing, a prolapsus of the iris may be caused. When an ulcer of the cornea penetrates the anterior chamber, the same inconvenience happens more frequently, than when there is a recent wound of that membrane; for

the solution of continuity in the cornea, arising from an ulcer, is attended with loss of substance, and, in a membrane so tense and compact as this is, the edges of an ulcer do not admit of being brought into mutual contact.

In purulent and scrofulous ophthalmia, where a minute ulceration of the cornea often occurs, the extensive implication of the iris, and consequent strabismus, Mr. R. Welbank conceives, might be prevented by the early application of belladonna; and "perhaps (he adds) where the ulceration is remote from the circumference of the cornea, and very small, the iris may be kept wholly disengaged, till processes of reparation prevent the risk of protrusion." (*Note in Frick's Treatise on Diseases of the Eye*, ed. 2. p. 11, 6.)

The little tumour is of the same colour as the iris, viz. brown or greyish, being surrounded at its base by an opaque circle of the cornea, on which membrane there is an ulcer, or a wound of not a very recent description.

As it usually happens that the cornea is only penetrated at one part of its circumference by a wound or ulcer, only one prolapsus of the iris is commonly met with in the same eye. But if the cornea should happen to be wounded, or ulcerated, at several distinct points, the iris may protrude at several different places of the same eye, forming an equal number of small projecting tumours on the surface of the cornea. Scarpa saw a patient who had three very distinct protrusions of the iris on the same cornea, in consequence of three separate ulcers penetrating the anterior chamber, one in the upper, and two in the lower segment of the cornea.

If, says Scarpa, the delicate structure of the iris; the great quantity of blood-vessels, which enter it; and the numerous nervous filaments, which proceed to be distributed to it, as a common centre; be considered, the nature and severity of those symptoms may be readily accounted for, which are wont to attend this disease, however small the portion of the iris projecting from the cornea may be, even if no larger than a fly's head. The hard and continual frictions, to which this delicate membrane is then exposed, in consequence of the motions of the eyelids, together with the access of air, tears, and gum to it, are causes quite adequate to the production of continual irritation; and the blood which tends to the point of the greatest irritation, cannot fail to render the projecting portion of the iris much larger, almost directly after its protrusion, than it was at the moment of its first passing through the cornea. Hence, it soon becomes more incarcerated and irritated. In the incipient state of the disease, the patient complains of a pain, similar to what would arise from a pin penetrating the eye; next he begins to experience, at the same time, an oppressive sensation of tightness, or constriction, over the whole eyeball. Inflammation of the conjunctiva and eyelids, a burning effusion of tears, and an absolute inability to endure the light, successively take place. As the protruded portion of the iris drags after it all the rest of this membrane, the pupil assumes an oval shape, and deviates from the centre of the iris, towards the seat of the prolapsus. The intensity of the pain, produced by the inflammation and other symptoms, do not,

however, always continue to increase. Indeed, old protrusions of the iris are often noticed, where, after the disease has been left to itself, the pain and inflammation spontaneously subside, and the tumour becomes nearly insensible.

Scarpa's unlimited condemnation of the plan of ever attempting to replace the iris is contrary to the advice delivered by Beer, as may be seen by referring to the article *Cataract*, where the treatment of the protrusion of the iris after the operation of extraction is noticed. And even with respect to the prolapsus of the iris from ulceration making its way through the cornea, Beer distinctly states, that, a recent prolapsus of this kind, formed in the second stage of ophthalmia, may not only be lessened by proper treatment, calculated to produce a quick cicatrization of the ulcer, but the iris may be again completely removed from the cornea, without any adhesion to the edge of the ulcer taking place. (B. ii. p. 63.) But where the prolapsus of the iris remains, as a consequence of previous inflammation of the eye, Beer confesses that it cannot be cured, without a partial adhesion of the iris to the cornea being left, and a dense scar on the latter membrane in the situation of the protruded iris. (Vol. cit. p. 66.)

As Dr. Mackenzie says, it is often impossible to effect the replacement; indeed, Mr. Lawrence states, that he has never seen it accomplished. "We may, however, occasionally succeed by the following means, if they be employed within an hour or two after the accident, and especially if it is the pupillary portion of the iris which is prolapsed. We find the eye already inflamed, intolerant of light, and probably acutely painful. The cornea will in general be more or less flaccid, and, on attempting to fix the eye, a farther discharge of aqueous humour is apt to follow. The first means to be had recourse to, is gentle friction of the eye through the eyelid, continued for the space of about half a minute, and then sudden exposure of the eye to a bright light. If this does not succeed, we may endeavour with a small blunt probe to lift one edge of the wound, and push the iris into the anterior chamber; and then, whether we succeed or not with the probe, repeat the friction of the eye and the exposure to bright light. If the wound is so situated between the centre and the edge of the cornea, that it is the pupillary portion of the iris which is prolapsed, we ought to lose no time in smearing the extract of belladonna on the eyebrow and lids, and dropping a filtered solution of it upon the eyeball. In the course of from fifteen to thirty minutes, the belladonna will have probably operated on the unprolapsed portion of the iris, so as to dilate the pupil, and perhaps to drag back into its natural place the prolapsed portion. But, if the wound is close to the edge of the cornea, belladonna ought not to be employed, as it only tends, in this case, to produce a greater degree of prolapsus. After the belladonna has been applied a sufficient length of time, our attempts by friction, and with the probe, are to be renewed. If we are successful, the wound ought to be touched with a sharp pencil of lunar caustic, which serves to prevent any further discharge of the aqueous humour.

"If the prolapsus of the iris still continues unreduced, it ought to be punctured, or a snip made in it with scissors. This allows the aqueous hu-

mour which lies behind the prolapsed portion to escape, and favours the return of the iris into its natural situation; which we must now endeavour to accomplish by the means already indicated." (See Mackenzie, *On Dis. of the Eye*, p. 359. ed. 2.; Macfarlane, in *Glasgow Med. Journ.* vol. i. p. 104.; and Gibson on *Artificial Pupil*, p. 42.)

In conformity to Scarpa's principles, there are two principal indications in the treatment of recent prolapsus of the iris. The first is, to diminish, as speedily as possible, the exquisite sensibility in the protruded part of the iris; the other is gradually to destroy the projecting portion of this membrane, to such a depth, as shall be sufficient to prevent the little tumour from keeping the edges of the wound or ulcer of the cornea asunder. The adhesion, however, which connects the iris with the inside of the cornea must not be destroyed.

For fulfilling these indications, Scarpa preferred the use of nitrate of silver.

While the assistant gently raises the upper eyelid, the surgeon depresses the lower one, with the index and middle fingers of his left hand; and, with the right, he touches the little prominence formed by the iris with the argenteum nitratum, scraped to a point like a pencil. This is to be applied to the centre of the little tumour, until an eschar of sufficient depth is formed. The pain which the patient experiences at this moment is very acute; but it subsides as soon as the eye has been bathed with warm water. The caustic, in destroying the projecting portion of the iris, destroys the principal organ of sensibility, by covering it with an eschar, of sufficient depth to protect the part affected from the effect of the friction of the eyelids.

These advantages only last while the eschar remains adherent to the little tumour formed by the iris; when it falls off, as it usually does two or three days after the use of the caustic, all the pain, inflammation, &c., are rekindled, with this difference, that they are less intense and acute than they were previously, and the tumour of the iris is not so prominent as it was before the caustic was applied. When these symptoms make their appearance, the surgeon must once more have recourse to the argenteum nitratum, and employ it a third, and even a fourth time, as occasion may require, until the prominent portion of the iris is sufficiently reduced.

There is a certain period, beyond which the application of caustic becomes improper. This is the case, whenever the surgeon continues to employ the caustic, after the little tumour of the iris has been destroyed to a level with the external edges of the wound, or ulcer of the cornea, and the application begins to destroy the granulations just as they are originating. He must now discontinue the caustic, and introduce between the eye and eyelids, every two hours, the collyrium zinci sulphatis; and, every morning and evening, Janin's ophthalmic ointment, weakened with lard, is to be applied. (See *Unguentum*.)

The adhesion, which the projecting part of the iris contracts to the internal margin of the wound, or ulcer of the cornea, during the treatment, continues during the rest of the patient's life. Hence, even after the most successful treatment, the pupil remains a little inclined towards the place of the scar, and of an oval figure. The change in the situation and shape of the pupil, however, causes

little or no diminution of the patient's faculty of discerning the smallest objects; and is much less detrimental to the sight, than one, inexperienced in these matters, might conceive; provided the scar on the cornea be not too extensive, nor situated exactly in its centre. If the prolapsus be considerable, Mr. Middlemore prefers dropping into the eye a solution of from one to four grains of nitrate of silver in an ounce of distilled water, or touching the protruded part of the iris with a fine camel-hair pencil, dipped in the solution, and occasionally bathing the eye with the common alum, or zinc lotion. He also recommends applying the extract of belladonna every twenty-four hours, to the forehead and eyebrow. But, when acute inflammation prevails, he enjoins caution, with respect to stimulants, until such inflammation has been subdued. (See *R. Middlemore on Dis. of the Eye*, vol. i. p. 714.)

According to Scarpa the recision of the protrusion with scissors can only be practised with success, when the iris has contracted a firm adhesion to the internal edge of the wound, or ulcer of the cornea; and, more especially, in that ancient prolapsus of the iris, in which the projecting portion of the iris has become with time almost insensible, hard, and callous, with its base strangulated between the edges of the wound, or ulcer of the cornea, and, besides being adherent to them, has also a slender pedicle. Scarpa, indeed, has seen an incarcerated one fall off of itself.

In such circumstances the recision of the old prolapsus of the iris is not attended with the least danger: for, after removing, with a stroke of the scissors, that prominent portion of the iris, which has already contracted internal adhesions to the ulcerated margin of the cornea, so as to reduce it to a level with the external edges of the ulcer, there is no hazard of renewing the effusion of the aqueous humour, or giving an opportunity for another piece of the iris to be protruded. One or two applications of the argenteum nitratum suffice afterwards for the production of granulations on the ulcer of the cornea, and the formation of a cicatrix. But, it is not so, in the treatment of the recent prolapsus of the iris, which has no adhesions to the internal edges of the wound, or ulcer of the cornea.

In four subjects, affected with recent prolapsus of the iris, after Scarpa had removed, with a pair of convex-edged scissors, a portion of that membrane projecting beyond the cornea, of about the size of a fly's head, he found, on the ensuing day, that a new portion of the iris, not less than the first, had made its way through the ulcer of the cornea, and that the pupil was very much contracted, and drawn considerably further towards the ulcer of the cornea. The advantage of caustic in the recent sensible prolapsus of the iris, and the use of scissors only in old callous cases, agree also with the directions given by Beer and Travers. (*Lehre von den Augenkr.* b. ii. p. 68.; and *Synopsis*, p. 280.)

There is a particular species of prolapsus, much less frequent, indeed, than that of the iris; but, which does occur, and, in Scarpa's opinion, is very improperly termed by modern oculists, "*prolapsus of the tunic of the aqueous humour*." (Janin, Peltier, Guérin, Gleize, &c.) Neither do his sentiments upon this subject agree with those of Beer, who terms the case *ceratocoele*, and describes it as

arising from a yielding of the inner layers of the cornea. And in his second volume, p. 59., he has given a description of the same kind of disease from the support of the outer layers of the cornea being destroyed by ulceration. This is a point, on which the most experienced men differ so much, that it is difficult to reconcile their statements. Dr. Vetch seems to have full reliance upon the accuracy of the accounts of a protrusion of the membrane of the aqueous humour. (*On Diseases of the Eye*, p. 54, &c.) Mr. Travers inclines to Beer's view of the subject, and details reasons for doubting, that the vesicle is a distinct texture: "its appearance corresponds accurately to that of the innermost lamella of the cornea." (*Synopsis*, &c. p. 116.)

It is, says Scarpa, a transparent vesicle, filled with an aqueous fluid, and composed of a very delicate membrane, projecting from a wound or ulcer of the cornea, much in the same way as the iris does under similar circumstances. Scarpa has several times seen this transparent vesicle full of water, elongating itself beyond the cornea, shortly after the operation for the extraction of the cataract, and sometimes, also, in consequence of an ulcer of the cornea, especially after rescinding a prolapsed portion of the iris.

Scarpa believed this pretended prolapsus of the tunic of the aqueous humour to be a protrusion of a portion of the vitreous humour, which, from too much pressure, being made on the eye, either at the time of the operation, or afterwards, or from a spasm of the muscles of the eye, insinuates itself between the edges of the wound after the extraction of the cataract, and projects in the form of a transparent vesicle. The same thing also happens after ulcers of the cornea, whenever the aqueous humour has escaped, and a portion of the vitreous humour is urged by forcible pressure towards the ulcer facing the pupil; or whenever an elongated piece of the vitreous humour, after the recision of a prolapsed portion of the iris, passes by a shorter route than through the pupil, between the lips of the ulcer of the cornea. At length, we understand why, in both these instances, a transparent vesicle forms, even after the recision of the tunic of the aqueous humour, or ulceration of the cornea; and why it very often reappears in the same place, though it has been cut away to a level with the cornea. It is because one or more cells of the vitreous humour, constituting the transparent vesicle, are succeeded after their removal by other cells of the same humour, which glide between the lips of the wound or ulcer of the cornea, into the same situation.

The treatment consists in removing the transparent vesicle, projecting from the wound or ulcer, by means of a pair of curved scissors with convex edges, and bringing the edges of the wound of the cornea immediately afterwards into perfect apposition, in order that they may unite together as exactly as possible. But, when there is an ulcer, as soon as the vesicle is removed, the sore must be touched with the argemum nitratum, so that the eschar may resist any new prolapsus.

If, in some particular cases, the vesicle should not project sufficiently from the wound or ulcer, to be included in the scissors, the same object may be accomplished by puncturing the tumour with a lancet or couching needle; for, when the limpid fluid which it contains is discharged, the mem-

brane forming it shrinks within the edges of the wound or ulcer, and no longer hinders the union of the former or the cicatrization of the latter.

Scarpa saw a prolapsus of the choroid coat, two lines from the union of the cornea with the sclerotic, in the inferior hemisphere of the eye. It was preceded by a small abscess, the consequence of severe ophthalmia. The treatment consisted in applying the argemum nitratum several times to the projecting part, until it was reduced to a level with the bottom of the ulcer of the cornea. The part then healed. The eye remained, however, considerably weakened, and the pupil afterwards became nearly closed.

Scarpa, sulle Principali Malattie degli Occhi, Venezia, 1802. *Richter's* Anfangs. der Wundarzneykunst, b. iii. *Pellier*, Obs. sur l'Œil, p. 350. *C. J. Beer*, Lehre von den Augenkrankheiten, b. i. § 402. 518. and 592. and b. ii. § 53. 62 &c. 8vo. Wien, 1813—1817. *J. Wardrop*, On the Morbid Anatomy of the Human Eye, vol. ii. p. 51. 8vo. Lond. 1815. *J. Vetch*, On the Dis. of the Eye, p. 53. &c. Lond. 8vo. 1820. *B. Travers*, Synopsis of the Dis. of the Eye, p. 116. 280. &c. 8vo. Lond. 1820. *Weller*, On Dis. of the Eye, Transl. by *Dr. Montcith*, 8vo. Glasgow, 1821. *Frick*, On Dis. of the Eye, ed. 2. by *R. W. Hank*, 8vo. Lond. 1825. *W. Lawrence*, On Dis. of the Eye, 8vo. Lond. 1833. *R. Middlemore*, On Dis. of the Eye, vol. i. 8vo. Lond. 1835. *Wm. Mackenzie*, On Dis. of the Eye, ed. 2. 8vo. Lond. 1835.

For a description of the manner of dividing the iris, in order to make an artificial pupil, when the natural one is closed, refer to *Pupil, Closure of*.

IRIS; effects of certain narcotics upon the. See **BELLADONNA** and **CATARACT**. The following work upon the subject also merits attention. *C. Limy*, de la Paralysie de l'Iris par une Application locale de la Jusquiame, et de son Utilité dans le Traitement de plusieurs Maladies des Yeux, 2de éd. 12mo. Altona, 1805.

IRITIS. Inflammation of the iris. See **OPHTHALMIA**.

ISCHURIA. (from *ἰσχω*, to restrain; and *ούρον*, the urine. A suppression or stoppage of the urine. The distinction between a *suppression* and *retention* of urine, is practical and judicious. The former most properly points out a defect in the secretion of the kidneys; the latter, an inability of expelling the urine when secreted. (*Hey*.) The first, named *ischuria renalis*, is in the idiopathic form, a rare disease, and in general, soon proves fatal. As a symptomatic affection, it is less uncommon; and, as every practitioner knows, usually presents itself as an effect of Asiatic cholera. *Ischuria renalis* belongs to the province of the physician. The second, named *ischuria vesicalis*, is an exceedingly frequent disorder, and its treatment altogether surgical. (See *Catheter and Urine; Retention of*.)

ISSUE, signifies an ulcer, made designedly by the practitioner, and kept open a certain time, or even the patient's whole life, for the cure or prevention of a variety of diseases.

The physician, in his practice, has frequent occasion to recommend the making of an issue, and the surgeon finds it a principal means of relief in several important cases, as, for instance, diseases of the eyes and joints, caries of the vertebra, &c. Many persons are never in health, or at least fancy themselves always ill, unless they have an issue formed in some part of their body or another. The making of an issue, indeed, is not unfrequently considered as an imitation of nature, who, of her own accord, often forms ulcers and abscesses in various parts of the body (as is not

uncommonly conjectured) for the purpose of discharging pernicious humours, whereby people are supposed to be freed from grievous disorders, and have their health preserved. The humoral pathologists were excessively partial to these notions, which, at the present time, will be found by every experienced practitioner to influence the mass of mankind, and render the formation of issues more common, than perhaps is consistent with the better established principles of medical science. Few old subjects will allow a sore of long standing to be dried up (as the expression is), without requiring the surgeon immediately afterwards to make an issue for them. When an ulcer has existed a great length of time, the constitution may possibly become so habituated to it, that the health may really suffer from its being healed. "I have often (says Dr. Parry) seen various thoracic affections, as pulmonary consumption, asthma, carditis, or hydrothorax, arise from the spontaneous or artificial cure of ulcers, perpetual blisters, or fistulae." (*Elements of Pathology, &c.*, p. 386.) Asthmatic complaints, severe headaches, &c., are frequently observed to follow the cicatrization of an old ulcer; but, whether they would have happened, if an issue had been made in time, is a question difficult of positive determination; for many persons who have old ulcers are not prevented from suffering from asthma and headache. The plan of making an issue, however, is commendable both as rational and exempt from danger. Whatever may be the solidity of the theories which have been offered by medical writers in regard to issues, the practitioner, who has his eyes open, cannot fail to see the benefit often derived from such means; and if there be any unquestionable facts in medicine and surgery, we may confidently set down amongst them the frequent possibility of relieving one disease by exciting another of a less grievous and more curable nature.

There are two ways of making an issue; one is with a lancet or scalpel; the other with caustic.

The place for the issue being fixed upon, the surgeon and his assistant are to pinch up a fold of the integuments, and, with a lancet or knife, make in them an incision of sufficient size to hold a pea, or as many peas as may be thought proper. The pea or peas are then to be placed in the cut, and covered with a piece of adhesive plaster, a compress, and bandage. The peas first inserted, need not be removed for three or four days, when suppuration will have begun; but the issue is afterwards to be cleaned and dressed every day, and have fresh peas put into it. The preceding is the ordinary method of making such issues as are intended to contain only one or two peas.

When the issue is to be larger, which is generally proper, in cases of diseased vertebrae, white swellings, &c., the best plan is to destroy a portion of the integuments with caustic. The caustic potassa, blended with quicklime, is mostly preferred for this purpose. The situation and size of the issue having been determined, the surgeon is to take care that the caustic does not extend its action to the surrounding parts. With this view he is to take a piece of adhesive plaster, and having cut a hole in it, of the exact shape and the issue intended to be made, he is to apply it to the part. Thus the plaster will the adjacent skin from the effects of the

caustic, while the uncovered portion of integuments, corresponding to the hole in the plaster, is that which is to be destroyed. The caustic is to be taken hold of with a bit of lint or tow, and its end having been a little moistened with water, is to be steadily rubbed upon the part of the skin where the issue is to be formed. The frictions are to be continued, till the whole surface intended to be destroyed, assumes a darkish corroded appearance.

The caustic matter may now be carefully washed off with some wet tow. The plaster is to be removed, and a linseed poultice applied. As soon as the eschar is detached, or any part of it is loose enough to be cut away, without pain or bleeding, the peas are to be inserted and confined in their proper place, with a piece of adhesive plaster. Some use beans for the purpose; others beads, which answer very well, and have the advantage of serving for any length of time, when washed and cleaned every day. If the issue is of a longitudinal shape, the peas, beans, or beads, may be more easily kept in their places when a thread is passed through them.

Issues ought always to be made, if possible, in a situation where the peas will not be much disturbed by the ordinary motions of the body, nor interfere with the action of muscles. The interspaces, between the margins and insertions of muscles, are deemed the most eligible places. Thus, issues in the arm are usually made just at the inferior angle of the deltoid muscle, by the side of the external edge of the biceps. In the lower extremities, issues are often made at the inner side of the thigh, immediately above the knee, in a cavity, that may be readily felt there with the fingers. Sometimes, issues are made upon the inside of the leg, just below the knee. For the relief of certain affections of the head or eye, the nape of the neck is commonly selected as a good situation. In caries of the vertebrae they are made on each side of the spinous processes. In cases of diseased hips they are formed in a depression just behind and below the trochanter major. When the nature of the disorder does not particularly indicate the situation for the issue, the arm should be preferred to the leg, as issues upon the upper extremities, especially the left arm, are much less annoying, than upon either of the lower limbs.

The great art of keeping an issue open for a long while consists in maintaining an equal and effectual pressure upon the peas, by which means they are confined in their places; little depressions are made for them, and the granulations hindered from rising. Compressions of pasteboard and sheet-lead will often be found highly useful. This plan is the surest one of preventing the issue from healing, and the most likely to save the patient all the severe and repeated suffering, which the fresh application of the caustic, or the use of stimulating powders, in order to renew the sore and repress the fungous flesh unavoidably occasions.

Sometimes, however, the method of applying the caustic from time to time, is preferred to the use of peas, on the ground of greater efficacy. The plan of exciting fresh irritation and discharge by dipping the peas in red precipitate of mercury or a powder composed of savin and subacetate of copper, I have sometimes seen adopted, as well as that of dressing issues with savine cerate.

There is a method of making issues with the

caustic made into a sort of paste; which is laid upon the part left uncovered by the adhesive plaster. It seems to me to be a more tedious and painful plan, and I do not recommend it.

It has been suspected, that the pain arising from the caustic might be lessened, by mixing opium with the application; but the idea seems not at all probable; the destruction of a part of the skin must inevitably cause considerable pain, with whatever substance it is produced; and opium itself, so far from being likely to diminish the agony, is itself a violent stimulus, whenever it comes into contact with the exposed extremities of the nerves. If the potash act with too much violence, its action may be immediately checked, by washing the part with vinegar, as practised in the United States. (See *Amer. Ed. of this Dict. art. ISSUE.*)

JAW-BONES, AMPUTATION OF. See BONES, EXCISION OF.

The operation of removing a considerable portion of the lower jaw-bone, is stated by Dr. Reese to have been first performed by Dr. Valentine Mott. This claim I was not aware of at the time when the article *Bones, Excision of*, was delivered to the printer, nor have I at the present moment leisure to ascertain the point. "Dr. Mott is not only the *first* (says Dr. Reese) but the *only* surgeon, who has amputated the bone successfully at the articulation, except (since) Dr. Cusack of Dublin." (See *Amer. Ed. of this Dict.*) I observe that one case is mentioned by Mr. Liston, in which, after a return of disease he removed the ramus at the condyle. (See *Elem. of Surgery*, part ii. p. 229.) The case was one of difficulty, owing to part of the bone having been previously removed, so that only a very short lever was left, wherewith the action of the temporal muscle could be resisted, and the coronoid process depressed from beneath the zygoma. For additional information, see BONES, EXCISION OF.

In this country, no surgeon would now think of tying the carotid artery as a preliminary measure in operations for the removal of the lower jaw, even at the condyle. The following are Dr. Reese's observations on this part of the subject: "The propriety of tying the carotid, as a preliminary step in this operation, or its necessity at least, may be questioned. Dr. Mott has since performed the same operation, without tying the carotid, and by experience, is convinced that it would be unnecessary in cases in which he would formerly have thought it indispensable. There may be cases for which this operation is necessary, in which, from the extension of the disease, and the state of the vessels, it would be unsafe to proceed to the operation, without tying the carotid. In general, however, it may be dispensed with. I recollect some years since, in removing a tumour from the neck, I commenced by tying the carotid, and from the hemorrhage I encountered immediately afterwards, in extirpating the tumour, I was well satisfied, that no advantage whatever had been derived from the ligature of that vessel; and I have never thought it needful to repeat it, although I have often removed tumours of the jaw and neck, for which it is said to be necessary. But to tie this vessel at one time, and then wait a few days before proceeding to the operation, is the climax of surgical folly; and it is mortifying to hear this course recommended by

very high authorities. Experience will convince any operator that the circulation will be as fully restored in a few hours, as though his ligature were in his pocket. "In amputating the lower jaw, the subsequent management of each individual case has been a work requiring much skill and attention. More than one of the cases, which have resulted unfavourably, have been attributed to the effort of deglutition, which became necessary before the parts had united. Indeed, the wound made by the surgeon is so extensive, and the adaptation of parts so important to success, that many days ought to elapse, before even the saliva should be suffered to pass into the stomach. Hence the patient is directed to lie on the side, so the saliva may flow out of the mouth, instead of collecting in the throat.

"The patient on whom I operated in April 1828, was in frail health, and 60 years of age. At the time of the operation, he was so reduced by starvation, and loss of sleep, consequent upon an osteo-sarcomatous tumour of the jaw, which obstructed deglutition and impaired his respiration, that I would not have ventured upon its removal, if I had designed to deprive him of food, even for six days, as surgeons direct. I knew there would be a necessity for food and drink of cordial and nutritious character; and accordingly, half an hour after the operation, I introduced the stomach tube of elastic gum, and thus poured into the stomach half a pint of wine and water. It was passed without inconvenience, several times a day for the first week; and water, coffee, chocolate, soup, and other fluids thus introduced, until the eighth day, when he could swallow with ease; entire union having already taken place, from the quiet state in which the parts had been kept." (See *Dr. Reese, in Amer. Ed. of this Dictionary.*)

I am very glad to have had this opportunity of recording the claim of Dr. Valentine Mott to the merit of having first removed the lower jaw at the articulation. The achievements of this distinguished surgeon, to whom I had the gratification of being introduced when he lately visited University College Hospital, I shall always be proud of noticing, as if they were the performances of any British practitioner.

With this feeling, I call the attention of the profession to the interesting operation, which he undertook for the relief of an immovable state of the jaw, caused by the contraction of a cicatrix, after extensive sloughing. The plan consisted in cutting away the cicatrix, and replacing it by sound integuments from the face and neck. This Talmecian proceeding completely answered. The particulars are detailed in *Amer. Journ. of Med. Science*, Nov. 1831; also, in *Dublin Journ. of Med. Science*, vol. i. p. 107.

JOINTS, DISEASES OF. The joints are subject to numerous diseases, which are more or less dangerous, according to their particular nature. Like all other parts, the joints are liable to inflammation and abscesses; their capsules frequently become distended with an aqueous secretion, and the disease termed *hydrops articuli*, is produced; but, the most important of all their morbid affections are the cases which, a few years ago were indiscriminately called *white swelling*, *scrofulous joints*, and the *disease of the hip-joint*. Here, as Sir Benjamin Brodie remarks, the same name has been frequently ap-

plied to different diseases, and the same disease has received different appellations. And confusion, with respect to the diagnosis, always gives rise to a corresponding confusion with respect to the employment of remedies. Although, says he, diseases in their advanced stage extend to all the dissimilar parts, of which the joints are composed, such is not the case in the beginning. Here, as elsewhere, the morbid actions commence, sometimes in one, and sometimes in another texture differing in their nature, and, of course, requiring to be differently treated, according to the mechanical organisation, and vital properties of the part, in which they originate. (See *Pathological and Surgical Obs. on Dis. of the Joints*, p. 2. 8vo. Lond. 1818.) It was this idea, which led Sir B. Brodie to trace by dissection the exact parts, in which several of the principal diseases of the joints commence; and how much light and discrimination his successful investigations have produced, it is needless for me here to insist upon, as his merit will be appreciated by every surgeon, who recollects the perplexity and ignorance which prevailed only a few years ago in this very interesting branch of surgery.

Wounds.—By the wound of a joint surgeons mean a case where the capsular ligament and synovial membrane are penetrated or divided. The injury is often accompanied with a division of the lateral or other ligaments, and sometimes also with that of the cartilages and bones. That the synovial membrane has been wounded may generally be learned by the introduction of a probe, and frequently by a discharge of a transparent viscid fluid, called the synovia. But, as a similar discharge may proceed from mere wounds of the *bursæ mucosæ*, we might form an erroneous judgment, were we unacquainted with the situation of these little synovial bags. In Aug. 1829, I attended a man, whose leg was attacked with erysipelas in consequence of a superficial laceration of the skin of the knee by a fell. A small abscess formed below the patella; and afterwards a considerable quantity of fluid, resembling white of egg, and evidently secreted by the neighbouring bursa, was daily discharged with the pus. Boyer met with several cases, in which a fluid resembling synovia was discharged from the wounds of the sheaths of tendons. (*Mat. Chir.* t. iv. p. 408.) Here, the advice which I have given in another place (see *Wounds of the Abdomen*), respecting the temerity of being too officious with the probe, is equally important, inasmuch as the rough introduction of this instrument into a large joint, like the knee, would be likely to excite inflammation of the synovial membrane, and a train of dangerous and even fatal consequences; while the information gained by such practice is of little use; because, whenever a wound is suspected to reach through the synovial membrane, exactly the same treatment should be followed as if the joint were positively known to be penetrated.

Notwithstanding simple wounds, even of large joints, often heal favourably, this is not constantly the case; and the records of surgery furnish many examples, in which the most alarming and fatal consequences ensued. (See *Hunter's Commentaries*, part i. p. 69.) When properly treated, punctured wounds of the joints (says Boyer) are in general attended with danger; but as some of them, which were apparently quite simple,

have been followed by bad symptoms, and even death, we should always be extremely circumspect in the prognosis. (*Op. cit.* t. iv. p. 409.) The treatment consists in endeavouring to heal the injury by the first intention; in applying cold lotions; forbidding all motion of the part; and employing bleeding and other antiphlogistic remedies. In the hospitals of this metropolis cases of punctured wounds of the knee and other joints frequently present themselves, and, if well-treated, often have a favourable termination.

Boyer relates two cases of punctured wounds of the elbow joint, which healed up in a few days, without any unfavourable symptom. I have seen others.

Incised wounds present only one indication; viz. that of healing the part by the first intention. At the moment of the accident some of the synovia is discharged, indicating that the capsular ligament is wounded. Should this circumstance not have been noticed at first, the surgeon may see the synovia flow out again, if he move, or press upon the joint. But, in making this examination, the greatest gentleness should be used, lest the irritation of the synovial membrane be increased. When the wound is large the cavity of the joint may be exposed to view.

When the edges of an incised wound of a joint are immediately brought together, the cavity of the joint has not been long exposed, and blood is not extravasated in it, the prognosis is mostly favourable. This last source of danger is also exaggerated, as will be noticed, in speaking of collections of blood in joints. With these exceptions, the wound may heal as readily as if the joints were not opened. Boyer has cited several facts in proof of this statement. Its truth is also confirmed by the success which attends operations, practised for the purpose of extracting cartilaginous substances from the knee. Nay, very bad cases sometimes recover under judicious management, even though the joint be large, and abscesses follow. Thus I saw in St. Bartholomew's Hospital, in the year 1820, two examples of compound fractures of the patella, where the opening in the capsule was so large that the finger could readily pass into the cavity of the joint; yet, after large abscesses, a great deal of fever, and separation of bone, the patients recovered with stiff joints. But, I would advise surgeons not to let any facts of this kind prejudice their judgment in the treatment of gunshot wounds of the large joints, where, in the circumstances elsewhere explained (see *AMPUTATION AND GUNSHOT WOUNDS*), amputation is the safest practice. In a sabre, or cut wound, the principal object is to heal the wound by the first intention. The rest of the treatment consists in using every possible means for the prevention of inflammation, as perfect quietude of the part, the use of cold applications, leeches, &c.

Let it be remembered, however, that wounds of the joints do not always heal in the above favourable manner. Even amongst those cases which appear the most slight and simple, there are but too many, which are followed by such aggravated symptoms as either prove fatal or occasion a necessity for amputation. And, in other instances of a less grievous description, when the patient is cured, the termination of danger is not without an ankylosis, by which the motion and functions of the joint are permanently destroyed.

The experienced Mr. Hey has noticed wounds of the joints, and made some pertinent remarks on them. He states, that, in these cases, the utmost care should be taken to *prevent* inflammation. "Upon this circumstance, chiefly depends a successful termination. I have seen (says he) many large wounds of the great joints healed without the superintention of any dangerous symptoms, where due care has been taken to prevent inflammation; whilst injuries, apparently trifling, will often be followed by a train of distressing and dangerous consequences where such care has been neglected. It is generally easier to prevent inflammation in the joints, after a wound, than to arrest its progress when once begun. I speak now of inflammation affecting the capsular ligament. A slight degree of redness and tenderness in the integuments only is of little consequence; but, when the capsular ligament becomes inflamed, the formation of abscesses, attended with a high degree of fever, and ultimately a stiffness of the joint, are the common consequences, if the life of the patient is preserved." (See *Practical Obs. in Surgery*, p. 354. edit. 2.)

For facts, in confirmation of the foregoing account, I particularly refer to several cases recorded in this last publication, p. 355., et seq., and by Boyer (*Mat. Chir.* t. iv. p. 426., &c.)

When the large joints, particularly the knee, are wounded, the stomach is frequently very much affected. I formerly saw under the care of Mr. Best, of Newbury, a man who, in his occupation as a wheelwright, happened to give himself a wound by which one side of the knee was laid open; a good deal of constitutional disturbance and of inflammation and suppuration ensued; and what particularly struck me was the great disturbance of the stomach.

In speaking of cataginous substances in the joints, I shall have occasion to advert again to the danger attendant on wounds of these parts; and the same fact is still further considered in the articles *Amputation*, *Dislocations*, *Fractures*, and *Gunshot Wounds*, in which last part of the Dictionary, the sentiments of Baron Larrey, and other writers on military surgery, are laid before the reader.

Inflammation of Joints, or Synovitis, is sometimes the consequence of a contusion, sprain, or wound. In other instances it arises as the effect of some constitutional or specific disease. But no cause is so frequent as the application of cold; and hence, Sir Benjamin Brodie explains the frequency of synovial inflammation in the knee, and its rarity in the hip and shoulder, which are covered by a thick mass of flesh. The inflammation, arising from a wound, is infinitely the most severe after it has once commenced. (See *James on Inflammation*, p. 157.)

In these cases the constitutional symptoms are often exceedingly severe, and the pulse is more frequent, and less full and strong, than when parts, more disposed to return to a state of health, are affected. The inflammation first attacks some part of the synovial membrane, and very quickly spreads over its whole extent.

The synovial membranes are naturally not very sensible; but like many other parts similarly circumstanced, they often become acutely painful, when inflamed. The complaint is accompanied with an increased secretion of the synovia, which

becomes of a more aqueous, and of a less albuminous quality, than it is in the healthy state. Hence, it is not so well calculated for lubricating the articular surfaces, and preventing the effects of friction, as it is in the natural condition of the joint; a circumstance, which may explain, why a grating sensation is often perceived on moving the patella.

It has been explained by Sir Benjamin Brodie, that the usual consequences of inflammation of the synovial membrane, are: 1. A preternatural secretion of synovia; 2. An effusion of fibrine into the cavity of the joint; 3. A thickening of the synovial membrane, a conversion of it into a substance resembling gristle, and an effusion of fibrine, and probably of serum, into the cellular tissue, by which it is connected with the external parts. The same gentleman has seen several cases where, from the appearance of the joint, and the symptoms, there was every reason to believe, that the inflammation had produced adhesions of the reflected folds of the membrane to each other: and in dissection he has occasionally observed adhesions, which might have arisen from inflammation at some former period. "These effects of inflammation of the synovial very much resemble those of inflammation of the serous membranes. There are, however, some points of difference. In the former, I have reason to believe, that suppuration rarely takes place independently of ulceration; but, this is a frequent occurrence in the latter. Inflammation of the peritoneum or pleura, though very slight in degree, and of very short duration, terminates in the effusion of coagulable lymph; but, it is only violent, or long-continued inflammation which has this termination in the membranes of joints." (*Med. Chir. Trans.* vol. iv. p. 216.)

When coagulable lymph is effused, the whole of it does not always adhere to the inflamed surface, but some of it forms flakes which float in the fluid within the joint in masses large enough to be felt through the capsular ligament. In other instances, the lymph becomes solid, adheres to the inside of the synovial membrane, and becomes vascular. The surface of this adventitious coating is sometimes smooth; but, occasionally, it forms thick projecting masses of different degrees of thickness and length, and so numerous as to conceal every part of the original smooth surface of the synovial membrane. (See *Wilson on the Skeleton*, &c. p. 319.)

When the inflammation attains a high pitch, an abscess may occur in the cavity of the joint; the synovial membrane and capsular ligament at length ulcerate; the pus makes its way beneath the skin, and is, sooner or later, discharged through ulcerated openings.

An abscess rarely takes place in an important articulation, in consequence of acute inflammation, without the system being greatly deranged. Severe febrile symptoms always afflict the patient, and occasionally delirium and coma taking place, death itself ensues. Two rapidly fatal cases of ulceration of the synovial membrane, where matter had formed within it from a sprain of the hip and a contusion of the shoulder, are recorded by Sir Benjamin Brodie. (See *Pathol. Chir. Obs.* p. 65.)

In some of these cases, the inflammatory fever is quickly converted into hectic: indeed, when an abscess has taken place in a large joint, in consequence of acute inflammation, hectic symptoms almost immediately begin to show themselves, and

the strong actions of the common inflammatory fever subside.

Local consequences, even worse than those above described, may follow inflammation of a joint. As the layer of the synovial membrane, reflected over the cartilages of the articulation, is often inflamed, the cartilages themselves may be destroyed. Parts of a cartilaginous structure, being very incapable of bearing the irritation of disease, often ulcerate, or, in other words, are absorbed, so as to leave a portion or the whole of the articular surface of the bones, completely denuded of its natural covering. At length, the heads of the bones themselves inflame, and become carious; or the consequence may be anchylosis. Sir Benjamin Brodie has seen some cases in which there was extensive destruction of the cartilages, apparently in consequence of neglected inflammation of the synovial membrane; but he believes, that, in most cases of caries of the joints, the disease begins in the harder textures, and that the inflammation of the synovial membrane, by which it is accompanied, is a secondary affection, in consequence of the formation of an abscess in the articular cavity. (*Pathol. and Surg. Obs. &c.* p. 12.)

Sir B. Brodie likewise takes notice of the occasional termination of inflammation of the synovial membrane in suppuration, without having produced ulceration either of the soft or hard textures of the joint. The deposits of pus in joints, in consequence of the direct introduction of pus into the circulation, in many cases of phlebitis, not unfrequently happen as an effect of inflammation of the synovial membrane, independently of ulceration.

According to the same experienced surgeon, who speaks chiefly of the inflammation which begins in the synovial membrane itself, and is not communicated to it from other textures, the disease very seldom attacks young children, but is frequent in adult persons, the reverse of what happens in some other diseases of the joints.

Inflammation of the synovial membrane frequently assumes the chronic form, and then may be confounded with other more serious diseases, under the general appellation of white swelling. It oftener arises from cold than any other cause, and hence is more common in the knee and ankle than in the hip or shoulder. It may take place as a symptom of a constitutional affection, where the system is under the influence of gout or rheumatism, where it is disturbed by the operation of the syphilitic poison; or where mercury has been exhibited improperly, or in too large quantities. But in these cases, the disease only occasions a preternatural secretion of synovia without effusion of fibrine, or thickening of the part. Sometimes, it attacks several joints at once, and even extends to the *bursæ mucosæ* and sheaths of the tendons; or leaves one joint to attack another. (Sir B. Brodie, in *Pathol. and Surg. Obs.*, &c. p. 16. ed. 3.) Dr. McDowal has published several cases exemplifying the extension of inflammation from the synovial membrane to the periosteum, as I shall presently notice again.

When local, the disorder is more likely to assume a severe character, and may be of long duration, leaving the joint with its functions more or less impaired, and occasionally terminating in its total destruction. The following are the chief symptoms of the complaint, pointed out by Sir Ben-

jamin Brodie. At first, although some pain is felt over the whole joint, the patient refers it principally to one spot, and it is not at its height before the end of a week or ten days. Sometimes, even at this period, the pain is trifling, but sometimes it is considerable, and every motion of the joint distressing. In a day or two, after the commencement of the pain, the joint is affected with swelling, which at first arises entirely from a collection of fluid in its cavity; and in the superficial joints an undulation may be distinguished. However, after the inflammation has prevailed some time, the fluid is rendered less perceptible, either in consequence of the synovial membrane being thickened, or the effusion of lymph; and the more solid the swelling is, the more is the mobility of the joint impaired. The form of the diseased joint does not correspond to that of the heads of the bones; but as the swelling is chiefly caused by the distension of the synovial membrane, "its figure depends in a great measure on the situation of the ligaments and tendons, which resist it in certain directions, and allow it to take place in others. Thus, when the knee is affected, the swelling is principally observable on the anterior and lower part of the thigh," where there is only a yielding cellular structure between the extensor muscles, and the bone. It is also often considerable in the spaces, between the ligament of the patella and the lateral ligaments; because at these points, the fatty substance is propelled outward by the collection of fluid. In the elbow, the swelling occurs principally above the olecranon, under the extensor muscles of the fore-arm; and in the ankle it is between the lateral ligaments, and the tendons in front of the joint. In the hip and shoulder where the disease is less frequent, the fluid cannot be felt, but the swelling is perceptible through the muscles. In the beginning of this disease in the hip, a fulness is remarked in the groin, and sometimes also in the nates. The pain is referred, not to the knee, as in cases of ulceration of the cartilages, but to the upper and inner part of the thigh. The pain is aggravated, when the patient stands erect, and allows the limb to hang, without the foot resting on the ground. It is also increased by motion, but not by pressing the articular surfaces against each other. The pain is often very severe, yet not equal to that which occurs when ulceration of the cartilages has taken place. From some cases which have fallen under the observation of Sir Benjamin Brodie, he cannot doubt, that inflammation of the synovial membrane of the hip occasionally terminates in dislocation of that joint. Indeed, he has recorded one example of this occurrence.

The pain is usually confined to the hip; but Sir Benjamin Brodie has seen cases in which it was also referred to the knee. It may be discriminated from the case, in which the cartilages of the hip are ulcerated by observing, that the pain is more severe in the beginning than in the advanced stage of the disease. After the inflammation has subsided, the fluid is absorbed, and the joint frequently regains its natural figure and mobility; but, in the majority of cases, stiffness and swelling remain, and the patient continues very liable to relapse, the pain returning, and the swelling being augmented, whenever the patient exposes himself to cold, or exercises the limb a great deal. In cases where the synovial membrane is thickened, a slow kind of

inflammation sometimes continues in the part, notwithstanding the fluid has been absorbed, and the principal swelling has subsided, the disease at length extending to the cartilages, suppuration taking place, and the articular surfaces being completely destroyed. According to Sir Benjamin Brodie, in this advanced stage, the history of the disease, and not its present appearance, is the only thing by which one can learn, whether the primary affection was inflammation of the synovial membrane, or ulceration of the cartilages. Though such is the most common character of inflammation of the synovial membrane, it is admitted, that its nature is sometimes more acute, exhibiting the symptoms mentioned at the beginning of this section. In venereal cases, synovitis rarely affects more than one or two joints at the same time. In rheumatism several joints are frequently affected, either at the same time or in succession; and the bursæ mucosæ and sheaths of tendons often participate in the disease. There is usually a good deal of pain and swelling, and the joints are often left stiff and enlarged. When the inflammation is connected with gout, the pain is usually out of all proportion to the other symptoms of inflammation. (See *Pathol. and Surg. Obs.* p. 18—25., &c.)

When the disorder is connected with rheumatism, the medicines advised are opium with ipecacuanha, diaphoretics, or preparations of colchicum or mercury; of the two latter Sir B. Brodie prefers colchicum, where several joints, and the bursa mucosa and sheaths of tendons are implicated. In such cases he prescribes the wine of the root of colchicum in doses varying from 15 to 30 minims, three times a day, or the acetous extract in doses of two or three grains every night. On the other hand, he considers calomel joined with opium best, where only one or two joints are affected at a time, and he recommends it to be given so as to affect the gums. In synovial inflammation, connected with gout, the relief produced by colchicum is still more remarkable. In cases from syphilis, a well-regulated course of mercury may be tried; and, in others, from the protracted or injudicious use of mercury, sarsaparilla. Sir Benjamin Brodie deems the last medicine especially useful, where the affection of the joints occurs in combination with diseases of the bones, and periosteum. (See *Pathol. and Surgical Obs. on Joints*, p. 28. ed. 3.)

In peculiar chronic cases, involving many joints in succession, Sir Benjamin Brodie enjoins attention to every thing calculated to improve the general health; sufficient exercise to create a moderate degree of perspiration, the avoidance of raw fruit and acids, indigestible food and fermented liquors; keeping the bowels open by means of rhubarb, or compound decoction of aloes. He has also known benefit derived from the exhibition of small doses of acetous extract of colchicum at intervals, for ten or twelve successive nights, and still greater good from taking the carbonate of potass in doses of ten or fifteen grains twice daily. But, as specific remedies are applicable to only a limited number of cases, Sir Benjamin Brodie insists on the necessity of treating the disease for the most part as a simple local affection, and, in no instance, says he, is topical treatment to be neglected.

There are not many surgical cases, in which general, and especially topical bleeding is more strongly indicated than in acute inflammation of the synovial membrane of a large joint. The vio-

lence of the inflammation, and the strength, age, and pulse of the patient must determine, with regard to the use of the lancet; but, cupping, or the application of leeches, may be said to be invariably proper. When the leeches fall off, the bleeding is to be promoted by fomenting the part. The surgeon should daily persist in this practice, until the acute stage of the inflammation has subsided. As Sir Benjamin Brodie observes, attention should also be paid to the state of the bowels, and saline draughts and diaphoretic medicines be exhibited. (*Pathol. and Surgical Obs.* p. 32.) In severe cases, the prompt exhibition of calomel joined with opium should immediately follow bleeding and purging. In conjunction with this treatment, the lotio plumbi acetatis must be employed.

In some instances, however, the patient seems to derive more ease and benefit from the employment of fomentations and emollient poultices, which, according to Sir B. Brodie, is the case, when the swelling has been produced rapidly, and is attended with considerable tension. But, on this point, as I have remarked in speaking of *Inflammation*, the feelings of the afflicted should always be consulted; for, if the pain be materially alleviated by this or that application, its employment will hardly ever be wrong. Nothing more need be said concerning the rest of the treatment, proper during the vehemence of the inflammation, as the duty of the surgeon is not materially different from what it is in other cases where organs of importance are inflamed.

As soon as the acute stage of the affection has subsided, the grand object is to remove its effects. These are a thickened state of the synovial membrane, and parts surrounding the articulation; a stiffness of the joint, and pain, when it is moved; fluid in the capsule, &c.

When the knee-joint has been much distended, Sir B. Brodie has sometimes discharged the fluid by puncture. The following were the results:—
1. In a thin person, if a few punctures be made with an instrument, a very little broader than a couching needle, a large quantity of fluid may be abstracted by means of a cupping glass, with no inconsiderable relief to the patient. But, while inflammation exists, the benefit is not permanent, the fluid being rapidly regenerated. If, however, the inflammation has been already subdued, the absorption of the fluid usually goes on so rapidly, that any more expeditious method of removing it is unnecessary. 2. If suppuration has taken place in the joint, not in consequence of ulceration, but from the surface of the synovial membrane, a free opening into it, made with a lancet, will often be the best practice. The most prudent plan seems to Sir Benjamin Brodie to be, that of first making a puncture with a needle, and ascertaining the nature of the discharge; if it be not simply turbid serum, but actual pus, the lancet may then be employed. (*Op. cit.* p. 32.)

At first, as Sir B. Brodie has observed, the joint should be kept perfectly quiet, and blood should be several times taken from the part, by means of leeches and cupping. The latter is the method, to which he gives the preference. The use of cold evaporating lotions is also to be continued until the inflammation has further abated, when a blister may be applied, and kept open with the *sevin* cerate, or a repetition of blisters kept up. "The

blisters (he says) should be of considerable size: and if the joint be deep-seated, they may be applied as near to it as possible; but, otherwise, at a little distance. Thus, when the synovial membrane of the hip is affected, they may be placed on the groin and nates; but, when that of the wrist is inflamed they should be applied to the lower part of the fore-arm." Sir B. Brodie thinks blisters have more effect, than any other means, in removing the swelling: but, excepting in very slight cases, he condemns their use, unpreceded by the abstraction of blood. After the subsidence of the inflammation, moderate exercise of the joint, and stimulating liniments are recommended. The camphor liniment is to be strengthened with the addition of liquor ammoniæ, or tinctura lyttæ, or the following formula adopted, as that to which the above gentleman seems to give the preference. R. Olei olivæ ʒ iss. acid. sulph. ʒ ss. M. In this stage of the disease, I find the tinctura of iodine possess considerable efficacy, particularly when blended with the soap liniment in the proportion of ʒj. to ʒij. Mr. Buchanan applies the tincture of iodine to the integuments, and his accounts represent it as being rapidly absorbed from the surface of the skin, and acting very powerfully in dispersing the thickening and induration of various diseases and abscesses of the joints. Indeed, he prefers such application of iodine to its internal exhibition, and states that its effects are produced without the aid of friction, so that it admits of being employed with advantage even when inflammation is present. (*On Diseased Joints, &c., Lond. 1828.*) Sir B. Brodie speaks favourably of the effects of the antimonial ointment in the proportion of ʒj of the antim. tart. to ʒj ung. cetacei. Plasters of gum ammoniac he regards as sometimes useful in preventing relapses. Issues and setons are never serviceable, unless ulceration of the cartilages has begun. For the removal of the remains of the swelling and stiffness, Sir B. Brodie joins other writers in praising the efficacy of friction and exercise. The friction may be made with camphorated mercurial ointment, or with powdered starch; but the friction is to be employed with caution, as otherwise it may produce a return of the inflammation. When this happens, it is to be discontinued, and blood taken from the part. On the whole, Sir B. Brodie appears to consider friction better adapted to cases, where the stiffness depends upon the state of the external parts, than to others, where it arises from disease in the joint itself. With respect to the plan of allowing a column of warm water to fall on the part as suggested by Le Dran, and practised at the watering-places, he allows, that it is beneficial, but that it requires the same caution as the employment of friction. (*Philos. and Surg. Obs. p. 30., &c.*)

I have met with several instances, in which lotions, containing vinegar and muriate of ammonia, sufficed for the removal of the chronic complaints, left after the acute stage of the disorder. The tincture and ointment of iodine are also valuable applications, and they may be blended with other liniments, which will then be rendered more efficient.

The severity of the constitutional symptoms is usually, it is always, greater when the inflammation of a large joint arises from a wound, than when it is the consequence of a bruise or sprain.

Dr. M'Dowel has published some observations on an unusual, common mode of loss with perioste-

itis. He met with several cases, attacking different articulations with great rapidity, and causing death, apparently by exciting pulmonary or cerebral inflammation, the affections of the joints and periosteum remaining throughout undiminished. The disease did not shift from one joint to another; but continued in the articulation first affected, when another was subsequently engaged. Where the periosteum was implicated, the inflammation obviously extended to it from the joint. The disease too frequently terminates fatally, not seeming to be influenced by the treatment ordinarily adopted in inflammation of joints and fibrous structures. It occurred with and without injury, and may therefore be considered as either idiopathic or symptomatic. The patients were invariably young, being from ten to twenty-two years of age. In several instances they had been exposed to cold, and engaged in labour beyond their strength. In one case it followed the disappearance of the eruption of scarlatina maligna. In every instance the symptomatic fever was violent, and characterised by great depression, anxious and flushed countenance, moaning or screaming, more or less delirium, rapid pulse, short respiration and slight cough; sometimes there was bilious vomiting, tenderness and fulness of the epigastrium, and always constipation and high-coloured scanty urine. The constitutional symptoms, viewed in connexion with the local, strikingly resembled those accompanying phlebitis. After describing the *post mortem* appearances, and the inefficiency of ordinary treatment, Dr. M'Dowel recommends early and active depletion, early and free division of the periosteum, quick exhibition of mercury, and, in the suppurative stage, means calculated to support the patient. (*See Dubl. Journ. of Med. Science, vol. iii. p. 382. and vol. ii. p. 1.*) Cruveilhier and others would regard several of Dr. M'Dowel's cases as examples of phlebitis.

Loose cartilages in Joints.—Hard, roundish, or flattened bodies, mostly of a cartilaginous nature, are sometimes formed within the synovial membrane, occasioning at times more or less pain in the joint, inflammation and lameness. The disorder, though not noticed by any of the very ancient writers, is far from being uncommon. Paré is the first who speaks of it: he says, that a *hard polished, white body, of the size of an almond*, was discharged from the knee of a patient, in the year 1558, in which he had made an incision for an *aqueous apostume*, or hydroyps articuli. (*Liv. xxv. chap. 15. p. 772.*) A hundred and thirty-three years afterwards, viz. in 1691, Pechlin published the full details of another case, in which a cartilaginous body was successfully extracted from the knee. (*Obs. Physico-Med. obs. 38. p. 306.*) Dr. A. Monro, in 1726, dissected the knee-joint of a woman who had been lung, and found in the articulation a cartilaginous body of the shape and size of a small bean. These were the only examples of the disease known until the year 1736, at which period Mr. Simpson cut out of the knee a similar substance, which he supposed at the time of the operation, was only beneath the skin. (*See Edinb. Med Essays, vol. iv.*) But of late years, the disease has been noticed and described by almost every writer.

These adventitious formations grow upon the attached surface of the synovial membrane, and principally upon that part of it, which is reflected

over the bone. (See *Mayo's Outlines of Human Pathology*; p. 108.)

Such detached and moveable cartilages are not peculiar to the knee, though here they are most frequently met with, and produce symptoms, rendering them the object of surgery. Morgagni and B. Bell met with them in the ankle; Haller in the joint of the jaw; Hey in the elbow; and Laennec in the shoulder. (*Andral, Anat. Pathol.* t. i. p. 291.) They have also been met with in the articulation between the head of the fibula and the tibia and in that between the pisiform and cuneiform bones. (*Ib.*)

According to Sir Everard Home, these substances are analogous in their structure to bone; but, in their external appearance, they bear a greater resemblance to cartilage. They are not, however, always exactly of the same structure, being in some instances softer than in others. Their external surface is smooth and polished, and being lubricated by the synovia, allows them to be moved readily from one part of the joint to another. They seldom remain long at rest, while the limb is in motion; and when they happen to be in situations where they are pressed upon with force by the different parts of the joint, they occasion a sudden attack of violent pain, and materially interfere with its motions.

The circumstance of their being sometimes loose and having no visible attachment, made it difficult to offer good conjectures respecting their formation; and, according to Sir E. Home, no satisfactory account of their origin had been given, when Mr. Hunter made his observations. In the course of experiments, instituted with the view of proving a living principle in the blood, Mr. Hunter was naturally induced to attend to the phenomena which took place when that fluid was extravasated, whether in consequence of accidental violence, or other circumstances. The first change he found to be conglobulation; and the coagulatum thus formed, if in contact with living parts, did not produce an irritation similar to extraneous matter, nor was it absorbed and taken back into the constitution, but in many instances preserved its living principle, and became vascular, receiving branches from the neighbouring blood-vessels for its support; it afterwards underwent changes, rendering it similar to the parts to which it was attached, and which supplied it with nourishment. When a coagulatum adhered to a surface, which varied its position, the attachment was rendered in some instances pendulous, and in others it was entirely broken.

Thus an explanation was attempted of the mode, in which those pendulous bodies are formed, which are sometimes attached to the inside of circumscribed cavities, and the principle being established, it became easy for Mr. Hunter, to apply it under other circumstances, since it seemed to him to be one of the laws in the animal economy, that extravasated blood, when rendered an organised part of the body, might assume the nature of the parts into which it is effused; and consequently, the same coagulatum, which in another situation might form a soft tumour, would when situated on a bone, or in the neighbourhood of bone, often form a hard one. The cartilages found in the knee joint, therefore, appeared to him to originate from a deposit of coagulated blood upon the end of one of the bones; which had acquired

the nature of cartilage, and had afterwards been separated. This opinion was further confirmed by the examination of joints which had been violently strained, or otherwise injured, where the patients had died at different periods after the accident. In some of these cases, there were small projecting parts, preternaturally formed, as hard as cartilage, and so situated as to be readily knocked off by any sudden or violent motion of the joint. (*Trans. for the Improvement of Med. and Chir. Knowledge*, vol. i.) At the present day, the production of these cartilaginous bodies is more frequently ascribed to the organisation of effused lymph or fibrine from the surface of synovial membranes, than to that of coagulated blood.

Sir Benjamin Brodie met with two cases, however, in which the loose bodies were of a different nature, and had a different origin from that referred to by Sir E. Home. Sometimes disease causes a bony ridge to be formed, like a small exostosis, round the margin of the cartilaginous surfaces of the joint. In the two examples alluded to, this preternatural growth of bone had taken place, and in consequence of the motion of the parts, portions of it had been broken off, and lay loose in the cavity of the joint. (*Med. and Chir. Trans.* vol. iv. p. 276.) And in a more recent publication, he remarks, that, in the majority of cases which he has met with, no inflammation preceded the formation of these preternatural substances, and, therefore he thinks it probable, that, in some instances, they are generated, like other tumours, by some different process. He further observes, that they appear to be situated originally either on the external surface, or in the substance of the synovial membrane, since before they become detached, a thin layer of the latter may be traced over them. (*Pathological and Surgical Obs.* p. 271. ed. 3.) This statement also agrees with the views formerly promulgated by Laennec and Bécclard. (See *Andral, Anat. Pathol.* t. i. p. 286.) and with that of Cruveilhier. (See *Anat. Pathol.*) The latter gentleman indeed has given an engraving, representing some of them as situated not only in the substance of the synovial membrane, but also in the cellular tissue external to it. All those which become detached and loose in the joint are covered by synovial membrane, and for some time were adherent by means of a slender pedicle formed of it. (See *Mayo's Outlines of Human Pathology*, p. 108.) Andral does not deny that these preternatural cartilaginous bodies may frequently form originally on the outside of the synovial membrane, as stated by Laennec, Bécclard, Cruveilhier and Sir B. Brodie; but he observes, that this cannot be the only mode in which they are produced.

One or more of these preternatural bodies may be formed in the same joint. Sir E. Home mentions an instance in which there were three. They are commonly about the size of a horse-bean, often much smaller and sometimes considerably larger; when very large, they do not give so much trouble to the patient as the smaller kind. A soldier of the 56th regiment had one nearly as big as the patella, which occasioned little uneasiness, being too large to insinuate itself into the moving parts of the joint. Morgagni saw twenty-five in the left knee of an old woman, who died of apoplexy; and Haller met with no less than twenty, in the articulation of the lower jaw. When there are several in the same joint, it is observed

that their size is generally small. (*Boyer, Mai. Chir. t. iv. p. 436.*)

The diagnosis of this disease, as Boyer observes, is seldom attended with any difficulty. When the formation of the extraneous substances follows a fall, or blow, upon the joint, the complaint begins with a swelling of the surrounding soft parts, and upon the subsidence of this swelling, the presence of the little cartilaginous tumours is indicated by certain symptoms, which are peculiar to them. In persons who have had no blow, nor fall upon the knee, the disease sometimes commences with a more or less acute pain in the joint, with, or without swelling of the surrounding soft parts, and which affection is usually regarded as rheumatism. To these first symptoms, which are common both to cases of foreign bodies in the joints, and other diseases of these parts, are soon added other particular signs, by which the nature of the case is evinced.

As the extraneous bodies are in general free and moveable in the joint, they can easily be made to slip about from one part of the articulation to another; a circumstance which is facilitated by the smoothness of their surface, as well as by the synovia, which is mostly in larger quantity than natural. According to the situation, which they happen to occupy, sometimes, they produce acute pain; sometimes no pain whatever. When they lodge in a depression, where they are not compressed, they cause no pain; and if they could be always kept in this position, their presence would not be likely to excite any inconveniences. But when they get between the articular surfaces, which in certain postures of the limb come into contact with each other, the following are the effects of the compression. Sometimes, the extraneous substance suddenly glides between the condyles of the thigh-bone and head of the tibia, and while it lodges there, excites acute pain in certain directions of the limb, and instantaneous loss of the power of moving the knee. But, when it shifts its place again, either naturally, or accidentally, during an examination of the affected part, the compression is removed, the pain all at once ceases, and the functions of the joints are as suddenly restored. Most frequently, when the extraneous body gets behind the patella, or the ligament of the patella, as the patient is walking, he is compelled to make a sudden stop and would fall down from the acuteness of the pain, if nothing were at hand to save him. Some patients have been observed however, who experienced no pain in these circumstances. Reimarus mentions a man, who suffered great pain and could not move his leg, when the extraneous body was at the side of the joint; but was immediately relieved by pushing it under the patella. B. Bell met with cases, in which the pain was so violent at the instant when the patients put their legs in certain postures, that fainting was brought on, and they were so afraid of a return of the suffering, that they preferred remaining perfectly quiet to running any risk of causing the pain again. He even asserts, that he had known some persons, in whom the least motion of the limb would cause such pain as to awake them out of the deepest sleep. The pain excited by the situation of the extraneous body betwixt the articular surfaces, recurs at intervals more or less long, and always in consequence of some motion or exertion. Sometimes it ceases

directly by the effect of a movement contrary to that which produced it; but most frequently it continues, and then the surrounding soft parts are affected with swelling, which obliges the patient to keep his bed, and have recourse to emollient anodyne applications. Sometimes, as I have already noticed, the foreign body lies at a part of the joint, where it causes no inconvenience, and makes no pressure on the articular surfaces. In this case all the symptoms have been known to cease for several months, so that the patient imagined himself cured, when suddenly the foreign body was urged by some effort into another situation, where it occasioned a renewal of all the former pain.

The foregoing circumstances afford strong presumptive evidence of the presence of extraneous cartilaginous substances in the joint; but they do not amount to certainty: this can only be acquired by the touch. In handling the knee, the surgeon feels a hard, prominent substance, which slips about under his fingers, and glides under the patella or the ligament of this bone, and sometimes under the tendon of the extensor muscles of the leg, from one side of the joint to the other. The extraneous body may make its appearance either at the inside or the outside of the articulation; but it most frequently presents itself at the former part, which is the broadest and most sloping, while the capsular ligament there is loosest. Desault met with one instance, in which the capsular ligament and soft parts were so loose, that the patient could turn the extraneous substance round and round.

It is only in the knee, that the disease ever becomes so troublesome as to require an operation, or indeed any surgical treatment.

If we except making an incision into the joint, for the purpose of extracting these cartilaginous formations, we are not acquainted with any certain means of freeing a patient from the inconvenience of the complaint. To this plan, the danger attendant on all wounds of so large an articulation as the knee is a very serious objection. Middleton and Gooch endeavoured to conduct the extraneous body into a situation, where it produced no pain, and to retain it in that position a long time by bandages, under the idea, that the cartilaginous substance would adhere to the contiguous parts, and occasion no future trouble. Some will be inclined to think, that no positive concussion ought to be drawn from the cases brought forward by these gentlemen, because they had no opportunity of seeing their patients again at the end of a reasonable length of time, and we know that loose cartilages in the joints sometimes disappear for half a year, and then make their appearance again. Yet, perhaps, the very circumstance of the patients not applying again, may justify the inference, that sufficient relief had been obtained.

However, it should not be concealed, that this method was also tried in St. George's Hospital without benefit, and that in one case, the pain was increased by it. (*See Reimarus de Fungo Articularum, § 27. 54. &c.*)

Mr. Hey, aware of the dangerous symptoms, which have occasionally resulted from the most simple wounds penetrating the knee-joint, was induced to try the efficacy of a laced-knee-cap, and the cases, which he has adduced, clearly demonstrate, that the benefit thus obtained is not

temporary, at least so long as the patient continues to wear the bandage. In one case, the method had been tried for ten years, with all the success which the patient could desire. • Boyer also made one patient use a knee-cap for a year; after which it was left off, the patient appearing cured. And, in a second instance, the same practitioner tried the same plan, which put a stop to the pain, and enabled the patient to walk with ease; but, it was not known whether the method answered permanently. (*Mal. Chir. t. iv. p. 444.*)

Contemplating the evidence upon this point, and the perilous symptoms sometimes following wounds of the knee-joint, I am decidedly of opinion, that the effect of a knee-cap or of a roller and compress, applied over the loose cartilage, ought generally to be tried before recourse is had to excision. I say generally, because the conduct of the surgeon ought, in such cases, to be adapted to the condition, and inclination of the patient. If a man be deprived of his livelihood, by not being able to use his knee; if he cannot, or will not take the trouble of wearing a bandage; if he be urgently desirous of running the risk of the operation after things have been impartially explained to him; if a bandage should not be productive of sufficient relief; and, lastly, if excessive pain, severe inflammation of the joint, a great deal of symptomatic fever, and lameness, should frequently be produced by the complaint (see *Brodie's Pathol. and Surg. Obs. p. 299.*), I think it would be the duty of a surgeon to operate. Under such circumstances, I lately removed a loose cartilage of considerable size from a gentleman's knee, without the previous trial of pressure; and the result was perfectly successful. It is very certain that success has generally attended the operation; but, small as the chance is of losing the limb, and even life, in the attempt to get rid of the disease, since the inconveniences of the complaint are, in most cases, very bearable, and are even capable of palliation by means of a bandage, endangering the limb and life in any degree must seem to many persons contrary to the dictates of prudence. At all events, we must agree with Boyer, that as the laced knee-cap can do no harm, we ought always to make trial of it, and never perform the operation except when pressure does not answer, and the return of frequent and violent pain makes the employment of the knife necessary. (*Mal. Chir. t. iv. p. 445.*)

I am ready to allow with M. Brochier, that the danger attendant on wounds of the large joints has always been exaggerated in consequence of ancient prejudices. (*Desault's Journ. vol. ii.*) But making every allowance for the influence of prejudice, a man must be very sceptical indeed who does not consider the wound of so large a joint as the knee to be attended with real cause for the apprehension of danger. At the end of Ford's case (*Med. Obs. and Inquiries, vol. v.*), we read on the subject of cutting loose cartilages out of the knee:—"The society have been informed of several cases in which the operation has been performed: some, like this, have healed up without any trouble; others have been followed by violent inflammation, fever, and death itself." A case was lately published, in which the patient nearly lost his life from suppuration in the knee-joint after this operation. (See *Kirby's Cases, p. 75.*) In the same work, reference is also made to two other cases, which actually had a fatal termination

(p. 82.); and even in Mr. Kirby's own instance, the recovery was not effected without the entire loss of the motions of the knee. I remember an example, in which the patient died, after the operation in St. Bartholomew's Hospital.

As the disorder is often attended with a degree of heat and tenderness in the articulation; as the danger of the operation is, in a great measure, proportioned to the subsequent inflammation; and since much of the danger is at once removed, if the wound unite by the first intention; the advice to keep the patient in bed a few days previously to the operation, to apply cold lotions to the knee, during the same time, and to exhibit before-hand a saline purgative, is highly prudent.

I shall next introduce an account of the plan of operating as described by various surgeons.

"As these loose bodies cannot always be found, no time can be fixed for the operation; but the patient who will soon become familiar with his own complaint, must arrest them when in a favourable situation, and retain them there till the surgeon can be sent for.

"Before the operation, the limb should be extended upon a table in an horizontal position, and secured by means of assistants; the loose cartilages are to be pushed into the upper part of the joint above the patella, and then to one side; the inner side is to be preferred, as in that situation only the vastus internus muscle will be divided in the operation. Should there be several of these bodies, they must be all secured, or the operation should be postponed till some more favourable opportunity, since the leaving of one will subject the patient to the repetition of an operation, not only painful, but attended with some degree of danger.

"The loose bodies are to be secured in the situation above mentioned by an assistant; a task not easily performed while they are cut upon, from their being lubricated by the synovia; and, if allowed to escape into the general cavity, they may not readily, if at all, be brought back into the same situation.

"The operation consists in making an incision upon the loose cartilage, which it will be best to do in the direction of the thigh, as the wound will more readily be healed by the first intention. If the skin is drawn to one side, previously to making the incision, the wound through the parts underneath will not correspond with that made in the skin, which circumstance will favour their union. The incision upon the cartilage must be made with caution, as it will with difficulty be retained in its situation if much force is applied. The assistant is to endeavour to push the loose body through the opening, which must be made sufficiently large for that purpose; but as this cannot always be done, the broad end of an eyed probe may be passed under it, so as to lift it out, or a sharp-pointed instrument may be passed into it, which will fix it to its situation and bring it more within the management of the surgeon.

"The cartilages being all extracted, the cut edges of the wound are to be brought together, and, by means of a compress of lint, not only pressed close to one another, but also to the parts underneath, in which situation they are to be retained by sticking plaster, and the uniting bandage.

As union, by the first intention, is of the

utmost consequence after this operation, to prevent an inflammation of the joint, the patient should remain in bed with the leg extended, till the wound is perfectly united, or at least all chance of inflammation at an end." (*Home, in Trans. for the Improvement of Med. and Chir. Knowledge*, vol. i. p. 239. &c.)

In one instance, Desault proceeded in the following manner: the surgeon, after relaxing the capsular ligament by extending the leg, brought the extraneous body to the inner side of the articulation against the attachment of the capsular ligament, and secured it in this situation, between the index finger and thumb of the left hand, whilst an assistant drew the integuments forwards towards the patella. The parts covering this extraneous body were now divided by an incision one inch in length, and its extraction accomplished by pushing it from above downwards, and raising it inferiorly with the end of the knife. This substance, on examination, was found similar in colour to the cartilages that cover the articular surfaces: it was three quarters of an inch in length, six lines and a half in width, and three lines in thickness; its surfaces were smooth, one concave and the other convex: its circumference irregular, disseminated with red points, forming small depressions, the inside was ossified, the outside of a cartilaginous texture. As soon as the substance was extracted, the assistant let go the integuments which he had drawn forwards; they consequently returned to their natural situation, on the inner side of the knee-joint, in such a manner that the external wound in the integuments was situated more inward than the one in the capsular ligament. The edges of the wound were brought into contact, and the limb kept in a state of extension. (*Desault's Journal*, t. ii.)

According to Mr. Abernethy the inner surface of the internal condyle of the os femoris presents an extensive and nearly a plain surface, which terminates in front and at its upper part by an edge which forms a portion of a circle. If the points of the finger be firmly pressed upon this edge so as to form a kind of line of circumvallation round these (cartilaginous) bodies, they cannot pass into the joint in this direction, nor can they recede in any other, on account of the tense state of the internal lateral ligament. Here these substances are near the surface, and may be distinctly felt: and they may be exposed by simply dividing the integuments, fascia, and the capsule of the joint.

In an interesting case which Mr. Abernethy relates, the integuments of the knee were gently pressed towards the internal condyle, and the fingers of an assistant applied round the circular edge of the bone. The integuments were gently drawn towards the inner hamstring, and longitudinally divided, immediately over the loose substance, to the extent of an inch and a half. This withdrawing of the integuments from their natural situation was designed to prevent a direct correspondence of the external wound to that in the capsule of the joint: for when the integuments were suffered to regain their natural position, the wound in them was nearer to the patella than the wound in the capsule. The fascia, which covers the joint, having been exposed by the division of the integuments, it was divided in a similar direction, and nearly to the same extent. The capsule was now laid bare, and gently divided to the extent of half an inch,

where it covered one of the hard substances which suddenly slipped through the opening, and by pressing gently upon the other it was also discharged. The bodies thus removed were about three quarters of an inch in length, and half an inch in breadth. They had a highly polished surface, and were hard like cartilage. The fluid contained in the joint was pressed toward the wound, and about two ounces of synovia were discharged. The wound of the integuments was then gently drawn towards the patella, and accurately closed with sticking-plaster. (*Surgical Observations*, 1804.)

When there are several extraneous cartilaginous bodies in the joint operated upon, the surgeon ought to extract them all through the same wound, if it can be done without producing too much irritation of the synovial membrane, and they will admit of it. But, frequently, only one can be made to present itself at a time, or can be easily extracted. Each little tumour will then require a separate operation, which is a far safer plan, than disturbing the part by long and repeated attempts to extract them all at once. (*Boyer, Mal. Chir.* t. iv. p. 448.) The surgeon is often obliged to make his incision at a particular point, because at no other can the extraneous substance be fixed. A case confirming all these latter observations was published by Dr. Clarke. (*See Med. Chir. Trans.* vol. v. p. 67.) In this instance, the operation was thrice performed upon the same knee-joint with perfect success. Sir Benjamin Brodie also extracted five loose cartilages, by three different operations, without any subsequent unpleasant symptoms, although the patient appears to have been previously subject to repeated attacks of severe inflammation of the joint. (*Pathol. and Surg. Obs.* p. 299.)

On the preceding subject, some observations, and the particulars of two successful operations, were published by Baron Larrey. (*See Mémoires de Chir. Militaire*, t. ii. p. 421. &c.) With the exception of a few wrong theories, he appears to have given a fair account of the disease.

Hydrops Articulii signifies a collection of serous fluid in a joint. The knee is more subject, than other joints, to dropsical disease, which has been known, however, to affect the wrist, ankle, and shoulder joints. (*Boyer, Mal. Chir.* t. iv. p. 456.)

Mr. Russell adopts the opinion, that some of these cases are venereal, and others scrofulous. *Hydrops articulii* generally arises from contusions, rheumatism, sprains, exposure to severe cold, the presence of extraneous cartilaginous bodies in the joint, and in general from any thing which irritates the synovial membrane; and, as already explained, it is a common attendant on inflammation of that texture; the complaint also sometimes follows fevers; but, in most instances, it is purely a local affection, quite independent of general debility. (*Boyer, t. iv.* p. 467.) As Sir Benjamin Brodie has noticed, cases do occur, but not often, in which a joint is swollen from a preternatural quantity of fluid collected in its cavity, without pain, or inflammation. The disease may be compared to hydrocele, and depend either upon diminished action of the absorbents, or increased action of the secreting vessels. This is the case sometimes particularly signified by the terms *Hydrarthrus* and *Hydrops articulii*. Much more frequently, the swelling of a joint, from an accumulation of fluid in it, is attended with pain and inflammation.

Then, it may be presumed that the synovial membrane is or has been inflamed, and the secretion from it augmented. (See *Brodie's Pathol. and Surg. Obs. on Joints*, p. 7. ed. 3.)

Hydrops articuli presents itself in the form of a soft tumour; circumscribed by the attachments of the capsular ligament; without change of colour in the skin; accompanied with fluctuation; it is indolent, and but little painful; causing hardly any impediment to the motion of the joint; yielding to the pressure of the finger, but not retaining any impression, as in œdema. The swelling does not occupy equally every side of the joint, being most conspicuous where the capsular ligament is loose and superficial. In the wrist, it occurs at the anterior and posterior parts of the joint, but, especially, in the former situation, while it is scarcely perceptible at the sides. In the ankle, it is more apparent in front of the malleoli, than anywhere else; and, in the shoulder, it does not surround the joint, but is almost always confined to the forepart of it, and can only be seen in the interspace between the deltoid and great pectoral muscles.

In the knee-joint, which is the most common situation of hydrops articuli, the tumour does not occur behind the articulation; but at the front and sides. Behind, the capsular ligament is too narrow to admit of being much distended with the synovia; while, in front, and laterally, it is broad, so that it can there yield considerably in proportion as the quantity of fluid increases. The swelling is at first circumscribed by the attachments of the capsular ligament; but, in consequence of the accumulation of fluid, it afterwards exceeds these limits above, and spreads more or less upward between the thigh bone and the extensor muscles of the leg, which are lifted up by it. Boyer has seen it reach to the upper third of the thigh. The swelling is irregular in shape; it is most prominent, where the capsular ligament is wide and loose; and it is, in some measure, divided longitudinally into two lateral portions, by the patella, the ligament of the patella, and the tendon of the extensor muscles of the leg: all which parts the synovia raises, and pushes forward, though in a much less degree than the capsular ligament. Of these lateral portions, the internal is broadest and most prominent, because the part of the capsule between the patella and edge of the internal condyle being larger, than that situated between the patella and edge of the external condyle, yields in a greater degree to the distending fluid. The motions of the leg, which are generally little interrupted by this disease, make a difference in the shape and consistence of the swelling. In flexion, the tumour becomes harder, tenser, and broader, and more prominent at the sides of the knee-pan, which is somewhat depressed by its ligament. In extension, the tumour is softer, and the fluctuation plainer.

In order to feel distinctly the fluctuation, which is one of the best symptoms of the disease, the ends of two or three fingers should be placed on one side of the swelling, while the opposite side is to be struck with the end of the middle finger of the other hand.

The patella, being pushed forward, away from the articular pulley, is very moveable, and, as it were, floating. When it is pressed backward, while the leg is extended, it can be felt to move a cer-

tain way, before it meets with the resistance of the articular pulley; and, on the pressure being discontinued, it immediately separates from this part again.

By such symptoms, hydrops articuli may easily be distinguished from other diseases of the joints, from tumours of the bursa mucosa under the extensor tendons of the leg, or in front of the knee-pan; from rheumatism, œdema, &c.

The prognosis is most favourable when the swelling is recent and small, and has been quick in its progress. On the contrary, when the tumour is of long standing and large; the effused fluid thick and viscid; and the synovial membrane thickened; the removal of the fluid by absorption, and the restoration of the parts to their natural state, will be more slow and difficult. The worst case is that which is complicated with disease of the synovial membrane, cartilages, and bones.

The cure depends upon the absorption of the effused fluid. And, when the case is combined with acute or chronic inflammation of the synovial membrane, the treatment is the same as that already recommended for those particular forms of disease. When inflammation subsides, the absorption of the fluid is sometimes altogether spontaneous, and it may always be promoted by friction, by rubbing the joint with camphorated mercurial ointment, the ointment or tincture of iodine, the soap liniment, containing ʒj. of the tincture of iodine in every two oz. of it, and particularly, by the employment of blisters.

The operation of a blister may be materially assisted with a moderately tight bandage. Among other effectual means of cure, we may enumerate frictions with flannel impregnated with the fumes of vinegar, electricity, and the exhibition of mercurial purgatives. When hydrops articuli occurs during the debility consequent to typhoid and other fevers, the complaint can hardly be expected to get well, before the patient regains some degree of strength.

As, however, hydrops articuli is generally quite a local disease, Boyer contends that it should be chiefly treated with topical remedies; and he sets down diuretics, sudorifics, hydragogues, &c. as improper or inefficient. (*Op. cit.* p. 467.) He is strongly in favour of repeated blisters, both for the prevention and cure of the disease.

Circumstances do not often justify the making of an opening into the joint; but excessive distension, in some neglected cases, might certainly be an urgent reason for such an operation. Also, if the complaint should resist all other plans of treatment, and the irritation of the tumour greatly impair a weak constitution, the practice would be justifiable. An interesting example of this kind is related by Mr. Latta. (*System of Surgery*, vol. ii. p. 490.)

The operation is not always successful, being sometimes followed by alarming symptoms, which either end fatally, or occasion a necessity for amputation. The fluid also generally collects again; and as the synovial membrane is mostly thickened, it often inflames, and suppuration in the joint ensues. Hence, when hydrops articuli originates from rheumatism; when it is recent, indolent, and not large; and when it does not seriously impair the functions of the joint; Boyer recommends the operation not to be done. But he sanctions its performance, when the disease is combined with

extraneous cartilaginous bodies in the joint; or when it is very considerable, and attended with severe pain, and impairment of the functions of the joint. (*Op. cit. t. iv. p. 473.*)

The safest plan of discharging the fluid would be by means of punctures made with an instrument not much broader than a couching needle, and then applying a cupping-glass, as suggested by Sir Benjamin Brodie.

Collections of Blood in Joints.—Most systematic writers speak of this case, though it must be uncommon. Tumours about the joints, composed of blood, and set down in numerous surgical works as extravasations within the capsular ligaments, are generally on the outside of them.

Were blood known to be undoubtedly effused in a large articulation, however, no man would be justified in making an opening for its discharge. No bad symptoms are likely to result from its mere presence, and the absorbents will, in the end, take it away. If an incision were made into the joint, the coagulated state of the extravasated blood would not allow such blood to be easily discharged.

The best plan is to apply discutient remedies; as the lotion of vinegar, spirits of wine, and muriate of ammonia, for a week or two; and, afterwards, friction with camphorated liniments may be safely adopted.

Mr. Hey relates a case, in which the knee-joint was wounded, and blood insinuated itself into the capsular ligament; yet, though the occurrence could not be hindered, no harm resulted from the extravasation, which was absorbed, without having created the smallest inconvenience. (*Practical Obs. in Surgery, p. 354.*)

White-Swelling.—The white-swelling, or spina ventosa, as it was at one time not unfrequently called, in imitation of the Arabian writers, Rhazes and Avicenna, has been a name indiscriminately applied to many diseases, which differ widely in their nature, curability, and treatment. Wiseman was the first who used the term white-swelling; and if the expression did not confound together complaints of very different kinds, not much fault could be found with it, because it unquestionably conveys an idea of one mark of some of these distempers, which is, that notwithstanding the increase of size in the joint, the skin is generally not inflamed, but retains its natural colour. (*Pott.*)

The name, therefore, appears objectionable, only inasmuch as it has tended to prevent the introduction of a sufficient number of well-founded and necessary distinctions. Formerly, systematic writers were generally content with the division into two kinds, viz. *rheumatic*, and *scrofulous*.

The last species of the disease they also distinguished into such tumours as primarily affect the bones, and then the ligaments and soft parts; and into other cases in which the cartilages, ligaments, and soft parts, became diseased, before there was any morbid affection of the bones.

Sir Benjamin Brodie endeavoured to form a more correct classification of the different complaints to which the term white-swelling is applied; and his descriptions are valuable, because founded upon extensive observation, and numerous dissections. With respect to the disease beginning in the ligaments, if the capsular ligaments be put out of consideration, it is, as this gentleman observes, a rare occurrence, and he has never met with a

case, in which the fact was proved by dissection. (*Pathol. and Surgical Obs. p. 7.*)

1. The first case is inflammation of the synovial membrane, as described in the foregoing pages, especially that form of the disease, which often arises from cold, and constitutes the disease, formerly termed a rheumatic white-swelling.

2. Another form of disease, ordinarily comprised under the general name of white-swelling, has been particularly described by Sir B. Brodie. The disease originates in the synovial membrane, which loses its natural organisation, and becomes converted into a thick, pulpy substance, of a light brown, and sometimes of a reddish brown colour, intersected by white membranous lines, and from $\frac{1}{4}$ to $\frac{1}{2}$ of an inch, or even more than an inch, in thickness. As this disease advances, it involves all the parts, of which the joint is composed, producing ulceration of the cartilages, caries of the bones, wasting of the ligaments, and abscesses in different places. The complaint has invariably proved slow in its progress, and sometimes has remained nearly in an indolent state for many months, or even for one or two years; but (says Sir Benjamin Brodie) "I have never met with an instance in which a real amendment was produced; much less have I known any in which a cure was effected." (*See Medico-Chir. Trans. vol. iv. p. 220. &c.*) The whole, or nearly the whole, of the synovial membrane has always been found affected; though if a very early examination were made, Sir B. Brodie conceives that this might not be the case; and, in one example, he found only a half of the membrane thus altered, while the rest was of its natural structure. (*Pathol. and Surg. Obs. p. 94.*) This gentleman further acquaints us, that the preceding affection of the synovial membrane is rarely met with except in the knee; that he has never known an instance of it in the hip, or shoulder; that it is peculiar to the synovial membrane of the joints; that he has never known an instance of it in other serous membranes, nor even in the synovial membranes, which constitute the bursæ mucosæ and sheaths of tendons; and that it generally takes place in young persons, under, or not much above, the age of puberty. In fact, Sir B. Brodie has not met with more than one instance, in which it occurred after the middle period of life. Mr. Hodgson, of Birmingham, met with one example of it in the ankle; and another in one of the joints of the fingers. "In the origin of this disease, there is a slight degree of stiffness and tumefaction, without pain, and producing only the most trifling inconvenience. These symptoms gradually increase; at last, the joint scarcely admits of the smallest motion, the stiffness being greater, than where it is the consequence of simple inflammation. The form of the swelling bears some resemblance to that in cases of inflammation of the synovial membrane, but it is less regular. The swelling is soft and elastic, and gives to the hand a sensation as if it contained fluid. If only one hand be employed in making the examination, the deception may be complete, and the most experienced surgeon may be led to suppose, there is a fluid in the joint when there is none; but, if both hands be employed, one on each side, the absence of fluid is distinguished by the want of fluctuation.

The patient experiences little or no pain, until abscesses begin to form, and the cartilages ulcerate,

and even then the pain is not so severe, as where the ulceration of the cartilages occurs, as a primary disease, and the abscesses heal more readily, and discharge a smaller quantity of pus, than in cases of this last description. At this period, the patient becomes affected with hectic fever, loses his flesh, and gradually sinks, unless the limb be removed by an operation." (*Med. Chir. Trans.* vol. v. p. 251, 252.) In the majority of cases Sir Benjamin Brodie believes, that the gradual progress of the enlargement, the stiffness of the joint without pain, and the soft elastic swelling without fluctuation will enable the practitioner readily to distinguish this from all other diseases of the joints. However, when the diseased synovial membrane happens to be distended with a quantity of turbid serum and flakes of coagulable lymph, the complaint somewhat resembles in its feel and appearance that stage of common inflammation of the synovial membrane, where this part is left thickened, and more or less distended with coagulable lymph; but the impossibility of relieving the former case by the same means, which cure the latter, and due attention to the history of the disease, will prove the difference between them. (*Pathol. and Surg. Obs.* p. 87. ed. 3.)

By means of rest and cold lotions, Sir Benjamin Brodie admits, that the progress of this disease may be checked, and that fomentation and poultices afford benefit after the cartilages have begun to ulcerate, but he has never known the disease cured.

3. *Ulceration of the articular cartilages* takes place in the advanced stage of several diseases of the joints, and it is also believed by Sir Benjamin Brodie to exist in many instances as a primary affection, in the early stage of which the bones, synovial membrane, and ligaments are in a natural state. If neglected, it may ultimately occasion the entire destruction of the articulation.

According to the researches of this excellent pathologist, ulceration of the articular cartilages may arise from various causes, the principal of which are the following:—1. It may be the consequence of disease originating in the neighbouring soft parts, especially inflammation of the synovial membrane. 2. It may depend on a morbid condition of the cartilage itself. 3. On a chronic inflammation of the surface or substance of the bone with which it is connected. 4. On a peculiar alteration in the cancellous structure of bones, met with in young scrofulous persons. (See *Pathol. and Surg. Obs. on Joints*, p. 96. ed. 3.)

The investigations of the same experienced surgeon dispose him to believe, that a conversion of these cartilages into a soft fibrous structure, is a frequent, though not constant, forerunner of ulceration. (P. 97.) The degeneration of the cartilage of a joint into a fibrous structure, however, seems to Mr. Key, to differ in many respects from the ordinary affections of the joints, that end in the destruction of the cartilage. When ulceration of the cartilage occurs in the superficial joints, it constitutes one of the diseases which have been known by the name of white-swelling. From cases which Sir Benjamin Brodie has met with, he is led to conclude, that when it takes place in the hip, it is this disease, which has been variously designated by writers, the "*morbus coxarius*," the "disease of the hip," the "*scrofulous hip*," the "*scrofulous caries of the hip joint*." At least it appears to him

that it is to this disease these names have been principally applied, though probably other morbid affections have been occasionally confounded with it. (*Med. Chir. Trans.* vol. iv. p. 236.) Ulceration of the articular cartilages takes place, as a primary disease, chiefly in children, or adults under the middle age. "Of sixty-eight persons affected with this disease, fifty-six were under thirty years of age; the youngest was an infant of about twelve months; the oldest was a woman of sixty. As the knee is more frequently affected by inflammation of the synovial membrane, so is the hip more liable than other joints, to the ulceration of the cartilaginous surfaces. In general the disease is confined to a single joint; but it is not very unusual to find two or three joints affected in the same individual, either at the same time or in succession. Sometimes the patient traces the beginning of his symptoms to a local injury, or to his having been exposed to cold; but, for the most part, no cause can be assigned for the complaint." (Brodie, in *Med. Chir. Trans.* vol. vi. p. 319.)

The symptoms of the disease of the hip-joint will be described in the ensuing section, and here I shall confine my remarks to the symptoms characterising ulceration of the cartilages of the knee as pointed out by Sir Benjamin Brodie. They differ from those of inflammation of the synovial membrane by the pain being slight in the beginning, and gradually becoming very intense, which is the reverse of what happens in the latter affection. The pain in the commencement is also unattended with any evident swelling, which never comes on in less than four or five weeks, and often not till after several months. It is not to be inferred, however, that every slight pain of the joint, unaccompanied with swelling, must of course arise from ulceration of the cartilages. But, when the pain continues to increase, and at last is very severe; when it is aggravated by the motion of the bones on each other, and when, after a time, a slight tumefaction of the joint takes place, we may conclude that the disease consists in such ulceration. The swelling arises from a slight inflammation of the cellular membrane on the outside of the joint; it has the form of the articulating ends of the bones; and for the most part it appears greater than it really is, in consequence of the muscles being wasted. No fluctuation is perceptible, as where the synovial membrane is inflamed; nor is there the peculiar elasticity, which exists, where the synovial membrane has undergone a morbid alteration of its structure.

Sir Benjamin Brodie has explained, however that, in some cases, the swelling has a different shape, and communicates the feel of a fluctuation. This happens, when inflammation of the synovial membrane, attended with a collection of the synovia of the joint, or abscesses in the surrounding soft parts, or in the articulation itself, occur as secondary diseases. When there has been considerable destruction of the soft parts from abscesses and ulceration, the head of the tibia may become dislocated and drawn towards the ham. (See *Med. Chir. Trans.* vol. vi. p. 326. &c.) In the 9th vol. of the same work, Mr. Mayo has described an acute form of ulceration of the cartilages, as displayed in three cases affecting the knee, elbow, and ankle. They were all attended with severe pain in the beginning: two ended in ankylosis after antiphlogistic treatment for two months; and

the third patient, a boy, died, during the existence of this disease, of an injury of the head. The bones of the ankle joint were found almost stripped of cartilage; what remained of this texture was thinned, and that unequally; but it seemed in other respects unchanged, and adhered firmly to the bone.

Sir Benjamin Brodie adverts to the doctrine maintained by some anatomists, that the articular cartilages are not endowed with vascularity; and that, when there is an appearance of their having been destroyed by ulceration, this must really have been effected, not by the action of vessels in the cartilages themselves, but by that of the vessels of the other parts with which they are connected, or with which they come in contact. Sir Benjamin adopts a different view:—"Up to the period of growth being concluded, we must suppose the articular cartilages to be vascular, for otherwise we cannot account for the changes of bulk and figure, which mark their progress towards complete development. In the child, canals or sinuses may be seen ramifying through their substance, containing blood, and manifestly intended to answer the purposes, though not constructed with the distinct tunics of ordinary blood-vessels. In the adult person, these canals for the distribution of the blood are not perceptible. This proves, that they are very minute, but not that they are altogether wanting. In the transparent cornea of the eye no vascular structure can be detected under ordinary circumstances; but the existence of vessels in the cornea is proved by the changes which it undergoes in disease; and, when it is inflamed, such vessels become distinctly visible and injected with red blood. So we meet with occasional, though rare, instances of vessels containing red blood, extending from a diseased bone into the cartilage covering it." (*Op. cit.* p. 91. ed. 3.) Amongst other facts, adverted to by Sir Benjamin Brodie in proof of the vascularity of cartilage, is the occasional conversion of it into ligamentous fibres, each of which is connected by one extremity to the bone, which is loose towards the cavity of the joint.

According to M. Andral, vessels are found in cartilage only when it ossifies, though he appears to infer, from the fully developed vessels seen in the cartilages of certain fishes, that ossification is not essential to the vascularity of this texture. (See *Anat. Pathol.* t. i. p. 292.)

Professor Cruveilhier pronounces, what he terms *l'usure des cartilages*, to be one of the worst and most constant effects of acute or chronic inflammation of the synovial membranes. He states, that it often continues after the cessation of its cause, and is a frequent source of pains referred to rheumatism. The loss of cartilage is described as bearing a relation of the friction and pressure which it sustains. Thus, in the knee, he remarks, it is always upon the inner condyle of the femur, and in the corresponding articular cavity of the femur, that the injury is observable in the greatest degree, because it is to the inner part of the joint that the weight of the trunk is principally transmitted. In all cases of loss (*usure*) of cartilages, Cruveilhier has found unequivocal signs of synovial inflammation, characterised in the case from which one of his drawings is taken, by the great development and redness of the synovial fringes. (See *T. 8, pl. 6, fig. 2. Livr. 9. Anat. Pathol.*)

Mr. Aston Key represents ulceration of cartilage as sometimes the result of acute or chronic inflammation of the synovial membrane; as occasionally a primary affection, independent of the other textures of the joint; or, as the result of disease commencing in the subjacent bone, and extending to the under surface of the cartilage. He is led to believe from the examination of many diseased joints, and the history of the cases, that inflammation of the synovial membrane is the most frequent cause of ulceration of the cartilage. After noticing the symptoms of the acute, chronic, and subacute forms of synovial inflammation, as a cause of ulceration of cartilage, he describes the different degrees of the latter as observed on opening the joint. His statement agrees with that of Cruveilhier, in representing the inner part of the knee-joint, as usually exhibiting the most extensive ulceration, "on account of the oblique bearing of the femur, and its consequently unequal pressure on the inner part of the head of the tibia. We therefore find the inner semilunar cartilage more often destroyed than the outer, and a corresponding destruction of the cartilage covering the inner condyle of the femur and inner part of the head of the tibia." Of the patella, the first part that ulcerates is commonly the margin of the cartilage, where the synovial membrane is reflected from it. "At this point, sulci, of different depths, are formed, which cannot be always distinguished, until the thickened edge of the synovial membrane is raised. The ulcerated surface sometimes exhibits parallel vascular lines verging towards the centre, and having their origin from the synovial membrane. The synovial membrane at this part, if the vessels are well filled with fine injection, appears highly vascular, and fringed, or villous, like a mucous membrane. This increased vascularity is particularly noticeable at the edge of the membrane, and in these portions of the fringed margin that correspond to the ulcerated surface of the cartilage; the other parts of the synovial membrane have their vascularity but slightly increased. This highly vascular fringe of membrane is a newly organised substance, and will be found in some parts to be a superadded structure, for the purpose of producing ulceration of the contiguous cartilage."

It appears, therefore, to Mr. Key, that the process by which the ulceration of cartilage is in this case effected, is through the medium of the newly organised synovial membrane, the cartilage itself being indisposed to ulceration by the low degree of its organisation. It is acted upon by the newly organised surface of the membrane, which is rendered highly vascular, and by means of its villous processes forms a groove in the edge of the cartilage, thus commencing the work of destruction. The cartilage at the edge is sometimes entirely destroyed, so as to lay bare the bone, in which case vascular granulations also arise from the surface of the exposed bone, and assist the membrane in the work of absorption. This, however, is more usually observed in the most acute form of inflammation. In the more chronic form, the vascular fringe of synovial membrane contracts adhesion to the surface of the cartilage, in which ulceration is going on, and gives rise to the formation of a new membrane, which gradually spreads over the surface of the cartilage.

The second mode referred to by Mr. Key, in

which nature seems to him to effect the ulceration of cartilage without the agency of its own vessels, may be seen in the rapid progress of disorganisation that follows a wound of the synovial membrane. Here the latter undergoes a change, which enables it to perform its new function. The surface becomes highly vascular, and in most parts covered with a new deposit of adhesive matter, which adheres firmly to the synovial membrane. The new surface is irregular, wanting the polish of the original membrane, and appears in many parts villous, or furnished with vascular fringed projections. In a joint (says Mr. Key), thus far advanced in disease, the only mode of arresting the disease, or of repairing the mischief occasioned by inflammation, consists in the production of ankylosis. To this end the removal of the cartilage is an essential step; and it would appear that the office of recovering it devolves on the inflamed synovial membrane."

Mr. Key further observes, that the want of all action in the cartilage, and a total want of vascularity in those parts where ulceration appears to be most active, were the circumstances that first led him to look for some agent in the work of ulceration. "The ulceration evidently begins on the surface of the cartilage, and not on that side next to the bone. It presents merely an eroded surface: there is no disorganisation of its texture in the parts, where absorption is about to take place; there is no previous degeneration of the cartilage into its primary fibrous structures as may be seen in other forms of ulceration: but the cartilage seems to have lost part of its surface, as if it had been dug out; the remaining part appearing healthy, and presenting no trace of increased vascularity. The grooves are found only in those parts of the cartilage that happen to be opposed to the fringed and vascular synovial membrane; and these highly organised portions of the membrane may be seen to be closely adapted, and even to fit into the grooves in the cartilage. Those parts of the cartilage, that happen to be in contact with another cartilaginous surface, present no signs nor trace of ulceration."

Mr. Key, admits, however, that it is not in every instance of suppuration in a joint that ulceration of the cartilage opposite the vascular fringed projections is to be looked for as a uniform occurrence. Strumous joints are sometimes examined, in which the synovial capsule has been for months distended with purulent secretion and the synovial membrane covered with flocculi hanging into the joint, without a trace of ulceration in the opposite cartilaginous surface. The condition, essential to the act of absorption, seems to Mr. Key to be here wanting. There is not a wound or opening by which the pus can escape as fast as it is secreted. It consequently collects in the cavity of the joint, and by distension prevents the membrane coming in contact with the cartilage; and the villous projections, even when the vessels are well filled with fine injection, do not exhibit that degree of vascularity, which is so clearly developed when ulceration of the cartilage takes place.

After briefly adverting to the removal of the cartilage from the heads of the bones in old persons, and the frequent substitution of an ivory deposit for it, Mr. Key notices that form of ulceration of cartilage which commences on the surface of it attached to the bone. According to

his researches, there are two varieties in which this secondary absorption of cartilage takes place: one chronic, the other acute; but, he remarks, that in the process of ulceration, the same passive condition of the cartilage may be observed as in that which commences within the cavity of the joint. When the cartilage begins to give way, vessels, he says, may be seen shooting towards it, and they accumulate in sufficient number to form a vascular tissue, covering the attached surface of the cartilage. He has never examined a joint in which disease appeared to have begun in the cancelli, and in which ulceration commenced on the surface of the cartilage within the joint. The ulceration having at length opened, or nearly so, that surface, the synovial membrane becomes inflamed, and the ulceration is then forwarded by a similar process commencing at the edge of the cartilage, by means of the synovial membrane, and a newly developed vascular structure. (See *C. Aston Key*, in *Med. Chir. Trans.* vol. xviii. art. 9.)

In the nineteenth vol. of the same work, Mr. Key endeavours to point out the difference between the foregoing process, by which the absorption of cartilage is accomplished in certain forms of disease, and ulceration of the same texture. The latter is described as commencing in the cartilage itself, which becomes broken up and converted into a purulent mass, that mixes with the synovia, and irritates the synovial membrane, so as to excite inflammation, and ultimately suppuration and ulceration. It appears to Mr. Key, that ulceration of cartilage is a much less frequent occurrence, than absorption through the intervention of the membrane. He does not remember to have examined a joint that had been the subject of ordinary chronic inflammation, in which this membrane was not found more or less developed. Nor has he seen an instance of chronic inflammation in the early stage of strumous disease, in which degeneration or ulceration of the cartilage existed as the primary action. Nature seems to him to endeavour, as long as she can, to remove the cartilage by absorption, in order to prevent the necessity of suppuration; for primary ulceration of cartilage leads to the formation of abscess. The breaking up of the tissue of the cartilage, is equivalent to the suppurative process in softer tissues. It creates a product that must be got rid of. The synovial membrane is irritated, and ulceration, with abscess, is the result. In absorption of the cartilage, through the intervention of the membrane, suppuration is not a necessary attendant, and we sometimes find the whole process completed without abscess. But, when the membrane is wanting, suppuration follows sooner or later.

It further appears to Mr. Key, that the diseases in which the texture of cartilage primarily undergoes ulceration, are, for the most part, acute from their commencement. Thus, the inflammation that follows wounds of joints often leads to rapid ulceration of the cartilage, and burrowing abscess. The cartilage is often found to be extensively destroyed, and the bone laid bare, without any appearance of a membrane for the purpose of absorption. The remaining cartilage sometimes exhibits different stages of approaching disorganisation: in some parts retaining its natural form, consistence and appearance; in others being soft and spongy, or even pulpy; and

in those parts, most advanced towards ulceration, the fibres of the cartilage can be seen to separate, and here and there flakes appear to be almost detached. Not unfrequently chronic inflammation of the synovial membrane, attended with absorption of the cartilage, becomes acute, and leads to ulceration and quick disorganisation of the joint. Here both ulceration and absorption are seen to operate.

In chronic affection of the semilunar cartilages, the softening of the fibro-cartilaginous texture, and its gradual conversion into a puriform mass, may be observed in every stage.

Another form of inflammation, attended with primary ulceration of cartilage, occurs in cachectic subjects, and assumes the character of acute rheumatism. It often follows subacute abscesses in different parts, and attacks more than one joint. (*C. Aston Key*, in *Med. Chir. Trans.* vol. xix. p. 134. *et seq.*)

Notwithstanding the results of Mr. Key's investigations, Sir Benjamin Brodie still finds abundant evidence, that the explanation of the former gentleman will not admit of a general application; and "that the absorption of the cartilage, commencing on the surface towards the cavity of a joint may take place under such circumstances, that it cannot be supposed to be the result of any other agency, than that of the vessels of the cartilage itself." For the facts in confirmation of this statement, I must refer to Sir Benjamin Brodie's publications. (*See Pathol. and Surgical Obs. on the Joints*, p. 332. ed. 3., and a paper by Mr. Mayo. *See Med. Chir. Trans.* vol. xi.)

While Mr. Mayo agrees with Mr. Key respecting the general inflammatory character of this affection, he does not concur with him in doubting the self-absorbing powers of cartilage. "Many cases are mentioned, says Mr. Mayo, in this volume (*Outlines of Human Pathology*), particularly that of a boy, who died of hernia cerebri, the details of which positively establish, that cartilage may disappear by spontaneous, or self-absorption, like other more evidently vascular tissues." (P. 94.)

4. I shall pass over ulceration of the synovial membrane, which Sir Benjamin Brodie considers in a separate section, and now proceed to the scrofulous white-swelling. In the scrofulous disease of the joints, the bones are primarily affected, in consequence of which ulceration takes place in the cartilages covering their articular extremities. The cartilages being ulcerated, the subsequent progress of the disease appears to be, the same as where this ulceration takes place in the first instance. (*Med. Chir. Trans.* vol. iv. p. 266.)

By Mr. Lloyd, scrofulous white-swellings are divided into three stages; the first being that in which the affection is confined to the bone; the second, that in which the external parts become thickened and swelled; and the third being what he names the suppurative stage, attended with ulceration of the cartilages, inflammation of the synovial membrane, and abscesses. (*On Scrofula*, p. 121.) It was formerly a common notion, that, in white-swellings, the heads of the bones were always enlarged. Mr. Russell, I believe, is the first writer who expressed an opposite sentiment, and he distinctly declares, that he has never heard, nor known, of an instance in which the tibia was enlarged

from an attack of white-swelling. (P. 37.) The inaccuracy of the opinion was afterwards pointed out by Mr. Lawrence to the late Mr. Crowther, and the subject was mentioned in the earliest edition of the "First Lines of the Practice of Surgery."

Deceived by the feel of many diseased joints and influenced by general opinion, I once supposed, that there was generally a regular expansion of the heads of scrofulous bones. But, excepting an occasional enlargement, which arises from spiculae of bony matter, deposited on the outside of the tibia, ulna, &c., and which alteration cannot be called an expansion of those bones for a long time, I never met with the head of a bone enlarged, in consequence of the disease known by the name of white swelling. I was formerly much in the habit of inspecting the state of the numerous diseased joints, which were every year amputated at St. Bartholomew's Hospital; and though I was long attentive to this point, my searches after a really enlarged scrofulous bone always proved in vain. Nor was there at that period any specimen of an expanded head of a scrofulous bone in Mr. Abernethy's museum. Some years ago, however, a specimen of an enlargement of the upper head of the ulna was found and shown to me by Mr. Stanley. Mr. Langstaff also had in his possession a knee-joint, in which the femur and tibia are much expanded, "the external laminae of the bones not being thicker than when the bones are of their natural size, and the cancelli healthy, though of rather greater solidity than natural." (*Lloyd on Scrofula*, p. 148.) However, this last form of disease evidently does not resemble the common scrofulous affection of the heads of the bones. I may add, that Mr. Wilson, whose dissections were very numerous, concurs with the best modern writers, concerning the rarity of an actual expansion of the substance of the heads of the bones. (*On the Skeleton*, &c. p. 336.) I have also heard of a few other instances in which the heads of the bones were actually enlarged in cases of white-swelling. However, I believe the occurrence is far from being usual, and doubts may yet be entertained, whether such enlargement is combined with the following alteration of structure. The change, which the head of the tibia undergoes in many cases, is first a partial absorption of the phosphate of lime throughout its texture, while at first a transparent fluid, and afterwards a yellow cheesy substance, are deposited in the cancelli. In a more advanced stage, and, indeed, in that stage, which most frequently takes place before a joint is amputated, the head of the bone has deep excavations in consequence of caries, and its structure is now so softened, that when an instrument is pushed against the carious part, it easily penetrates deeply into the bone. Occasionally, as Mr. Lloyd has observed, all the bones of a joint are affected in this way; but, frequently only one of them. (*On Scrofula*, p. 120.)

According to Sir Benjamin Brodie, "The morbid affection appears to have its origin in the bones, which become preternaturally vascular, and contain a less than usual quantity of earthy matter; while, at first, a transparent fluid, and afterwards a yellow cheesy substance, is deposited in their cancelli. From the diseased bone, vessels, carrying red blood, shoot into the cartilage,

which afterwards ulcerates in spots, the ulceration beginning on that surface which is connected to the bone. The ulceration of the cartilage often proceeds very slowly. I have known a knee amputated on account of this disease, in which the cartilage was absorbed for not more than the extent of a sixpence. Occasionally, a portion of the carious bone dies and exfoliates. As the caries of the bones advances, inflammation takes place of the cellular membrane external to the joint. Serum, and afterwards coagulated lymph, are effused, and hence arises a puffy and elastic swelling in the early, and an oedematous swelling in the advanced stage of the disease. Abscess having formed in the joint, makes its way by ulceration through the ligaments and synovial membrane, and afterwards bursts externally, having caused the formation of numerous and circuitous sinuses in the neighbouring soft parts." In one of the cases related by Sir B. Brodie, these layers of cartilage were found lying on the ulcerated surface of the bone, apparently unconnected to it. In some instances, in the advanced stage, we find nearly the whole of the cartilage forming an exfoliation, instead of being ulcerated. (*Med. Chir. Trans.* vol. iv. p. 272., and *Pathol. Obs.* p. 193. ed. 3.) The above-described alteration of the structure of the bones, this author has never seen in the cranium, nor in the middle of the cylindrical bones; but it is asserted by another late writer, that the cheesy matter sometimes pervades the cancelli of the whole bone, and is deposited in innumerable portions of the most minute size. (*E. A. Lloyd, on Scrofula*, p. 120.) Also, with respect to the increased vascularity of the diseased part of the bone, although Mr. Lloyd assents to the truth of this statement, as applied to the early stage of the disorder, he represents the vascularity as afterwards being diminished, in proportion as the quantity of cheese-like deposit increases. (*Vol. cit.* p. 122. 123.)

A cursory examination of a diseased joint, even when it is cut open, will not suffice to show that the heads of the bones have not acquired an increase of size. In making a dissection of this kind in the presence of a medical friend, I found that even after the joint had been opened, the swelling had every appearance of arising from an actual expansion of the bones. The gentleman with me felt the ends of the bones after the integuments had been removed, and he coincided with me, that the feel, which was even now communicated seemed to be caused by a swelling of the bones themselves. But, on cleaning them, the enlargement was demonstrated to arise entirely from a thickening of the soft parts. So unusual, indeed, is the expansion of the heads of the bones, that the late Mr. Crowther, who paid great attention to these cases, joined Mr. Russell in believing that such a change never happened: a conclusion not entirely correct. (*See Practical Obs. on White-Swelling*, 8vo. edit. 2. p. 14. 1808.)

Mr. Russell has particularly noticed how much the soft parts frequently contribute to the swelling. He describes the appearances on dissection thus: "The great mass of the swelling appears to arise from an affection of the parts, exterior to the cavity of the joint, and which, besides an enlargement in size, seem also to have undergone a material change in structure. There is a larger than natural proportion of a viscid fluid, inter-

mixed with the cellular substance; and the cellular substance itself has become thicker, softer, and of a less firm consistence than in a state of health." (*On the Morbid Affections of the Knee*, p. 30.)

"Scrofula attacks only those bones, or portions of bones, which have a spongy texture, as the extremities of the cylindrical bones, and the bones of the carpus and tarsus; and hence, the joints become affected from their contiguity to the parts, which are the original seat of the disease." (*See Med. Chir. Trans.* vol. iv. p. 273.)

Sir B. Brodie observes, however, that sometimes the effects of these morbid changes may be traced even in the shaft of a cylindrical bone, so that the middle of the femur, or tibia, is converted into a thin shell, enclosing a medullary cavity of unusual magnitude. (*Pathol. and Surg. Obs.* p. 195. ed. 3.)

In the cavity of the joint we sometimes find a quantity of curd-like matter, and the cartilages absorbed in various places, but more particularly round the edges of the articular surfaces.

As the name of the disease implies, the skin is not at all altered in colour. According to Mr. Lloyd, the first decided symptom of disease in the articulating extremity of a bone is an occasional deep-seated, dull, heavy pain, unattended by swelling, and not increased by motion; and, if it be the hip, knee, or ankle, which is affected, the patient keeps the knee rather bent, and never fully extends it in progression. (*On Scrofula*, p. 138.) In some instances, the swelling yields in a certain degree to pressure; but it never pits, and is almost always sufficiently firm to make an uninformed examiner believe that the bones contribute to the tumour. It is remarked by Sir B. Brodie, that, while the disease is going on in the cancellous structure of the bones, before its effects have extended to the other textures, and while there is still no evident swelling, the patient experiences some degree of pain, which, however, is never very severe, and often is so slight, that it is scarcely noticed. After a time, varying from a few weeks to several months, the external parts begin to swell, and serum and coagulated lymph to be effused in the cellular membrane, so as to form a puffy, elastic swelling. (*Pathol. Obs.* p. 197. ed. 3.) In the majority of scrofulous white-swelling, let the pain be trivial, or more severe, it is particularly situated in one part of the joint; viz. either the centre of the articulation, or the head of the tibia. Sometimes the pain continues without interruption; sometimes there are intermissions; and in other instances the pain recurs at regular times, so as to have been called, by some writers, periodical. Almost all authors describe the patient as suffering more uneasiness in the diseased part, when he is warm, and particularly, when he is in this condition in bed.

In the early stage of the disease, the swelling is mostly very inconsiderable, or there is even no visible enlargement whatever, excepting perhaps after exercise. In the little depressions naturally situated on each side of the patella, a fullness generally first shows itself, and gradually spreads all over the affected joint. According to Mr. Lloyd, however, when the soft parts, on the outside of the knee-joint, permanently swell, the swelling often commences on each side, just behind the condyles, so that the joint appears wider, and he says, that he has often seen the enlargement commence by the swelling of a gland, im-

mediately above the inner condyle. He observes, that there is no point of the joint where the swelling may not begin. (*Op. cit.* p. 139.)

The patient, unable to bear the weight of his body on the disordered joint, in consequence of the great increase of pain thus created, gets into the habit of only touching the ground with his toes, and the knee being generally kept a little bent in this manner, soon loses the capacity of being completely extended again. When the disease has lasted a good while, the knee is almost always found in a permanent state of flexion. In scrofulous cases, the pain constantly precedes any appearance of swelling; but the interval between the two symptoms differs very much in different subjects.

The morbid joint in the course of time acquires a vast magnitude. Still the integuments retain their natural colour, and remain unaffected. The enlargement, however, always seems greater than it really is, in consequence of the emaciation of the limb, both above and below the disease.

An appearance of blue distended veins, and a shining smoothness, are the only alterations to be noticed in the skin covering the enlarged joint. The shining smoothness seems attributable to the distension, which obliterates the natural furrows and wrinkles of the cutis. When the joint is thus swollen, the integuments cannot be pinched up into a fold, as they could in the state of health, and even in the beginning of the disease.

As the disease advances, the cartilages ulcerate, and collections of matter form around the part, and at length burst. Their progress, as Sir Benjamin Brodie has stated, is slow, and, when they burst, or are opened, they discharge a thin pus, with portions of a curd-like substance floating in it. The discharge afterwards becomes less copious and thicker. (*Pathol. Obs.* p. 199. ed. 3.) The ulcerated openings sometimes heal up; but such abscesses are generally followed by other collections, which pursue the same course. In some cases, these abscesses form a few months after the first affection of the joint; on other occasions, several years elapse, and no supuration of this kind makes its appearance. They sometimes communicate with the cavity of the diseased joint, or lead down to diseased bone, portions of which occasionally exfoliate. In the generality of cases, several abscesses take place in succession, some healing up, and others ending in sinuses.

As the cartilages continue to ulcerate, Sir B. Brodie has observed, that the pain becomes aggravated, though not in a very great degree, and he says, that it is not severe, until an abscess has formed, and the parts over it are distended and inflamed.

The local mischief must necessarily produce more or less constitutional disturbance. The patient's health becomes gradually impaired; he loses his appetite, and natural rest and sleep; his pulse is small and frequent; an obstinate and debilitating diarrhoea, and profuse nocturnal sweats, ensue. These complaints are, sooner or later, followed by dissolution, unless the constitution be relieved, in time, either by the amendment, or removal of the diseased part. In different patients, however, the course of the disease, and its effects upon the system, vary considerably, in relation to the rapidity with which they occur.

Rheumatic white-swollings, or inflammations and thickenings of the synovial membrane from cold, or other causes, are very distinct diseases from the scrofulous distemper of the large joints. In the first, the pain is said never to occur without being attended with swelling. Scrofulous white-swollings, on the other hand, are always preceded by a pain, which is particularly confined to one point of the articulation. In rheumatic cases, the pain is more general, and diffused over the whole joint.

Mr. Lloyd thinks, that the scrofulous white-swelling may be distinguished from all other diseases of the joints, by its being attended with less pain, by the great degree of external swelling often existing for a long time before matter forms in the cavity of the articulation, and by the swelling being but little diminished by any discharge of matter which may take place. In its first stage, before the interior of the joint is affected, it may be distinguished from primary ulceration of the cartilages, by the pain not being much increased by motion. The grating, produced by moving the joint, is also commonly less in this disease than in ordinary ulceration of the cartilages. (*Lloyd on Scrofula*, p. 142.) And, according to Sir Benjamin Brodie, the principal criterion between scrofulous diseases of joints and the primary ulceration of cartilages, is the little degree of pain in the former cases, which is never much complained of before an abscess forms, nor particularly severe, "except in a few instances, and in the most advanced stage of the disease, when a portion of ulcerated bone has died, and having exfoliated, so as to lie loose in the cavity of the joint, irritates the parts with which it is in contact, and thus becomes a source of constant torment." (*Brodie's Pathol. Obs.* p. 200. ed. 3.)

It seems probable, that cases in which the cancellous structure of the bones is found quite undiseased, and in which the mass of disease is confined to the soft parts, are not scrofulous white swellings. Few persons, who have attained the age of five and twenty, without having had the least symptom of scrofula, ever experience after this period of life, a first attack of the white-swelling of the stumous kind. The general correctness of this observation, I believe, is universally admitted, and that there are but few exceptions to it is confirmed by the statements of Volpi, of Pavia. However, Mr. Lloyd attended a man, who, at the age of between forty and fifty, died of phthisis, and had at the time a scrofulous ankle, besides several abscesses about his hip and groin. And the same gentleman met with another patient, upwards of forty years old, with a similar disease. (*On Scrofula*, p. 137.) But if these patients had had no marks of scrofula in their younger days, a circumstance not specified, they form deviations from what is usual, as indeed Mr. Lloyd seems to admit. My own observations lead me to concur with Sir B. Brodie, that scrofulous affections of the joints, so frequent in children, are rare after the age of thirty. (*Pathol. Obs.* p. 196. ed. 3.) This observation, however, is to be received as correct, only with reference to persons who have been free from scrofula up to that period of life. I attended (Aug. 1829), a woman nearly forty, who had been first attacked with a scrofulous white-swelling.

ing of the left knee about a year previously; but then she had had enlarged glands in the neck in her youth, and a scrofulous ulcer of long duration was still open on one of her legs. All cases in which the internal structure of the heads of the bones become softened, previously to the affection of the cartilages and soft parts, are probably scrofulous.

Mr. Russell has noticed the frequent enlargement of the lymphatic glands in the groin, in consequence of the irritation of the disease in the knee; but he justly adds that the secondary affection never proves long troublesome.

When the bones are diseased, the head of the tibia always suffers more than the condyles of the thigh-bone. (*Russell*.) The articular surface of the femur sometimes has not a single rough or carious point, notwithstanding that of the tibia may have suffered a great deal. The cartilaginous coverings of the heads of the bones are generally eroded first at their edges; and in the knee, the cartilage of the tibia is always more affected than that covering the condyles of the thigh-bone. Indeed, when white-swelling has its origin in the bones, and the knee is the seat of the disorder, there is some ground for supposing, that it is in the tibia that the morbid mischief usually first commences.

The ligaments of the knee are occasionally so weakened, or destroyed, that the tibia and fibula become more or less dislocated backward, and drawn towards the tuberosity of the ischium, by the powerful action of the flexor muscles of the leg. It is observed by Sir B. Brodie, that just as ulceration of the cartilages is sometimes followed by dislocation of the hip, so we find, that dislocation of the knee occasionally takes place from the same cause. When there has been considerable distension of the soft parts, in consequence of ulceration extending to them, the head of the tibia is gradually drawn backwards by the action of the flexor muscles; and Sir B. Brodie has even known this happen, previously to the formation of any abscesses. (*Pathol. Obs.* p. 172. ed. 2.)

I have also seen one or two examples of this, and another case, in which the leg could be bent to each side for a considerable distance, both when the knee was extended and bent; a state implying a preternatural looseness of the ligaments.

Scrofulous white-swelling, no doubt, are under the influence of a particular kind of constitution, termed *scrofulous* or *strumous*, in which every cause capable of exciting inflammation, or an irritable state of a joint, may bring on this severe disease. On the other hand, in a man of a sound constitution, a similar irritation would only induce common healthy inflammation of the joint. In scrofulous habits, it also seems as if irritation of a joint were much more easily produced than in other constitutions; and no one can doubt, that when once excited in the former class of subjects, it is much more dangerous, and difficult of removal, than in other patients.

The doctrine of particular white-swelling being scrofulous diseases, is supported by many weighty reasons, the opinions of the most accurate observers, and the evidence of daily experience. Wiseman (*Book iv. chap. 4.*) calls *spina ventosa* a species of scrofula, and tells us that infants and children are generally the subjects of

it. The disorder is said, by Severinus, to be exceedingly frequent in young subjects. Petrus de Marchettis had observed both male and female subjects affected with what are called strumous diseases of the joints, as late as the age of five and twenty; but not afterwards, unless they had suffered from scrofula before that period of life, and had not been completely cured. R. Lowerus also maintains a similar opinion. Even though a few persons have scrofulous diseases of the joints, for the first time, after the age of twenty-five, this occurrence, like the first attack of scrofula after this period, must be considered as extremely uncommon.

Another argument in favour of the doctrine, which sets down particular kinds of white-swelling as scrofulous, is founded on the hereditary nature of such forms of disease.

Numerous continental surgeons, particularly Petit and Brambilla, have noticed how subject the English are both to scrofula and white-swelling of the joints. We every day see that young persons, afflicted with the present disease, are in general manifestly scrofulous, or have once been so. Frequently enlarged lymphatic glands in the neck denote this fatal peculiarity of constitution; and very often the patients are known to have descended from parents who had strumous disorders. (*Crouther*.) The disease is also frequently combined with swelled mesenteric glands, or tuberculated lungs. (*Brodie's Pathol. Obs.* p. 221.) As the same author remarks, since the disease depends upon a certain morbid condition of the general system, it is not surprising that we should sometimes find it affecting several joints at the same time, or that it should show itself in different joints in succession; attacking a second joint after it has been cured in the first, or after the first has been removed by amputation. (*P.* 230.)

Besides the general emblems of a scrofulous constitution (see SCROFULA), we may often observe a shining, coagulated, flaky substance, like white of egg, blended with the contents of such abscesses as occur in the progress of the disease. This kind of matter is almost peculiar to scrofulous abscesses, and forms another argument in support of the foregoing observations, relative to the share which scrofula frequently has in the origin and course of many white-swelling.

Sir Benjamin Brodie's experience leads him to believe, that, in scrofulous cases, the chance of ultimate recovery is much less, when the disease attacks the complicated joints of the foot and hand, than when it is situated in larger articulations of a more simple structure. (*Pathol. and Surg. Obs.* p. 235.)

Treatment of White-swelling.—In practice we meet with all these cases, both scrofulous and rheumatic, in two opposite states; sometimes the diseased joint is affected with a degree of acute inflammation; in other instances, the malady is entirely chronic.

The imprudence of patients in walking about, and disturbing the diseased part, is often the occasion of a degree of acute inflammation, which is denoted by the tenderness of the joint when handled by the surgeon, and also by the integuments feeling hotter than those of the healthy knee. When such state exists, there can be no doubt that topical bleeding, fomentations, emol-

lient poultices, or cold saturnine lotions, are means which may be eminently serviceable. The antiphlogistic regimen is now strongly indicated. Cooling purges of the saline kind should also be exhibited. Blood may be taken from the arm, and also from the diseased part, either by means of leeches or cupping. Mr. Latta gives the preference to the latter method, whenever it can be employed; and he very properly remarks, that little advantage can be expected from topical bleeding of any kind, unless the quantity of blood taken away be considerable. Ten or twelve ounces by cupping should be taken away at a time, and the operation should be repeated at proper intervals, till the tenderness and heat of the skin have entirely subsided. When leeches are used, the number ought to be considerable, at least, sixteen or twenty. (See *Latta's Surgery*, vol. i. chap. 6.)

Although antiphlogistic means are judicious, when acute inflammation prevails; yet such practitioners as lose weeks and months in the adoption of this treatment are highly censurable. While the skin is hot and tender, while the joint is affected with acute pain, and while the patient is indisposed with the usual symptoms of inflammatory fever, great benefit may be rationally expected from the above plan. When, however, the disease is truly chronic, different plans are indicated. In ordinary cases of scrofulous joints, Sir Benjamin Brodie considers topical bleeding as generally unnecessary. (*Pathol. and Surg. Obs.* p. 240.)

It is quite needless to expatiate on the mode of treating white-swellings, complicated with acute inflammation, particularly as the treatment of those cases which consist of inflammation of the synovial membrane has been already noticed, and may be said to be applicable to other forms of white-swelling, when they are attended with heat and inflammation of the soft parts. The most eligible plan of arresting the morbid process in the bones, cartilages, and soft parts surrounding the articulation, and the most successful method of lessening the chronic enlargement of the joint, are the subjects at present demanding our earnest investigation.

The works of Hippocrates, Celsus, Rhazes, Hieron. Fabricius, &c., compared with modern surgical books, will soon convince us, that the practice of the ancients in the treatment of diseased joints does not differ much from the plan now pursued by the best modern surgeons. Mr. Crowther remarks, that the ancients used local and general blood-letting, the actual and potential cautery, with vesicating and stimulating applications to the skin. They further maintained, that sores, produced by these means, should have their discharge promoted, and continued for a considerable length of time.

With regard to the cases, which Sir B. Brodie describes as depending upon a total loss of the natural structure of the synovial membrane, which is converted into a pulpy substance, one quarter, or one half, of an inch in thickness, though the progress of the disease may be somewhat checked by rest and cold lotions, it is according to this gentleman, incurable; and at length it ends in ulceration of the cartilages, abscesses, &c. When there is considerable pain in consequence of the cartilages beginning to ulcerate, partial relief

may derived from fomentations and poultices; but nothing will effect a cure. Hence, when the health begins to suffer, he considers amputation to be indicated. (*Med. Chir. Trans.* p. 254.)

Professor Syme, who does not concur with Sir Benjamin Brodie, in regarding the disease as altogether incurable, makes the following remarks. "Pressure (says he) is apt to occasion pain, and by thus exciting irritation, give rise to inflammation; so as to hasten on the malady to its last stage, it ought therefore to be employed with precaution. The best plans of treatment are, after subduing any inflammatory symptoms that happen to exist, either to blister the joint repeatedly, and then apply pledgets of lint covered with an ointment composed of camphorated mercurial ointment and hydriodate of potass, and surrounding the limb and joint with a common roller; or to keep the joint constantly moist with some discutient lotion. The former method is best suited to cases of a truly chronic kind, and the latter to those, in which there is some tendency to excited action." Mr. Syme prevents motion of the joint by means of a splint, made of leather or paste-board, or iron wire covered with shamoy leather. (See *Principles of Surgery*, p. 204. ed. 2.) Possibly, however, the cases which Mr. Syme may have cured by these plans were not really associated with the organic change of structure in the synovial membrane particularly described by Sir B. Brodie.

When white-swellings are accompanied with ulceration of the cartilages, all motion of the joint is extremely hurtful. Indeed, as Sir B. Brodie well observes, keeping the limb in a state of perfect quietude is a very important, if not the most important, circumstance to be attended to in the treatment. According to this gentleman, it is in these cases in which ulceration of the cartilages occurs as a primary disease that caustic issues are usually productive of singular benefit; but he deems them of little use in any other diseases of the joints. He thinks setons and blisters, kept open with savine cerate, may also be used with advantage. Bleeding is indicated only when, from improper exercise, the articular surfaces are inflamed, and there is pain and fever. Sir B. Brodie finds that the warm bath relieves the symptoms in the early stage, if it does not stop the progress of the disease; but he condemns plasters of gum ammoniac, embrocations, liniments, and frictions, as either useless or hurtful. (See *Med. Chir. Trans.* vol. vi. p. 332—334.)

Topical applications, consisting of strong astringents of the mineral and vegetable kingdom, are of no service in examples of ulceration of the cartilages, or of the scrofulous form of disease, though they often suffice for the cure of some mild descriptions of white-swelling, depending upon a thickening of the synovial membrane. A decoction of oak bark, containing alum, was recommended by Mr. Russell.

My own experience will not allow me to say any thing in favour of electricity, as an application for the relief of white-swellings; and it must be more likely to do harm than good, whenever the indication is to lessen irritation.

"If the tumour is quite indolent (says Richerand), the application of galvanism may be proposed; it is not, however, exempt from danger, and on one occasion, where I employed it, lanci-

nating pains and swelling of the joint were brought on by it." (*Nosogr. Chir.* t. iii. p. 174. ed. 2.)

Mr. John Hunter had confidence in cituta and sea-bathing, as possessing power over many scrofulous diseases, and that such diseases of the joints are often materially benefited, by the patient's going to the sea-side and bathing, is a fact which cannot be doubted, whatever may be the mode of explaining the benefit thus obtained. I fully believe that sea-air and sea-bathing have a beneficial influence over scrofulous diseases of the joints; but probably their effects are produced on the part through the medium of the constitution, and they should only be recommended as an auxiliary plan, to be adopted in conjunction with other still more efficacious measures.

Every one is well acquainted with the efficacy of friction in exciting the action of the absorbents. To this principle we are to impute the great benefit which arises from what is termed *dry rubbing*, in cases of white-swellings. This kind of friction is performed by the naked hands of an attendant, without using at the same time any kind of liniment, or other application whatsoever, excepting sometimes a little flour, or hair powder, and the rubbing is continued several hours every day. At Oxford, many poor persons used to earn their livelihood by devoting themselves to this species of labour, for which they were paid a stipulated sum per hour. This practice, however, is chiefly advantageous in the chronic stage of white-swelling, arising from inflammation of the synovial membrane.

I look upon all merely emollient applications, such as fomentations and poultices, as destitute of real efficacy, except when great pain, or active inflammation, is present, or abscesses are forming. Some surgeons are particularly liberal in the praises which they bestow on warm emollient remedies, poultices, steam of hot water, fomentations, &c., and they adduce instances of white-swellings being cured in this manner. But the cases, to which they refer, were no doubt mere inflammations, and thickening of the synovial membrane; a disease, which, in general, readily yields to several other plans.

One method of treatment, which my own personal experience enables me to recommend for scrofulous white-swellings in a chronic state, consists in keeping the joint motionless, by means of a splint, and maintaining a discharge from the skin covering it. The opportunities which I have had of observing the effects of blisters, and caustic issues, rather incline me to prefer the former to the latter. In particular individuals, however, blisters create so much irritation, heat, fever, and suffering, that a perseverance in them would be rashness.

The blister should be large. Many surgeons, instead of following Crowthorpe's plan, prefer blistering first one side of the joint, and then the other alternately, for a considerable length of time. "Blisters (says Mr. Latta) may be put upon each side of the patella, [and ought to be of such a size and shape as to cover the whole of the swelling on the inside, from the hinder part of the joint, at the edge of the hollow of the thigh, to the edge of the patella, over the whole extent of the swelling above and below. As soon as the blister is taken off from one side, it ought to be applied to the other, and thus repeated alternately, until both

swelling and pain be completely removed. When this is the case, the patient ought to be directed to rub the joint well with a liniment, composed of half an ounce of camphor dissolved in two ounces of oil, with the addition of half an ounce of spir. sal-ammon. caust., or, as it is now called, liquor ammoniac. This is to be used three times a day; and in this way (continues Mr. Latta) I have successfully treated many cases of white-swellings. (*Syst. of Surgery*, vol. i. chap. 6.)

In the beginning, caustic issues are even more painful than blisters; but they afterwards become more like indolent sores, and are more easily kept open, for a length of time, than blisters. Such issues are commonly made on each side of the diseased joint, and of about the size of a half-crown. The manner of making the eschars, and keeping issues open, has been already explained. (See *Issue*.)

The question has been contested, among surgical writers and practitioners, whether blisters and issues produce benefit, upon the principle of counter-irritation, or in consequence of the discharge which they occasion. They probably operate efficaciously in both ways; for there is no doubt that simple rubefacients possess the power of rousing the action of the absorbents, and they may also modify the vascular action in diseased parts. Yet it is obvious that they can only act upon the principle of counter-irritation, and they have not been here recommended, particularly for white-swellings, because, it seems to me, that whenever some good might be derived from their employment, much more benefit might always be obtained from blisters and issues. This sentiment is confirmed by experience, and we must, therefore, impute a great degree of efficacy to the maintenance of a purulent discharge from the vicinity of the diseased part.

Though my own observations have led me to think quietude of the joint, with issues and blisters, as efficient as any means hitherto devised for stopping the progress of scrofulous disease of the heads of bones, I am far from meaning to say, that such disease can generally be stopped by these, or any other remedies, local or general. Sir B. Brodie has seldom known any benefit derived from blisters, or stimulating liniments; nor has he seen the same degree of good produced by issues in scrofulous cases, as in examples of primary ulceration of the cartilages. Cold evaporating lotions in the early stage of the complaint; perfect quietude of the joint; attention to the patient's health; and riding in a carriage in the fresh air; are the means which this gentleman particularly recommends in scrofulous diseases of the joints. During the formation of abscesses, he approves of fomentations and poultices. (*Pathol. Obs.* p. 242.) In a subsequent edition, Sir Benjamin observes, "I much doubt whether setons and issues are ever useful, except in some cases, in which the disease has its seat in the hip-joint, and in which the patient suffers, in an unusual degree, from pain and muscular spasms in the limb, apparently in consequence of the irritation communicated to the trunk of the anterior crural nerve." (*Ed. 3.* p. 205.)

With respect to medicines, Sir B. Brodie has found preparations of steel generally more useful than others. They must, however, be continued, with occasional intermissions, for two or three

years, or even longer. Purgatives should be occasionally exhibited, and the use of steel suspended whenever the tongue is furred, or the skin hot. Sir Benjamin Brodie bears testimony also to the usefulness of other tonics, especially bitters, combined with liquor potassæ. When there is a disposition to night sweats, and the appetite fails, the mineral acids may be prescribed. He has also no doubt that iodine is sometimes beneficial, if given in small doses. When the excretions are unhealthy, he approves of mercurial alteratives. (*Op. cit.* p. 208. ed. 3.)

We have noticed the efficacy of friction, in exciting the action of the absorbents, by which the thickened state of parts around the affected joint may be considerably lessened, and, on this principle, the utility of dry-rubbing arises. We have now to notice the method of producing the same effect by pressure. I have seen cases in which the swelling of the joints has been materially diminished, by encircling them with strips of adhesive plaster, applied with moderate tightness.

A somewhat similar plan, though its modus operandi is differently accounted for, appears also to have been tried in France. "J'ai dans quelques occasions (says Richerand) obtenu les plus grands avantages de l'application d'un taffetas ciré autour de l'articulation tuméfiée. On coupe un morceau de cette étoffe, assez large pour envelopper la totalité de la tumeur; on enduit les bords d'une gomme dissoute dans le vinaigre, et susceptible de la faire adhérer intimement à la peau; on l'applique ensuite de manière que tout l'accès soit interdit à l'air entre lui et les teguments. Lorsque au bout de quelques jours on lève cet appareil, on trouve la peau humide, ramollie par l'humour de la transpiration condensée en gouttelettes à la surface intérieure du taffetas. Dans ce procédé on établit un espèce de bain de vapeur autour de l'articulation malade." (*Nosogr. Chir.* t. iii. p. 175. edit. 2.)

The late Mr. C. W. Cruttwell, of Bath, sent me an excellent case illustrative of the efficacy of treatment by pressure. He remarks, that, "after cupping the part, and endeavouring to quiet the inflammation, I used blisters; but they excited such intolerable pain, and produced so great a degree of swelling and inflammation, that I was under the necessity of healing them immediately. After two months strict confinement to bed, and the use of leeches and refrigerant washes, the inflammation having again subsided, and the pain being removed, I again ventured to apply one small blister, and again a similar attack of pain, swelling, and inflammation, was produced. The joint became distended with fluid, of which it had always contained a large quantity, and the irritation of the constitution was excessive. By the liberal use of opium, I once more succeeded in quieting the disturbance, and, convinced of the hazard of using blisters in such a subject, I applied moderate pressure, by means of a roller, together with a wash, containing a large proportion of spirit, in order to keep up a constant evaporation. The skin, which was before much inflamed, and hard, has become natural and flaccid, the pain has ceased, the swelling has diminished, and I have every prospect of effecting a cure, with the preservation of tolerably free motion in the joint."

Mr. Cruttwell, in a subsequent letter, informed me that this case got completely well, by the

treatment with pressure, and had remained so for upwards of six months, under full and free exercise. This case proves the impropriety of using blisters in certain constitutions. In some remarks, annexed to the above case, Mr. Cruttwell expresses his conviction, that *absolute rest, cold applications, and pressure*, would succeed in many cases *without local counter-irritation*. Pressure, he adds, succeeds best, when fluid is effused, and the disease is indolent; but he is convinced that it may be used with advantage in later stages, when abscesses have formed, and sinuses already exist; and he reminds me how very serviceable continued pressure is to the scrofulous finger-joints of children.

The good effects of pressure in scrofulous cases are confirmed by the observations of Sir Benjamin Brodie; when, says he, after several abscesses have taken place, the tendency to suppuration has ceased, and the swollen joint has become diminished, anchylosis is probably disposed to take place. At this period, pressure, by means of strips of linen, spread with soap-cerate, or some other moderately adhesive plaster, and applied in a circular manner around the limb, will be productive of benefit. This will promote the healing of the sinuses; and by more completely preventing the motion of the joint, will lessen the chance of fresh suppuration, and favour the union of the ulcerated bony surfaces. (*Pathol. and Surg. Obs.* p. 206. ed. 3.)

Analogous to the plans sometimes followed by M. Richerand, Mr. Cruttwell, and Sir B. Brodie, is that described by Mr. Scott. According to this gentleman, issues, perpetual blisters, and other irritating remedies, may be all superseded by the following treatment. The surface of the joint is first to be cleaned with a sponge and soft brown soap and water, and then thoroughly dried. It is next to be rubbed with a sponge soaked in camphorated spirit of wine, until it begins to feel warm, smart a little, and assume a red appearance. It is now to be covered with a cerate, composed of equal parts of ceratum saponis and the ung. hydrarg. fortius cum camphora. This is thickly spread on large square pieces of lint, and applied to every side of the joint, and this, in the knee, for at least six inches above and below the point, at which the condyles of the femur are opposed to the head of the tibia. The limb is next to be supported to the same extent with strips of calico, spread with the emplastrum plumbi, and applied so as to prevent motion of the joint. Then is to be laid on an additional covering of emplastrum saponis, spread on thick leather, and cut into four broad pieces; one for the front; another for the back; and the two others for the sides of the joint: lastly, the whole is secured by means of a calico bandage, which is put on very gently, and rather for the purpose of securing the plaster, and giving greater thickness and security to the whole, than for the purpose of compressing the joint.

It is remarked by Mr. Scott, that in some cases, in which the skin is thick and indolent, sufficient irritation will scarcely be excited by the above applications, and it is necessary to rub on the part a small quantity of tartar emetic ointment, previously to the application of the cerate. In some instances, and particularly in children, it is proper to adopt a plan, by which the motion

of the joint may be more effectually hindered. This is done by applying on each side of the joint, externally to the plasters, a piece of pasteboard softened in warm water, and cut into the length, breadth, and form of splints, and when dry, it will be found to make a firm case for the limb. (See *Surgical Obs. on Chronic Inflammation*, &c. p. 133. et seq. 8vo. Lond. 1828.) The applications here described are stated not to require very frequent removal. "The time, during which they may be left undisturbed, (says Mr. Scott,) will depend chiefly on the necessity for a repetition of the bleeding, in which we must be guided by the degree of pain; or, when there are open abscesses, by the quantity of the discharge. In some cases, the dressings must be renewed every week; but, in the generality of examples, they may remain a fortnight, and sometimes longer. Even when there are sores, or sinuses, Mr. Scott lets the applications continue on the part several days or a week, as he finds the presence of the matter do less harm than the frequent disturbance of the joint. The foregoing method, combined with remedies for the improvement of the health in general, the regulation of the digestive organs, the prevention of costiveness, &c., and with occasional topical bleeding, when the state of the inflammation requires it, seems to be employed by Mr. Scott in several forms of disease of the joints, as that commencing in the synovial membrane, that beginning in the cartilages, and that which originates in the cancellous structure of the heads of the bones. He also extends the practice to diseases of the hip, and to various examples of induration and tumours, the result of chronic inflammation and scrofula. It is to be particularly noticed, that the three principles on which it acts, are, first, its mechanical operation of supporting and steadying the part; secondly, its medicinal action on the same by means of the mercury blended with the cerate; and, thirdly, the mild degree of counter-irritation kept up in the skin by the applications.

Some practitioners cover the joint with linen, or lint wet with a solution of gum, starch, or other liquids, which, when dry, leave the lint or linen in the form of a stiff case, perfectly adapted to the shape of the part.

When the knee is affected, the limb has a tendency to become permanently bent. It must undoubtedly be judicious to prevent this position, by means of pasteboard or splints, which will also serve to prevent all motion of the diseased joint, an object of the very highest importance. Were the disease to end in ankylosis, the advantage of having the limb in a state of extension is certainly a great advantage.

In cases which commence in the cancellous structure of the heads of the bones, it seems rational to combine, with the local treatment, the employment of such internal remedies as have been known to do good in other scrofulous diseases. (See *SCROFULA*.) "It is to be supposed, (as Sir B. Brodie observes,) that the air of a crowded city must be more or less unfavourable; and that a residence on the sea-coast is likely to be more beneficial than a residence in the country elsewhere. The patient should live on a nourishing but plain diet; he should be in the open air in summer, as much as he can, without exercising the joint. His mode of life should, in all respects,

be regular and uniform." Sir B. Brodie has found more benefit derived from the long use of steel medicines than any others, suspending their use, however, and substituting the mineral acids for them, when the formation of abscesses excites febrile action. With such means, in children, he combines the occasional exhibition of mercurial purgatives. (*Pathol. Obs.* p. 245.) In the work which Mr. Lloyd has published, it is assumed as a fact, that in scrofula there always is more or less disorder of the functions of the digestive organs, and primarily of no other important function. Hence, the regulation of diet, the state of the bowels, and the hepatic secretions, is with this gentleman a principal object; and, with the latter views, he employs, after Mr. Abernethy's plan, five grains of the blue pill every night, and half a pint of decoct. sars. twice a day, with opening medicines, if necessary, to procure regular daily evacuations. When acidity of the stomach is present, he gives soda, and when the stomach is weak, cinchona, steel, and mineral acids. (*On Scrofula*, p. 37. &c.) However, no doubt can be entertained that these means, like many others, have no specific power over scrofulous diseases, and, like sea-air and sea-bathing, only answer by sometimes improving the state of the constitution. In the local treatment of scrofulous joints, Mr. Lloyd commends quietude of the limb, which is to be confined in a sling, or in splints; the occasional resistance of inflammatory action by leeches, and a diminution of temperature; poultices when abscesses form; opening such collections of matter early; and, after all irritation has ceased, issues setons, blisters, or the antimonial ointment; or compression upon Mr. Baynton's plan. (P. 152. &c.) With respect to opening these abscesses early, Mr. Lloyd differs from many excellent surgeons, especially Dr. Albers, who distinctly states that it is generally best to allow them to burst of themselves. On this subject, however, great diversity of opinion prevails, and Langenbeck is amongst the advocates for making an early opening. (*Bibl.* b. ii. p. 39.) Hectic symptoms are those, which we commonly have to palliate in these cases. When the appetite is impaired, and the stomach will bear bark, this medicine should be given with the aromatic confection, or the sulphate of quinine may be exhibited. Above all, opium claims high recommendation, as it tends to keep off and relieve a debilitating diarrhoea, which too frequently prevails, at the same time that it alleviates pain, and procures sleep. In some cases, amputation becomes indispensable; for not only are the cartilages destroyed, and the heads of the bones diseased, but there are abscesses in and around the joint, with sinuses, and hectic disturbance threatening life itself. (See *AMPUTATION*.) In a few cases, excision of the diseased joint is preferred to amputation of the limb, as will be hereafter noticed. (See *JOINTS, EXCISION*, &c.)

Disease of the Hip-joint.—It seems probable that this disease has its varieties, some of which may be connected with scrofula, while others cannot be suspected to have any concern with it. Sir B. Brodie's investigations lead him to believe, however, that the disease is of that nature, in which the first change is mostly ulceration of the cartilages. The present complaint is most frequently seen in children under the age of fourteen; but no age, no sex, no rank, nor condition of life

is exempt from the possibility of being afflicted, so that though children form a large proportion of those subjects who are attacked, yet the number of adults, and even of old persons, is considerable. The disease is considered by Van der Haer and Morgagni to be more frequent in females than males; but by Albers, Fricker, and Rust, the male sex is specified as more often afflicted than the female. (See *W. Coulson on Dis. of the Hip-joint*, p. 15.)

The approach of this disease of the hip-joint may be rather insidious, its only forerunner being sometimes a slight weakness, and limping of the affected limb. These trivial symptoms are often not sufficiently urgent to excite much notice, and, when observed by superficial practitioners, are commonly misunderstood, and wrongly treated. As there is sometimes an uneasiness in the knee, when the hip is affected, careless practitioners frequently mistake the seat of disease, and I have many times seen patients, on their entrance into an hospital, having a poultice on their knee, while the wrong state of the hip was not at all suspected.

This mistake is extremely detrimental to the patient, not on account of any bad effect, resulting from the applications so employed, but because it is only in the incipient period of the complaint that a favourable prognosis can be made. In this stage of the disease, mere rest and repeated topical bleeding, will do more good in the course of a fortnight, than large painful issues will afterwards generally accomplish in the long space of a twelvemonth.

The symptoms of this disease of the hip-joint, when only looked for in the situation of that articulation, are not very obvious. Though, in some instances, the attention of the surgeon is soon called to the right situation of the disease, by the existence of a fixed pain behind the trochanter major; yet it is too often the case, that mere pain about an articulation, entirely destitute of visible enlargement and change of colour, is disregarded as a complaint of no importance among young subjects, and as a rheumatic, or gouty affection in adults. Patients frequently complain of their most painful sensations being in the groin, and all accurate observers have remarked that, in the hip disease, the pain is not confined to the real seat of disease, but shoots down the limb to the knee.

Sir C. Bell is of opinion that the pain arises from an affection of the obturator nerve, "which passes through the thyroid foramen, down to the hip-joint, and after supplying the muscles, is distributed upon the inner part of the knee. The nerve in its course is thus involved in the inflammation which affects the hip-joint, and the pain is referred to its extreme cutaneous branches, at a part distant from the seat of the disease."

The pain, as Sir Benjamin Brodie observes, is at first trifling and only occasional; but it afterwards becomes severe and constant. It resembles a good deal the pain of rheumatism, since it often has no certain seat. As the disease advances, the pain becomes exceedingly severe, particularly at night, when the patient is continually roused from his sleep by painful startings of the limb. Sometimes he experiences a degree of relief in a particular position of the joint, and no other. As the pain increases in intensity, it becomes more

fixed. In the greater number of instances, it is referred both to the hip and knee, and the pain in the latter joint is generally the most severe. At other times, there is pain in the knee and none in the hip. A boy in St. George's hospital complained of pain in the inside of the thigh, near the middle; and another patient referred the pain to the sole of the foot. Wherever the pain is situated, it is aggravated by the motion of the joint, and especially by whatever occasions pressure of the ulcerated cartilaginous surfaces against each other. (*Brodie's Pathol. Obs.* p. 139.)

"Eversion of the thigh, and abduction of the limb from the other, produce the greatest degree of suffering to the patient, while he can bear the joint to be flexed, and to be slightly inverted, without complaining. A similar indication of the ligamentum teres being inflamed, is the pain sometimes experienced on pressing the head of the femur on the acetabulum." (*C. Aston Key, in Med. Chir. Trans.* vol. xviii. p. 31.)

When the functions of a limb are obstructed by disease, its bulk generally diminishes, and the muscles become emaciated. Nearly as soon as the least degree of lameness can be perceived, the leg and thigh have actually wasted, and their circumference has diminished.

If the surgeon make pressure on the front of the joint, a little on the outside of the femoral artery, after it has descended below the os pubis, great pain will be experienced.

"Soon after the commencement of the complaint (as Sir B. Brodie remarks), the hip-joint is found to be tender, whenever pressure is made on it, either before or behind. The absorbent glands become enlarged, and occasionally there is a slight degree of general tumefaction in the groin." The same gentleman has also adverted to the curious circumstance of there being in some cases a tenderness of the parts, to which, though not diseased themselves, the pain is referred from sympathy with the disease of the hip. This occurrence he has observed in the knee several times, and in one instance in the course of the peroneal nerve. He has also seen a slight degree of puffy swelling of the knee in a case, in which pain was referred to this joint, in consequence of disease of the hip. (P. 142, 143.)

The limping of the patient is a clear proof that something about the limb is wrong, and, if such limping cannot be imputed to diseased vertebrae, or some recent accident, and if, at the same time, the above-mentioned emaciation of the limb exists, there is great cause to suspect, that the hip is diseased, particularly, when pressing the front of the acetabulum causes pain.

Diseased vertebrae, perhaps, always produce a paralytic affection of both legs at once, if they produce it at all, and they do not cause painful sensations about the knee, as the hip disease does.

The increased length of the limb, in the early stage of the present disease, is a very remarkable occurrence. This symptom is easily detected by a comparison of the condyles of the os femoris, the trochanter major, and malleoli, of the diseased limb, with those parts of the opposite member, care being taken that the patient's pelvis is evenly situated. The thing is the more striking, as the increased length of the member is frequently as much as four inches. The rationale of this fact, John Hunter used to explain, by the diseased side

of the pelvis becoming lower than the other. (*Crowther*, p. 266.) The same thing had also been noticed by Falconer (*On Ischias*, p. 9.); and this, long before the period when Mr. Crowther printed his second edition. According to Sir B. Brodie, it is easy to understand how the crista of one ilium becomes visibly depressed below the level of the other, when the position is remembered, in which the patient places himself when he stands erect. "He supports the weight of his body upon the sound limb, the hip and knee of which are in consequence maintained in the state of extension. At the same time, the opposite limb is inclined forward, and the foot on the side of the disease is placed on the ground considerably anterior to the other, not for the purpose of supporting the superincumbent weight, but for that of keeping the person steady, and preserving the equilibrium. Of course this cannot be done without the pelvis on the same side being depressed. The inclination of the pelvis is necessarily attended with a lateral curvature of the spine, and hence one shoulder is higher than the other, and the whole figure in some degree distorted. These effects are in general all removed by the patient's lying in bed a few weeks, except when the deformity has continued a long time in a young growing subject. (*Pathol. Obs.* p. 146.)

In justice to the memory of the late respected Dr. Albers, of Bremen, I ought here to mention that he appears in his work on *Coxalgia*, to have first pointed out the deformity of the spine in this disease, and the reason of such change, the tenor of his observations upon this point agreeing with those subsequently made by Sir Benjamin Brodie. Putting out of consideration the alteration in the position of the pelvis, Mr. Coulson states, that the greatest extent to which real lengthening of the limb can take place, without destruction of the round ligament, is a little more than an inch. (*On Dis. of Hip-joint*, p. 54.) It would seem, from a passage quoted by this gentleman, that Palletta described the tense condition of the ligamentum teres both in the flexed, and pendulous state of the limb.

An appearance of elongation of the limb is not exclusively confined to the early stage of morbus coxarius: it may attend other cases. I remember in one of the wards of St. Bartholomew's Hospital, a little girl with a diseased knee, whose pelvis was considerably distorted in this manner, so that the limb of the same side appeared much elongated. Her hip-joint was quite sound. This case was pointed out to Mr. Lawrence and myself by Mr. Cother, of Gloucester.

Volpi, Albers, and others, dwell upon the fact, that the early stage of this disease is sometimes attended with an appearance of elongation, sometimes with that of a shortening of the limb. An explanation of the circumstance is given by Sir B. Brodie, as follows:—"In a few cases, where the patient is in the erect position, it may be observed, that the foot which belongs to the affected limb, is not inclined more forward than the other, but the toes only are in contact with the ground, and the heel raised, at the same time that the hip and knee are a little bent. This answers to the patient the same purpose of enabling him to throw the weight of his body on the other foot; but it produces an inclination of the pelvis in the

opposite direction. The crista of the ilium is higher than natural, and there is an apparent shortening, instead of elongation of the limb on the side of the disease." (*Pathol. and Surg. Obs.* p. 147.)

Another writer thinks it probable, that the head of the bone may occasionally be drawn by the muscles to the upper edge of the acetabulum, and the already lengthened limb shortened, without the head of the femur being pushed back into the acetabulum. (See *W. Coulson*, *Op. cit.* p. 55.) It is added, that, in this case, the shortening is never so considerable as in a later stage.

The late Mr. Ford called the attention of surgeons to the alteration, with respect to the natural fullness and convexity of the nates, that part appearing flattened, which is usually most prominent. The glutæus magnus becomes emaciated, and its edge no longer forms so bold a line as it naturally does at the upper and back part of the thigh, in the sound state of the limb.

Although this symptom, in combination with others, is of importance to be attended to, it has been explained by Sir Benjamin Brodie, that "it is not in itself to be regarded as a certain diagnostic mark of disease in the hip; since, in its early stage, this symptom is wanting; and it is met with in other diseases, in which the muscles in the neighbourhood of the hip are not called into action, although the joint itself is unaffected" (See *Med. Chir. Trans.* vol. vi. p. 322.)

Though there may be more pain about the knee than the hip, at some periods of the malady in its incipient state, yet, the former articulation may be bent and extended, without any increase of uneasiness; but the os femoris cannot be moved about, without putting the patient to immense torture.

The patient soon gets into the habit of bearing the weight of his body chiefly upon the opposite limb, while the thigh of the affected side is bent a little forward, that the ground may only be partially touched with the foot. This position is found to be the most comfortable, and every attempt to extend the limb occasions an increase of pain.

This is the first stage of the disease, or that which is unaccompanied with suppuration.

The symptoms, which precede the formation of pus, vary in different cases, according as there is acute, or chronic inflammation present. When the diseased joint is affected with acute inflammation, as generally happens, the surrounding parts become tense and extremely painful; the skin is even reddish; and symptoms of inflammatory fever prevail. When the severity of the pain abates, a swelling occurs in the vicinity of the joint, and a pointing quickly follows. In this stage, startings and catchings during sleep are said to be among the most certain signs of the formation of matter. "The shortening of the limb, which mostly takes place in the advanced stage of the disease, is usually, but not always, the precursor of abscess. The formation of matter is also indicated by an aggravation of the pain; by more frequent spasms of the muscles, by greater wasting of the whole limb, and by the circumstance of the thigh becoming bent forward, and being incapable of extension," and by the pulse becoming quick, the tongue furred, and the whole system being in a state of

preternatural excitement. "The abscess usually shows itself in the form of a large tumour over the vastus externus muscle; sometimes on the inside of the thigh, near the middle: and occasionally two or three abscesses appear in different parts and burst in succession." (*Brodie's Pathol. Obs.* p. 152.)

I have noticed the lengthened state of the limb, in the first period of the hip-disease. This condition is not of very long duration, and is sooner or later succeeded by a real shortening of the affected member. "In the very advanced stage of the disease, when the head of the femur has been completely destroyed by ulceration, there is nothing to prevent the muscles from pulling the bone upwards. This may be compared to a case of fractured neck of the femur. The limb is not only apparently but really shortened. The foot may be turned inwards; but, if left to itself, it is generally turned outwards. In other cases, the limb is shortened; the thigh is bent forwards; the toes are turned inwards, and do not admit of being turned outwards." (*Sir B. Brodie, Pathol. Obs.* p. 129. ed. 3.) and all the symptoms of a luxation upwards and outwards may be observed, the head of the bone, indeed, being actually drawn into the external iliac fossa, and carried betwixt the os innominatum and glutæus minimus, which is raised up by it. (*See Richerand, Nosogr. Chir.* t. iii. p. 171, 172. ed. 2.)

In one case, dissected by Sir B. Brodie, "the head of the femur was lodged on the dorsum of the ilium. The capsular ligament and synovial membrane were much dilated; and, at the superior part, their attachment to the bone was thrust upwards, so that, although the head of the bone was no longer in the acetabulum, it was still within the cavity of the joint." (*Op. cit.* p. 130.) In Mr. Coulson's work is an excellent drawing, taken from a case of dislocation of the head of the femur on the dorsum of the ilium from the effects of disease. (*On the Dis. of the Hip-joint*, pl. 6. 4to. Lond. 1837.) In rarer cases, the head of the femur, after being dislodged, has been drawn downwards and inwards on the foramen ovale. In still rarer cases, the head of the femur is drawn forward, and rests on the pubes, the knee and toes being turned outwards. (*See IV. Coulson on Dis. of the Hip-joint*, p. 40.)

In some cases, indeed, the shortened state of the limb arises from nothing less than an actual dislocation of the head of the thigh-bone, in consequence of the destruction of the cartilages, ligaments, and articular cavity. This retraction sometimes comes on long before any suppuration takes place. The head of the bone may be dislocated, and the disease terminate in ankylosis, without any abscess whatever. However, if suppuration has not taken place, Sir B. Brodie believes it rarely happens, that the limb, after the cure, does not regain its natural degree of mobility. (*See Med. Chir. Trans.* vol. vi. p. 325.)

In University College Museum is a fine specimen of the termination of the disease in a new joint, the articular cavity being formed in the upper portion of the femur, and a new ball on the ilium. The old acetabulum is nearly obliterated, and near it, within the pelvis, the remains of the cyst of an abscess. I obtained this preparation from a woman who died in the neighbourhood of

University College Hospital: I believe it to be the only one of the kind in London.

When a dislocation happens, it is almost always upwards and outwards. A case is related by Cocchi, in which a spontaneous dislocation of the thighbone, as it is termed, happened upwards, forwards, and a little inwards. (*See Lezeulé, Nouvelle Doctrine Chir.* t. iii. p. 595.) On a également vu la tête du fémur luxée en dedans et en bas, et placée sur le trou obturateur, mais cette mode de déplacement consécutive, dans lequel le membre est allongé, est infiniment rare. (*Richerand, Nosogr. Chir.* t. iii. p. 172.)

A case is mentioned by Mr. Earle, in which the head of the bone was dislocated into the ischiatic notch. (*See Coulson on Dis. of Hip*, p. 60.) In the Museum of the College of Surgeons in London is a preparation, in which the head of the femur is dislocated from the effects of disease into the foramen ovale. Other instances of it are mentioned by Mr. Coulson (*Op. cit.* p. 61.), Boyer, and Sir B. Brodie.

Mr. Coulson attended a young woman, whose thigh-bones were both dislocated from disease, and who could walk about very well; and Mr. Wickham has recorded a similar case, in which the limbs are represented in the everted position, so that I infer that the new joints are formed on the ossa pubis.

A real shortening of the limb often takes place without dislocation. A late writer states, that "dislocation from disease in the hip-joint is of rare occurrence, and can only happen when the ring of the acetabulum is broken down by absorption, or the head of the femur so lessened as to allow of a wider range to its movements in the socket, by which a slight degree of irregular action may displace it." He further suspects, that as the head of bone diminishes, it is closely drawn into the acetabulum. (*See Wickham on Dis. of Joints.*)

A fact, mentioned by Mr. Coulson, fully proves that a dislocation is less common than was once supposed. "There are (says he) now in the Infirmary thirty-four cases, two only of which are in second, and none in the first stage. In thirty of these cases, the toes of the affected limb are slightly everted, and in the remaining four inverted." (*Op. cit.* p. 58.) When a dislocation takes place on the dorsum ili, the usual situation, the limb must be inverted, and it may then be shortened to the extent of nearly four inches.

Mr. Liston observes, that the shortening and deformity do not in general arise from that cause, but from the femur being a little drawn up by the action of the muscles, and loss of substance in the head and neck of that bone, and a corresponding destruction of the acetabulum.

The hip-disease generally induces hectic symptoms, after it has existed a certain time. In some subjects, they soon come on; in others, the health remains unaffected a considerable time.

"The health of the patient usually suffers, even before abscesses have formed, from the want of exercise, pain, and particularly from the continued disturbance of his natural rest. I recollect no instance of an adult, in whom abscesses had formed, who did not ultimately sink exhausted by the hectic symptoms which these induced. Children may recover in this ultimate stage of the

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disease; but, seldom without a complete ankylosis of the joint." (Sir B. Brodie, in *Med. Chir. Trans.* vol. vi. loco cit.)

Some subjects, previously to the fatal termination, become dropsical. This was exemplified in a girl, a patient of mine, at the Broomsbury Dispensary. In a young lady whom I attended at Walthamstow with Sir A. Cooper, and Dr. Blicke, and who died in the suppurative stage of the hip-disease, the lungs were tuberculated. In many scrofulous cases, the mesenteric glands are found diseased.

When abscesses of the above description burst, they continue, in general, to emit an unhealthy thin kind of matter for a long time afterwards; and sometimes portions of bone exfoliate from time to time.

With respect to the morbid anatomy of the disease in its incipient state, until lately little was known. A few years ago two dissections related by Mr. Ford, were, perhaps, the only ones throwing light upon this point. In one, there was a teaspoonful of matter in the cavity of the hip-joint. The head of the thigh-bone was somewhat inflamed, the capsular ligament a little thickened, and the ligamentum teres united in its natural way to the acetabulum. The cartilage, lining the cotyloid cavity was eroded in one place, with a small aperture, through which a probe might be passed, underneath the cartilage, into the internal surface of the os pubis on one side, and on the other, into the os ischii; the opposite, or external part of the os innominatum showing more appearance of disease, than the cotyloid cavity. In the other instance, the disease was more advanced. These examples are important, inasmuch as they prove, that what is commonly called the disease of the hip-joint, primarily affects the cartilages, ligaments, and bones, and not the surrounding soft parts.

As the disorder advances, the portions of the os ischium, os ilium, and os pubis, composing the acetabulum, together with the investing cartilage, and synovial gland, are destroyed. The cartilage covering the head of the os femoris, the ligamentum teres, the synovial membrane, and the capsule of the joint, suffer the same fate, and caries frequently affects not only the adjacent parts of the ossa innominata, but also the head and neck of the thigh-bone. The bones of the pelvis, however, are always more diseased than the thigh-bone, a fact which displays the absurdity of ever thinking of amputation in these cases. Mr. Ford observes, "In every case of disease of the hip-joint, which has terminated fatally, I have remarked that the os innominatum has been affected by the caries in a more extensive degree than the thigh-bone itself." (*Obs. on the Disease of the Hip-joint*, p. 107.)

Sometimes, however, the head and neck of the thigh-bone are annihilated as well as the acetabulum.

Sir B. Brodie has had opportunities of dissecting some diseased hip-joints both in the incipient and advanced stage of the complaint. From his observations, it appears, 1st, That the disease commences with ulceration of the cartilages, generally that of the acetabulum first, and that of the femur afterwards. 2dly, That the ulceration extends to the bones, which become carious; the head of the femur diminishing in size, and the ace-

tabulum becoming deeper and wider. 3dly, That an abscess forms in the joint, which after some time makes its way by ulceration through the synovial membrane and capsular ligament, into the thigh and nates, or even through the bottom of the acetabulum into the pelvis. Sir A. Cooper showed Sir B. Brodie two specimens, in which the abscess had burst into the rectum. Sometimes the matter makes its way through the acetabulum into the pelvis, or even into the vagina. Some years ago, there was, in the London Hospital, a case, in which both hips were affected, and the abscesses communicated with the cavity of the pelvis through the acetabula. (See *Scott on Chronic Inflammation*, &c. p. 106.) In the Museum of University College is a beautiful specimen, in which the head of the femur has passed through the bottom of the acetabulum into the pelvis. In a case, under Dr. Mackenzie of Glasgow, a lad of sixteen died of enormously enlarged liver; but, on dissection, a communication was found through the bottom of the acetabulum, between the cavity of the hip-joint and the colon, smooth, as if of long standing. Another sinus, communicating with the joint, led into the thigh. In Mr. Liston's collection is a specimen of extensive destruction of the acetabulum, head and neck of the femur, with several sinuses leading from the joint; and one, in particular, of large size, leading towards the rectum through the foramen ovale. There is also the rectum, with a rounded aperture, sufficient to admit the point of the little finger, about an inch and a half above the anus. (See *W. Coulson on Dis. of Hip-joint*, p. 40.) 4thly, In consequence of the abscess, the synovial membrane and capsular ligament become inflamed, and thickened. The muscles are altered in structure; sinuses are formed in various parts, and, at last, all the soft parts are blended together in one confused mass, resembling the parietes of an ordinary abscess. (*Med. Chir. Trans.* vol. iv. p. 246, 247.)

Sometimes the pus is healthy; sometimes fetid, sanious, and black. In the latter case, small portions of bone sometimes exfoliate. "Even the head of the bone has been known to come away almost entire." (See *Coulson*, *Op. cit.* p. 63.)

Such are the beginning and progress of the ordinary disease of the hip-joint; but it is admitted by Sir B. Brodie, that there are other scrofulous cases, in which the mischief begins in the cancellous structure of the bones, and also other instances which consist in chronic inflammation and abscesses of the soft parts in the neighbourhood of the hip. (*Op. cit.* vol. vi. p. 326.)

The cases, which Mr. Key has had the opportunity of examining, lead him to believe, that the ulceration of the cartilage is preceded by inflammation of the ligamentum teres. (See *Med. Chir. Trans.* vol. xviii. p. 230.)

External violence; lying down on the damp ground in summer time; and all kinds of exposure to damp and cold; are the exciting causes to which the disease has sometimes been referred. In almost all the cases which I have attended, the patients were decidedly scrofulous.

According to Mr. Key, the observation of this disease in its different stages, and of the mode in which it is brought into action, together with the *post mortem* appearances, affords strong proof, that "at least, in many instances, the action is propagated from the ligament to the cartilage, and

that ulceration of the latter is consequent upon inflammation of the former. The beginning of the affection is frequently to be traced to a fall, by which the legs have been forcibly separated, and the ligamentum teres stretched. In some cases, the injury has been so considerable as to occasion the patient to rest the limb for some days, on account of the severity of the pain. This to a certain extent subsides, and the inflammation that remains assumes the chronic form. If the patient's health is good, he recovers with only a slight temporary weakness in the joint; in the more feeble habit, with a tendency to strumous action, the disease gradually passes into the ulcerative form. Sometimes, from the tender age of the child, no cause can be assigned for the disease; perhaps, in some instances, it may have a purely constitutional origin." (See *Med. Chir. Trans.* vol. xviii. p. 231.)

Treatment of the Disease of the Hip-joint.—The writings of Hippocrates, Celsus, Cælius Aurelianus, &c. prove, that the ancients treated the present disease much in the same way as it is treated by the moderns. Forming an eschar, and keeping the sore open; topical bleeding; cupping, fomenting the part, &c. were all proceedings adopted in the earliest periods of surgery. Drs. Charlton, Oliver, and Falconer, have spoken of Bath water, as a most efficacious application to diseased hip-joints, previously to the suppurative stage. However, had not their accounts been exaggerated, all patients of this kind would long ago have flocked to Bath, and the surgeons in other places would never have had further occasion to adopt a more painful mode of treatment. The plan pursued at Bath, is to put the patient in a warm bath, two or three times a week, for fifteen or twenty-five minutes.

In the first stage of coxalgia, the late Dr. Albers, however, had a high opinion of warm bathing, fomentations, and of bathing in mineral waters and the sea. But though he commenced the treatment with the frequent use of the warm bath, and continued the plan a long while, he combined with it an issue. After the patient had been in the bath a period not exceeding half an hour, he was taken out and his whole body well rubbed with flannel.

It seems to Mr. Coulson that the period, at which the patients derive most benefit from the sea-side, is either at the commencement of the disease, before much inflammatory action has begun, or in a later stage, when the abscesses are discharging, and the health is impaired. "The patient commences with a warm salt water bath, about three times a week, at the temperature of 98°, and is directed to remain in it from fifteen to twenty minutes each time; afterwards the tepid bath is used, and then, dependent on the state of the weather, and the health of the patient, the cold bath is employed, one dip only in the sea being allowed each time. The time selected for bathing is in the morning. The cold or warm *douche* bath is often used in this stage of the complaint, and with very good effect." Cold sea-bathing is forbidden in cases complicated with a delicate state of the lungs. (*Op. cit.* p. 88.) In the early stage of serofulous disease of the hip, unattended with acute inflammation, Mr. Coulson is an advocate for mild purgatives, moderate exercise in the open air, sea-bathing, hydriodate of potash, and light nutritious diet.

In the early period of the disease, entire rest, the application of fomentations, and the employment of topical bleeding, particularly cupping, are highly proper. Such practice is judicious, while symptoms of inflammation prevail. When fomentations are not applied, the *lotio plumbi acetatis* may be used.

Some practitioners give calomel and opium, so as to affect the mouth, or colchicum combined with alkaline aperients, if mercury cannot be borne. (*Coulson on Dis. of Hip-joint*, p. 80.) Mr. Liston, with the view of assisting the local means, prescribes diaphoretics, such as antimony joined with morphia. For the purpose of subduing the force of the circulation, he occasionally prescribes a solution of 4 grs. of extract of aconite in 8 oz. of water, of which two table spoonfuls are taken every four or six hours. He observes, that "it often has a wonderful effect in subduing inflammatory fever, causing perspiration, and cessation of pain." Of the efficacy of this plan, I cannot speak from my own experience.

With respect to rubbing the joint with the ointment of aconitina, grs. vj. to 3vj. of lard, see *Coulson, Op. cit.* p. 82. I apprehend that the friction, unless very gently conducted, would be objectionable.

"When the cartilages of the hip are ulcerated, the patient should, in the first instance, be confined to a couch, if not to his bed; and if the disease is far advanced, the limb should be supported by pillows properly disposed, so as to favour the production of an anchylosis, by allowing it to vary as little as possible from one position." (*Sir Benjamin Brodie, in Med. Chir. Trans.* vol. vi. p. 335.) In serofulous cases commencing in the cancellous textures of the bones, he does not entertain any confidence in the usefulness of blisters and issues.

Quibus diuturno dolor (says Hippocrates) *ischiadico reatis cora exidit, is femur contabescit et claudicant nisi urantur*. Forming an eschar, or issue, is one of the most efficacious plans of treating the disease even now known. A caustic issue seems to me more beneficial than a blister. The depression just behind and below the trochanter major is the situation in which surgeons usually make the issue, and the size of the eschar should be nearly as large as a crown piece. In general, it is necessary to keep the issue open a long time.

For the cure of the disease in adults, Sir B. Brodie and Dr. Albers express a preference to caustic issues; but in children, and even in grown-up persons, when the complaint is recent, they agree in thinking blisters capable of affording complete relief. Sir B. Brodie states, that, in these cases, they are more efficacious when kept open with the savine ointment, than when repeatedly applied. With respect to issues, he acknowledges, that behind the great trochanter, is the most convenient place for them; but, he believes, that they have more effect when made on the outside of the joint, on the front edge of the tensor vaginæ femoris muscle. Instead of keeping the issue open with beans, Sir B. Brodie has found it a more effectual practice to rub the sore two or three times a week with the *potassa fusa*, or sulphate of copper. In particular cases, where the pain was very severe, this gentleman made a seton in the groin, over the trunk of the anterior crural nerve, which plan, he says, af-

fords quicker relief, though, in the end, it is less to be depended upon for a cure, than caustic issues.

In Dr. Albers's work, the great efficacy of issues and blisters, in giving immediate relief to the severe pain in the knee, is illustrated by some valuable observations. He speaks favourably of the moxa, the employment of which he says is not very painful; a remark in which Langenbeck concurs. (See *Bibl.* b. ii. p. 27.) Dr. Albers, in the hectical stages, recommends opium as highly useful, especially when combined with musk or camphor.

When the intensity of the inflammation has been in some degree subdued, Mr. Coulson applies a blister; and, if necessary, several blisters in succession, in preference to keeping one open. In the chronic stage, he has recourse to the camphor or ammonia liniment, joined with tinct. cantharidum; or to antimonial ointment, or strong mercurial ointment, with which iodine and tartrate of antimony are blended. In this stage, however, he deems Mr. Scott's plan most serviceable, unless there be a large abscess near the joint; in which case it fails to bring about absorption of the matter, and causes it to spread. But when a discharge from sinuses is going on, he considers the support and action of the plaster as useful. (*Op. cit.* p. 84.)

The occurrence of suppuration makes a vast difference in the prognosis. "The formation of even the smallest quantity of pus in the joint, in cases of this disease, in the young persons, considerably diminishes, and in the adult, almost precludes the hope of ultimate recovery." (*Brodie*, in *Med. Chir. Trans.* vol. vi. p. 347.) This gentleman is not much in favour of opening the abscesses early, at least, before the joint has been kept for some time perfectly at rest. He has seen no ill consequences arise from the puncture of the lancet remaining open, and he has not found that, in cases of carious joints, the method of evacuating the matter, recommended by Mr. Abernethy (see *LUMBAR ABSCESS*), is attended with any particular advantage.

Mr. Scott treats this disease on the same principles as white swelling and other chronic inflammations; viz. after having brought the joint into a quiet state by means of aperient medicines, topical bleeding, quietude, &c., he covers the skin with pledgets of the emplastrum saponis and strong camphorated mercurial ointment in equal proportions. These are next covered with strips of adhesive plaster, over which is laid some large pieces of soap-plaster spread on thick leather. The whole is then supported with a bandage, and allowed to remain on the part a week, or two, according to the circumstances already detailed in the section on white-swelling. (See *Scott on Chronic Inflammation*, p. 227. &c.)

In the second stage, if there be much pain and constitutional irritation, antiphlogistic means are employed, together with saline and antimonial medicines, purgatives, low diet, perfect rest, and, in severe cases, local bleeding, mercury with opium, and mercurial frictions with iodine. If these means fail, a blister is applied to the back of the hip. In this stage, Mr. Coulson has long renounced the employment of issues, setons, moxæ, and the cautery, as he considers, that the same amount of relief may be derived from a blister, or the use of

mercurial ointment with iodine and tartar emetic. He approves of Mr. Liston's mode of keeping the limb at rest, by means of slips of patent lint, dipped in a strong solution of gum arabic, which is laid upon the parts previously greased. Several layers of dry lint are added, and the whole is confined with a bandage. When the composition dries, a firm case, exactly fitting the parts, from the knee to the false ribs, is formed. For weak and strumous subjects, Mr. Coulson recommends gentle mercurial alteratives, with sarsaparilla in lime water, or joined with small doses of hydriodate of potass and iodine, or liq. potassæ.

In the stage of caries and suppuration, the limb is to be kept at rest, but no attempts are to be made to get the limb straight, until the local and constitutional irritation has subsided. (*Coulson*, *Op. cit.* p. 94.)

The same writer particularly recommends attempting to bring about the absorption of purulent matter by means of the external and internal use of iodine. He notices the practice of Sir Astley Cooper, with reference to abscesses, connected with diseased joints, which is to postpone the opening of them as long as possible. If the abscess be opened early, the cavity of the joint is exposed to irritation; whereas, if the abscess be suffered to extend far from the joint, and then opened, much irritation of the joint will not be produced by it.

When the disease appears to be checked, and there is a prospect of ankylosis, the limb should be brought as nearly as can be managed into the straight position, and even moderate extension employed as Sir B. Brodie recommends, for the purpose of resisting the retraction of the limb by the muscles. An upright piece of wood, furnished with a pulley, is fixed to the foot of the bedstead; a bandage is placed round the thigh, just above the condyles, and a cord fastened to it, and a small weight suspended over the pulley.

I have known so many instances of a return of the hip disease after it had been for a considerable time apparently cured, and this from accidental blows and rough exercise of the limb, that I always recommend children who have had an attack of morbus coxarius, not to be sent to school, nor to be allowed to follow rough exercises.

Mr. J. Burns, in the second volume of his *Dissertations on Inflammation*, p. 311., has recorded a remarkable instance, in which this joint was affected with that intractable and fatal distemper, fungus hematodes. The case was at first supposed to be the disease of which we have just been treating in the preceding columns. The limb seemed to be elongated, and issues were employed without any material benefit. The upper part of the thigh swelled, while the lower wasted away. The patient lost his appetite, had a quick pulse, and passed sleepless nights. The part was rubbed with anodyne balsam, and laudanum given every night; but these means were only productive of temporary benefit. After some months, a difficulty of making water came on, which ended in a complete retention. It being found impracticable to introduce a catheter, and a large elastic tumour, supposed to be the distended bladder, being felt within the rectum, a trocar was pushed into the swelling. A good deal of bloody fluid was thus discharged. After

wards, a considerable quantity of high-coloured fetid urine continued to escape from the urethra. In about a week after this operation, the patient died.

On dissection, Mr. Burns found the hip-joint completely surrounded with a soft matter, resembling brain, enclosed in thin cells, and here and there other cavities, full of thin bloody water, presented themselves. The acetabulum and head of the os femoris, were both carious. The muscles were quite pale, and almost like boiled liver, having lost their fibrous appearance. The same kind of substance was found in the pelvis, and most of the inside of the affected bones was carious. Large cells containing bloody water, were observed in the diseased substance, and it was into one of these cavities, that the trocar had entered when the attempt was made to tap the bladder.

For a further account of malignant diseases of the joints, I must refer to Sir B. Brodie's valuable publication.

J. G. Widdmann, *De Genuum Structura eorumque Morbis*. Helmstad, 1744 (*Haller*, *Disp. Chir.* iv. 489). Ford's Obs. on the Dis. of the Hip-joint, 8vo. Lond. 1794. Doerner, *De Gravioribus quibusdam Cartilaginum Mutationibus*, 8vo. Tubingæ, 1798. B. Crowther on White-Swelling, &c. ed. 2. 1808. J. Burns on Inflammation, vol. ii. p. 311. Wm. Falconer on Ischia, and the Use of Bath Waters, 8vo. Lond. 1805. Russell on Morbid Affections of the Knee, 8vo. Edinb. 1802. H. Park, A New Method of treating Dis. of the Knee and Elbow, 8vo. Lond. 1783. J. A. Aberra, *Abhandlungen über die Coxalgie, oder das sogenannte freywillige Hinken der Kinder*, 4to. Wien, 1807. (This work includes many valuable remarks.) G. Wirth, *De Coxalgia*, 12mo. Wienn. 1809. *Paletta, Adversaria Chir.* Prima, 4to. Hey's Practical Obs. in Surgery, p. 354, &c. ed. 3. Boyer, *Traité des Mal. Chir.* t. iv. Paris, 1814. *Hernardus, De Tumore Ligamentorum circa Articul. Fungo Articuli dicto. Leyde, 1767. Brambilla, in Acta Acad. Med. Chir. Vindob.* t. i. Sir Benj. Brodie's Pathological Researches respecting the Diseases of Joints, in vols. iv. and vi. of the *Med. Chir. Trans.*—Also his Pathological and Surgical Obs. on the Joints, 8vo. Lond. 1818, and three subsequent editions;—a work containing correct and original information; and, in my estimation, the most scientific book ever published on the subject. Schreger, *Chirurgische Versuche*, b. ii. p. 299, &c. Beiträge zur Nosologie der Gelenkrankheiten, 8vo. Nürnberg, 1818. J. N. Rust, *Arthrokologie oder über die Verrenkungen durch innere Bedingung*, 4to. Wien, 1817;—a publication of great merit. Tomaso Falpi, *Abhandl. über die Coxalgie*, aus dem Ital. übersetzt von Dr. P. Hencken. Langenbeck, Neue Bibl. b. ii. p. 337. G. Gots, *De Morbis Ligamentorum*, 4to. Berol. 1799. Delpech, *Précis Elém. des Mal. Chir.* t. ii. p. 377. t. iii. p. 194. 470. 711. &c. Paris, 1816. H. Mayo on an Acute Form of Ulceration of the Cartilages of Joints, in *Med. Chir. Trans.* vol. ii. p. 104, and vol. xix. J. Wilson on the Structure and Physiology of the Skeleton, and Dis. of Bones and Joints, 8vo. Lond. 1820. E. A. Lloyd on the Nature, &c. of Scrofula, 8vo. Lond. 1821. Alex. Manson on the Effects of Iodine in Bronchocele, Paralysis, Chorea, Scrofula, White-Swelling, &c. 8vo. Lond. 1825. John Scott on Chronic Inflammations in various Structures, particularly as exemplified in Diseases of the Joints, 8vo. Lond. 1828. Thos. Buchanan on Diseased Joints, and the Non-union of Fracture, 12mo. Lond. 1828. W. J. Wickham on Dis. of the Joints, 8vo. Winchester, 1833. W. Coulson on Dis. of the Hip-joint, 4to. Lond. 1837. with Plates.

JOINTS, EXCISION OF. This operation consists in the removal of the parts of bones, entering into the formation of a diseased joint, together with the whole of the capsular ligament and synovial membrane. It has a two-fold object: the first is to remove a formidable disease; and this might be effected by amputation; the second is to preserve a useful limb; and this amputation could not effect. The fact in morbid anatomy, in which the proposal mainly rests, is, that, in the large majority of the ulcerative diseases of joints, the bone is either primarily affected, or

becomes so secondarily." (See *Blackburn*, in *Guy's Hospital Reports*, vol. i. p. 277.)

Whether a passage, quoted by M. Velpeau, from Hippocrates, refers to the complete excision of joints, as sometimes practised at the present day, is doubtful. As Mr. Blackburn observes, it may only allude to the removal of the ends of bones in compound dislocations. The record of the first actual performance of the operation, is to be found in a note appended by Mr. Park, of Liverpool, to a collection of pamphlets on this subject, published by Dr. Jeffray, of Glasgow, in 1805. It is there stated, that in 1762, Mr. Filkin, of Northwich, in Cheshire, in a case of diseased knee, removed the patella, along with the articular extremities of the femur and tibia. A similar operation was performed on the shoulder, in 1767, by M. Vigaroux, of Montpellier. (*Œuv. de Chir. Pratique*, Montpellier, 1812.) In 1769, Mr. White, of Manchester, removed the diseased head of the humerus; and with such success, that the patient could afterwards carry heavy weights, and regained every motion of the arm. (See *White's Cases and Obs. Phil. Trans.* vol. lix.) In 1771, White's practice was imitated by Mr. Bent, of Newcastle; and a few years afterwards, by Mr. Orrel, of Chester. (See *Phil. Trans.* vols. lxi. and lxix.) With the exception of Mr. Filkins's case, however, in all these examples only one articular surface was removed. (See *AMPUTATION*.) The merit of suggesting the operation, as defined in the first sentence of this article, unquestionably belongs to Mr. Henry Park, of Liverpool. In a letter to Mr. Pott, dated 1782, Mr. Park made the proposal of totally extirpating many diseased joints, by which the limbs might be preserved, with a share of motion that would still allow them to be very useful. In order to learn whether the popliteal vessels could be avoided, without much difficulty, in the excision of the knee, Mr. Park made an experiment on the dead subject. An incision was made, beginning about two inches above the upper end of the patella, and extending about as far below its lower part. Another one was made across this at right angles, immediately above the patella, down to the bone, and nearly half round the limb, the leg being in an extended state. The lower angles formed by these incisions were raised, so as to lay bare the capsular ligament; the patella was then taken out; the upper angles were raised, so as fairly to denude the head of the femur, and to allow a small catling to be passed across the posterior flat part of the bone, immediately above the condyles, care being taken to keep one of the flat sides of the point of the instrument quite close to the bone all the way. The catling being withdrawn an elastic spatula was introduced in its place, to guard the soft parts, while the femur was sawn. The head of the bone, thus separated, was carefully dissected out; the head of the tibia was then with ease turned out, and sawn off, and as much as possible of the capsular ligament dissected away, leaving only the posterior part covering the vessels, which, on examination, had been in very little danger of being wounded.

The next attempt was on the elbow: a simple longitudinal incision was made from about two inches above, to the same distance below, the point of the olecranon. The integuments having been raised, an attempt was made to divide the

lateral ligaments, and dislocate the joint; but this being found difficult, the olecranon was sawn off, after which the joint could be easily dislocated, without any transverse incision, the lower extremity of the os humeri sawn off, and afterwards the heads of the radius and ulna. This appeared an easy work; but Mr. Park conceives the case will be difficult in a diseased state of the parts, and that a crucial incision would be requisite, as well as dividing the humerus above the condyles, in the way done with respect to the thigh-bone.

Mr. Park first operated, July 2. 1781, on a strong, robust sailor, aged 33, who had a diseased knee, of ten years' standing. The man's sufferings were daily increasing, and his health declining. Mr. Park wished to avoid making the transverse incision, thinking that, after removing the patella, he could effect his object by the longitudinal one; but it was found, that the difference between a healthy and diseased state of parts, deceived him in this expectation. Hence, the idea was relinquished, and the transverse incision made. The operation was finished exactly as the one on the dead subject related above. The quantity of bone removed was very little more than two inches of the femur, and rather more than one inch of the tibia. The only artery divided was one on the front of the knee, and it ceased to bleed before the operation was concluded, but the ends of the bones bled very freely. In order to keep the redundant integuments from falling inwards, and the edges of the wounds in tolerable contact, a few sutures were used. The dressings were light and superficial, and the limb was put into a tin case, sufficiently long to receive the whole of it, from the ankle to the insertion of the glutæus muscle.

I shall not follow Mr. Park throughout the treatment. Suffice it to remark, that the case gave him a great deal of trouble, and that it was attended with many embarrassing circumstances, arising chiefly from the difficulty of keeping the limb in a fixed position, the great depth of the wound, and the abscesses and sinuses which formed. On the other hand, however, the first symptoms were not at all dangerous. But the patient was obliged to keep his bed nine or ten weeks, and it was many months more before the cure was complete. The man afterwards went to sea, and did his duty very well.

Subsequently to the publication of the letter to Mr. Pott, another excision of the knee was performed by Mr. Park, on the 22d of June, but the event was unsuccessful, as the patient lingered till the 13th of October, and then died.

In 1783, the year following that of the publication of Mr. Park's pamphlet, the subject was brought before the Academy of Surgery in France, by M. Moreau. In 1786, this surgeon excised the head of the humerus and the glenoid cavity. In 1792, he operated on the elbow, and he and his son, several times, excised the articular surfaces of the knee, ankle, shoulder, elbow, and wrist. Their example was followed by Sommeilher and Baron Percy. In 1809, Mùkler, of Gröningen, cut out a knee-joint. (See *Wachter, Diss. de Articulis Extirpandis*; 1810.) In 1819, M. Roux, of Paris, performed the excision of the elbow. (See *Révue Méd.* 1830.) In 1823, the same operation was executed by Mr. Crampton, who has likewise excised the knee with success

(see *Dublin Hospital Reports*, vol. iv.); and in 1825 by Mr. Syme, who has excised the elbow in fourteen cases. The operation has since been repeated by these three surgeons; by Mr. Spence of Otley, in Yorkshire; by Dr. Simpson, of Edinburgh; by one of the surgeons of the Glasgow Infirmary (see *M^r Farlane's Clin. Reports*, &c.); by Mr. C. Aston Key (see *Blackburn*, in *Guy's Hospital Reports*, vol. i.); and in University College Hospital, by Mr. Liston. The operation has also been executed by MM. Champion and Mazozza (see *Velpéau, Nouv. Elém. de Méd. Opér.* t. i. p. 559.).

In the first elbow case operated upon, in 1782, by M. Moreau, the patient went on so favourably, that he was allowed to go about wherever he pleased, with his arm supported in a case. The limb was at first powerless, but it slowly regained its strength, and the man could ultimately thrash corn with it, and hold the plough. Seven months after another operation of the same kind, performed by M. Moreau the father, the patient was completely well, and in two years more, the flexion of the arm was very distinct. In another case the patient got well in six weeks, and in three months more joined his regiment.

In all Moreau's cases, the flexion and extension of the forearm were preserved, which circumstance, no doubt, depended very much on the insertion of the biceps not being destroyed. After the excision of the knee, however, the bones grew together.

Excision of the Elbow Joint.—The following is the plan of operating recommended by Mr. Syme, which is nearly the same as that practised by M. Moreau. The patient should lie with his face downwards, so as to present the posterior surface of the joint. The surgeon with a straight, narrow sharp-pointed knife, makes a transverse incision into the joint, close above the olecranon, and extending from the inner edge of this process to the external condyle. In doing this, care must be taken to avoid the ulnar nerve, which lies close to the inner side of the olecranon; and with this view, the safest plan is to introduce the knife perpendicularly into the joint, with its back directed towards the nerve. At each extremity of the transverse cut, the surgeon next makes an incision about an inch and a half long, both upwards and downwards, in the long direction of the limb, so as to form two square flaps, and give to the wound the shape of the letter H. These flaps being detached from the subjacent parts, the olecranon may be easily removed with the saw, or pliers, after which no difficulty will be experienced in cutting the lateral ligaments, making the end of the humerus protrude, and sawing it off above the condyles. The head of the radius may next be cut away with pliers, and then the excision of the sigmoid cavity of the ulna left after the removal of the olecranon, may easily be accomplished with the same instrument. "It might be thought better to take away all the ulna that required excision at once; but the attachment of the brachialis internus to the coronoid process, renders this very difficult, especially if it is attempted before the free space afforded by the removal of the other bones has been obtained." (See *Syme's Principles of Surgery*, p. 214. ed. 2. 8vo. 1837; also *Treatise on the Excision of Diseased Joints*, 8vo. Edinb. 1831.)

M. Moreau began the operation by making an incision, between two and three inches long, on each side of the joint, commencing about two inches above the condyles, and carried down in the direction of the ridges leading to them. These two wounds were next connected by a transverse incision through the skin, and tendon of the triceps, immediately above the olecranon; and the flaps were then raised.

As soon as the flaps have been raised, Dupuytren recommends us cautiously to open the sheath of the ulnar nerve, behind the internal condyle, and the nerve to be kept inwards and forwards by an assistant, with a bent probe, at the period when the humerus is to be divided. The preliminary removal of the olecranon as directed by the same eminent surgeon, is regarded by M. Malgaigne, as uselessly complicating the operation. (See *Manuel de Méd. Opér.* p. 241. ed. 2.)

When the flaps have been dissected, and the ulnar nerve drawn forwards in front of the inner condyle, the undivided soft parts are to be drawn in the same direction; the muscular fibres then detached from the bone with the point of the knife; a spatula, or flat piece of wood introduced in front of the humerus, and the bone sawn through from behind forwards. The lower piece of it is then to be inclined downwards and backwards, and separated from all its connexions, the anterior, external and internal lateral, and posterior ligaments being cut through in succession. As a thick muscle, the brachialis internus is interposed between the humerus and the artery, the avoidance of the vessel is never attended with any difficulty. If it be necessary to carry the incisions down to the forearm, as far as the bifurcation of the artery, this vessel is more exposed to injury. It is of great importance, if possible, to saw the ulna above the insertion of the brachialis, and more especially the radius above that of the biceps. Mr. Syme, however, has divided the bones lower down, and yet the use of the hand was preserved. (See *Velpeau Nouv. Elém. de Méd. Opér.* t. i. p. 563.)

Mr. Liston prefers a single perpendicular incision at the outer side of the joint, and the transverse one. An incision is made on the radial side of the ulnar nerve, and in the direction of the limb, by pushing the point of the knife through the integuments and fibres of the triceps to the back of the humerus, and carrying it in contact with the ends of that bone and the ulna for about three inches. Another incision, commencing over the outer condyle of the humerus, and penetrating to the articulation, is made to fall on the middle of this at right angles. The two flaps are reflected, and the soft parts, with the ulnar nerve are turned over the inner condyle. The ends of the bones but slightly retained by their ligaments, are turned out of the wound by bending the forearm. During the cutting of the bone, the spatula is of use in protecting the nerve or other soft parts. "A partial ankylosis will be found occasionally to have formed, and then the small saw, and cutting forceps may be called for. In operating upon young subjects, the cutting forceps may sometimes be used in preference to the saw, the bones being soft and extensive removal not demanded." After bringing the edges of the wound together with three sutures, Mr. Liston applies wet lint to the wound for a few hours, and then strips of plaster;

the sutures are soon removed, and the tepid water dressing employed. After a week or two, the limb, which has been kept half bent on a pillow, is secured in splints, and supported in a sling. (See *Liston on Pract. Surgery*, p. 140.)

"The elbow-joint, Mr. Blackburn observes, has been so frequently excised, that it would be alike useless and tedious to present an analysis of each operation. The two Moreaus record three cases, all successful; and state that they had operated several other times, and always with fortunate results. M. Roux counts three cases which have terminated favourably; and one which terminated unfavourably. (*Révue Méd.* 1830.) Mr. Syme numbers no less than nineteen operations, of which only two have been attended with unhappy results. (*On Excision of Joints, &c.*, in *Ed. Med. and Surg. Journ.* for 1832-33-4-5.) and Messrs. Key, Crampton, Champion, Spence, Simpson, and one of the surgeons to the Glasgow Infirmary, can each furnish a successful case. The operation is said to have been performed with fortunate results by Mazozza, in Italy; by Sommeiller, in France; and by Mr. Beard, of Newcastle. Altogether there are 32, of which histories have been given. Of these, three have been fatal; one patient dying at the end of five weeks, from the combined effects of phthisis, and of an enormous abscess of the hip; and the two others from accidents more immediately connected with the operation. Of the remaining twenty-nine, nearly all recovered the motion of the joint: in three or four, it remained stiff and rigid, principally from neglect of the instructions given as to exercise. In no one of these cases was the constitutional irritation that followed alarming. All the patients had been suffering for many months, or for years; the most approved methods of treatment had been tried unsuccessfully; and in many instances, eminent surgeons had recommended amputation. In a few, the recovery was very rapid; but, in the majority, some months elapsed before the joint could be pronounced to be quite sound, as one or two small sinuses remained open, though occasioning no annoyance. *The patients, in general returned to their previous occupations. One of Moreau's was accustomed to use his arm in thrashing, ploughing, &c., and one of Mr. Syme's wrote to him, two or three years after the operation, to say that his arm was strong enough to carry eighteen or twenty pounds weight with ease; that he could raise six or eight pounds to his head; and that he could write and perform any ordinary work, "so that no person would know (he says), whether I had my elbow, or was without it," &c. At the meeting of the British Association, held at Edinburgh in 1834, Mr. Syme produced several persons, on whom the operation had been performed along with the portions of bones removed, and Dr. Hodgkin, that the other members present were surprised and gratified by the strength and mobility which the new articulations had acquired. (See *Guy's Hospital Reports*, vol. i. p. 291—293.)

There is not, in reality, a new joint with a capsule formed, but the ends of the bones become connected by ligamentous fibres, and a sufficiently firm substance is produced to serve as a fixed point for the muscles, which execute the flexion and extension of the forearm. (See *A. Velpeau, Nouv. Elém. &c.* t. i. p. 564.)

Besides the cases above referred to, Mr. Liston has had others which proved successful, and one of them in University College Hospital.

In general, no vessel requires a ligature. One patient, under M. Roux, however, died of secondary hemorrhage—a solitary occurrence.

Mr. Syme recommends the wound to be closed with sutures, and a long figure of 8 bandage to be applied to support the limb, "which should be bent at a right angle, and to prevent the ends of the bones from moving, or pressing injuriously on the soft parts." Rigid cases of iron, or wood he deems less convenient. "The patient, after the first two or three days, will find himself most comfortable in the erect posture; and when the inflammatory tension begins to subside, he should gently, but diligently, exercise the limb, so as to preserve the mobility of the elbow." (See *Syme's Principles*, p. 215. ed. 2.)

In the five operations which Mr. Liston has performed on the adult, he has aimed at bringing about a sort of ligamentous ankylosis, by steadying the part for a long while by means of leathern splints, with the forearm at a right angle. On the contrary, in young patients, he says, "The motions of the part may be encouraged, and with every chance of their becoming free and strong." (*On Practical Surgery*, p. 138.)

Excision of the Knee-Joint.—In a knee case, Moreau, the father, operated as follows:—He made a longitudinal incision on each side of the thigh, between the vasti and the flexors of the leg, down to the bone. These incisions began about two inches above the condyles of the femur, and were carried down along the sides of the joint, till they reached the tibia. They were united by a transverse cut, which passed below the patella, down to the bone.

The flap was raised; but the patella attached to it, being diseased, was dissected out. The limb was then bent, so as to bring the condyles of the femur into view. As it was desired to cut them from the body of the bone, before dislocating them, every thing adhering to them behind, where they joined the body of the bone, was separated, and at that place the forefinger of the left hand was passed through, in order to press back the flesh from the bone, while the saw was used. The knee having been bent, Moreau drew the cut piece towards him, and easily detached it from the flesh and ligaments.

The head of the tibia was laid bare by an incision, nearly eighteen lines long, made on the pine of that bone. The first lateral incision on the outer side of the knee was extended nearly as far down on the head of the fibula. Thus were obtained one flap, which adhered to the flesh filling up the interosseous space, and another triangular flap formed of the skin, covering the inner surface of the tibia, which bone was of necessity exposed before the saw could be applied.

Upon raising the outer flap, the head of the fibula came into view, and, after being separated from its attachments, was cut off with a small saw. The inner flap was then raised, and the head of the tibia, having been separated from the muscles behind was sawn off. (See Moreau (*le fils*), *Obs. pratiques relatives à la Resection des Articulations affectées de Carie*. Paris, an xi.) Some cases and remarks in favour of the excision of diseased joints, have been published by Mr. Cramp-

ton. (*Dublin Hospital Reports*, vol. iv. p. 185. &c.) He has removed with success one knee and one elbow. Another knee operation may be set down as a failure, no union having taken place, and a sinus and discharge having continued in the ham, until the patient's death, three years and two months after the operation. Respecting the plan of operating on the knee, he concludes thus: "I am satisfied from repeated trials on the dead subject, that the operation can be most safely and rapidly executed, by separating the condyles from all their attachments previously to sawing the bone. As soon, therefore, as the flap, containing the patella, is turned upwards, the edge of the knife, should be carried round the condyles close to the bone, so as to divide all the ligaments, which connect the femur with the tibia. The tibia can then with great ease be pushed backwards, and as much of the projecting condyles can be removed, as the operator may think necessary." (*Vol. cit.* p. 213.)

It does not appear necessary to insert in this work the account of cutting out the ankle-joint, an operation which will never be extensively adopted; nor shall I add any thing more concerning the mode of removing, in a similar way, the shoulder-joint. In treating of amputation in this situation, I have already said enough, and whoever wishes for further information, respecting this practice, must refer to Dr. Jeffray's work, entitled, "*Cases of Excision of Carious Joints*," Glasgow, 1806. Dr. Jeffray recommended a particular, and, indeed, a very ingenious saw, for facilitating the above operation. The saw alluded to is constructed with joints, like the chain of a watch, so as to allow itself to be drawn through behind a bone, by means of a crooked needle, like a thread, and to cut the bone from behind forward, without injuring the soft parts. In placing the saw under a bone, its cutting edge is to be turned away from the flesh. Handles are afterwards hooked on the instrument.

According to my notions of the treatment of diseased joints, so long as the patient's strength is not subdued by the irritation of the local disease, humanity dictates the propriety of persevering in an attempt to save the affected limb, &c. Will a patient, greatly reduced by hectic symptoms, be able to recover from so bold and bloody an operation, as the dissection of the whole of the knee-joint out of the limb? If some few should escape, with life and limb preserved, would the bulk of persons, treated in this manner, have the same good fortune? I cannot admit, that the extirpation of the whole of so large an articulation as the knee, can be compared with the operation of amputation, in point of simplicity and safety. However, it is not on the difficulty of practising the former, that I would found my objections; for I believe, that any man possessing a tolerable knowledge of the anatomy of the leg might contrive to achieve the business. The grounds, on which I withhold my approbation from the attempt to cut out the knee are the following:—1. The great length of time which the healing of the wound requires. Whoever peruses the case of Hector Mc'Caghan will find that the operation was performed on the 2d of July, 1781, and that it was February 28th of the following year before all the subsequent abscesses and sores were perfectly healed. This space of time is very nearly eight months! Mr. Park describes the

patient as a strong robust sailor, and gives no further particulars concerning the state of his constitution, than that his health was declining. I entertain little doubt, that if the excision of the knee had been performed in that state of the health in which amputation becomes truly indispensable, this man would not have survived the illness arising from the operation. The only other case in which Mr. Park extirpated the knee ended fatally. In the instance related by Moreau, there seemed, indeed, to be considerable debility. This patient escaped the first dangers consequent to so severe an operation; and, after three months' confinement, the patient was in such a state, that Moreau expected he would be able to walk upon crutches in another month or six weeks! The young man in the meantime was attacked by an epidemic dysentery, and died. On the 21st of October, 1809, Milder extirpated the knee-joint of a pregnant woman in the hospital at Gröningen; but she died of tetanus on the 8th of the following February. He conceives that the operation is much facilitated by removing the ends of the femur and tibia in their connected state. (See *Diss. de Articulis extirpandis auctore G. H. Wachter*; 1810.) 2. Even supposing the excision of the knee to be followed by all possible success, is the advantage of having a mutilated, shortened, stiff limb, in lieu of a wooden leg, sufficiently great to induce any man to submit to an operation, beyond a doubt, infinitely more dangerous than amputation? I think not. The practice is at present nearly exploded in this country; but I hear every now and then of its being adopted at Paris, and Mr. Crampton has thought it worthy of revival. The difficulties of his operations, however, and tediousness of the after-treatment, and, in particular, the general course and termination of one of his two knee-cases, as represented by himself, are sufficiently discouraging. No doubt, more limbs might be saved by this practice, than by that of amputation, but more lives would be lost. On this principle, I see no reason for preferring excision of the knee to amputation. Many interesting observations on the extirpation of various diseased joints may be found in the above-mentioned dissertation by Wachter, and in the analysis of it by Langenbeck (*Bibl. für die Chir.* b. 3. Göttingen, 1811.); likewise in Mr. Blackburn's paper, in *Guy's Hospital Reports*, vol. i.

The latter gentleman's conclusion, from a review of nearly all the cases on record, is, that excision is advisable in the shoulder and elbow, that it is admissible, though of doubtful utility, in the ankle; and that it is inadmissible, except under very peculiar circumstances, in the wrist, hip, and knee. (*Op. cit.* p. 298.)

Consult *White's Cases in Surgery*. *Sabatier*, *Séances publiques de l'Acad. de Chir.* Paris, 1799, p. 73.; et *Mém. de l'Institut National*, vol. v. 1806. *Roux*, de la Résection, &c. des Portions d'Os Malades, &c. Paris, 1812. *P. Crampton*, in *Dublin Hospital Reports*, vol. iv. 1827. *A. Velpeau*, *Nouv. Elem. de Méd. Opér.* t. i. *Blackburn*, in *Guy's Hospital Reports*, vol. i.; *Wachter*, *Diss. de Articulis Extirpandis*; Groning. 1810; *Jaffroy's Cases of Excision of Joints*, &c. Evo. Glasgow, 1815. *James Syme on the Excision of Diseased Joints*, &c. Edinb. 1841, and in *Principles of Surgery*, 1837, ed. 2.

JUGULAR VEIN, how to bleed in. (See *Bleeding*.)

JUGULAR VEIN, INTERNAL, WOUNDED. Dr. Garsud cursorily mentions a case, in which a French surgeon, in the military hospital of Lou-

louse, early in the year 1814, passed a ligature round the trunks of the common carotid artery and internal jugular vein. Both these vessels had been wounded by a musket-shot. On the sixth day from the application of the ligature, nothing unfavourable had occurred; but, the final result of the case is not related. (See *Journ. Générale de Méd. &c. par Sedillot*.) Dr. Mott, in removing a diseased clavicle, was obliged to tie and divide the internal jugular vein. This circumstance did not prevent the patient's recovery.

JUGUM PENIS. A contrivance for preventing the inconveniences of an incessant dribbling of the urine in persons, who are unable to retain this fluid in the bladder. A jugum penis, strictly speaking, is an instrument that operates by compressing some part of the urethra. A jugum of this kind, which was invented by Nuck, is described in *Wicster's Surgery*. (See tab. xxvi. fig. 8. et 9.) But, when erections are likely to take place, a jugum constructed on this principle is not applicable; and, indeed, in most cases, it creates pain, and is not found to answer. Desault's contrivance for hindering a stillicidium urinæ, is noticed in the article *Urine, Incontinence of*; and a still better one was proposed by Le Rouge. (*Journ. de Méd. Chir. et Pharmacie*, t. lxxvi. p. 459.) When, in men, the infirmity is incurable, and a jugum cannot be worn, an apparatus for receiving the urine, directly it escapes from the urethra, is the best resource. A description of such a contrivance may be found in *Juville's Traité des Bandages*. The instrument consists of three pieces; namely, an ivory mouth, a neck made of elastic gum, and a silver flask. It is fastened with pieces of tape to a leathern belt, which goes round the waist. The ivory mouth is round, and about eighteen lines in diameter. In its external edge, there are several small holes, through which the tapes are passed, which fasten it to the belt. Its inner surface is slightly excavated, so that it may adapt itself precisely to the parts about the pubes. The outer surface is rather convex, and formed with a prominent border, perforated in several places, to which the elastic gum neck, or tube is fastened. This latter part must be four or five inches long, and wide enough to hold the penis: its convex end is made to screw on to the silver flask. At the upper part of the screw are three pegs, which cross each other in a stellated form, and serve for fixing a sponge within the neck. The silver flask is four inches wide, and of a flat shape: it lies on the inside of the thigh, or in a pocket made in the breeches. If necessary, a larger flask must be used. One of the best contrivances, however, which I have ever seen, was made by a German, residing in Prince's Court, Drury Lane. It was worn by a gentleman in a family where I was lately attending a patient. He was desirous to have some invention which would receive a sufficient quantity of urine, and yet cause no disfigurement. The machine consisted of a long tube made of oiled silk, water-proof, and perfectly flexible, which extended down the inner side of the thigh, within his trowsers. The diameter of it being very moderate, prevented it from making any prominence, while its length rendered it capable of holding two or three pints of urine. Dr. Mackenzie, of Glasgow, informs me, that he has seen a bandage, binding up the penis to the ab-

domen, answer very well in a stillicidium urinæ after lithotomy.

KERATONYXIS. The term *keratonyxis*, derived from *κέρας*, a horn, and *νύξ*, a puncture, is employed by the professors in Germany to denote the operation of couching performed through the cornea, or horny coat of the eye, the opaque lens being in this manner sometimes depressed, sometimes broken piecemeal, and, in other instances, merely turned, so as to place its anterior and posterior surface in the horizontal position. The latter method is what the German surgeons particularly imply by the phrase *reclinatio*. See CATARACT.

KNEE, DISEASES, AND INJURIES OF THE. See DISLOCATIONS; FRACTURES; GUNSHOT-WOUNDS; JOINTS, &c.

KREOSOTE. (from *κρέας*, flesh, and *σύνω*, I save.) A new principle, discovered by M. Reichenbach, in 1804, in pyroigneous acid and all the tars, and so named from its property of preserving animal matter. According to this gentleman, it is of service in caries, cancerous ulcers, rheumatic pains, and other diseases. It appears from Dr. Elliotson's researches, that it has considerable power in checking vomiting, even that attending Asiatic cholera. He also found it of use in phthisis, epilepsy, diabetes, and neuralgia. "Of its external application (says he) I can speak favourably. When an ulcerated surface has required a stimulus, or when a slough, or unhealthy, perhaps offensive, discharge existed, I have seen it of great utility. As it prevents, or arrests putrefaction, and removes all taint in dead matter, we cannot be surprised at its removing the offensive nature of discharges, whether from mucous membranes, or ulcers, and preventing the injurious effects of diseased animal matter upon the part, with which it is in contact. When the contents of the intestines have been very offensive, I have impregnated clysters with it advantageously; and I have employed it as a wash in mercurial fætor, as well as ulceration, and in fætor of various parts of the system. I have seen foul ulcers become clean, and ulcers of long standing have sometimes healed rapidly on its application." Dr. Elliotson bears testimony also to its efficacy in pruritus podicis, toothach, and porrigo. (See *Med. Chir. Trans.* vol. xix. p. 217.) For external use, he says that from half a drop to two or three, diffused in water by means of mucilage, will usually be sufficient, though its application must be very frequent. I have tried it in a few examples of phagedenic ulceration, in University College Hospital, and occasionally with success. I have known it used in the proportion of from three to eight or ten drops in each ounce of water. If given internally, it is best to begin with one or two drops, and increase the dose very gradually. In this way, one lady, under Dr. Elliotson's care, was able at last to take forty drops as a dose.

It is alleged, that kreosote, as an external application, is advantageous in preventing the contraction of cicatrices, and that it is therefore useful in burns. (See Sir F. Smith, in *Dublin Journ. of Med. Science*, vol. xi. p. 237.) "In different eruptions of a scaly nature (says this gentleman) kreosote has been found decidedly useful, and results the most favourable, have followed its application to ulcers, and solutions of continuity,

having a venereal, or scrofulous origin. From its known antiseptic properties, it has been recommended in gangrene." He also refers to its use in external, and internal hemorrhages. Sir F. Smith tried it with success in phagedenic ulceration of the penis, disease of the septum narium, fistula in ano, tinea capitis, and cancerum oris. Sometimes, he employed one part of kreosoto to sixty of water; sometimes one of kreosoto to sixty of acetic acid; and occasionally he brushed the edges and surface of ulcers with pure kreosote. His observations lead him to expect, that kreosote would prove useful in cutaneous cancer, and chronic ulcers of the cornea. Further observations on kreosote will be found in *Edinb. Med. and Surg. Journ.* No. cxviii.

LACHRYMAL ORGANS, DISEASES OF THE. The lachrymal gland cannot be said to be a part which is frequently the seat of disease. Richerand has seen no instance of an inflammation of this gland, unless by this expression be implied cases, in which all the contents of the orbit are more or less affected. (*Nosogr. Chir.* t. ii. p. 32.) Mr. Lawrence has met with no example of it. (*On Dis. of the Eye*, p. 691.) Mr. Middlemore regards it as not of great frequency, and, when idiopathic, as mostly met with in children of a strumous habit. (*On Dis. of the Eye*, vol. ii. p. 637.) I believe that the surrounding cellular substance is more frequently attacked with inflammation and suppuration than the gland itself. According to Beer (*Lehre von den Augenkr.* b. i. p. 349), true idiopathic inflammations of the lachrymal gland are very rare, and he declares, that, in the course of a practice of twenty-seven years, he has but seldom met with them. On this point he differs from Schmidt, who fancied that he had often had under his care cases of this description in gouty and scrofulous subjects. (*Ueber die Krankh. des Thränenorgans*, p. 134.) Mr. Todd also states, that acute and chronic inflammation and abscesses of the lachrymal gland, are common occurrences. (See *Dublin Hospital Reports*, vol. iii.) When the lachrymal gland is attacked with inflammation, its secretion, far from being augmented, as Richerand describes, is considerably lessened, and therefore one of the earliest symptoms is an uneasy dry state of the eye, the secretion from the Meibomian glands, and mucous membrane of the eyelids, not being alone sufficient for keeping the eye duly moist and lubricated. This state is succeeded by a throbbing acute pain in the temple, shooting to the eyeball, forehead, upper and lower jaws, and back of the head. In the meanwhile, the temporal portion of the upper eyelid becomes swelled, tense, red, and exceedingly tender, the tunica conjunctiva being scarcely at all affected, and merely exhibiting a slight degree of redness and tumefaction towards the outer canthus. However, as the swelling of the gland increases, the eyeball becomes pushed more or less downwards, and inwards towards the nose. But, though there is little or no redness, nor any mark of inflammation, about the eye, this organ is tense, and extremely tender. The freedom of its movements towards the temple is much lessened in the beginning of the complaint, and when the tumour has acquired a very large size, is quite destroyed. The impairment of vision is always proportionate to the protrusion of the eyeball, the pupil

diminished, and the iris motionless. The second, or suppurative stage, Beer describes as ushered in by fiery appearances before the eye; an increased displacement of the eyeball; throbbing pain; great increase of the swelling of the upper eyelid, and of the conjunctiva, towards the temple; an annoying sensation of cold, and heaviness in the eye and orbit. Now, under febrile symptoms, shiverings, &c. a yellowish point presents itself, either on the reddened portion of the conjunctiva, or on the outside of the eyelid, and a fluctuation becomes distinguishable. (Beer, *Lehre*, &c. b. i. p. 350.) Beer speaks of abscesses sometimes forming in the vicinity of the lachrymal gland, and terminating in a small sinus, which communicates with one of the principal excretory tubes, and discharges occasionally a thin limpid fluid. (*Lehre von den Augenkr.* b. ii. p. 184.) The experience of this author leads him to consider these sinuses either as a consequence of an unskillfully treated abscess of the upper eyelid, or of a similar neglected affection of the cellular membrane, near the lachrymal gland; or, lastly, of the presence of a portion of the sac of a burst encysted tumour. According to Mr. Travers, the lachrymal gland often suppurates in children, and occasions an excessive swelling above the upper eyelid, depressing the tarsus so as completely to conceal the eye. The abscess, he says, may be conveniently opened, and discharged beneath the eyelid. (*Synopsis of the Diseases of the Eye*, p. 228.) With respect to the treatment of any local inflammation in and about the lachrymal gland, the best means of relief would be leeches, fomentations, emollient poultices, and other common antiphlogistic remedies. In the suppurative stage, Beer recommends mixing with the poultice a good deal of hemlock.

The lachrymal gland is subject to scirrhus enlargement, and, in cases of carcinoma of the eye, it is one of the parts, in which a return of the disease is apt to occur. Hence it is now generally considered right to remove it, as soon as the eyeball has been taken away. (See *EYE*.) Sometimes, though rarely, the gland is primarily affected. Schmidt never met with the disease confined to the gland. Guérin removed one in the state of scirrhus, and so much enlarged, that the eye was entirely covered by it. This operation was performed with such dexterity that the external straight muscle was not at all injured. Mr. Travers removed a scirrhus and enlarged lachrymal gland. The vision of the eye had suffered considerably during the growth of the tumour. The only deformity, after the operation, was a slight prolapsus of the eyelid. This gentleman recommends operations of this kind to be always done, if possible, beneath the eyelid. (*Synopsis*, &c. p. 228.) The lachrymal gland, in the state of scirrhus, has been successfully removed by Mr. Todd (see *Dublin Hospital Reports*, vol. iii.), by Mr. O'Beirne of Dublin, and Mr. Lawrence. (*On Dis. of the Eye*, p. 697.) The latter gentleman does not regard the disease as malignant, like true scirrhus. It does not become adherent to the surrounding parts. It does not contaminate the absorbent glands; nor does it return after extirpation. (See also *Guthrie's Operative Surgery of the Eye*, p. 159, &c., and J. Schmidt, *Ueber die Krankheiten des Thränenorgans*.)

Cases are related, in which the secretion of tears is stated to have gone on as usual after the operation; but it is conceived that the accounts cannot be correct. M. Magendie removed the lachrymal gland from rabbits, and tears were no longer secreted. (See R. Middlemore on *Dis. of the Eye*, vol. ii. p. 652.) Leeches, iodine and mercury should be tried, before the operation is decided upon.

The caruncula lachrymalis is liable to chronic induration and enlargement, constituting the disease already spoken of in a foregoing part of this work, under the name of *ENCANTHIS*, of which there is also a scirrhus, carcinomatous, or malignant form, quickly extending its effects to the eyeball, and the adjacent thin bones of the orbit. (Beer, *Lehre von den Augenkr.* b. ii. p. 188.)

From these subjects, I proceed to consider the diseases of the excreting parts of the lachrymal organs; cases which, though of the most various natures, were formerly all confounded together, under the title of *fistula lachrymalis*, and it is only within the last few years, that these complaints have been subjected to the same principles and distinctions, which are conceived to be highly useful in other branches of surgery. One important improvement, now adopted, is the discrimination of *epiphora* from *stillidium lachrymarum*. The meaning of the former term being now applied to a watery state of the eye, occasioned by a redundant secretion from the lachrymal gland; while *stillidium lachrymarum* is produced by causes, which interfere with the regular excretion of the tears. This distinction at once informs us, that every case of disturbance of vision by the tears collecting in the corner of the eye, does not depend necessarily upon any disease of the nasal duct. As Dr. McKenzre has judiciously remarked, the consequence of not distinguishing the different diseases of the excreting parts of the lachrymal organs from each other has been an attempt to discover a single successful method of curing them all. "Now there is no one method of treatment by which this can be accomplished; and hence it is that the several remedies which have been proposed, being eminently successful in one or other of these diseases, but not adapted to all the rest, have at different times been held in such various degrees of estimation." (*On Dis. of the Lachrymal Organs*, p. 10. 8vo. Lond. 1819.) And an intelligent critic observes, that in lachrymal diseases, obstruction of the nasal duct appears to be almost the only circumstance, against which the treatment recommended by the surgeons of France and England has been directed. "On sait qu'au rétrécissement ou à l'oblitération du canal nasal, produits par une cause quelconque, est due, dans presque tous les cas, la maladie qui nous occupe; soit que, restées intactes, les parois du sac présentent une tumeur lachrymale, d'où les larmes refluent continuellement sur les joues, à travers les points lachrymaux: soit qu'en partie détruites et ulcérées, ces parois présentent une fistule, qui offre aux larmes un passage contre nature, sans cesse entretenue par elles; en sorte que ces deux états, la tumeur et la fistule, sont presque toujours des degrés différens d'une même affection, et que le traitement qui convient à l'une repose sur les mêmes bases que celui indiqué dans l'autre." (*Œuvres Chir. de Desault*, t. ii. p. 120.) It is evident, from the writings of Pott and Wäre, that even these authors considered the obstruction

of the nasal duct as the foundation of all the train of varied symptoms, presented by the excreting lachrymal organs. "An obstruction in the nasal duct, is most frequently the primary and original cause of the complaint." "The seat of this disease is the same in almost every subject," says Mr. Pott (*Obs. on the Fistula Lachrymalis*); and the late Mr. Ware, in his observations on the same disease, sets out with the same assumption. Now, obstruction of the nasal duct is an occasional consequence merely of inflammation of the excreting lachrymal organs; in most of their diseases, obstruction of the nasal duct has no part; and one might, with as much propriety, treat all the affections of the bladder and urethra, by the dilatation of the latter part, as treat all the diseases of the excreting lachrymal organs, by dilating the nasal duct. The false assumption in question has led to most erroneous treatment. For instance, in blennorrhœa of the sac, and in hernia of the sac, though in both these diseases the nasal duct is free, the common treatment, in this country, is to open the sac with a knife, and thrust down a style, or some other instrument, into the nose; thus destroying the organisation of the parts which are affected merely with a gleet secretion in the one case, and with extreme relaxation in the other. Suppose (says the same critical writer) that some charlatan should make oath at the Mansion-house, that he had cured fifty, or a hundred cases of gonorrhœa by opening the urethra in the perinæum, and passing a bougie through that tube, from behind forwards, who would approve of such an operation? Yet the laying open of the lachrymal sac, and thrusting a probe down into the nose, when the nasal duct is either perfectly free, or, at the most, slightly tumid from inflammation, is neither less preposterous, nor less uel. (See *Quarterly Journ. of Foreign Medicine*, vol. i. p. 293.) Indeed, it is somewhat surprising, that errors of this kind should have prevailed so long, particularly as experience had taught Mr. Pott, that slight cases might be benefited by the simple employment of a vitriolic collyrium; a fact which ought to have convinced him, that the disease did not always depend upon obstruction of the nasal duct. It is curious, therefore, that he did not fully see this mistake; for, that he knew of these diseases having great variety, is evident from the following remark:—"As the state and circumstances of this disease are really various, and differ very essentially from each other, the general custom of calling them all by the one name of fistula lachrymalis, is absurd." I believe that one great cause of deception has been the fact, that, though laying open the lachrymal sac, and the introduction of instruments down the nasal duct, have been frequently practised, when milder plans would have answered every purpose, yet a cure has often followed the practice, and thus confirmed the supposition of relief having been effected by the removal of the imaginary obstruction in the nasal duct. Thus, the late Mr. Ramsden, of St. Bartholomew's, with whom I lived as articled student, always followed the common plan of passing a probe down the nasal duct, and letting the patient keep a piece of bougie, or a style, in the part for two or three months afterwards; and I scarcely recollect an instance in which he failed to accomplish a cure, though I have no doubt, that the same benefit

might sometimes have been obtained without any operation at all. And a discerning practitioner should never forget that, if no permanent obstruction exists in the nasal duct, a cure will generally follow, on the subsidence of inflammation, and a change taking place in the action of the parts, whether a probe, style, cannula, bougie, or seton, be employed or not.

Erysipelas of the Parts covering the Lachrymal Sac.—Beer considers it highly necessary that this case should be discriminated from inflammation of the sac itself, which is often but little affected, and this even when an abscess forms. Unless the true nature of the disease be comprehended, the surgeon is apt to suppose, that the matter is in the sac itself, and believes, that, when he makes an opening, he is puncturing that receptacle, whereas he is, in reality, merely dealing with a superficial abscess of the integuments. Nor, as Beer has observed, is the mistake free from ill consequences; for, imagining that the wound is made into the sac, the surgeon pokes about with his probe so long, that a good deal of unnecessary pain and inflammation is produced. The case is not very frequent, and is mostly met with in scrofulous subjects, who have had for a considerable time a blennorrhœa of the lachrymal sac. The inflammation partakes of the usual characters of erysipelas, and commonly extends to the eyelids, particularly the upper one. The absorption and conveyance of the tears into the lachrymal sac are interrupted, because the inflammation constantly affects the lachrymal ducts and papillæ, the latter appearing considerably shrunk. When the inflammation spreads over the side of the face, Beer says, there is usually a discharge of thin mucus from the nose; and when the affection extends more deeply, to the anterior portion of the lachrymal sac, as may easily happen, when the case is neglected, or treated in its first stage with stimulating applications, a bean-shaped, circumscribed, hard, painful tumour may be felt, or is even denoted by its very red appearance. The puncta lachrymalia are now completely closed, the papillæ shrivelled up, and the nostril on the affected side dry and tender.

If in the first stage of the disorder, the lachrymal papillæ and canals have not been too violently affected, the former parts expand again, and the absorption of the tears recommences, with the second stage. But, at this period, according to Beer, a good deal of mucus is secreted from the caruncula lachrymalis and Meibomian glands, and collects and glues the eyelids together, especially during sleep. At the same time, mucus generally accumulates in the lachrymal sac itself, and may be voided both through the puncta lachrymalia and nasal duct, by gentle pressure. The mucus, discharged from the nostril, also acquires a thicker consistence. Should the lachrymal papillæ and ducts have suffered more severely in the first stage of the disease, the due absorption of the tears does not begin after the subsidence of the inflammation, and a dropping of them over the cheek, a *stillicidium lachrymarum*, frequently continues a long while after the termination of the other symptoms. It depends upon the atony of the lachrymal puncta and ducts, and is very troublesome in cold wet weather. And when the lachrymal sac itself has been a good deal inflamed in the

first stage of the complaint, a large quantity of mucus collects within it in the second stage, and may be discharged by pressure. Sometimes the subcutaneous abscess actually communicates with the cavity of the sac; a case, which Beer terms a spurious fistula of the lachrymal sac, the matter not being formed in that receptacle itself, but getting into it from the external abscess. As the skin is generally rendered very thin, these abscesses near the bridge of the nose usually burst by several openings. Beer remarks, that it is easy to learn whether the ulceration extends through the lachrymal sac; for when this has happened, the slightest pressure upon the superior part of the sac produces a discharge of pus and mucus from the external opening, and, if the lachrymal canals have already recommenced their functions, the discharge will also be mixed with tears. (See *M'Kensie on Dis. of the Lachrymal Organs*, p. 22.) The quantity of matter which flows out, is likewise so copious, that it is evident it could not have been all lodged between the skin and orbicularis palpebrarum muscle, but must have come partly out of the lachrymal sac. The use of a fine probe will remove any doubt which may be left. (*Beer, Lehre von den Augenkr. b. i. p. 332—335.*)

On the subject of the causes of this complaint, the preceding author delivers no remark worthy of notice. In speaking of the prognosis, he observes, that when the case is not neglected, nor wrongly treated in its first stage, and the inflammation has not extended to the lachrymal sac, the prognosis is favourable; for, after the subsidence of the inflammation, a temporary atony of the lachrymal puncta and ducts, an imperfect conveyance of the tears into the nose, and of course a slight boozing of them over the cheek, most troublesome in cold, wet weather, are the chief inconveniences which remain. But, when the lachrymal sac participates in the inflammation, the prognosis is much less favourable; because, when suppuration takes place, ulceration is apt to form an opening in the front part of the sac, or else, during the second stage, a large quantity of mucus may collect in the sac, and, if not skilfully treated, it frequently ends in a very obstinate blennorrhoea of that part. As Beer observes, this is a case which is often, though quite erroneously, named a fistula lachrymalis (*b. i. p. 336.*)

The prognosis is also very favourable in the second stage of the complaint, as long as the suppuration is restricted to the integuments, and it is characterised by desquamation and scabbing; but the case is more serious, when a large collection of matter forms, and particularly when the abscess makes its way into the lachrymal sac. In these last circumstances, an obstinate blennorrhoea from the sac often follows, notwithstanding the fistulous sore be treated in the most skilful manner, and sometimes the matter spreads so far around, as to spoil, and even annihilate, the lachrymal canals, and cause an irremediable dropping of tears over the cheek, during the rest of the patient's life. (*Beer, Lehrb. d. Augenkr. b. i. p. 336.*)

The suppuration, says Dr. M'Kensie, may destroy the membranous layer of the lower eyelid, and even the total obliteration of the cavity of the sac. But when the sac is not thus annihilated, and the lachrymal canals are destroyed, it is necessary that the cavity of the sac should be obliterated by artificial means, for otherwise a form of

disease will follow, which Beer denominates *drops sacci lachrymalis*, and Dr. M'Kensie, *mucocoele*.

"In common cases, a piece of folded linen, dipped in cold water, and applied to the parts affected, and the administration of gentle doses of sulphate of magnesia, make up the treatment. In severe cases, it will be found necessary, not only to continue the cold applications, and to open the bowels, but to administer an emetic of tartaric acid of antimony, to purge freely, and even sometimes to take away blood from the arm." (*M'Kensie, p. 24.*)

In the second stage, a warm dry air, and a linen compress, are commended, with the exhibition of diaphoretics. In the two first of these means, I confess, that I should place little or no confidence. When the formation of matter cannot be prevented, poultices are to be used. Beer particularly cautions us not to leave the abscess to burst of itself, but to open it immediately a fluctuation can be felt, so as to prevent an ulcerated opening from taking place in the anterior part of the lachrymal sac. And if the surgeon has not been consulted before such a communication has been established between the sac and subcutaneous abscess, he should avoid all unnecessary disturbance of the parts with probes and syringes, and, at most, only wash out the abscess once a day with Anel's syringe, filled with luke-warm water and a little of the vinous tincture of opium. Beer also recommends introducing into the superficial abscess, but not into the sac, a small quantity of lint, dipped in the tincture. If the blennorrhoea of the sac continue, it is to be treated in the way which will be explained in considering the second stage of inflammation of that part.

Inflammation of the Lachrymal Sac.—According to Beer, the symptoms of the first stage are as follows:—In the corner of the eye, precisely in the situation of the lachrymal sac, a circumscribed, very hard, tender, swelling arises, of the shape of a bean, producing a lancing pain when it is touched, and gradually acquiring considerable redness. The absorption and conveyance of the tears into the lachrymal sac, and thence into the nose, are completely interrupted; the lachrymal papillae are shrunk; the puncta cannot be seen; and of course the tears fall over the cheek. The nostril on the affected side is at first very moist, but soon becomes perfectly dry, the mucous membrane being a good deal affected. As the inflammation also constantly spreads to the orbicular muscle and integuments in the corner of the eye, the complaint often presents an erysipelatous appearance, extending to the eyelids and down the cheek; but the circumscribed swelling, caused by the inflamed sac, is still not only capable of being distinctly felt, but even seen. It rarely happens, in cases of common inflammation, that, on the change of the first stage into the second, the nasal duct is rendered impervious by an effusion of lymph; but such an occurrence is more frequent when the inflammation is not of a healthy description, and the patient is scrofulous. Under these circumstances, the lachrymal canals may also be permanently obliterated. In weak, irritable constitutions, towards the end of the first stage of the inflammation a degree of symptomatic fever prevails, with severe headache, great redness and swelling of the whole inner canthus, involving the caruncle lachrymalis.

the semilunar fold, the conjunctiva, the edges of the eyelids, and the lachrymal puncta.

Here, as in inflammation of every mucous membrane, at the very commencement of the second stage, a copious morbid secretion takes place, and accumulates in large quantity: for, either in consequence of the thickening of the mucous membrane, the adhesion of the sides of the nasal duct together, or there being no mixture of the tears, the secretion within the sac, cannot escape either into the nostril, or out of the lachrymal puncta, and consequently it distends in a prodigious degree the anterior side of the sac, where it is uncovered by bone. Hence, the swelling is here very manifest, and a fluctuation may be felt in it, even before the suppurative stage has actually begun. According to Beer, whoever is induced by the fluctuation to open the lachrymal sac at this period, will certainly bring on a very hurtful suppuration of the part, exceedingly likely to render the excreting parts of the lachrymal organs completely unserviceable. At the beginning of the second stage, there is also a morbid secretion from the mucous membrane of the nostril and caruncula lachrymalis. Now, not only the swelling of the lachrymal sac increases more and more, but the redness acquires a deeper colour, the skin becomes more shining, the fluctuation still more evident; and at length, in the centre of the tumour formed by the lachrymal sac, a yellowish, soft point presents itself. In this state of things in order to prevent a true fistula, the surgeon should make an opening in the lachrymal sac, without the least delay; for, if the abscess be left to itself, the pus will at last make a passage for itself through the orbicular muscle and integuments; but it will only be a small fistulous opening, surrounded with callous hardness, and merely capable of letting some of the pus and mucus of the sac escape, so that the thicker part of the matter remains behind, and, consequently, though the swelling diminishes after the formation of a spontaneous opening, it does not entirely subside. A quantity of blood is also remarked to be blended with the discharge from the sac. This last is the case, which Beer denominates a *true fistula of lachrymal sac*. When the abscess bursts of itself, the fistulous opening in the sac is not always exactly opposite the aperture in the skin and, though there is commonly but one communication with the sac, it sometimes happens, that several small external openings are produced more or less distant from the sac. The diagnosis is easy enough; for, on pressing upon the upper portion of that receptacle, mucus and pus, blended together, are immediately discharged from all the fistulous apertures. After the disease has lasted a good while, it not unfrequently happens, that tears are also voided from the fistulous opening; a circumstance, indicating the restored action of the lachrymal puncta and canals; but, according to Beer, such tears are never duly blended with the mucous and purulent matter. He further remarks, that, when the second period of the second stage, or the suppurative process is over, a morbid secretion of mucus still continues in the third period of the second stage, that secretion becoming whitish, thick, opaque, and only partly resembling pus. As, in consequence of its thickness, and the swelling of the mucous membrane of the nasal duct, the secretion cannot descend into the nose, it collects in the sac, and sometimes pushes off any piece of lint, or

plaster, with which the external opening in the sac has been closed. At length by means of judicious treatment, this third period of the second stage is also brought to a termination; the mucus is secreted again in due quantity; it becomes transparent like white-of-egg, and viscid; but white streaks may be for some time perceived in it. Afterwards the mucus becomes thinner, and, if the functions of the lachrymal puncta and ducts, are not destroyed, it is thoroughly mixed with the tears. The opening in the lachrymal sac now either heals up of itself, or under skilful treatment; but, in general, a minute fistulous aperture still remains, from which the tears and mucus are occasionally voided, if the passage through the nasal duct be not free. However, if the small fistulous aperture should happen to heal up completely, the mucus and tears accumulate in the sac, and the patient is obliged to press them out through the puncta lachrymalia, several times a day.

When the surgeon is consulted early enough, and proper treatment is adopted, Beer sets down the prognosis in the first stage of the inflammation as very favourable. But, if the practitioner be called in later, it will not be in his power completely to disperse the inflammation, and prevent the morbid secretion, and accumulation of mucus in the lachrymal sac; the *blemnorrhœa*, of Beer, or the *dacryops blepharoides*, of Schmidt; a state, however, which soon gives way to judicious treatment. But, when the case is neglected, or wrongly managed at the period when the lachrymal sac is violently inflamed, a complete, or partial, closure of the nasal duct by adhesive inflammation is apt to be the consequence. And, the same effect may also be produced in the lachrymal canals, in which event, the absorption of the tears is for ever impeded, and the patient must remain the rest of his life afflicted with *stiltidium lachrymarum*.

With regard to the prognosis in the second stage of inflammation of the lachrymal sac, Beer considers it as very dubious, on account of the impairment of the functions of the excreting parts of the lachrymal organs; for, says he, no surgeon can exactly know, what may have been the result of the first stage, in relation to the perviousness of the nasal duct and lachrymal canals, and an officious examination of the parts with a probe, for the purpose of obtaining information, would be attended with considerable mischief. However, generally speaking, the prognosis is most hopeful at the first period of the second stage, just when the morbid secretion of mucus is beginning; the suppuration may yet be moderated by right treatment, and the excreting parts of the lachrymal organs preserved. But, if the suppurative stage has already come on, much will depend upon the consideration, whether the matter has been originally formed in the lachrymal sac, has lodged there a good while, and the sac is ready to burst, or whether there is actually an opening in the sac opposite that in the skin, or, lastly, whether the openings do not correspond. In the first case, the suppuration yet admits of being regulated by judicious treatment, and the lachrymal sac can be punctured; but, in the other circumstances, the management of the case is far more difficult, especially when the patient's health is not good. However, the surgeon should be careful not to disfigure the patient with a large scar; and the aim should be to prevent atony of the lachrymal

puncta and ducts, and a consequent stillicidium lachrymarum. These are the least serious evils to be apprehended from mismanagement; for, if the case be ill-treated, or neglected in the latter stage of the suppurative process, necessarily attending a fistulous state of the sac, the lachrymal organs may be rendered quite useless, or even entirely destroyed, and the nasal duct obliterated, or obstructed by the effects of caries. In some few instances, indeed, the whole lachrymal sac is destroyed, or will require to be so by art, as will be presently explained. It is always a favourable circumstance, when the tears are seen to issue from the fistulous opening with the mucus and pus, as it is a proof, that the absorption and conveyance of the tears into the lachrymal sac are established again; and that now the only question is about the state of the nasal duct, which point cannot be determined, before the fistula is completely healed, and the third period of the second stage is entirely obviated. (*Beer, Lehre von den Augenkr. b. i. p. 356—367.*)

In the first stage, the indication is to endeavour to resolve the inflammation. "It is (as Dr. M'Kenzie observes) by combating the inflammation, that we are to cure this disease, and not by attacking merely one, or even several of the symptoms. Dilatation, for instance, by the introduction of probes through the canals into the sac, and even into the nose, would only be subjecting the inflamed parts to a new course of irritation, and might thus produce effects, which would render a complete cure difficult, if not impossible." On the contrary, in the first stage, Dr. M'Kenzie joins Beer in praise of antiphlogistic measures; the application of cold lotions to the part; and, in severe cases, venesection and leeches are set down as proper, together with opening and diaphoretic medicines. (*On the Lachrymal Organs, p. 33, 34.*)

In the second stage, when resolution is no longer practicable, emollient applications are the most beneficial, and all debilitating means are to be stopped, by the further use of which an incurable blennorrhœa of the lachrymal sac would be likely to be induced. And, as soon as the sac is so distended with mucus and matter, that the centre of the swelling begins to be soft, and a fluctuation is perceptible, the sac should be freely opened, so as to let its contents have a ready outlet. If, after this evacuation, there should be any deep-seated hardness of the lachrymal sac, Beer recommends the application of a camphorated hemlock poultice. Afterwards, the wound in the skin and sac is to have introduced into it a little bit of lint, dipped in the vinous tincture of opium, over which dressing a piece of diachylon plaster may be placed. When under such treatment the suppuration diminishes, but a preternatural secretion of mucus yet continues, Beer introduces into the wound every day a piece of lint, on which is spread a little bit of the following ointment: R Butyri recentis iussulsi, 3 ss. Hydrargyri nitrico-oxydi, gr. x. Tutie pt. gr. vj. M. And, on changing the dressings, some of the following lotion may be dropped into the inner canthus, and injected lukewarm into the sac itself: R Subacetatis cupri, Potasse nitratis, Aluminis, ʒ i gr. iii. —vj. Camphoræ tritæ gr. ij. —iv. Aquæ distillatæ ʒ ss. Solve et cola. Liquori coctivo addæ Vinæ opii ʒj. —3 ij. Aquæ rosæ ʒ iv. M.

Beer melts the three first articles together in equal proportions, and terms the composition the *lapis divinus*, of which he makes the lotion, and then adds the other ingredients. When, by means of such treatment, the mucous secretion from the sac has been brought into a healthy state, and all the induration has subsided, the period has arrived for the surgeon to think of taking measures for the reestablishment of the passage through the nasal duct, if it should not already have become pervious of itself, which, when the inflammation has been of a healthy kind, and the treatment judicious, very frequently happens. (*Beer, Lehre, &c. b. i. p. 369. 371.*)

Chronic Blennorrhœa of the excreting Parts of the Lachrymal Organs.—Dr. M'Kenzie, whose essay contains a faithful account of Beer's opinions upon the present subject, describes the inflammation, with which this form of disease commences, as seldom considerable; and in scrofulous patients, it is not unfrequently quite disregarded, no advice being taken until the lachrymal sac is much distended with mucus. By means of pressure upon the bean-shaped tumour, caused by such distension of the sac, a quantity of puriform mucus is forced out of the puncta lachrymalia, and overflows the eye; and so far are the lachrymal canals from being obstructed, that, excepting when any return of inflammation happens, they even absorb, and convey the tears into the sac. Pressure, however, will rarely make the contents of the sac pass through the nasal duct, on account of the thickened state of the mucous membrane, and therefore the nostril is generally very dry. "In the course of this tedious disease, the accumulated mucus varies much both in quantity and quality. For instance, the mucus accumulates more rapidly, and is much thicker after a good meal, than at other times. The secretion of it is very plentiful, but thinner than usual, when the patient continues long in a moist cold atmosphere. In this case the overflowing of the sac takes place so rapidly, that the compression of the orbicularis palpebrarum in the action of winking is sufficient to evacuate the sac through the canals to such a degree, that the whole surface of the eyeball is suddenly overflowed, and the puriform fluid runs down upon the cheek. After the patient has remained for a short time in a warm and dry atmosphere, the morbid secretion becomes sparing and ropy. We find, that this chronic blennorrhœa almost completely disappears in many individuals during warm weather; upon which the yet inexperienced patient and the inexperienced surgeon are apt to express a great, but a premature joy, for, on the very first change to cold and wet weather, the disease most frequently returns."

During chronic blennorrhœa, the lachrymal sac is extremely liable to repeated attacks of inflammation, and sometimes a fistula, with a good deal of induration of the surrounding cellular substance is produced. Dr. M'Kenzie represents this disease as the most frequent of all those, to which the excreting parts of the lachrymal organs are liable, and as consisting in inflammation of these organs, modified by scrofula, general debility, disorder of the digestive organs, or other constitutional causes, which prolong its second stage. "Even regarded locally, the present disease is seldom a primary affection, but is most frequently excited by catarrhal inflammation of the Schneiderian membrane, or by a long-continued disorder of the Meibomian glands

(*McKensie on Dis. of the Lachrymal Organs*, p. 37—40.)

Scarpa's opinions on the present subject are in some degree peculiar to himself; for he considers the affection of the Meibomian glands and inside of the eyelids, the *puriform palpebral discharge*, as he terms it, as constituting the first degree of all those complaints, which have usually gone under the name of fistula lachrymalis; the second degree or effect, being the tumour of the lachrymal sac; and the third, the fistula, or ulcerated opening in the latter part. Scarpa asserts, that the chief part of the yellow viscid matter, which accumulates in the lachrymal sac, is secreted by the lining of the eyelids, and by the little glands of Meibomius; and that the altered quality of this secretion has a principal share in the cause of the disease. He states, that the truth of this fact may at once be ascertained by everting the eyelids, and especially the lower one of the affected side; and by comparing them with those of the opposite eye. The former will always exhibit an unnatural redness of the internal membrane, which has a villous appearance all over the extent of the tarsus; while the edge of the lid is swollen; and numerous varicose vessels are distinguishable on it. The follicles of Meibomius are also turgid and prominent, and, when examined with a magnifying glass, not unfrequently appear to be slightly ulcerated,

"The villous structure, then, which the surface of the internal membrane of the palpebra assumes in these cases, becomes an organ secreting a larger quantity of fluid than usual, resembling viscid lymph, which, as before stated, being mixed with the sebaceous matter, copiously effused from the glands of Meibomius, constitutes the whole of the viscid fluid, with which the eyelids are imbued, and which is continually carried by the puncta lachrymalia into the sac, so as to fill, and also frequently distend it, until it forms a tumour.

"If, indeed, the lachrymal sac is emptied of this matter by means of compression, and the eye and internal surface of the palpebrae are carefully washed, so that none of the glutinous humour, pressed from the sac, may remain upon them, and the eyelids are everted half an hour afterwards, the internal surface, especially of the lower one, will be found covered with a fresh effusion of mucus mixed with sebaceous matter, which has evidently not flowed back from the lachrymal sac to the eye, but has been generated between the eye and the palpebrae." Another argument, brought forward by Scarpa in support of his theory, is, that if the morbid secretion of the eyelids be retarded, or suppressed, either accidentally, or by means of astringent applications, little, or none of the viscid secretion collects in the lachrymal sac, or can be forced out of the puncta lachrymalia. He has also constantly observed, that the puriform discharge may be radically cured at its commencement, and before it has induced any flaccidity of the sac, by a timely correction of the morbid secretion from the inside of the eyelids, and keeping the lachrymal passage cleansed, by means of injections of simple water through the puncta lachrymalia into the nose. As for the internal membrane of the sac itself, he argues, that its structure does not qualify it for secreting a tenacious unctuous matter, like what is chiefly discharged from it, as it is entirely destitute of sebaceous glands, and can in reality only furnish a thin mucus. However, he

admits, that if the sac happen to be inflamed and ulcerated, a turbid matter may issue from it with the tears; but, says he, this matter is true pus, and quite different from the curdy unctuous fluid, which takes place in the puriform palpebral discharge." (*On the Principal Dis. of the Eyes*, transl. by Briggs, ed. 2. p. 4—7.)

The foregoing opinions of Scarpa have not met with universal assent, and, though there is probably, some truth in them, he may have overlooked too much the simultaneous affection of the mucous membrane of the lachrymal sac and nasal duct. To Scarpa's hypothesis, Himly and Majani have made the following objections:—First, that they have observed the fistula lachrymalis, without the least morbid alteration of the eyelids, and Meibomian glands. Secondly, that every puriform discharge of the eyelids is not succeeded by obstruction of the nasal duct. Lastly, that the fistula lachrymalis is cured by means of the operation alone, without any attention being paid to the morbid state of the eyelids, when it exists. And Mr. Travers also regards Scarpa's account of the origin of the disease, independently of a permanent stricture, as hypothetical; for, if founded in fact, the distension of the lachrymal sac, and the regurgitation of the fluid on pressure, would attend every severe lippitudo, or ophthalmia with puriform discharge, which is not the case. If Scarpa's account were correct, Mr. Travers sees no reason why the fluid, once admitted, should be arrested, or regurgitate, instead of passing into the nose (see also Nicod. in *Révue Méd.* t. i. p. 155.; and *Laurence on Dis. of the Eye*, p. 708.), and he thinks there is every reason to believe, that the fluid so discharged, is the proper secretion of the sac, and that cases are frequent, in which it is retained and cannot be expressed, owing to strictures both of the lachrymal and nasal ducts. (*Synopsis of the Dis. of the Eye*, p. 360.) Some of the arguments with which Scarpa meets this reasoning are already anticipated, especially that which refers to the difference between the secretion of the sac itself, and that of the sebaceous glands of the eyelids. Also, in ascertaining, that the origin of the fistula lachrymalis generally manifests itself on the eyelids, before the lachrymal passages are affected, Scarpa declares, that he does not pretend thereby to exclude altogether the possibility of a case, in which the membranes of the nasal duct and lachrymal sac may not be thickened and ulcerated, independently of the disease of the eyelids. That this is the case, I think is evident from the account, already delivered of Boer's opinions respecting the consequences of inflammation of the integuments and other parts about the inner angle of the eye, as well as respecting the effects of acute inflammation of the lachrymal sac itself. However, Scarpa admits the fact; and the question left is, whether he is right in assigning the morbid secretion from the inside of the eyelids as the most common cause of the swelling, ulceration, &c. of the lachrymal sac? That every puriform discharge from the eyelids is not followed by fistula lachrymalis, he allows, is unquestionable; and this, he conceives, most probably happens, because the lippitudo has not been entirely neglected, or because the secretion being less dense and viscid than usual, descends freely with the tears into the nose through the lachrymal canals, which are large and pervious. But, in the

acute stage of purulent ophthalmia, he asserts, that the reason why the discharge is not conveyed into the sac is, that the inflammation and swelling actually close the puncta lachrymalia, and change their direction, so that both the puriform matter and the tears fall over the cheek, and cannot descend into the sac.

For my own part I am disposed to believe that, whether the disease begin in the eyelids, or elsewhere, generally both their lining and that of the sac and nasal duct are also more or less affected; and, consequently, though Scarpa's theory may not be in every respect satisfactory, nor at all applicable to certain disorders of the excreting parts of the lachrymal organs, the practice, to which his sentiments lead, will, in the generality of cases, which Beer denominates *chronic blephorrhœa*, be highly advantageous.

The local treatment of chronic blephorrhœa does not differ essentially from that of inflammation of the excreting parts of the lachrymal organs. But, every possible means must also be employed for improving the general health; for, otherwise, all local remedies will be unavailing. In scrofulous cases particular attention must be paid to diet and mode of living. In weakly persons, the preparations of iron will be highly beneficial; and, when the disease is connected with disorder of the digestive organs the treatment recommended by Mr. Abernethy is that to which Dr. McKenzie expresses a preference. The employment of Anel's syringe and probe is strongly reprobated. "I grant, (says this author) that the application of certain substances to the mucous membrane affected, is one of the most powerful means, which we possess, of correcting its disposition to chronic blephorrhœa. But he who believes that the best manner of applying these substances is to inject them with Anel's syringe, introduced through the puncta, is lamentably mistaken. He is, in fact, closing his eyes upon what he must know of the functions of the several parts of the lachrymal organs, and is doing that very thing which is calculated to prolong and exasperate the disease. Except at the time of a smart renewal of the inflammation, the puncta and canals, during this disease, continue in the exercise of their functions. Whatever fluid, therefore, is dropped into the *lacus lachrymarum*, will be taken up by the puncta, conveyed through the canals, and applied to the whole internal surface of the sac. Even ointments, placed within reach of the puncta, will be absorbed in the same manner. We ought then first of all to empty the sac by pressure, and, if possible, through the nasal duct into the nose. Having placed the patient upon his back, we drop into the *lacus lachrymarum* a small quantity of a weak solution of corrosive sublimate. ℞ Aq. ros. ʒ iv. Hydrarg. oxymercuriatis gr. ss. — ʒ j. Mucil. ʒ j. Vin. opii ʒ j. M. After remaining for a quarter of an hour in that position, he ought to rise, but without wiping away any of the collyrium which may remain. After another quarter of an hour, the eyelids are to be carefully dried, and a little of Janin's ophthalmic ointment applied with a camel-hair pencil to the caruncle lachrymalis and edges of the eyelids. All this is to be carefully repeated twice a day." Professor Sedgwick recommends the following collyrium: — ℞ Aq. ros. ʒ v. Acid. nitric. ʒ j. Alcoholis ʒ j. M. For the removal of the induration over the

sac, gentle friction, with camphor, and mercurial ointment, is recommended. And, says Dr. McKenzie, if the blephorrhœa depend upon chronic inflammation of the Meibomian glands, the diluted citrin ointment is to be applied every evening at bed-time. (*On Diseases of the Lachrymal Organs*, p. 43. &c.) In the first stage of what Scarpa terms the puriform discharge of the palpebræ, when the weeping is incipient, this author states that a cure may be effected, without dividing the sac, or any other painful operation. His practice consists in restraining the immoderate secretion from the Meibomian glands and internal membrane of the palpebræ, and in cleansing the *viae lachrymales* through their whole extent by means of injections of warm water, rendered more active by the addition of a little spirit of wine, and thrown into the puncta lachrymalia every morning and evening; a measure, which, as already stated, is disapproved of by McKenzie, Schmidt, &c. (See also R. Middlemore on *Dis. of the Eye*, vol. ii. p. 691.) Scarpa considers Janin's ophthalmic ointment, weakened with lard, or fresh butter, as the best application for correcting the morbid secretion of the eyelids. A portion equal in size to a barley-corn, is to be introduced upon the point of a blunt probe, every morning and evening, between the eye and eyelids, near the external angle, and the edges of the eyelids are to be smeared with it. The eye is then to be shut, and the eyelids gently rubbed, so that the ointment may be distributed upon the whole of their internal surface. A compress and bandage should be applied, and the eyelids kept closed for two hours. At the end of this time the eye should be washed with the zinc collyrium. When there are superficial ulcerations at the edges of the eyelids, Scarpa applies to them either Janin's ointment, or the unguentum hydrarg. nitrat., and, in very obstinate cases, the *argentum nitratum* itself. If the vessels of the conjunctiva are varicose, he drops into the eye the *tinctura thebaica*. (*Scarpa*, ed. 2. by Briggs, c. 1.)

The late Mr. Ware was earlier than Scarpa, in pointing out the advantage of making applications to the inside of the eyelids, for the relief of certain forms of disease usually classed with *fistula lachrymalis*.

"When an epiphora (says he) is occasioned by an acrimonious discharge from the sebaceous glands on the edges of the eyelids, it must be evident, that injections into the sac will be very insufficient to accomplish a cure, because the sac is not the seat of the disorder. The remedies that are employed must be directed, on the contrary, to the ciliary glands themselves, in order to correct the morbid secretion that is made by them; and, for this purpose, I do not know any application that is likely to prove so effectual as the unguentum hydrargyri nitrat. of the new London Dispensatory, which should be used here in the same manner in which it is applied in common cases of the psorophthalmia. It will be proper to cleanse the eyelids every morning from the gum that collects on their edges during the night, with some soft unctuous applications; and I usually apply to them, two or three times in the course of the day, a lotion composed of three grains of white vitriol, in two ounces of rose or elder-flower water." (*Additional Remarks on the Epiphora*.)

In a modern periodical work may be perused some interesting remarks by M. Nicod, which perfectly accord with the sentiment already expressed, that whatever may be its primary seat, the chronic inflammation is not generally limited to the inside of the eye-lids, but extends throughout the membranous lining of the sac and nasal duct; and that this circumstance, in conjunction with the altered and viscid nature of the secretions, accounts for their not readily descending into the nose, but regurgitating through the puncta. M. Nicod also relates cases exemplifying, that the ointment applied to the inside of the eyelids actually passes with the matter into the lachrymal sac, and thence into the nose, so as to act upon and cure the chronic inflammation of the sac and nasal duct, as well as that of the Meibomian glands and lining of the eyelids. (See *Révue Médicale Historique*, &c. t. i. p. 156, 8vo, Paris, 1820.) The proceedings for adoption, when the nasal duct is obstructed, will now be considered.

Obstruction of the Nasal Duct.—That a permanent closure of this canal does not so frequently attend diseases of the lachrymal organs, as writers have generally imagined, must be evident from the remarks already delivered; and also that its perviousness, when interrupted partly by inflammation and thickening of its lining, and partly by the viscid curdy nature of the matter, may often be restored, without thrusting any probes, tubes, or other instruments down the passage (measures, more likely, under these circumstances, to do harm than good), is a fact, which is no longer questionable. If the inflammation of the sac be treated at first on right principles, “the cases, requiring operation, will be very few.” (See *Lawrence on Dis. of the Eye*, p. 711.) The treatment, necessary in such cases, must be already intelligible from what has been said in the preceding sections; the indication being the diminution of the thickened state of the mucous membrane, by means adapted to the acute or chronic form of the inflammation, and, in many cases, the correction also of the morbid state of the Meibomian glands and internal membrane of the eyelids. It is only when the treatment, conducted upon these mild principles, is found ineffectual, that the surgeon should think of examining the state of the nasal duct, and learning, by the introduction of a fine probe into the passage, whether any permanent stricture or obstruction is present. This may take place as a consequence of acute or chronic inflammation; or it may be produced by extension of disease from the nose. It comes on occasionally in the latter way in strumous children. Inflammation begins in the Schneiderian membrane, and then creeps on to the lining of the sac; a case, in which the sulphate of quinine is particularly serviceable. (See *Lawrence, Op. cit.* p. 710.) I have seen several examples, in which a permanent obstruction of the nasal duct arose from syphilitic disease of the nose, or the pressure of polypi. Supposing there is no direct opening through the skin into the lachrymal sac, one should be made with a lancet. A mere puncture will suffice, as a large incision, beginning just below the tendon of the orbicularis palpebrarum muscle, and extending in a semilunar form, nearly an inch downwards and outwards, as used to be the old practice, can here answer no rational object, the surgeon merely having occasion for a small direct opening through

which he may conveniently pass a small probe, for the purpose of ascertaining the state of the nasal duct. “The probe (as Dr. M’Kenzie observes) is to be introduced horizontally, till it touches the nasal side of the sac; it should then be raised into a vertical position, and its point directed downwards and a little backwards. Turning the probe upon its axis, we pass it from the sac into the duct; and as we continue to press it gently downwards, the instrument, if the sac is pervious, enters the nose. If its point meets with some obstruction, we must not immediately conclude, that there is an obliteration of the duct. We must press down the probe a little more strongly, yet without violence, turning it round between the fingers, and giving it different directions. By these means the obstacle is frequently overcome, and the probe suddenly descends. If the obstacle remains as before, and is extremely firm, still this is not sufficient ground for us to conclude, that there is a real obliteration,” because, as the author proceeds to point out, the difficulty may arise from a mere thickening of the mucous membrane, and swelling and induration of its cryptæ. (M’Kenzie on the *Lachrymal Organs*, p. 78.)

Beer is of opinion, that the mechanical treatment with catgut, bougies, cannulae, &c., will only answer, when attention is paid to rectifying the morbid state of the mucous membrane of the lachrymal sac by means of suitable applications, the use of which, he thinks, ought to commence with the first employment of catgut, which he preferred to cannulae, bougies, &c. And he adds, that even such treatment will only succeed, when the diseased state of the membrane of the sac is entirely a local complaint, and uncomplicated with an unfavourable condition of the health. In the beginning, if the probe can be introduced without any great trouble, and the lining of the duct is only trivially thickened, Beer moistens the catgut, on its daily introduction into the passage, with the vinous tincture of opium, and injects into the sac a tepid lotion, containing subacetate of copper, nitrate of potass, alum, camphor, and vinum opii. The lint which Beer places in the orifice of the sac, is also dipped in the vinum opii. When the probe meets with more resistance, the catgut is smeared with the unguentum hydrargyri nitrati, which is to be at first weakened, and afterwards gradually increased in strength. The wound is also to be dressed with the same application, and some of the following lotion injected down the sac twice a day. *R̄ Aq. ros. ʒ iv. Hydrarg. oxymer. gr. ss. gr. j. Mucil. pur. ʒ j. Vin. opii ʒ j. M.* When any irregularities and indurated points are felt with the probe in the course of the nasal duct, Beer smears the catgut with an ointment, containing a small quantity of red precipitate, and directs friction with a little camphorated mercurial ointment to be employed every day round the external opening.

Beer joins the generality of writers in believing, that a long perseverance in the mechanical means is necessary, in order to remove all disposition in the nasal duct to close again. (P. 176.) And as the use of the probes, syringe, catgut, and dosilla of lint, may be supposed to have done more or less injury to the lachrymal ducts, so as to cause some impediment to the due conveyance of the tears into the lachrymal sac, Beer advises a trial to be made, whether a couple of drops of some coloured fluid, introduced into the inner canthus, while the patient

is lying upon his back, will pass into the lachrymal sac; and if they will not do so, the same author thinks that an attempt should be immediately made to clear the lachrymal ducts, by means of Anel's probe. (P. 177.)

According to Beer, the foregoing treatment is perfectly useless, whenever the lachrymal puncta and ducts are obliterated; because even if it were practicable to restore their perviousness, it would yet be impossible to communicate to the new formed apertures and canals the power of absorbing the tears and conveying them into the lachrymal sac. He thinks, that, in this state of things, the practitioner need not trouble himself about the condition of the nasal duct; because, even if it were rendered duly pervious, this improvement would not continue long; as Beer's experience has fully convinced him, that, when the mucous secretion of the lachrymal sac is not blended with the tears, a closure of the nasal duct sooner or later ensues, and of course an accumulation of the mucus of the sac, a disease sometimes termed, under such circumstances, *hydrops sacculi lachrymalis*. And, in order to prevent this complaint in the state of things just now described, Beer is an advocate for the total obliteration of the cavity of the sac with escharotics. (B. ii. p. 181.)

Such is the practice of Beer, with the view of clearing away obstruction in the nasal duct, and restoring its natural diameter. Let us now consider what methods have been suggested by others. Beginning then with the screw, invented by Fabricius ab Aquapendente, for compressing the distended lachrymal sac, I need only remark with M. Nicod, that, as this plan was not directed against the cause of the disease, it is not surprising, that it should have been unavailing, and ultimately banished from practice. In the year 1716, Anel invented a probe of so small a size, that it was capable of passing from the upper punctum lachrymale into the lachrymal sac and nasal duct, the obstructions in which latter passage it was intended to remove. Anel also invented a syringe, whose pipe was small enough to enter one of the puncta, and by that means to furnish an opportunity of injecting a liquor into the sac and duct; and with these two instruments he pretended to be able to cure the disease whenever it consisted in obstruction merely, and the discharge was not much discoloured. "The first of these, viz. the passage of a small probe through the puncta (says Mr. Pott) has a plausible appearance, but will, upon trial, be found very unequal to the task assigned: the very small size of it, its necessary flexibility, and the very little resistance it is capable of making, are manifest deficiencies in the instrument; the quick sensation in the lining of the sac and duct, and its diseased state, are great objections on the side of the parts, supposing that it was capable of answering any valuable end, which it most certainly is not.

It must be at once obvious, that Anel's instruments were devised with the view of avoiding a puncture in the lachrymal sac; but the principle has been strongly objected to by Beer, there being no comparison between the inconveniences of a small opening made in the sac, and the injury done to the lachrymal puncta and canals by the long and repeated introduction of instruments through them, whereby their functions are likely to be forever ruined, of which Beer has known many examples. (Lehrs, &c. b. ii. p. 169.)

The next practice, deserving notice, is that of Laforest, who used to introduce into the termination of the nasal duct in the nostril a probe, with which he cleared away the obstruction in the passage. He also introduced into the same orifice a curved tube, which was left in the part three or four months, for the purpose of employing injections. This method was sometimes found not only troublesome and difficult, on account of the anatomical varieties, to which the termination of the nasal canal was liable, but subject to frequent failures. Hence, it never gained many advocates. Of late, however, it has found one in M. Gensoul, who, in most cases, employs escharotics through the inferior orifice of the nasal canal. He filled it in the dead body with fusible metal, which, becoming cold, formed a model for probes. "These are bent nearly at a right angle, about nine or ten lines from their extremity; and near this curve there is a slight lateral inflection, the direction of which must be reversed for the two nostrils. This inflection corresponds to the projection of the nasal process of the superior maxillary bone." (See *Dict. de Méd. et de Chir.* t. viii.)

Following up the principles of Anel, another French surgeon, Méjean, dilated the nasal duct with a seton, which was drawn up into the lachrymal sac by means of a thread, first introduced from the upper punctum lachrymale. But it was soon discovered, that what was gained on one side, was lost on the other; the lodgment of the thread in the lachrymal duct for several months, and the irritation of its orifice in changing the seton every day, not only causing inflammation of the punctum lachrymale, but even such ulceration and cicatrises, as sometimes destroyed the functions of the parts.

J. L. Petit, sensible of the inconveniences of Méjean's practice, and disgusted with the barbarous imitation of the ancients in cauterising the fistula, sac, and os unguis, conceived that, instead of these plans, or that of perforating the os unguis, as proposed by Woolhouse, it would be better to endeavour to restore the natural passage, by removing the obstruction in the nasal duct, which obstruction Petit regarded as the cause of the disease. His method consisted in opening the lachrymal sac with a small bistoury, introducing through the wound, sac, and nasal duct a probe, down into the nostril, and then using bougies for the dilatation of the passage. This method may be said to be the model of that, which has been most extensively followed even down to the present time. Pellier and Watien recommended the introduction of a metallic tube down the nasal duct, and leaving it for a time in that situation; with the view of preventing the duct from closing again; and the use of a cannula was preferred by Dupuytren.

The tube is placed in the nasal duct by means of a steel stilet bent at a right angle, of which the portion beyond the bend corresponds to the cavity of the tube. The latter must be fairly lodged in the duct, with its upper or expanded portion occupying the lower part of the sac. The skin heals over the tube which constitutes an artificial passage for the tears. Experience proves that a metallic tube will not serve permanently for the natural duct; after a few months the tube gets out of its place, rises too high, or sinks too low, or becomes obstructed. In some instances it causes inflammation; and, in other examples, severe pain and

aching in the corner of the eye, not remediable unless the tube be withdrawn. Mr. Lawrence observes, that the necessity for such removal is not a very rare occurrence, as may be inferred from the circumstance of Baron Dupuytren having devised means expressly calculated for the extraction of the tube. (*On Dis. of the Eye*, p. 714.) M. Darcet records twenty-seven cases in which this became indispensably necessary. In some instances it glides into the nostrils, and the operation completely fails. M. Delpach knew it make its way through the roof of the mouth: the operation of taking it out is worse than the original one. (See *A. Velpeau, Nouv. Élém. de Méd. Opératoire*, t. i. p. 647.)

The desire of avoiding any puncture of the sac has influenced many practitioners besides Anel, and given rise to various ingenious inventions. Thus, in 1780, Sir William Blizard proposed, instead of injecting water, to introduce quicksilver through a small pipe, communicating with a long tube full of this fluid. The specific gravity of the quicksilver, when the sac was distended with it, he believed, would have more power, than water propelled through a syringe, to remove the lachrymal obstruction. (See *Phil. Trans.* vol. xx. p. 239.)

The late Mr. Ware, after trying Sir William Blizard's plan, gave the preference to Anel's syringe, with which he generally injected warm water, through the lower punctum lachrymale, into the lachrymal sac, and put a finger over the superior punctum to prevent the fluid from escaping through it. With his finger, he also occasionally compressed the lachrymal sac, in order to assist in propelling the water down into the nose. He sometimes used the injection thrice a day, though, in general, less frequently.

"I in general begin the treatment by injecting some warm water through the inferior punctum lachrymale, and I repeat the operation four or five days in succession. If, in this space of time, none of the water pass through the duct into the nose, and if the watering of the eye continue as troublesome as it was before the injection was employed, I usually open the angular vein, or direct a leech to be applied near the lachrymal sac; adding here a caution, that the leech be not suffered to fix on either of the eyelids, lest it produce an extravasation of blood in the adjacent cells. About the same time that blood is taken away in the neighbourhood of the eye, I usually vary the injection, and try the effects either of a weak vitriolic, or anodyne, lotion. In some instances, also, when I have found it impossible, after several attempts, to inject any part of the liquid through the duct, I have introduced a golden probe, about the size of a bristle, through the superior punctum lachrymale, and, attending to the direction of the duct, have insinuated its extremity through the obstruction, and conveyed it fully into the nose; immediately after which I have found, that a liquid, injected through the inferior punctum, has passed without any difficulty; and by repeating these operations for a few successive days, I have at length established the freedom of the passage, and completed the cure. In other instances, I have recommended a strongly stimulating sternutatory to be snuffed up the nose, about an hour before the time of the patient's going to rest, which, by exciting a large discharge from the Schneiderian membrane, has

sometimes also greatly contributed to open the obstruction in the nasal duct."

When the discharge was fetid, Mr. Ware sometimes found, that the zinc lotion, injected into the sac, quickly corrected the quality of the matter.

In a subsequent tract, Mr. Ware observes, that if, after "about a week or ten days, there be not some perceptible advance towards a cure, or if, from the long continuance of the obstruction, there be reason to fear, that it is too firmly fixed to yield to this easy mode of treatment, I do not hesitate to propose the operation which is now to be described. The only persons, with respect to whom I entertain any doubts as to the propriety of this opinion, are infants. In such subjects, I always think it advisable to postpone the operation, unless the symptoms be particularly urgent, until they are eight or nine years old.

"If the disease has not occasioned an aperture in the lachrymal sac, or if this aperture be not situated in a right line with the longitudinal direction of the nasal duct, a puncture should be made into the sac, at a small distance from the internal juncture of the palpebræ, and nearly in a line drawn horizontally from this juncture towards the nose, with a very narrow spear-pointed lancet. The blunt end of a silver probe, of a size rather smaller than the probes that are commonly used by surgeons, should then be introduced through the wound, and gently, but steadily, be pushed on in the direction of the nasal duct, with a force sufficient to overcome the obstruction in this canal, and until there is reason to believe, that it has freely entered into the cavity of the nose. The position of the probe, when thus introduced, will be nearly perpendicular: its side will touch the upper edge of the orbit, and the space between its bulbous end in the nose and the wound in the skin, will usually be found, in a full-grown person, to be about an inch and a quarter, or an inch and three eighths. The probe is then to be withdrawn, and a silver style of a size nearly similar to that of the probe, but rather smaller, about an inch and three eighths in length, with a flat head like that of a nail, but placed obliquely, that it may sit close on the skin, is to be introduced through the duct, in place of the probe, and to be left constantly in it. For the first day or two after the style has been introduced, it is sometimes advisable to wash the eye with a weak saturnine lotion, in order to obviate any tendency to inflammation which may have been excited by the operation; but this in general is so slight, that I have rarely had occasion to use any application to remove it. The style should be withdrawn once every day for about a week, and afterwards every second or third day. Some warm water should each time be injected through the duct into the nose, and the instrument be afterwards replaced in the same manner as before. I formerly used to cover the head of the style with a piece of diachylon plaster spread on black silk, but have of late obviated the necessity for applying any plaster by blackening the head of the style with sealing wax."

On first trying this method, Mr. Ware did not expect any relief, till the style was left off. However, he found, that the watering of the eye ceased as soon as the style had been introduced, and the sight became proportionably more useful and strong.

The wound was only just large enough to admit the end of the probe or style; and this soon became a fistulous orifice, through which the style could be passed without pain.

Some, finding no inconvenience from the style, and being afraid to leave it off, wear it for years; many others disuse it in about a month, or six weeks, and continue quite well. The ulcerations, sometimes existing over the lachrymal sac, commonly heal, as soon as the tears can pass down into the nose; but Mr. Ware mentions two instances, in which such sores did not heal until bark, and small doses of the oxy muriate of mercury, had been administered.

Mr. Travers is strongly disposed to doubt, whether any permanent benefit was ever derived from letting the style remain in the passage. When an abscess over the sac has been opened, this gentleman, instead of the introduction of a style into the ductus nasalis, recommends simply the examination of the duct with a fine probe. "If the probe passes without resistance into the nose, the case requires no further operative treatment; the integument recovers its healthy condition under an emollient application; the discharge gradually diminishes, and the wound heals. If, on the other hand, upon examination with the probe, introduced through the wound into the sac, resistance is offered to its passage into the nose, no more favourable opportunity will be presented for overcoming such resistance. This, therefore, should be accomplished, but to this the operative process should be limited, and the wound should be suffered to heal without further disturbance." When there is what Mr. Travers terms a stricture in the nasal duct, and the passage of the probe is more firmly resisted, he admits that some means must be employed for keeping the duct pervious, after it has been reopened. He never interferes with the integuments, except in the case of abscess discolouring the skin, and threatening to produce a fistula; and for the purpose of restoring the passage, he uses a set of silver probes, about five inches long, of various sizes, flattened at one end, and slightly bulbous at the point. When there is no obstruction, these, he says, may be introduced with perfect facility from either of the puncta lachrymalia into the nostril. "If the punctum be constricted, it is readily entered, and dilated by a common pin; and upon withdrawing it, by one of the smaller probes. The direction and relative situation of the lachrymal ducts, the sac, and nasal canal, point out the proper course of the instrument. It is confined by its advance, without the employment of force, and the sensation conveyed by the free and unencumbered motion of its point. Until the point is fairly within the sac, it is necessary to keep the eyelid gently stretched and slightly everted; the upper lid being drawn a little upward toward the brow, the lower, as much downward toward the zygoma. The point carried home to the sac, and touching lightly its nasal side, the lid may be left at liberty while a half-circular motion is performed by the instrument; the surgeon neither suffering the point to recede nor, on the other hand, allowing it to become entangled in the membrane. The probe now rests, in a perpendicular direction, upon the eyelid, towards its inner angle, and, in this position, it is to be gently depressed, until it rests upon the floor of the nostril, where its presence is readily ascertained by a common probe

passed beneath the inferior turbinated bone. The probe, of smallest dimensions, is of sufficient firmness to preserve its figure in its passage through the healthy duct, but it is too flexible to oppose any considerable obstruction. For the stricture of the lachrymal ducts, it is of sufficient strength. Very many cases of recent origin, and in which the stricture has no great degree of firmness (Mr. Travers says), are completely cured by three or four introductions of the probe into the nostril, at intervals of one or two days. I have seldom met with a stricture so firm as not to yield to the full-sized probe." When the resistance is not altogether removed, after this plan has been tried some days, Mr. Travers introduces a style, having a small flat head, a little sloped, through the punctum lachrymale into the nose, and leaves it in the nasal duct for twenty-four hours. If worn longer, he says that it causes ulceration of the orifice. A day or two is to elapse before the style is again introduced, which must now be passed through the other lachrymal duct. On the intervening days, tepid water should be injected with Anel's syringe. (*Synopsis of the Diseases of the Eye*, p. 369, 370, 372, 374.)

Thus we see, that Mr. Travers's practice bears a considerable resemblance to that of Anel, inasmuch as the sac is never opened, except when likely to ulcerate, and nearly every thing is done with probes and injections, introduced through the lachrymal puncta and ducts. I wish that my views of the nature of these diseases, and of the parts concerned, would allow me to think the latter proceedings, in the case of stricture of the nasal duct, as commendable as another part of Mr. Travers's practice, where, in cases of slighter obstruction, he contents himself with opening the sac, clearing away the stoppage of the nasal duct with a probe, and healing up the wound, without leaving any style, cannula, or seton, in the passage. When the obstruction is very slight, such practice must be judicious. But, if in other cases, it be deemed right, for the prevention of a relapse, that the nasal duct should be either filled with some dilating instrument a certain time, or repeatedly probed, I am decidedly of opinion, with Beer, Nicod, &c., that the object of not making a small opening in the sac is attended with no advantage at all likely to counterbalance the mischief, which must be done to the lachrymal puncta and ducts, not only by the repeated introduction of probes and of syringes, but by the lodgment of the former in them for the space of twenty-four hours together. If there be an opening in the sac, its convenience in permitting the easy use of a probe is generally acknowledged; and, in order to gain this advantage, and avoid the evils, which are inseparable from taking too much liberty with the lachrymal puncta and ducts, surely a slight puncture in the sac, if there be no opening already, must be the most rational, simple, and successful practice.

Supposing the nasal duct to be obliterated, for a considerable part of its extent, by a firm substance, what practice should be followed? Ought the formation of an artificial passage to be attempted? On this point modern practitioners differ; but, as the expedients, adopted for this purpose, cannot be judged of previously to their description, it will be better in the first place briefly to notice them. As Pott has remarked, the upper and hinder part of the lachrymal sac is firmly attached

LACHRYMAL ORGANS, DISEASES OF THE.

to the os unguis, a small, and very thin bone, just within the orbit, which bone is so situated, that, if it be by any means broken through, the two cavities of the nose and orbit communicate with each other; consequently, the os unguis forms the partition between the hinder part of the lachrymal sac, and the upper part of the cavity of the nose; and it is by making a breach in this partition, that the formation of an artificial passage has been attempted. In Pott's time, the cautery had long been disused for making an aperture in the os unguis, and various instruments were recommended for this object, such as a large strong probe, a kind of gimblet, a curved trocar, &c., each of which, says this practical writer, if dexterously and properly applied, will do the business very well: the only necessary caution is, so to apply whatever instrument is used, that it may pierce through that part of the bone which lies immediately behind the lachrymal sac, and not to push it too far up into the nose, for fear of injuring the os spongiosum behind, while it breaks its way. Pott always used a curved trocar, the point of which was turned obliquely downward, from the angle of the eye, towards the inside of the nose. The accomplishment of the breach was known by the discharge of blood from the nostril, and of air from the wound, upon blowing the nose.

As soon as the perforation had been made, Pott introduced a tent of lint, and afterwards a piece of bougie, or a leaden cannula.

Were preferred a nail-headed style, about an inch long, which was worn for as long a time as was thought necessary to establish the freedom of the communication.

Unfortunately for the scheme of making an artificial passage, nature was generally so busy, that she completely frustrated the aim of the surgeon by gradually filling up the new aperture again. Hence, some practitioners were not content with drilling a hole through the os unguis, but actually removed a portion of this bone, either with the forceps proposed by Lamorier in 1729 (see *Mém. de l'Acad. des Sciences*), or with cutting instruments, amongst which the most celebrated is the sharp-edged kind of cannula devised by Hunter. While this was being applied, however, it was necessary to support the os unguis with something passed up the nose, and a piece of horn was found to answer very well.

I do not feel it necessary to enter further into the details of these methods of forming an artificial passage between the lachrymal sac and nostril. I have never seen a case in which I should have deemed such practice advisable; and that the necessity for it must be rare, may be inferred from what Mr. Travers has observed, viz. that he does not believe the perforation of the os unguis ever really required. (*Synopsis, &c.* p. 379.) Beer's remarks are also decidedly against the practice; for he states, that, in order that the new opening may not be closed with lymph, it must be made too high up to serve the purpose of a drain, through which the mucus can descend by its own gravity. He has not met with a single case, either in his own practice, or amongst the patients whom he has had opportunities of seeing under other practitioners, where the perforation of the os unguis had a successful result. On the contrary, in one healthy lad, the operation, which had been done by an experienced surgeon, was followed by the destruction

of the nasal process of the upper maxillary bone, one of the ossa nasi, and all the bones contributing to the formation of the passage from the orbit into the nose. (See *Lehre von den Augenkr.* b. ii. p. 182.) Hence, Beer thinks, that the patient had better either submit to the inconvenience of being obliged to empty the distended sac by pressure several times a day, or let the cavity of the sac be obliterated by means calculated to excite the adhesive inflammation in it. But if the lachrymal puncta and ducts, as well as the nasal duct, are obliterated, Beer conceives that there is no alternative; because, if the cavity of the sac be left, the case, which he terms *hydrops sacculi lachrymalis*, will ensue, whenever the fistula is closed.

Of Hernia and Hydrops of the Lachrymal Sac.—The diseases, described by Beer under these appellations, are not discriminated in this country, although they are characterised by widely different symptoms, and require opposite methods of treatment. In the case of hernia, or simple relaxation, the lachrymal sac forms a tumour which never surpasses the size of a common horsebean, the integuments are of their natural colour, the tumour is soft and yielding to pressure, by which the contents of the sac are readily discharged through the puncta, or nasal duct. Hydrops grows to the size of a pigeon's egg, is purplish from the beginning, very hard, and incapable of being emptied by the strongest pressure. Hernia is cured by compression, and the application of astringents to the relaxed parts; hydrops requires the incision of the sac. In hernia, the nasal duct is natural; in hydrops, it and sometimes the puncta are obstructed.

Stillicidium Lachrymarum.—According to Beer, the valuable treatise of Schmidt is the only work, in which the important practical distinction is drawn between *stillicidium lachrymarum* and *epiphora*; the immediate cause of the first complaint being some impediment to the passage of the tears from the *laeus lachrymarum* into the lachrymal sac; while the other affection consists in a redundant and extraordinary secretion of the tears. The curable form of *stillicidium*, here to be noticed, arises from relaxation of the lachrymal puncta and canals, in consequence of previous inflammation of the parts. The puncta are widely open; but, in other respects, have quite a natural appearance. When touched with Anel's probe, they do not contract, as in the healthy state. The tears, which from time to time fall over the cheek, are not in considerable quantity, only trickling from the inner canthus by drops at intervals; and the nostril on the affected side is found to be rather drier than natural.

Erysipelatous inflammation of the eyelids and parts over the lachrymal sac, and the purulent kinds of ophthalmia, frequently cause this sort of *stillicidium*. The latter cases, indeed, the more readily produce the disorder, inasmuch as the semilunar fold of the conjunctiva is relaxed and swelled, so as to push the puncta out of their right position for the due performance of the absorption of the tears, and obstruct this function more than would be the case, if the diminished action of those orifices and the lachrymal ducts were the only thing concerned.

Beer delivers an exceedingly favourable prognosis, observing, that the complaint often disappears of itself on the approach of warm dry weather, and may be readily cured, by means of astringents.

Amongst other remedies specified by this author, I need only mention a solution of the sulphate of iron, to which a small quantity of camphorated spirit, or tincture of opium, has been added. It is to be dropped out of a pen into the inner angle frequently in the course of the day, the patient lying upon his back for some time after each application, so as to let the medicine have more effect upon the parts. (See *Lehre von den Augenkr.* b. ii. p. 41—43.)

Mr. Travers mentions a constricted state of the lachrymal puncta and canals, which is curable by the introduction of a small probe. (*Synopsis*, &c. p. 366.) All modern writers agree, that the obliterated puncta and canals can never be restored.

See Mém. de l'Acad. de Chir. t. v. edit. 12mo., in which are several essays on fistula lachrymalis: viz. one by M. Bordenave, entitled "Examen des Réflexions Critiques de M. Molinell, insérées dans les Mémoires de l'Institut de Bologne, contre le Mémoire de M. Petit, sur la Fistule Lachrymale, inséré parmi ceux de l'Acad. Royale des Sciences de Paris, année 1734." Another essay, by M. de la Forest, styled "Nouvelles Méthodes de traiter les Maladies du Sac Lachrymal, nommées communément Fistules Lachrymales." A third by M. Louis, called "Réflexions sur l'Opération de la Fistule Lachrymale." J. L. Petit, Traité des Mal. Chir. t. i. p. 289, &c. 8vo. Paris, 1774. A. Bertrandi, Traité des Opérations, p. 297. 8vo. Paris, 1784. Ane! has described his plan of treatment in various works: "Obs. singulière sur la Fistule Lachrymale, dans laquelle l'on apprendra la Méthode de la guérir radicalement." Turin, 1713, in 4to. "Nouvelle Méthode de guérir les Fistules Lachrymales." Turin, 1713, in 4to. "Suite de la Nouvelle Méthode." &c. Ibid. 1714, in 4to. "Dissertation sur la Nouvelle Découverte de l'Hydropisie du Conduit Lachrymal." Paris, 1716, in 12mo. And, lastly, Ane! has published, in the Mém. de l'Acad. des Sciences, année 1713, "Précis de sa Nouvelle Méthode de guérir les Fistules Lachrymales." Méjean, in Mém. de l'Acad. de Chir. t. ii. p. 193. 4to. Palucci, Methodus curandæ Fistulæ Lachrymalis, Vindob. 1762; a tube preferred. Richter's Anfangsgründe der Wundarzneikunst, b. ii. kap. 14. Pott's Obs. relative to Fistula Lachrymalis, 8vo. Lond. 1758. Sir W. Bizard, A New Method of Treating Fistula Lachrymalis, 4to. Lond. 1780. Ware on Empyora and Fistula Lachrymalis, 8vo. Lond. 1792—93. Scarpa, sulle principali Malattie degli Occhi, capo 1. Walther's New and Easy Method of applying a Tube for the Fistula Lachrymalis, Lond. 1781. and 2d ed. 1792. Sprengel, Geschichte der Wichtigsten Chir. Operationen, p. 105. Nicod, Mém. in Revue Méd. Historique, &c. livr. i. et ii. 8vo. Paris, 1820. Fournier, Dis. de l'Appareil des voies Lachrymales, Montpellier, 1803. J. L. Angely, De Oculo Organique Lachrymalibus ratione Etatis, Secus, Gentiis, et Vartorum Animalium, 8vo. Erlange, 1805. J. A. Schmidt, über die Krankheiten des Thränenorgans, 8vo. Wien, 1808. Reil, Dis. de Chir. Fistulæ Lachrymalis Curatione, Berol. 1812. Rajani, Collezione d'Osservazioni, t. iii. Desault, Œuvres Chir. t. i. p. 119. 8vo. Paris, 1801. J. C. Rosenmüller, Partium Externarum Oculi Humani, imphris Organorum Lachrymalium, Descriptio Anatomica; Iconibus Illustrata, 4to. Lips. 1810. C. H. T. Schreger, Versuch einer Vergleichenden Anatomie des Auges und der Thränenorgane des Menschen und der übrigen Thierklassen, 8vo. Leips. 1810. Berr, Lehre von den Augenkrankheiten, b. ii. 8vo. Wien, 1813—1817. Wm. Mackenzie, Essay on the Dis. of the Excreting Parts of the Lachrymal Organs, 8vo. Lond. 1819; and in Treatise on Dis. of the Eye, ed. 2. 8vo. Lond. 1835. H. Travers, Synopsis of the Diseases of the Eye, p. 228—359, &c. 8vo. Lond. 1820. W. Lawrence, on Dis. of the Eye, chap. 29. 8vo. Lond. 1833. R. Middlemore, on Dis. of the Eye, chap. 22. vol. ii. 8vo. Lond. 1835. Ph. v. Walther, ueber die steinigen Concretionen der Thränenflussigkeit, in Journ. für Chirurgie von C. Graefe, b. i. p. 163. 8vo. Berlin, 1820. M. le Baron Dupuytren, in Leçons Orales de Clinique Chir. t. iii. art. 9. 8vo. Paris, 1833.

LAGOPHTHALMIA, or LAGOPHTHALMOS. (from *lagos*, to hare; and *ophthalmos*, an eye.) *Hare's Eye.* *Oculus Lepirinus.* A disease, in which the eye cannot be completely shut. The following complaints may arise from it: a constant weeping of the organ, in consequence of the interruption of the alternate closure and opening of the eyelids, which motions so materially contribute to the propulsion of the tears into the

nose; blindness in a strong light, in consequence of the inability to moderate the rays, which fall on the eye; on the same account, the sight becomes gradually weakened; incapacity to sleep where there is any light; and irritation, pain, and redness of the eye, from its being exposed to extraneous substances in the atmosphere.

An enlargement or protrusion of the whole eye, or a staphyloma, may obviously produce lagophthalmos. But affections of the upper eyelids are the common causes. Heister saw the complaint produced by a disease of the lower one. Now and then lagophthalmos depends on paralysis of the orbicularis muscle. A cicatrix is the most frequent cause.

When lagophthalmos arises from a paralytic affection of the orbicularis palpebrarum, the eyelids may be rubbed with a liniment containing the tinctura lyttæ, or the linimentum camphoræ. Electricity, or galvanism may be tried, together with bark, the shower-bath, &c.

When the affection arises from spasm of the levator palpebræ superioris, the surgeon may try a blister on the temple, rub the eyelid and eyebrow with the tinctura opii, and prescribe antispasmodic medicines.

When lagophthalmos arises from the contraction of a cicatrix, its relief is to be attempted precisely on the same principles as are applicable to ectropium. (See *Ectropium*.)

The inconveniences, depending on the eye being unable to shelter itself from the light, are to be obviated by means of a green shade.

LARYNGOTOMY. (from *λάρυγξ*, the larynx; and *τέμνω*, to cut.) The operation of making an opening into the larynx.

It consists either in puncturing the crico-thyroid membrane, as first proposed by Vicq d'Azyr; or, in dividing at the same time the thyroid cartilage in the median line, as first suggested by Desault; or in dividing the cricoid cartilage and upper rings of the trachea, as originally recommended by Boyer. The last operation is sometimes termed *laryngo-tracheotomy*. To these methods is to be added that of making the opening through the hyo-thyroid membrane, as proposed by M. Malgaigne. 1. The first modification of laryngotomy consists in opening the inferior part of the larynx, in the small triangular membranous space, which lies between the thyroid and cricoid cartilages. The thyroid cartilage is exposed by dividing the skin and subcutaneous fascia: into the posterior surface of it, near the middle line, and at its lower third, are inserted the thyro-arytenoid muscles, and the chordæ vocales. The patient should be in the recumbent posture, with the head thrown back so as to render the pomum Adami prominent. The incision should begin over the upper part of the thyroid cartilage, and be carried down to the cricoid cartilage. The crico-thyroid membrane having been exposed, the crico-thyroid artery is to be depressed with the nail, and the membrane opened directly above it. A probe-pointed bistoury, or the blade of a pair of blunt-pointed scissors, may then be introduced, with the edge turned upwards, and the cartilage cut in the direction of the middle line, without inclining to the right or left, for fear of injuring the chordæ vocales. (See F. Malgaigne, *Mém. de Méd. Opér.* p. 468. ed. 2.)

Of the operation, performed in the crico-thyroid

membrane, Sir Charles Bell entertains a favourable opinion. He directs us to slit up the membrane, and open the incision with the handle of the knife, when the patient will immediately breathe with ease. Here, says he, there is nothing to alarm the most timid operator. No great turgid veins are opened: the cut is made above the thyroid gland, and above the anastomosing branch of the thyroid arteries. The part is strongly marked by the prominence of the thyroid cartilage above, and the ring of the cricoid cartilage below. "If the occasion be temporary, a simple slit of the membrane will be found sufficient. If necessary, a transverse cut will afford any degree of opening. If a round hole be desired, the four corners, left by the incisions, may be snipped off;" or the edges of the opening may be kept asunder by means of the doubled wire of a catheter, the middle part of which lies on the wound, while the ends are bent round the neck, and tied with a ligature behind. In Sir C. Bell's cases, less annoyance was caused by this contrivance than the tube.

2. *Laryngo-Tracheotomy.* As the lower part of the incision implicates the trachea, the isthmus of the thyroid gland must be cut; but the plexus of thyroid veins should, if possible, be avoided. Higher up, the knife passes through the skin, the fascia, the cricoid cartilage, and the cricothyroid membrane, on which a small artery runs transversely. This it is desirable not to wound. The patient's head and neck being inclined back, so as to render the larynx prominent, an incision is to be made from the lower edge of the thyroid cartilage, and extended downwards an inch and a half so as to bring a portion of it over the trachea. As soon as the crico-thyroid membrane has been exposed, the artery is to be pushed upwards with the nail of the left fore-finger; the larynx opened below the vessel; and then the cricoid cartilage, and three or four of the upper rings of the trachea divided from above downwards. (See *J. F. Malgaigne, Op. cit.* p. 488, ed. 2.)

3. *Laryngotomy through the Thyro-hyoid Membrane.*—This method has been proposed by M. Malgaigne. A transverse incision, about two inches in length, is made directly below the thyroid bone. With the second stroke of the knife, the platysma, and the inner half of each sternohyoid muscle is divided. The point is then directed upwards and backwards, and the thyro-hyoid membrane divided in the same transverse direction, together with those fibres of it which proceed to the epiglottis. The mucous membrane is thus exposed, and, at each expiration, it protrudes through the wound. It is now taken hold of with forceps, and divided, whereby the epiglottis is brought into view; and, being forced into the wound by the breath, is to be taken hold of with forceps or a hook, by which means the whole of the interior of the larynx will be exposed to view, and the instrument passed into it under the guidance of the eye. (See *Manuel de Méd. Opér.* p. 489, ed. 2.)

With respect to the advantages of laryngotomy, Mr. Potter pronounces it to be "an operation unattended either with difficulty or danger, and will answer every purpose when the cause of obstruction is seated in the rima glottidis, or above it." (On the *Surgical Pathology of the Larynx*, p. 265.) A single opening in the crico-thyroid membrane would suffice for the introduction of a

cannula, for the purpose of enabling the patient to breathe; but for the extraction of foreign bodies, it would be necessary also to cut the thyroid cartilage. The fact, that extraneous substances, when they are loose, are almost always lodged at the upper part of the larynx proves, that laryngotomy, in such cases, must commonly be most advantageous; and, according to Desault, even when the foreign bodies are lower down in the trachea, they may in general be most easily extracted with the aid of a pair of curved forceps.

"Of the three situations (says Mr. Lawrence) in which it has been proposed to make the opening, viz. in the thyroid cartilage, between that and the cricoid, or in the trachea, I consider the first as the least eligible. Besides the objections from the ossification of the cartilage, and the danger of wounding, or otherwise injuring, the chordæ vocales, there is the inconvenience in the case of angina laryngea arising from the swollen and thickened state of the membrane, which may actually impede the passage of the air. I am not aware of any objection to a transverse opening between the thyroid and cricoid cartilages. The prominence of the former in the neck, serves as a guide to the part which should be opened. Whether bronchotomy, or laryngotomy, ought to be selected, must of course depend upon the nature of the case: in cases of cynanche, the proximity of the inflamed parts would be an objection to laryngotomy; while, in examples of foreign bodies within the glottis, this operation may generally be most advisable. It is absurd to think of confining one mode of operating to different cases." (See *Medico-Chir. Trans.* vol. vi. p. 248.)

Laryngotomy, in Vicq d'Azyr's manner, seems to M. Velpeau to be most easily performed, and to have the advantages of implicating no part of importance, and of leaving the glottis uninjured; but when foreign bodies require extraction, the opening is too small for the introduction of instruments; and it would not admit a cannula of sufficient size to let respiration be freely carried on. Hence, M. Velpeau thinks favourably of the plan of opening the larynx more extensively, especially as no artery or vein of importance is in danger of being wounded. This, he says, is the only method of exposing foreign bodies, which mostly lodge in the rima glottidis, and of getting at polypi, and other growths within the larynx. "Although an injury of the chordæ vocales (says he) is easy to avoid, and of little consequence; and although the voice is not more impaired by this operation than others, yet it merits preference only in the cases specified, and when the thyroid cartilage does not contain too much phosphate of lime." (See *A. Velpeau, Nouv. Élém. de Méd. Opér.* s. ii. p. 207.)

As for laryngo-tracheotomy, which usually leaves the thyroid gland uninjured, but wounds the crico-thyroid artery, M. Velpeau observes, that it does not, like the method of Desault, enable the surgeon to see to the bottom of the larynx; and, while it is too far from the bronchi, to be convenient for the extraction of such foreign bodies as are not movable, it is too near the glottis for the safe employment of a tube. Hence, except when Desault's plan is especially indicated, M. Velpeau generally prefers tracheotomy. Of M. Malgaigne's operation, I cannot speak

from experience; but, as being less simple than a division of the crico-thyroid membrane, or of this and the thyroid cartilage, it seems not to be entitled to general adoption, even where an opening very high up is desirable. Whatever considerations it may have in its favour, in especial cases, depend upon its bringing the interior of the larynx more completely into view, than is effected by other plans.

LATERAL OPERATION. One mode of cutting for the stone. (See LITHOTOMY.)

LEECHES are often preferable to cupping, which is attended with more irritation than many surfaces, under particular circumstances, can bear, especially when the topical bleeding is to be frequently repeated; and they can be used in cases in which it would not be safe or convenient to employ the lancet.

Formerly medicinal leeches were very abundant in England, but owing to their now being in greater request, and to the draining and cultivation of waste lands, it is necessary to import large supplies from the continent, chiefly from Bourdeaux and Lisbon. As much imposition prevails in this branch of commerce, it should be understood, that, unless a leech be marked with yellow rings or spots, or with variegated lines, running the whole length of the back, it will generally be found useless. (See *J. R. Johnson on the Medicinal Leech*, p. 133. 8vo. Lond. 1816.) When leeches are to be kept in any considerable quantity, this gentleman recommends them to be placed in a large vessel, provided with a false bottom, so perforated as to allow them a ready passage. "This false bottom should be raised from three to six inches above the real bottom, or to such an extent as will admit of a turf, of nearly equal dimensions, being placed between them. It should fit closely to the sides, that the earth may not be disturbed by the frequent introduction of fresh water. It is necessary that the vessel be also furnished with a stop-cock, in order that the water may be drawn off as often as may be considered expedient. But, previously to our placing the leeches in this vessel, they should be singly examined. If, on being handled, they contract, and feel hard and firm, it affords the best indication of their being healthy; but, should they feel flabby, or exhibit protuberances, or white ulcerous specks on the surface, they should be kept in jars by themselves, the water and the turf of which should be frequently renewed." (*Op. cit.* p. 136.)

Sometimes leeches cannot be easily made to fix on the part to which they ought to be applied; but they will generally do so, if the temperature of the part be lowered with a cloth dipped in cold water, or if the surface be moistened with cream or milk, and they be confined in the situation with a small glass.

The following directions are given by Dr. Johnson: The part, on which they are intended to fix, should be as clean as possible. It should, therefore, be first washed with soap and water, and afterwards with water alone, which will be more necessary, should any liniment or embrocation have been employed. Leeches are often found to bite better, when removed from the water, at least an hour previously to their application. In the common practice of putting as many of them, as may be required, into a wine-glass, and inverting it upon the part affected, there is the disadvantage, that they frequently

retire to the upper part of the glass, and cannot be got down again, without some risk of displacing those which have already fastened. To remedy this inconvenience, Dr. Johnson's glass vessels are of various sizes and figures, but none of them more than an inch deep. But in his own practice, he prefers applying leeches with his hand. "Bring a leech towards the part, whereon you intend to fix it, and as soon as it begins to extend the head to seek an attachment, endeavour that it may affix itself to the place required." When it evinces no disposition to bite, a little puncture may be made with a lancet, and the animal will fix itself. "When the patient is fearful of the lancet, and one leech only shall have bitten, though several are required, it may be of use to remove it, which is readily done by inserting the nail of the finger between its mouth and the skin. The blood then flowing from the orifice, will induce the remainder to bite with the greatest avidity. As soon as the leeches are gorged, they drop off; this usually happens within ten or fifteen minutes. Sometimes they remain affixed a considerable time, and become indolent; but they are quickly aroused from this state by sprinkling them with a few drops of cold water." (*Johnson, Op. cit.* p. 141.) When they fall off, the bleeding may be promoted, if necessary, by fomenting the part. When the bleeding continues longer than is desirable, a slight compress will usually stop it; but in more troublesome cases, the compress must be dipped in brandy or spirits. In young infants the hemorrhage from the bites of leeches has sometimes proved fatal, and the same thing may happen in adults. (See HEMORRHAGE.)

In order to make a leech disgorge, it is usual to throw a little salt upon it: in a few seconds the blood is ejected, the leech assumes a coiled form, and is seldom found fit for use again before the end of four or five days. As salt, however, frequently blisters the leech, it has been proposed to empty the animal by regular and uniform pressure; but though Dr. Johnson considers this plan better than the other, he admits that it is scarcely practicable, without injuring the internal structure of the leech. He says, the best method, and that from which the animal suffers the least inconvenience, is pouring a small quantity of vinegar upon its head. Leeches which have been recently applied should always be kept by themselves, and allowed to retain, for their nourishment, about one third of the blood which they extract. For a great deal of valuable information respecting leeches, see Dr. Johnson's work, the title of which is above specified.

When leeches are very scarce, their tails may be snipped off, while they are sucking, and the blood will then flow, drop by drop, from the artificial opening, as fast as the animals suck it; or, with the same view, an incision may be made with a lancet close to the tail. (*Johnson, Op. cit.* p. 144.)

Instead of applying warm wet cloths to promote the bleeding from leech-bites, a plan which is fatiguing, and sometimes objectionable, as making the bed-clothes damp, Dr. Osborne recommends the application of warm cloths of linen, or calico, perfectly dry, and removed in succession, as they become saturated. By these means, the blood is absorbed by capillary attraction. (See *Dublin Journ. of Med. Science*, vol. iii. p. 337.)

In many cases, where no fear exists of the bleeding taking place too copiously, it is an excellent plan to cover the part with a linseed poultice, as soon as the leeches have fallen off.

Leeches will live and draw blood, although immersed in water at a temperature considerably above 100°. Hence, in violent inflammation of the abdominal viscera, when local bleeding and fomentation are both at the same time indicated, the patient may be placed in a hip bath, without waiting for the leeches to fall off. (Osborne, *Op. cit.*) The application of leeches to mucous surfaces, a plan recommended by Mr. Crampton, is occasionally tried with great benefit. The latter adopted this method in cynanche; and Dr. Osborne in some other cases. A thread is passed through the tail of the leech, and held, and the mouth guided to the desired point, by means of a probe or channel made with card. In this way, leeches may be applied to the Schneiderian membrane, tunica conjunctiva, inside of the meatus auditorius, and even to the rectum, by means of a metallic rod, to which the leeches are fastened with thread. (See *Dublin Journ.* vol. iii. p. 340.)

Professor Major puts the leeches under a cupping glass, with a piece of lighted wax taper. The glass is a little raised for a moment, and the rarified air allowed to escape. The light goes out, and the leeches instantly begin to bite the prominent integuments. In this plan, the patient does not feel the bites at all, which bleed more effectually from the atmospheric pressure being removed. (See *Journ. Clin. des Hôpitaux de Lyons*, t. i. p. 376.)

LENTICULAR. (from *lenticulaire*, doubly convex.) An instrument employed for removing the irregularities of bone from the edge of the perforation made in the cranium with the trephine. One side of its blade is convex, the other concave; and one of its edges is sharp. On the end of the blade is fixed a little shallow cup, with its concavity towards the handle of the instrument. This part serves the purposes of receiving the little pieces of bone, when detached, keeping the end of the blade from hurting the dura mater, and, when applied under the margin of the opening enables the operator to guide the edge of the instrument all round it with steadiness and security.

LEUCOMA. (from *λευκός*, white.) Leucoma and albugo are often used synonymously to denote a white opacity of the cornea. A dense coagulating lymph is extravasated from the arteries, sometimes superficially, at other times deeply into the substance of the cornea. On other occasions, the disease consists of a firm callous cicatrix, the effect of an ulcer or wound of the cornea with loss of substance. The term *albugo* strictly belongs to the first form of the disease; *leucoma* to the last.

A recent albugo, the consequence of ophthalmia, is of a clear milky colour; but, when of ancient date, it becomes pearl-coloured. It may generally be dispersed by the means employed for the relief of the first and second stages of acute ophthalmia; viz. general and topical blood-letting, with internal antiphlogistic medicines, and topical emollients for the first; and slightly irritating and corroborant applications for the second stage. As soon as the inflammation has subsided, the latter should

be employed; for, by exciting the absorbents to remove the coagulating lymph, deposited in the cornea, they restore the transparency of this membrane.

But, though this may often be accomplished in the recent state of albugo, it is more difficult when the long duration of the disease has paralysed the absorbents of the affected part; or when the deposition of a dense tenacious substance into the cornea has subverted its organisation. (*Scarpa.*)

The recent condition of the disease, without disorganisation of the structure of the cornea; its occurrence in young subjects whose absorbents are readily excited by external stimulants; are circumstances favourable to the cure. In children the albugo, arising from the small-pox, and insulated in the centre of the cornea, often disappears of itself in the course of a few months. For promoting this absorption, Scarpa recommends the following collyrium: R Ammon. muriatis ʒij. Cupri acetatis gr. iv. Aquæ calcis ʒ viij. Misce. The fluid is to be filtered, after standing twenty-four hours. He praises also this ointment: R Tutia prepar. ʒj. Aloes. s. p. gr. ij. Hydrargyri subaur. gr. ij. Adipissuillæ, ʒ ss. Misce; and Junin's ophthalmic ointment.

Dr. Mackenzie recommends a solution of from two to ten grains of lunar caustic, or from one to two grains of oxy muriate of mercury, in an ounce of distilled water; red precipitate salve of various strength; or a finely levigated powder, consisting of ʒj. of red precipitate, and ʒj. of white sugar. The powder is to be blown into the eye with a quill; the salve is to be introduced behind the upper eye-lid, and rubbed on the cornea by moving the lid with the finger for some minutes. The solution may either be dropped in by means of a camel-hair pencil, or injected with a syringe. Hydriodate of potass salve, the bile of various animals, and oil of walnuts have all been employed.

We are able, as Dr. Mackenzie observes, by various applications, to quicken the action of the absorbents in the removal of specks, especially if the applications in question be employed at the proper time. If we commence their use too soon, that is to say, before the cause of the opacity is subdued, we shall torment the patient unnecessarily, and impede the cure. "For instance, suppose that, in a case of albugo, arising from serofulous cornetis, and still attended with considerable vascularity, the practitioner forthwith begins to attack the opacity of the cornea with stimulating powders, and solutions of irritating, or caustic substances; not only would he fail in effecting his object, but run a great chance of rendering his patient totally blind. But, if he began by combating the inflammation, which still lingered in the eye, and that chiefly by constitutional remedies; not merely would he witness the dispersion of the redness, but he would find the cornea begin to clear, and day after day, a little more of the effused lymph being removed, the patient's vision would proportionably improve." In general, the internal and constitutional remedies, which do good in cases of specks of the cornea, are those which operate in removing the ophthalmia, in which the opacities have originated, and the same observation is also true in regard to local remedies. At the same time, there are both general and local

means peculiarly adapted for hastening the absorption of opaque depositions in the cornea. Mercury is a general remedy of this kind. Some opacities yield only to country air and generous diet. (See *MacKenzie on Dis. of the Eye*, p. 584. ed. 2.)

The same experienced practitioner notices also the usefulness of a blister kept open behind the ear or on the nape of the neck, and of repeatedly scarifying the inner surface of the eyelids. The vascular albugo he has found incurable, until the vessels proceeding to it had been divided, and the gums made sore with mercury.

All the expedients, proposed for the inveterate albugo or leucoma from a cicatrix, consisting of scraping or perforating the layers of the cornea, and exciting ulceration, are unavailing. For, though the enlargement of the cornea should be lessened by such means, its diaphanous state could not be restored; or should the patient perceive a ray or two of light immediately after the operation, the benefit would only be transient; for, as soon as the wound had healed, the opacity would recur. The formation of an artificial ulcer might prove useful, if leucoma depended on a mere extravasation of lymph; but the disease arises from the deposition of an opaque substance, and the disorganisation of the texture of the cornea, conjointly.

(See *Scarpa sulle Malattie degli Occhi*, 8vo. Venezia, 1802. Richter, *Anfangsgründe der Wundarznei*, b. iii. *Essays on the Morbid Anatomy of the Eye*, by J. Wardrop, Edinb. 1808. chap. xi. *Wm. MacKenzie on Dis. of the Eye*, 8vo. ed. 2. Lond. 1835.)

LIGATURE. In the article **HEMORRHAGE**, it has been explained, that the immediate effect of a tight ligature on an artery, is to cut through its middle and internal coats, a circumstance that tends very much to promote the adhesion of the opposite sides of the vessel to each other. Hence, I think with Dr. Jones, in opposition to Scarpa, that the form and mode of applying a ligature to an artery should be such as are most certain of dividing the above coats of the vessel in a regular manner. A broad flat ligature does not seem likely to answer this purpose well; because it is scarcely possible to tie it smoothly round the artery which is apt to be thrown into folds, or to be puckered by it, and consequently, to have an irregular bruised wound made in its middle and internal coats. (Jones.) A ligature of an irregular form is likely to cut through these coats more completely at some parts than others; and if it does not perfectly divide them, though adhesion may yet take place, it is a slower and less certain event, and secondary hemorrhage more likely to follow. The fear of tying a ligature too tight may often lead to the same disadvantages. These, and many other important circumstances are noticed in the article **HEMORRHAGE**.

Ligatures used commonly to be made of inkle, and rubbed with white wax. They should be round, and very firm, so as to admit of being tied with some force, without risk of breaking. (See *Jones on Hemorrhage*, p. 172.)

The principles, which should guide the surgeon in the use of the ligature, were not known, until the late Dr. Jones published his valuable treatise on hemorrhage. As an able surgeon has observed "He has banished (at least in this country) the use of thick and broad threads, of tapes, of reserve ligatures, of cylinders of cork and wood,

linen compresses, and all the contrivances which, employed as a security against bleeding, only served to multiply the chances of its occurrence." (Lawrence, in *Med. Chir. Trans.* vol. vi. p. 162.)

In the article **AMPUTATION**, I have noticed the method of cutting off both ends of the ligature close to the knot, on the face of the stump, with the view of lessening the quantity of extraneous matter in the wound, and promoting the complete union of the divided parts, without suppuration. This plan was tried by Mr. Lawrence:—"The method I have adopted, says this gentleman, consists in tying the vessels with *fine silk ligatures* and cutting off the ends as close to the knot as is consistent with its security. Thus the foreign matter is reduced to the insignificant quantity, which forms the noose actually surrounding the vessel, and the knot by which that noose is fastened. Of the silk which I commonly employ, a portion sufficient to tie a large artery, when the ends are cut off, weighs between $\frac{1}{30}$ and $\frac{1}{50}$ of a grain: a similar portion of the thickest kind I have tried weighs $\frac{1}{20}$ of a grain, and of the slenderest, $\frac{1}{50}$."

The kind of silk twist, which is commonly known in the shops by the name of dentist's silk, and which is used in making fishing lines, is the strongest material, in proportion to its size, and therefore the best calculated for our purpose, which requires considerable force in drawing the thread tight enough to divide the fibrous and internal coats of the arteries. This twist is rendered very hard and stiff by means of gum, which may be removed by boiling it in soap and water; but the twist then loses a part of its strength. The stoutest twist, which Mr. Lawrence has used, is a very small thread, compared with ligatures made of inkle. The quantity of such a thread necessary for the noose and knot on the iliac artery, weighs $\frac{1}{50}$ of a grain; or, if the gum has been removed, about $\frac{1}{35}$. But the finest twist, kept in the silk-shops, is strong enough, in its hard state, for any surgical purpose; and the noose and knot, according to Mr. Lawrence's statement, would not weigh $\frac{1}{60}$ of a grain.

It further appears, from the report of this gentleman on the subject, that there is no danger of these ligatures cutting completely through the vessel, as some surgeons have apprehended; and that, although he has not yet ascertained what becomes of the pieces of ligature after the wound is united, he has never seen abscess nor any other bad symptoms occasioned by them. At the time when Mr. Lawrence wrote, he had employed this method of securing the arteries in ten or eleven amputations, in six operations on the breast, and in the removal of two testicles. The cases all did well, excepting a man who lost his thigh, and who died of an affection of the lungs. (See *Lawrence on a New Method of tying the Arteries in Aneurism*, &c., in *Medico-Chir. Trans.* vol. vi. p. 156. &c.)

The foregoing method was tried by myself in several amputations, which I performed in 1815, at Brussels, and in a larger number of cases by my friend, Mr. Collier. Our ligatures, however, though small, were not so small as those judiciously recommended by Mr. Lawrence; and, on this account, no accurate inferences can be drawn from our examples.

This subject was noticed by Mr. Guthrie as follows.—"Some military surgeons, both French

and English, have lately adopted the practice of cutting off both ends of the ligatures, close to the knot on the artery; uniting the parts if possible, over them, and allowing the knots to find their way out as they can. The edges of the wound, in some instances, have united thoroughly in a few days; and when the knots have come off the ends of the arteries, they have caused small abscesses to be formed, which point at the nearest external surface, and are discharged with little uneasiness. I know, that many cases, treated in this manner in the campaign of 1813, ended successfully, and healed in as short a time as the most favourable ones by the usual method; and at Montpellier, in June, 1814, Mons. Delpech, Professor of Surgery in that University, showed me at least twenty cases in which he had practised, and was still practising, this method with success. I have seen, however, in two or three instances some ill-looking abscesses formed by them, and I suspect some disagreeable consequences will ensue, if this practice be continued.

"I consider this improvement as very valuable in all cases, that will not unite by the first intention. The ligatures, if there be many, form into ropes, are the cause of much irritation, and are frequently pulled away with the dressings: by cutting them off, these evils are avoided, and the knots will come away with the discharge." (*On Gunshot Wounds*, p. 93, 94.)

M. Roux tried the plan in three operations on the breast: the cases did well; and no ill consequences arose from the presence of the bits of thread under the cicatrix. (See *Relation d'un Voyage fait à Londres en 1814, ou Parallèle de la Chirurgie Angloise avec la Chirurgie Française*, Paris, 1815, p. 134—136.) Mr. Fielding, of Hull, admits that this method occasions less irritation in the first instance, than the usual mode of leaving one or two ends of silk attached to the knot, and bringing them out of the wound, and that union by the first intention is thus more certainly effected; but he assures us that, in a great variety of cases, in which he has adopted the practice, the knots of silk were not absorbed, and were ultimately thrown off unchanged, after a slow suppuration, attended with pain and irritation for several weeks or months. (See *Edinb. Med. Chir. Trans.* vol. ii. p. 341.) Ligatures of silk-worm gut, according to his experience, do not lead to the above inconveniences. (See AMPUTATION, ANEURISM, and HEMORRHAGE.)

According to Mr. Liston, "Ligatures, of whatever substance, do now and then remain hid for a long time; but, very generally they occasion trouble. They, perhaps, after the cure has been thought complete, give rise to irritation, pain, inflammatory swelling, and formation of matter; abscess after abscess ensues; one knot comes out after another; and ultimately all the offending bodies may be expelled; but the perfect recovery is thus very long protracted. In all wounds, likely to heal at an early period, the one end of the ligature on the small vessels had best be cut off close to the knot, and the other left only of such length as to project but little from the surface of the integuments. They should be brought out at one or other end of the incision, and, if possible, the whole, or the greater number at the most depending extremity. In such wounds as it is not advisable, or possible to bring together, both ends

of all the ligatures may be cut off close to the surface of the wound. (*On Practical Surgery*, p. 24. 8vo. Lond. 1837.)

Dr. Reese also concurs with Mr. Guthrie. "Where resolution (says he) is not expected, nor desirable, the practice is less exceptionable; and in certain amputations and gunshot wounds, where the escape of these knots is easy from the exposed condition of the stump, this method may be safely adopted. But in wounds made by the surgeon for securing arteries, which are deep-seated, and where union by the first intention is often important, the old method is greatly to be preferred. Some of the most distinguished surgeons in this country, after having repeatedly tried Mr. Lawrence's plan, with attention to all the minute particularity which he so judiciously enjoins, as regards the size and material of the ligature, have laid it aside altogether, and prefer always to leave the end of their ligatures hanging from the wound or stump. Among these is Professor Mott, of New York." (See *Reese's Amer. ed. of this Dictionary*, vol. ii. p. 130.)

The method of cutting off both ends of the ligature close to the knot, may now be said to be generally abandoned, and only adopted in a few cases where the wound cannot be brought together, or must inevitably suppurate freely.

The silk-worm-gut, preferred by Mr. Fielding, was first suggested as an advantageous material for ligatures, by Dr. M'Sweeny, of Cork (see *Edinb. Med. and Surgical Journ.* vol. xiv. p. 597.); and I have great pleasure in here mentioning his claims to the proposal.

Although, in the present state of surgery in England, less importance is attached to the materials, than to the size, consistence, and form of ligatures, I deem it right to insert the remarks of Drs. Reese and Jamieson, of the United States, on what has been termed the *animal ligature*. "To our distinguished countryman, Professor Physick, of the University of Pennsylvania, is undoubtedly due the honour of having first introduced, in 1814, what is known as the *animal ligature* into surgical practice. His ligatures are made of chamois leather, and he and the late Dr. Dorsey, usually rolled their ligatures on a slab to make them hard and round. The advantages, proposed by the ligatures of Dr. Physick, and, that being made of animal matter, the knot, which is all that is left in the wound will serve long enough to obliterate the artery, and be speedily removed by the absorbents, thus avoiding the difficulty arising from a foreign body, however minute. These ligatures have been used in this country to great extent, and Sir Astley Cooper has demonstrated their superiority in his own operations. (Sir Astley Cooper has since relinquished them.) Dr. Harbison used strips of parchment for his ligatures. My friend, Dr. H. G. Jamieson, Professor of Surgery in Washington Medical College, Baltimore, has for a series of years been employing the animal ligature in an extensive surgical practice; a number of his operations I have witnessed. He has used it in many amputations of the limbs and the mamma: he has tied the carotid, the iliac, the femoral, the radial, the posterior tibial, the spermatic, and other arteries, with the *chamois ligatures*; and, in no instance, had secondary hemorrhage occurred; and he states that he has never seen any thing of his ligatures, and, of course,

the wounds have generally healed by the first intention." (See *Amer. ed. of this Dictionary*, art. *LIGATURE*.)

Dr. Jamieson's principles are entirely different from those which influence all the most distinguished practitioners in Great Britain, and which appear to me to have been the means of rendering secondary hemorrhage, after the application of a proper ligature, rather an uncommon event. Dr. Jamieson is an advocate for tying the artery with a very soft buckskin ligature, and a little broader than the thickness of the skin, taking care not to tie it too tight. He states, as the result of his observation and experiments upon sheep, dogs, and other animals, that a capsule will surround the ligature, if the capillary vessels be not much disturbed; or the vessel will be surrounded by an abundance of lymph, and the ligature dissolved. Like Scarpa, he prefers flat ligatures; but, by the use of buckskin, has no need to remove the ligatures on the fourth day, as the Italian professor had. (See *Dr. Reese*, *Op. cit.*; and *H. G. Jamieson*, in *Medical Recorder*, No. xxxvii. January, 1827.)

If any surgeons here were likely to become admirers of flat tape like ligatures, I would remind them of the evils formerly attending their use in the London Hospitals, and of Dupuytren's observation:—"It has been proved, says he, that the efficacy of the action of ligatures is independent of their flat form, because, however broad they may be, they assume a roundish shape when tightened." (See *Clinique Chir.* t. iv. p. 398.)

Dr. Veitch, while doing duty, in the years 1803-4-5, as surgeon of the Royal Naval Hospital, at Plymouth, had frequent occasion to remark the danger of large flat ligatures, then employed for the stoppage of bleeding; and his reflections led him to try very small ones, so that the quantity of extraneous matter in the wound, and in contact with the secured blood-vessels, might be reduced. "This improvement (says Dr. Veitch), which extends itself to all the operations in surgery, I carried to an extent that no one has usefully exceeded; not only by the diminution of foreign matter in securing the divided arteries, but by the distribution of these ligatures in the wounds, inflicted by the operations of surgery, and which distribution of the ligatures combined, with their form, brought this part of surgery as near perfection as it is capable of being. The sufferance of foreign matter in the wound, by cutting off the dependent ligatures, and allowing the knots only to remain on the arteries, and attempting to heal the wounds over them, has not been found to answer. The mode of arresting hemorrhage, which I adopted, was carried into effect before the book of Dr. Jones was published, and without any knowledge of his experiments. I was not aware, at the time I so successfully employed the single round ligatures, of the change that the artery undergoes by their action, and which knowledge led Dr. Jones very properly to recommend a round ligature; but, I may here remark, that such recommendation was not sufficiently explicit; for it left the surgeon at liberty to introduce as much foreign matter in a round, as had previously been done in a flat form, in securing arteries, &c. My experience and reasoning led me to recommend a small ligature; and its nature and form were not left to conjecture, but, clearly laid down, and the introduction of this practice to sur-

gery, by which its limits have been extended; is I think, unquestionably due to me." Dr. Veitch transmitted his first Essay on the Ligature of Arteries to the editor of the *Edinb. Med. and Surg. Journ.* in 1805, though it was not published till 1806, Dr. Jones's work came out in 1804. I am glad to have this opportunity of mentioning the claim of Dr. Veitch to the honour of the above-mentioned very important improvement. (See his *Obs. on the Ligature of Arteries, Secondary Hemorrhage, and Amputation at the Hip-joint*, 8vo. Lond. 1824.) The evils of reserve ligatures are so generally known, that no chance exists of their ever being resorted to again by any well-educated surgeon. M. Delpach, once a zealous advocate for them, entirely relinquished them many years previously to his lamented assassination, and became firmly convinced of the advantages of following the practice dictated by the results of Dr. Jones's investigations. Some surgeons adopt the practice of removing neither end of the ligature, when a large artery, such as the carotid, external iliac, or subclavian is tied. But if care be taken to apply the ligature with due tightness, this method can never be advisable.

Mr. Guthrie considers a ligature, composed of one thread of dentist's silk, well waxed, to be sufficiently strong for any artery of moderate size; and is of opinion, that two threads will be found strong enough by the most cautious. "The advantages, (says he) to be derived from the application of a small ligature, from the least possible disturbance of the surrounding parts, and from absolute quietude, whilst the healing processes are going on, must be so obvious as to require no further observation." Mr. Guthrie has adduced several cases in which secondary hemorrhage was the consequence of motion of the limb at too early a period, and of undue interference with the ligature. "When secondary hemorrhage occurs to any extent (he observes) either through ulceration of the artery, or from extension of ulceration, or sloughing of surrounding parts to it, a ligature must be placed upon it nearer to the heart, and as far above the mischief, which has taken place, as the collateral circulation will permit." He adds, however, that "many secondary hemorrhages may be restrained, and ultimately suppressed by moderate pressure; and the ligature should only be had recourse to, when the application of pressure appears to be, or has been proved to be, insufficient for the purpose." (See *G. J. Guthrie on the Diseases, &c. of Arteries*, p. 163—166.)

The great difficulty in such circumstances arises from the general inability of the parts to bear pressure, without an extension of gangrene being the result. Great caution and skill must be used therefore, in the adjustment of it; for much circular constriction of the part will surely have the most fatal consequences.

According to Mr. Guthrie, "the reflux blood from the lower end of a great artery, after its division, will be of the colour of venous blood: it will flow also like blood from a vein. After the lapse of several days, it will assume more and more the character of arterial blood, but will not obtain the same degree of impulse, which is so remarkable when it proceeds from the upper extremity of the artery." (*Op. cit.* p. 137.) Many years ago, Sir Astley Cooper operated for

a popliteal aneurism, and, after applying two ligatures to the femoral artery, divided the vessel in the interspace: the lower ligature slipped, and a violent bleeding arose from the distal end of the artery; but so dark was the colour of the blood, that it was at first conjectured to come from the vein.

These observations are intended by Mr. Guthrie to refer chiefly to the wounds of middle portions of the femoral and brachial arteries; and not to wounds of the radial and ulnar, where branches form direct communications between one vessel and the other; and the blood has not to pass through the capillaries to reach the distal part of the wounded vessel.

These statements, if found to agree with general experience, will be practically useful, as affording a clue to the end of the vessel, from which the bleeding arises, and to which the ligature should be applied.

Various instruments for conveying a ligature under a very deep artery, have been invented by Desault, Ramsden, Weiss, M'Intyre, and others. (See ANEURISM.)

The most complete invention for the application of ligatures round certain tumours which admit of being thus extirpated, is that of Baron Graefe, termed the *encircling ligature apparatus*. A pamphlet, containing a correct description of it, has been translated from the German, by Fred. F. Weiss, of the Strand.

LINIMENTUM ACIDI SULPHURICI.—R Olei olivæ ʒjss. Acid. sulph. ʒss. M. Recommended by Sir Benjamin Brodie for the removal of some effects of inflammation of the synovial membrane. (See JOINTS.)

LINIMENTUM AMMONIÆ FORTIUS. R Liq. ammon. ʒj. Olei olivæ ʒijj. Misce. Properties stimulating.

LINIMENTUM CALCIS.—R Aquæ calcis, Olei olivæ, sing. ʒviij. Spirit. vinosi rectificati ʒj. Misce. A common application to burns and scalds.

LINIMENTUM CAMPHORÆ COMPOSITUM.—R Camph. ʒij. Liq. Ammon. ʒvj. Spiritus lavand. ʒxvj. Sixteen ounces are to be distilled of the last two ingredients, from a glass retort, and the camphor then dissolved in the distilled fluid. For bruises, sprains, rigidities of the joints, incipient chilblains, &c.

LINIMENTUM CAMPHORÆ ÆTHEREUM.—R Camphoræ drach. j. Ætheris unc. ss. Olei viperarum, drach. ij. Misce. The camphor is to be dissolved in the æther, and the oil afterwards incorporated with it. The late Mr. Ware sometimes used this application in certain obscure affections of the eye, in which it was not easy to determine, whether the imperfection of the sight proceeded from an incipient cataract, or a defect of sensibility in the optic nerve. The outside and edges of the eyelids were rubbed with it, every morning and evening, for two or three minutes.

LINIMENTUM HYDRARGYRI COMPOSITUM.—R Ung. hydrargyri fortioris, adipis suillæ, sing. ʒj. Camph. ʒij. Spirit. vinosi, rectific. ʒj. Liq. Ammon. ʒj. The camphor being dissolved in the spirit of wine, add the liq. ammon. and the ointment previously blended with the hog's lard. (Pharm. Sancti. Barthol.) An excellent formula for all surgical cases in which the object is to quicken action of the absorbents, and stimulate the surfaces of the parts. Instead

of the liquor ammoniæ, it is better in some cases to add the tincture of iodine, or ʒij. of the hydriodate of potassa.

LINIMENTUM IODINÆ.—R Lin. sapon. comp. ʒj. Tinct. iodinæ ʒj. Misce. (See *Manson's Researches on the Effects of Iodine*, p. 451.)

LINIMENTUM POTASSÆ SULPHURETI.—R Saponis albi ʒiv. Olei amygdalæ ʒviij. Potassæ sulphureti ʒvj. Olei thymi gr. xv. vel ʒj. This liniment, used twice a day, will cure the itch in five days, or at latest in eight. It has not a very unpleasant smell, and would be preferable to sulphur ointment, if equally efficacious. (See *London Medical Repository*, vol. iii. p. 242; and *Crusse's Sketches of the Medical Schools of Paris*, p. 176.)

LINIMENTUM SAPONIS COMPOSITUM.—R Sapon. ʒijj. Camph. ʒj. Spirit. rorismar. ʒj. Dissolve the soap in the spirit, and then add the camphor. Uses, the same as those of the linimentum camph.

LINIMENTUM SAPONIS CUM OPIO.—R Lin. sapon. comp. ʒvj. Tinct. opii ʒij. Misce. For dispersing indurations and swellings attended with pain, but no acute inflammation.

LINIMENTUM TEREBINTHINÆ.—R Ung. rosinæ flavæ ʒiv. Ol. terebinthinæ q. s. Misce. The well-known application for burns, recommended by Kentish. (See BURNS.)

LINIMENTUM TEREBINTHINÆ SULPHURICUM.—R Olei olivæ ʒx. Ol. terebinth. ʒiv. Acidi sulph. ʒijj. Misce. Efficacious in some chronic affections of the joints, and in the removal of the effects of old sprains and bruises. (Pharm. Chirurgica.)

LIP, CANCER OF. The lips are subject to ulcers which put on a very malignant aspect, although some of them are not in reality malignant; and many, situated just on the inside of these parts, will be found to depend on the bad state of the constitution, and the irritation and disturbance which the sores are continually suffering from the incessant motion of the parts, and their rubbing against a projecting or rough tooth.

"The continual irritation arising from the introduction of food, the effort of speaking, and the constant flow of saliva (as Mr. Earle remarks), are sufficient to keep up the morbid disposition, and to prevent any reparative effort of nature from being carried into effect. After a time, the neighbouring glands will often become enlarged, which confirms the surgeon in the opinion he had been induced to form of the nature of the affection." (See *Med. Chir. Trans.* vol. xii. p. 272.) The irritation of tobacco-pipes frequently gives rise to malignant, and even truly cancerous, diseases of the lip. The use of cigars may have the same effect. (See vol. cit. p. 278.)

The internal exhibition of arsenic may prove serviceable in subduing the obstinacy and malignity of certain ulcers and diseases of the lip, reputed to be cancerous. (Stark, *De Cancro Labii Inferioris*.)

When cancer takes place, it is usually in the lower, and very seldom in the upper lip. Sir A. Cooper has seen but one instance of it in the latter part.

The disease sometimes puts on the appearance of an ulcerated wart-like excrescence, occasionally acquiring a considerable size. Sometimes it is seen in the form of a very destructive ulcer, which consumes the surrounding substance of the lip;

and, 'in other examples, the disease resembles a hard lump, which, at length, ulcerates. The disease, in its infancy, is often no more than a pimple, which gradually becomes malignant. As the disease advances, the glands under the jaw enlarge. According to Mr. Travers's observations, cancer of the lower lip begins in the cellular tissue between the mucous membrane and the skin. The enlargement and induration, he says, render it conspicuous before the villous surface of the lip cracks transversely, and a thin fluid oozes; it then exulcerates and scabs by turns, and ultimately penetrates more deeply, and throws out a fungus. The patient is generally a healthy male of advanced years, and accustomed to smoking. Pus sometimes escapes when the fungus is divided; but the base of the tumour is hard and granular. The skin and mucous membrane, and the labial glands, now prominent and warty, form a close compact mass. As the ulceration proceeds, the induration extends, and the salivary glands, and the lymphatic glands at one or both angles of the jaw, become enlarged and tender. (Travers, in *Med. Chir. Trans.* vol. xv. p. 239.) Whenever there is reason to believe that the disease is of an unyielding, cancerous nature, and it does not soon give way to arsenic, iodine, hemlock, or mercurials, the sooner it is extirpated the better. For this purpose, some surgeons admit the propriety of using caustic, when the whole disease can be completely destroyed by one application. But as the action of caustic is not capable of being regulated with so much precision as the extent of a wound can be, and as caustic will not allow the parts to be united again, the knife is the only justifiable means, especially as it also occasions less pain. Two incisions are to be made, meeting at an angle below (supposing it to be the lower lip), and including the whole of the disease. The sides of the wound are then to be united by the twisted suture. (See *LABELLIP*.) When the affection is extensive, however, the surgeon is frequently necessitated to remove the whole of the lip, or too much of it to admit of the above plan being followed. This circumstance has generally been regarded as particularly unfavourable; and it has been commonly believed, that, unless some attempt can be made to succour the patient by the Tullian practice, in the manner mentioned by Mr. Earle (*Med. Chir. Trans.* vol. xii. p. 276.), the patient's spittle would continually run over his chin, or only admit of being kept from doing so by some artificial contrivance. It was also thought that the deformity would be very great, and that pronunciation and swallowing would be but imperfectly performed. Baron Dupuytren many years ago, occasionally adopted the practice of cutting off a considerable portion of the lip by a semilunar incision, and yet the part healed so as to leave but little disfigurement. M. Malgaigne deems the plan of excising the lip by a semilunar incision proper, only when the cancer is superficial and extends along the border of the lip. The incision, in the shape of the letter V, is to be preferred, in the opposite circumstances, and especially when the commissures of the lips are implicated. (See *Man. de Méd. Opér.* p. 447. ed. 2.) Some observations published by Mr. Travers, however, tend to prove that the disadvantages of this plan have been exaggerated; and, convinced of the prudence of a free removal of the disease

in its early stage, he prefers "a full crescent-shaped section of the substance of the lip" to an operation resembling that for the cure of a hare-lip. He recommends the commissure of the mouth to be spared, if possible: "The contraction, during the healing process under a double-headed bandage, passing over the vertex and occiput, so as to keep a little moistened lint, or simple ointment, on the cut surface, shapes and adapts the lip with singular neatness; and, what is more remarkable, the cut surface takes a depth of colour, and a plumpness, and a defined border, which give much the appearance of the natural surface." In one case of malignant ulcer published by Mr. Earle, he removed the angle of the mouth, and a large portion of each lip, together with a considerable part of the cheek, yet succeeded in uniting the wound, which object was facilitated by the extraction of five teeth from the lower jaw previously to the operation, which were useless, in consequence of having no corresponding ones in the upper jaw. (*Med. Chir. Trans.* vol. xii., p. 274.)

LIPPITUDO. (from *lippus*, bleared-eyed.) *Blearedness.* The ciliary glands, and lining of the eyelids, only secrete, in the sound state, just a sufficiency of a sebaceous fluid to lubricate the parts in their continual motions. But it sometimes happens from disease, that this sebaceous matter is secreted in too great a quantity, and glues the eyelids together during sleep, so that, on waking, they cannot be easily separated. Hence the margin of the eyelids becomes red all round, and even the sight itself weakened.

The best remedies are the unguentum hydrargyri nitratis, smeared, at night, on the edges and inside of the eyelid with a hair pencil, after being melted in a spoon; the unguentum tutiæ, applied in the same way; and a collyrium, composed of ʒj. of the sulphate of zinc in ʒ viij. of rose-water. When alterative medicines are requisite a grain of calomel, or the compound calomel pill, may be given every night.

Persons, who have lippitudo and cataracts together, bear couching much better than one would expect from the appearance of the eyes; and Mr. Hey never rejected a patient on this account, provided such state were habitual. (*Pract. Obs.* p. 61.) However, the lippitudo, if possible, should be removed, before the operation is undertaken.

LIQUOR ARSENICALIS.—For internal use the dose is iij. drops gradually increased to xx. twice a day. It is frequently given in cases of anomalous ulcers, and cancerous affections of the face. It is also used as an external application in similar cases, and especially in hospital gangrene. (See *ARSENIC*, and *HOSPITAL GANGRENE*.)

LIQUOR CALCIS.—Sometimes used as an astringent injection, lotion, or gargle. It has been given internally as a lithontriptic, and as an alterative in scrofula.

LIQUOR CUPRI SULPHATIS CAMPHORATUS.—℞ Cupri sulphatis, boli Gallici, sing. unc. ss. Camphoræ drach. j. Aquæ ferventis, lb. iv. The boiling water is to be added to the other ingredients, and the liquor filtered when cold. It is chiefly employed in a diluted state, as a collyrium; but sometimes as an application to ulcers.

When used for the cure of purulent ophthalmia, it is to be injected under the eyelids, by means of a blunt syringe; and if necessary, the application

repeated once or twice every hour. (See OPHTHALMY.)

LIQUOR POTASSÆ, has been given with the view of dissolving stone in the bladder. (See URINARY CALCULI.) By the employment of it, in large doses, certain fatty tumours have been dispersed. (Sir B. Brodie.) This occurrence must be extremely rare.

The ordinary dose is from ten to twenty drops, twice a day, in some linseed tea, veal broth, or table beer. It is useful in lepra, psoriasis, and some other cutaneous diseases. (See *Paris's Pharmacologia*, vol. ii. p. 281. ed. 5.)

LIQUOR POTASSÆ SUBCARBONATIS.—This is deserving of notice on account of its use in gonorrhoea and scrofula, and its having been given to dissolve calculi in the bladder, so as to remove the necessity of performing the dangerous and painful operation of lithotomy. It may be exhibited in doses of 20 or 40 drops, or of a drachm, in a basin of gruel. Experience does not justify the indulgence of much hope, with regard to the complete efficacy of the medicine in dissolving urinary calculi, and on some kinds it is not calculated to act at all, even on chemical principles; but it has often materially palliated the pain, which attends the presence of a stone in the bladder. (See URINARY CALCULI.)

LIQUOR POTASSÆ ARSENICATÆ.—R Potassæ arsenicatæ grana duo. Aquæ mentha sativæ uncias quatuor. Spiritus vini tenuioris unciam. Misce et cola. Two drachms of this may be given thrice a day in cases of cancer. My friend, Mr. Barnes, of Exeter, once showed me a lupus, or noli me tangere, which was greatly benefited by this remedy externally applied. He was using the lotion with double the proportion of arsenic. Certain ulcerations about the roots of the nails of the fingers and toes, to which Plunket's caustic is sometimes applied, are benefited by this lotion.

LIQUOR PLUMBI ACETATIS.—Is used largely diluted with water, as a common application to inflamed parts. (See INFLAMMATION.) One drachm to a quart of water is strong enough for common purposes. Mr. Justamond and Dr. Cheston used to apply it, mixed with an equal proportion of the tincture ferri muriatis, to the edges of cancerous sores.

LITHONTRIPTICS. (from λίθος, a stone; and *τρίπτω*, to break.) Medicines for dissolving stones in the bladder. (See URINARY CALCULI.)

LITHONTRIPTOR. The name of an instrument for breaking calculi in the bladder, or reducing them into small particles, which are voided with the urine, and lithotomy thus rendered unnecessary. According to some accounts, the invention is an ancient one; according to others, it was devised by Gruithuisen, Elderton, or M. Le Roy d'Étiolles, but first brought into much notice by the exertions of Dr. Civiale of Paris. It is not for me to enter now into the dispute concerning the degree of merit, which may belong in this subject to each of these gentlemen, or to Baron Heurteloup, who has warmly defended the priority of M. Le Roy's claim, at the same time that he has himself contributed very much to the perfection of the instruments and the success of the practice. (See LITHOTOMY.)

The lithonriptor will effect the removal of much larger calculi than can be drawn out with

the urethral forceps made by Mr. Weiss (see LITHOTOMY); and, in this respect, is superior to the latter instrument, and a truly great improvement. But, for other cases, in which the calculi are numerous, and not too large to be drawn out in an unbroken state through the urethra, the urethral forceps still merits the preference. (See LITHOTOMY.)

LITHOTOMY. (from λίθος, a stone; and *τέμνω*, to cut.) The operation of cutting into the bladder, in order to extract a stone. No operation in surgery has attracted so much notice, or had so much written upon it, as lithotomy. A full and minute account of the sentiments of every writer who has treated of it, and a detail of the infinite variety of plans of making an opening into the bladder, would occupy as many pages as are allotted to the whole of this Dictionary. It must be my endeavour, therefore, rather to describe what is most interesting and important, than pretend to offer an article, which is to comprehend every thing.

Throughout the following columns, I suppose the reader to be already well informed of all that relates to the anatomy of the bladder and adjacent parts, especially the perineum. Without correct knowledge of this kind, a man must be presumptuous, indeed, to set himself up for a good lithotomist; and if he were to distinguish himself at all, it would only be by the murders which he committed. No man, therefore, should attempt lithotomy, who has not made himself familiar with the relative situation of all the parts in the pelvis and perineum, by careful and repeated dissection.

The nature of calculi in the bladder, the circumstances under which they form, and the influence of different periods of life, sex, climate, and localities, in promoting or preventing their production, will be considered under the head of URINARY CALCULI, where will also be found some observations on lithontriptics. The manner of searching for the stone, or, as it is now more commonly expressed, of sounding, will be explained in the article SOUNDING.

Here I shall principally confine myself to the symptoms of the disease, and the chief methods of executing the much-diversified operation of lithotomy.

SYMPTOMS OF THE STONE.

The symptoms of a stone in the bladder are, pain in the extremity of the urethra, and in the glans; and hence, the patient often acquires the habit of pulling the prepuce, which sometimes becomes much elongated, especially in children; frequent propensities to make water, and go to stool; great pain in voiding the urine, and difficulty of retaining it, and often of keeping the feces from being discharged at the same time. In consequence of the calculus falling against the vesical orifice of the urethra, the stream of urine is liable to stop suddenly, while flowing in a full current, although the bladder is not empty, so that the fluid is expelled by fits, as it were. The pain is greatest towards the end of, and just after, the evacuation; there is a dull pain about the neck of the bladder, together with a sense of weight or pressure at the lower part of the pelvis; and even when the calculus is small, a slight cloudiness is seen in the urine, as soon as it begins to cool; and afterwards, a large quantity of mucus

is mixed with it; and sometimes the urine is tinged with blood, especially after exercise.

It is correctly noticed by Sir Benjamin Brodie, that the symptoms differ—1st, according to the size of the stone, the smoothness or roughness of its surface, and its general figure; 2dly, according to the quality of the urine. If the urine be unusually acid, or very alkaline, and deposit the triple phosphate, it will be stimulating, and the symptoms of stone will thereby be aggravated; 3dly, according to the state of the bladder. Nothing aggravates the symptoms so much as inflammation of the mucous membrane; this increases the sensibility of the bladder a hundred-fold, and causes a small stone to produce much greater distress and pain, than a large one under ordinary circumstances. If the bladder be healthy, a very small stone may produce trifling and equivocal symptoms. The patient has rather more frequent occasion to make water; a sense of irritation, scarcely amounting to pain, referred to the neck of the bladder, urethra, and, perhaps, the hypogastrium, after the bladder has been emptied. In one instance, the patient complained for many months of nothing except an occasional and trifling pain in one of the groins, and of the urine being tinged with blood, after riding on horseback. Bloody urine, after any jolting exercise, is a strong indication of a calculus, either in the bladder or kidney. But this symptom is often absent in the early stage, while the stone is small, especially if the patient is leading an inactive life. (See *Sir B. Brodie on Dis. of the Urinary Organs*, p. 225. ed. 2.)

The pain in the glans penis, and fossa navicularis, is most severe after making water, or exercise, when the stone suddenly falls down on the neck of the bladder. This pain "is one of the most marked symptoms of the disease. A child, who labours under stone, tells you of it, not in words, but in his actions. He is always pulling the end of the penis, and pinching it with his fingers, even so as to cause the prepuce to become elongated. You often find his fingers with the cuticle soft and sodden, as if they had been soaked in water, from the urine which has been imbibed." (*Op. cit.* p. 229.)

It seldom happens, that calculous patients void blood with their urine, before other symptoms have taken place. It is not till after the foreign body has descended into the bladder, acquired some size, and presented itself at the orifice of that viscus, that pain is occasioned, particularly when the surface of the stone is unequal. The patient then experiences frequent inclination to make water, attended with pain. The jolting of a carriage, riding on horseback, and much walking, render the pain more acute. The urine appears bloody, and its course is frequently interrupted, and sabulous matter and particles of stone are sometimes discharged with it. The want to make water becomes more frequent and more insupportable. The bladder is irritated and inflamed; its parietes become thickened and indurated; and its diameter is lessened. A viscid, more or less tenacious, matter is observed, in greater or less quantity, in the urine, and is precipitated to the bottom of the vessel. The urine becomes black and putrid, and exhales an intolerable alescent smell, which is perceived at the very moment of the evacuation, and is much stronger a little while afterwards. The patient

can no longer take any exercise, without all his complaints being redoubled. The urine then becomes bloody. (See *Traité Historique et Dogmatique de l'Opération de la Taille*, par J. F. L. Deschamps, t. i. p. 163. Paris, 1796.)

The symptoms of stone in the bladder are exceedingly equivocal, and may be produced by several other disorders, "Pain in making water, and not being able to discharge the urine without the feces, are common consequences of irritation of parts about the neck of the bladder, from a diseased prostate gland and other causes. The urine stopping in a full stream is frequently caused by a stone altering its situation, so as to obstruct the passage; but the same thing may happen from a tumour, or fungus in the bladder. I have seen an instance of this, where a tumour, hanging by a small pedicle, would sometimes cause obstruction, and by altering the posture would retire, and give a free passage. The dull pain at the neck of the bladder, and the sensation of pressure on the rectum, are frequently owing to the weight of the stone, &c.; but these may proceed from a diseased enlargement of the prostate gland. Children generally, and grown persons frequently are subject to a prolapsus ani, from the irritation of a stone in the bladder; but it will likewise be produced by any irritation in those parts." (*Sir J. Earle*.) The rest of the symptoms are equally fallacious; a scirrhus enlargement of the os tincæ, and disease of the kidneys may occasion a copious quantity of mucus in the urine, with pain, irritation, &c. "The least fallible sign (says Sir James Earle) which I have remarked, is the patient making the first portion of urine with ease, and complaining of great pain coming on when the last drops are expelled. This may readily be accounted for, from the bladder being at first defended from contact with the stone by the urine, and, at last, being pressed naked against it. But, to put the matter out of all doubt, and actually to prove the existence of a stone in the bladder, we must have recourse to the operation of sounding."

A stone in the ureter or kidneys, or chronic inflammation in the bladder from any other cause, will sometimes produce the same effects; but if the patient cannot void his urine, except in a certain posture, it is almost a sure sign that the orifice of the bladder is obstructed by a stone. If he find ease by pressing against the perineum with his fingers, or sitting with that part upon a hard body, there is little doubt the ease is procured by taking off the weight of the stone; or, lastly, if, with the other symptoms, he thinks he can feel it roll in his bladder, it is hardly possible to be mistaken; however, the only sure judgment is to be formed from searching.

An enlarged prostate gland is attended with symptoms resembling those of a stone in the bladder; but with this difference—that the motion of a coach, or horse, does not increase the grievances when the prostate is affected, while it does so in an intolerable degree in cases of stone. It also generally happens, that the fits of the stone come on at intervals; whereas, the pain from a diseased prostate is neither so unequal nor so acute. (*Sharp, in Critical Inquiry*, p. 165. ed. 4.)

Though, from a consideration of all the circumstances above related, the surgeon may form a probable opinion of there being a stone in the bladder, he must never presume to deliver a positive

one, nor be so rash as to undertake lithotomy, without having greater reason for being certain that there is a stone to be extracted. Indeed, all prudent surgeons, for centuries past, have laid it down as an invariable maxim, never to deliver a decided judgment, nor undertake lithotomy, without having previously introduced a metallic instrument, called a sound, into the bladder, and plainly felt the stone.

As Dr. Reese has observed, there are frequently cases, in which the symptoms of stone in the bladder are all present, and yet, on examination with the sound, the surgeon will not be able to feel it distinctly, so as to satisfy himself or others. But, as the operation should never be attempted until the stone is plainly felt, when any difficulty exists in ascertaining the presence of the calculus, the patient may be placed nearly on his head, so as to render the fundus of the bladder the lowest part of it, and thus bring the foreign body into contact with the point of the sound. This method is stated to have been first suggested by Dr. Physick, who thus detected calculi, where other surgeons sounded repeatedly without success. (See *Reese, in American Ed. of this Dict.*)

I know of at least seven cases, and at two of them I was present, where the patients were subjected to all the torture and perils of this operation, without there being any calculi in their bladders. The maxim, therefore, cannot be too strictly enforced, that the operation ought never to be attempted, unless the stone can be distinctly felt with the sound or staff. In one of the examples, of which I was a spectator, not only the symptoms, but the feel which the sound itself communicated when in the bladder, made the surgeons imagine that there was a calculus, or some extraneous body in this organ. Most of the above cases, I understand, recovered, which may be considered fortunate; because, when the stone cannot be found, the disappointed operator is apt to persist in roughly introducing his fingers, and a variety of instruments, so long, in the hope of catching what cannot be got hold of, that inflammation of the bladder and peritoneum is more likely to follow, than when a stone is actually present, soon taken out, and the patient kept only a short time upon the operating table.

In a valuable practical work is recorded an instance, in which what is called a horny cartilaginous state of the bladder made the sound communicate a sensation, like that arising from the instrument actually touching a stone, and the surgeon attempted lithotomy. This patient unfortunately died in twenty-four hours. (See *Desault's Parisian Chir. Journal*, vol. ii. p. 125.)

However, were the symptoms most unequivocal, there is one circumstance which would always render it satisfactory to touch the stone with an instrument just before the operation; I mean the possibility of a stone being actually in the bladder to-day, and not to-morrow. Stones are occasionally forced, by the violent contractions of the bladder, during fits of the complaint, between the fasciculi of the muscular coat of this viscus, together with a portion of the membranous lining of the part, so as to become what is termed encysted. Or, as there is reason to believe, the cyst is sometimes produced first, and the calculus is formed in it, as a kind of effect of the existence of the separate pouch. The opening into the cyst is frequently

very narrow, so that the stone is much bigger, than such orifice, in consequence of which it is impossible to lay hold of the extraneous body with the forceps, and the operation would necessarily become fruitless. (*Sharp's Critical Inquiry*, p. 228. ed. 4.)

In the article URINARY CALCULI, I have noticed the probability of this having occurred in some of the instances, in which Mrs. Stevens's medicine was supposed to have actually dissolved the stone in the bladder; for, an encysted stone is not likely to be hit with the sound, nor to cause any inconvenience, compared with what a calculus, rolling about in the bladder, usually occasions.

The degree of pain experienced by the patient depends, not only on the state of the urine and bladder, but on the size, shape, chemical qualities, and situation of the calculus. "A patient with a simple lithic acid calculus, suffers less than one with a calculus composed externally of the triple phosphate; and the latter, less than one with a fusible calculus. The oxalate of lime, or mulberry calculus, on the whole, occasions more distress than the lithic acid calculus, probably on account of the irregularities, which so frequently exist on the surface of the former; but it occasions less distress, than calculi composed of the phosphates." (See *Sir B. Brodie, Op. cit.* p. 229.)

According to the same distinguished practitioner, patients with diseased prostate gland do not generally suffer more from stone in the bladder, when it afflicts them, than other individuals, and perhaps less, in consequence of the swelling of the prostate gland hindering the stone from falling on the neck of the bladder. He has, however, seen three cases, in each of which there was a calculus in the bladder, complicated not only with an enlarged, but an ulcerated prostate; and the sufferings were in these instances horribly severe. In two of them, lithotomy was performed: one of the patients died in five minutes after the operation; and the other became immediately comatose, and sank in a few hours.

It is remarked by Deschamps, that when the stone is lodged in an excavated corner of the bladder, in a particular cyst, or depression; when it projects but very little; when it cannot shift its situation in the bladder, so as to fall against the orifice of this viscus; and when it is also smooth, polished, and light; the patient may have it a long while, without experiencing any afflicting symptoms. He may even live to an advanced age, if not without some degree of suffering, at all events, with such pain as is very supportable. Daily experience proves, that persons may live a considerable time, with one, two, or even three stones in the bladder, and, during the whole of their lives, have not the least suspicion of the existence of these foreign bodies.

According to Deschamps, this must have been the case of M. Portalien, a tailor. This individual, eighty years old, was frequently attacked with a retention of urine from paralysis, and Deschamps introduced a sound several times, and distinctly felt a stone in the bladder. The patient, however, never had any symptom of the disorder, nor even at the end of two years from the time when Deschamps was first consulted. Very large and exceedingly rough stones have also been found in the dead bodies of persons, who had never complained of the symptoms of the disease. Thus, at the Anatomical Theatre of La Charité, Richerand found an enormous mulberry stone in the bladder

of a person, who died altogether of another disease, and never had had any symptom, that led to the suspicion of the stone. (*Nosographie Chir.* t. iii. p. 530. edit. 4.) But, cases of this kind must be rare, because it is well known, that the pain, which a stone produces, is less in a ratio to its size, than to its shape and situation. A small stone, owing to its situation, may be more painful than an enormous calculus, which fills the bladder, as is proved by the following case, by Deschamps.

Pochet, a watchmaker, until the age of forty-five, had never had any infirmity, except that of not being able to retain his water a long while. One day, while he was carrying a very heavy clock, he made some exertions, which, probably, by changing the situation of the calculus, caused at the instant an acute pain in the hypogastric region. Symptoms of the stone soon came on; the pain became intolerable, and the patient went into the Hôpital de la Charité. He was sounded; the stone was felt, and judged to be of considerable size. The incision in the neck of the bladder not sufficing for its extraction, the patient was put to bed again. The next morning, he was operated upon above the pubes by Frère Côme, who extracted an oval calculus that weighed twenty-four ounces. The patient died four and twenty hours after this second operation. This case proves, then, that very large stones may lie in the bladder without occasioning any serious complaints; since the preceding patient apparently had had such a calculus a long time, without suffering inconvenience from it, and it seems likely that he might have continued well still longer, had it not been for the accidental effort, which first excited the symptoms. (*Traité Historique, &c. de la Taille*, t. i. p. 166, 167.)

A gentleman, who had an enormous stone in the bladder, and who consulted Sir Benjamin Brodie, had experienced very slight inconvenience from it during ten years. At length the symptoms became much aggravated, and he submitted to lithotomy. (*See On Dis. of the Urinary Organs*, p. 227.)

A priest, in whom Morand had ascertained the presence of a stone by sounding, could not be persuaded that his case was of this nature. However, he bequeathed his body at his decease to the surgeons, and the examination of the bladder fully justified Morand's prognosis. The celebrated D'Alembert also died with a stone in his bladder, having always refused to be sounded. (*Richter's*, *Op. cit.* t. iii. p. 538.)

At first, the general health is not disturbed; but, in time, it begins to suffer, and the urine becoming alkaline, the triple phosphate is deposited on the original stone. The patient's sufferings are now greatly increased, in consequence of the more stimulating quality of the urine, and the morbid sensibility of the nervous system always accompanying the secretion of such urine. As the disease advances, the irritation of the calculus excites inflammation of the mucous coat of the bladder; and, hence, still greater pain; almost constant desire to make water; the offensive, putrid, and ammoniacal smell of the urine; and a thick mucous sediment in it, streaked with blood. (*See Sir B. Brodie on Dis. of the Urinary Organs*, p. 228.)

When stone in the bladder proves fatal, the usual cause of death is inflammation of the mucous

membrane of the bladder. A moderate degree of chronic inflammation of it may continue for a long time, and, if the stone be extracted, the patient recover. But if it become aggravated, so as to assume an acute form, the patient's situation becomes desperate. The inflammation extends up the ureters to the kidneys. Even the glandular structure of the kidneys becomes affected, and rendered more vascular and softer than natural. Sometimes abscesses form in the kidneys, or a collection of muco-purulent fluid takes place in the pelvis and in the infundibula. Inflammation sometimes extends to the loose cellular tissue around the bladder, and putrid, gangrenous abscesses are produced in it. In one case, where the patient died very soon after lithotomy, a very large pelvic abscess was found to communicate with the bladder. (*Brodie, Op. cit.* p. 231—234.)

A question may here suggest itself: Ought lithotomy to be practised where calculi are under a certain size? Certainly not, because they frequently admit of being extracted through the urethra, or discharged with the urine, without any operation at all, even from the male subject; and how much more likely this is to happen in females, must be plain to every body who recollects the direct course, the shortness, ample size, and dilatability of the meatus urinarius. On this subject, various facts, and, in particular, the dilator used by Sir A. Cooper, will be adverted to in considering lithotomy in women. Sometimes, also, when a calculus is too large to pass completely through the male urethra, it lodges in this passage, where it may be more safely cut upon and removed, than from the bladder; and, in a few very rare examples, it has been discharged by an ulcerative process. Thus Dr. R. A. Langenbeck has published a case, in which a stone made its way out by ulceration, and was discharged immediately behind the testes. (*See J. C. Langenbeck's Bibl. für die Chir. Gött.* 1809.) And G. Coopmans has recorded an almost incredible case, in which a calculus, weighing five ounces, one dram and a half, was discharged on the left side of the urethra of an elderly man, a little below the glans penis. In fact, without some further explanation, this case would be pronounced impossible; but, it should be recollected, that after a small calculus has made its way out of the urethra by ulceration, if the urine have still access to it, it will continue to increase in size in its new situation; and this is what happened in the present example; for, the extraneous body, when first felt externally, was not larger than a pea. The calculus is now preserved in Camper's museum. (*Neurologia*, 8vo. Francoeræ, 1795.)

Sir Benjamin Brodie refers to a preparation, at St. George's Hospital, of a bladder ulcerated at its fundus. There were several calculi, and one of them was fixed in the ulcerated opening, half in and half out of the bladder. The same gentleman also records a case, in which the mucous membrane of the bladder was found extensively ulcerated in a man, who had died after lithotomy, and the ulcer communicated with the ulcerated cavity in the perineum, in which the stone was lying at the time of the operation. (*On Diseases of the Urinary Organs*, p. 232. ed. 2.)

In many cases, small calculi may be voided by dilating the male urethra with elastic gum catheters of very large diameter, and then desiring the

patient to expel his urine with considerable force, a plan which Baron Larrey has repeatedly found to answer. The idea of withdrawing calculi from the bladder through the urethra, by suction, and dilatation of the passage, seems to have been entertained by several practitioners of former days, especially Alpinus, Muys, Verduc, Mayerne, and Le Dran. (See *Dr. Kerrison's Paper, in Med. Chir. Trans.* vol. xii. p. 315.) Desault even tried experiments with a kind of forceps, which admitted of being protruded, and of opening and shutting at the extremity of a cannula, which was introduced into the bladder; but no instance of success with it on the human subject is recorded. (See *Journ. de Chir.* t. ii. p. 375. Paris, 1791.) The honour of bringing the plan to perfection was reserved for Sir Astley Cooper:—"The instrument (says he) which I first had made for the purpose of removing these stones from Mr. Buller, were merely common forceps, made of the size of a sound, and similarly curved; but Mr. Weiss, surgeons' instrument maker, in the Strand, showed me a pair of bullet forceps, which, he thought, would, with a little alteration, better answer the purpose I had in view. He removed two of the blades of these forceps (for there were four), and gave them the form of the forceps which I had constructed: the blades of this instrument could be opened whilst in the bladder, by means of a stilette, so as to grasp and confine the stone, and they appeared so well constructed for the purpose as to induce me to make trial of them, on the 23d of November, 1820; and the manner in which they were used was as follows:—Mr. Buller was placed across his bed, with his feet resting on the floor, and a silver catheter was then introduced, and the bladder emptied of urine. I then passed the forceps into the bladder, and was so fortunate in my first operation as to extract eight calculi. The instrument gave but little pain on its introduction, but, when opened to its greatest extent, and the stones admitted between its blades, their removal was painful, more especially at the glans penis, which appears to be the portion of the urethra, which makes the greatest resistance to the removal of the stones. A dose of opium was given after each operation." (*Med. Chir. Trans.* vol. xi. p. 358.) Sir A. Cooper thus removed from the above patient 84 calculi at different times. From one patient, Sir B. Brodie also extracted in the same manner about sixty calculi, of various sizes; but the largest measured half an inch in one diameter, and five-eighths in the other. (*Op. cit.* vol. xii. p. 383.) In one case, Sir Astley Cooper took out with the urethral forceps a calculus, that weighed fifty-four grains, after having gradually dilated the urethra with bougies. (*Vol. cit.* p. 387.) Other convincing examples of the practicableness and success of the practice are also related by the same distinguished surgeon. According to his valuable observations, when a great number of calculi are found in the bladder, they are generally attended with an enlargement of the prostate gland, and are lodged in a sacculus formed directly behind it. (*Vol. xi.* p. 357.)

To me, the establishment of the preceding practice by Sir Astley Cooper, and of lithotrity for cases properly admitting of it, seem two of the greatest triumphs of modern surgery; and I have no doubt, that the names of all concerned in bringing them about, will receive from the latest

posterity the honour which cannot fail to attach itself to improvements, by which the necessity for a severe and highly dangerous operation is rendered considerably less frequent. Even when the stone cannot be drawn completely out of the urethra, by the forceps, but only into it, the advantage is great, because it may then be easily cut down to, and extracted, without any wound or injury of the bladder. (See *Med. Chir. Trans.* vol. xi.)—See LITHOTRITY.

I shall next describe the various methods of cutting for the stone.

OF THE APPARATUS MINOR, CUTTING ON THE GRIPE, OR CELSUS'S METHOD.

The most ancient kind of lithotomy was that practised upwards of two thousand years ago, by Ammonius, at Alexandria, in the time of Herophilus and Erasistratus, and by Mege; at Rome, during the reign of Augustus; and, being described by Celsus, is named *Lithotomia Celsiani*. As the stone, fixed by the pressure of the fingers in the anus, was cut directly upon, it has been called *cutting on the gripe*, a knife and a hook being the only instruments used. The appellation of the *lesser apparatus* was given to it by Maranus, in order to distinguish it from a method which he described, called the *apparatus major*, from the many instruments employed.

The operation was done in the following way. The rectum was emptied by a glyster, a few hours previously; and immediately before cutting, the patient was desired to walk about his chamber, to bring the stone down to the neck of the bladder; he was then placed in the lap of an assistant, or secured in the manner now practised in the lateral operation. The surgeon then introduced the fore and middle fingers of his left hand, well oiled, into the anus; while he pressed with the palm of his right hand on the lower part of the abdomen, above the pubes, in order to promote the descent of the stone. With the fingers the calculus was next gripped, pushed forward toward the neck of the bladder, and made to protrude, and form a tumour on the left side of the perineum. The operator then took a scalpel, and made a lunated incision through the skin and cellular substance, directly on the stone, near the anus, down to the neck of the bladder, with the horns toward the hip. Then, in the deeper and narrower part of the wound, a second transverse incision was made on the stone into the neck of the bladder itself, till the flowing out of the urine showed, that the incision exceeded in some degree the size of the stone. The calculus, being strongly pressed upon with the fingers, next started out of itself, or was extracted with a hook for the purpose. (*Celsus*, lib. vii. cap. 26. *J. Bell's Principles*, vol. ii. p. 42. *Allan on Lithotomy*, p. 10.)

The objections to cutting on the gripe, are—the impossibility of always dividing the same parts; for, those which are cut will vary, according to the degree of force employed in making the stone project in the perineum. When little exertion is made, if the incision be begun just behind the scrotum, the urethra may be altogether detached from the prostate; if the stone be much pushed out, the bladder may be entered beyond the prostate, and both the vesiculæ seminales and vasa deferentia inevitably suffer. Lastly, if the parts are just sufficiently protruded, the neck of the

bladder will be cut, through the substance of the prostate gland. (*Allan on Lithotomy. Burns, in Edinb. Surg. Journal. No. xiii. J. Bell, vol. ii. p. 59.*)

The preceding dangers were known to Fabricius Hildanus, who attempted to obviate them by cutting on a staff, introduced through the urethra into the bladder. He began his incision in the perineum, about half an inch on the side of the raphe; and he continued the cut, inclining the knife as he proceeded, towards the hip. He continued to divide the parts till he reached the staff; after which, he enlarged the wound to such an extent as permitted him easily, with a hook, to extract the stone, which he had previously brought into the neck of the bladder, by pressure with the fingers in the rectum. (*Burns.*) In this way, Sir C. Bell has operated with success.

The apparatus minor, as practised by Fabricius, with the aid of a staff, is certainly a very simple operation on children, and some judicious surgeons doubt the propriety of its present neglected state. You cut, says an eminent writer, upon the stone, and make, of course, with perfect security, an incision exactly proportioned to its size. There is no difficult nor dangerous dissection; no gorget, nor other dangerous instrument, thrust into the bladder, with the risk of its passing betwixt that and the rectum; you are performing, expressly, the lateral incision of Raw and Cheselden, in the most simple and favourable way. The *prisca simplicitas instrumentorum* seems here to have been deserted, for the sake of inventing more ingenious and complicated operations. (*J. Bell.*)

Celsus has delivered one memorable precept in his description of lithotomy, *ut plaga paulo major quàm calculus sit*; and he seems to have known very well, that there was more danger in lacerating than cutting the parts.

The simplicity of the apparatus minor, however, formerly emboldened every quack to undertake it; and as this was followed by the evils and blunders unavoidably originating from ignorance, at the same time that it diminished the emolument of regular practitioners, the operation fell into disrepute. (See *Heister.*) It was longer practised, however, than all the other ancient methods, having been continued to the commencement of the 16th century; and it was performed at Bordeaux, Paris, and other places in France, on patients of all ages, by Raoux, even as late as 150 years ago. Frère Jacques occasionally had recourse to it; and it was successfully executed by Heister. (Part ii. chap. 140.) A modern author recommends it always to be preferred on boys, under fourteen. (*Allan, p. 12.*)

APPARATUS MAJOR.

So named from the multiplicity of instruments employed; or the Marian method, from having been first published by Marianus Sanctus, in 1524, as the invention of his master, Johannes de Romanis.

This operation, adopted from avaricious motives, was rude and painful in its performance, and very fatal in its consequences. The apology for its introduction was the declaration of Hippocrates, that wounds of membranous parts are mortal. It was contended, however, that such parts might be dilated with impunity; and, on this principle of dilata-

tion, a generous plan of operating; one very incompetent to fulfil the end proposed; one, which, though supposed only to dilate, really lacerated the parts. (*Burns.*)

The operator, kneeling on one knee, made an incision, with his razor, along the perineum, on one side of the raphe; and, feeling with his little finger, for the curve of the staff, he opened the membranous part of the urethra; and, fixing the point of the knife in the groove of the staff, gave it to an assistant to hold, while he passed a probe along the knife into the groove of the staff, and thus into the bladder. The urine now flowed out, and the staff was withdrawn. The operator next took two conductors, a sort of strong iron probes; one, named the female conductor, having in it a groove, like one of our common directors; the other, the male conductor, having a probe point, corresponding with that groove. The grooved, or female conductor, being introduced along the probe into the bladder, the probe was withdrawn, and the male conductor passed along the groove of the female one, into the bladder. Then commenced the operation of dilating. The lithotomist took a conductor in each hand, and, by making their shafts diverge, dilated, or, in plain language, tore open the prostate gland. (*J. Bell.*)

It would be absurd in me to trace the various dilating instruments, contrived for the improvement of this barbarous operation, by the Colots, Maréchal, Le Dran, Paré, &c. Among the numerous glaring objections to the apparatus major, I need only notice the cutting of the bulb of the urethra, not sufficiently dividing the membranous part of the urethra, nor the transversalis perinæi muscle, which forms a kind of bar across the place where the stone should be extracted; violent distention of the membranous part of the urethra and neck of the bladder; laceration of these latter parts; large abscesses, extravasation of urine, and gangrene; frequent impotency afterwards; and extensive fatality. Bertrandi even saw the urethra and neck of the bladder torn from the prostate by the violence employed in this vile method of operating. (*Opérations de Chir. p. 169.*) However, Paré, Le Dran, Le Cat, Mery, Morand, Maréchal, Raw, and all the best surgeons in Europe, most strangely adhered to this rash method for two hundred years, till Frère Jacques, in 1697, taught at Paris the original model of lithotomy, as commonly adopted at the present day.

THE HIGH OPERATION

Was first practised in Paris, in 1475, by Colot, as an experiment on a criminal, by permission of Louis the XIth; and the patient recovered in a fortnight. The earliest account of this method of operating was published in 1556, by Pierre Franco, in his *Treatise on Hernia*, ed. 1. He performed it on a child, two years old, after finding the calculus too large to admit of being extracted from the perineum, where he had first made an opening; his remarks, however, tended to discourage the practice. Rossetus recommended it, with great zeal, in his book intitled *Partus Cæsarius*, printed in 1591; but he never performed the operation himself. Tolet mentions the trial of it in the Hôtel-Dieu, but, without entering into the particular causes of its discontinuance, merely says, that it was found inconvenient. About the year 1719 it was first performed in England, by Dr. Douglass;

and, after him, practised by others. (*Sharp's Operations*.)

The patient being laid on a square table, with his legs hanging off, and fastened to the sides of it by a ligature, passed above the knee, his head and body lifted up a little by pillows, so as to relax the abdominal muscles, and his hands held steady by some assistants; as much barley-water as he could bear, which was often about eight ounces, and sometimes twelve, was injected, through a catheter, into the bladder.

In order to prevent the reflux of the water, an assistant grasped the penis, the moment the catheter was withdrawn, holding it on one side, in such a manner as not to stretch the skin of the abdomen; then, with a round edged knife, an incision, about four inches long, was made between the recti and pyramidal muscles, through the membrana adiposa, as deep as the bladder, bringing its extremity almost down to the penis; after this, with a crooked knife, the incision was continued into the bladder, and carried a little under the os pubis; and immediately upon the water flowing out, the forefinger of the left hand was introduced, which directed the forceps to the stone. (*Sharp's Operations*.) Sabatier disapproves of making the cut in the bladder from below upward, lest the knife injure the peritoneum. (*Méd. Oper.* t. iii. p. 160.)

Although this method of operating appears at first view feasible enough, several objections soon brought it into disuse. 1. The irritation of a stone often causes such a thickened and contracted state of the bladder, that this viscus will not admit of being distended, so as to rise above the pubes. 2. If the operator should break the stone, the fragments cannot be easily washed away, but, remaining behind, form a nucleus for a future stone. 3. Experience has proved, that the high operation is very commonly followed by extravasation of urine, attended with suppuration and gangrenous mischief in the cellular tissue of the pelvis. This happens because the urine more readily escapes out of the wound in the bladder than through the urethra; and also because when the bladder contracts, and sinks behind the os pubis, the wound in it ceases to be parallel to that in the linea alba and integuments, and becomes deeper and deeper. For the prevention of these ill consequences, says Sabatier, it will be in vain to make the patient lie in a horizontal posture, and keep a catheter introduced, as Rousset and Morand recommended: the bad effects being still neither less frequent, nor less fatal. (*See Méd. Opératoire*, t. iii. p. 161. ed. 2.) And Sir Everard Home confesses, that while the high operation for the stone had no other channel but the wound for carrying off the urine, it seemed to him a method, which ought never to be adopted; "the urine almost always insinuating itself into the cellular membrane behind the pubes, producing sloughs, and consequently abscesses." (*On Strictures*, vol. iii. p. 359. 8vo. Lond. 1821.) 4. The danger of exciting inflammation of the peritonæum. 5. The injection itself is exceedingly painful, and, however slow the fluid be injected, the bladder can seldom be dilated enough to make the operation absolutely secure; and, when hastily dilated, its tone may be destroyed. (*See Sharp, Allan, Sabatier, &c.*)

Some surgeons are of opinion, that when a stone in the bladder is known to be very large, no at-

tempt ought to be made to extract it from the perinæum. Scarpa declares, that the lateral operation should not be practised when the calculus exceeds twenty lines in its small diameter. (*See Memoir on the Cutting Gorget of Hawkins*, p. 8. *transl. by Briggs*.) In such cases, it is true, the surgeon may perform the lateral operation, and try to break the stone. But ought this proceeding to be preferred to the high operation? I speak particularly of cases in which the stone is known to be of very large dimensions before any operation is begun. Were the lateral operation commenced, the stone, if too large for extraction, must of course be broken; for it is then too late to adopt the high operation with advantage. That such things have been done, however, and yet the patients escaped, is a truth, which cannot be denied. Deschamps mentions an instance, in which M. Lassus, after using Hawkins's gorget, could not draw out the calculus, and he therefore immediately performed the high operation, and the patient recovered. Indeed, the second example of the high operation on record was executed by Franco under similar circumstances, and the patient was saved. I have also heard of a modern French surgeon, who began with the lateral operation, but, finding a large calculus, ended with performing the high operation, without the least delay or hesitation: the patient died.

Mr. S. Sharp, an excellent practical surgeon in his time, after noticing with great impartiality the objections which were then urged against the high operation, says, that he should not be surprised, if hereafter it were revived and practised with success; an observation which implied, that he foresaw that the method was capable of being so improved, as to free it from its most serious inconveniences. In fact, since his time, various attempts have been made to introduce the high operation anew, and upon improved principles. Frère Côme, in particular, knew very well, that there were circumstances, as, for instance, a calculus above a certain size, disease of the urethra or prostate gland, &c., where the lateral operation was liable to great difficulties and disadvantages, and where the high operation, if it could be perfected, would be a fitter and safer mode of proceeding. However, it was only in such cases, and not in all, that Frère Côme thought the latter method better than the lateral operation. He had also discernment enough to perceive, that it was extremely desirable to invent some means, whereby the painful and hurtful distention of the bladder, for the purpose of making this organ rise behind the pubes, would be rendered unnecessary, at the same time that some measure was adopted for letting the urine have a more depending outlet, than the wound in the hypogastric region. In the early editions of this Dictionary, the error was committed of representing Côme to have cut the neck of the bladder, as well as its fundus; a mistake which I first became aware of upon the perusal of Mr. Carpue's interesting work on lithotomy. The fact is, that Côme did not wound the bladder in two places; but operated after the following way:—He first introduced through the urethra into the bladder a staff, which was then held by an assistant. An incision, an inch in length, was now made in the perineum, in the same direction as in the lateral operation. Another incision was made in the membranous part

of the urethra along the groove of the staff, as far as the prostate gland. A very deeply grooved director was then passed along the staff into the bladder, and the latter instrument was withdrawn. By means of the director, a *sonde à dard*, or kind of catheter furnished with a stilet, was now introduced into the bladder, and the director taken out. An incision was then made, about three or four inches in length, just above the symphysis of the pubes, down to, and in the direction of, the linea alba. A trocar, in which there was a concealed bistoury, was next passed into the linea alba, close to the pubes, and the blade of the knife then started from its sheath towards the handle of the instrument, while its other end remained stationary. In this manner, the lower part of the linea alba was cut from below upwards, and an aperture was made, which was now enlarged with a probe-pointed curved knife, behind which a finger was kept, so as to push the peritonæum out of the way. Côme then took hold of the *sonde à dard* with his right hand, and, elevating its extremity, lifted up the fundus of the bladder, while with the fingers of his left hand he endeavoured to feel its extremity in the wound. As soon as the end of the instrument was perceived, it was taken hold of between the thumb and middle finger, the peritonæum was carefully kept up out of the way, and the stilet was pushed by an assistant from within outwards, through the fundus of the bladder. The bladder being thus pierced, the operator introduced into a groove in the stilet a curved bistoury, with which he divided the front of the bladder, from above downwards, nearly to its neck. He then passed his fingers into the opening, and keeping up the bladder with them, withdrew the *sonde à dard* altogether. But, as it was desirable that both his hands should be free, the bladder was prevented from slipping away by means of a suspensory hook, held by an assistant as soon as the opening was found to be already ample enough, or had been enlarged to the necessary extent. Côme next introduced the forceps, took out the stone, and passed a cannula, or elastic gum catheter, through the wound in the perineum into the bladder, so as to maintain a ready outlet for the urine, and divert this fluid from the wound in the bladder. In women, of course, the catheter was passed through the meatus urinarius. And I ought here to observe, that Côme, like Scarpa, thought the high operation especially advisable for females, because his experience had taught him, that the division, or dilatation, of the meatus urinarius was generally followed by an incontinence of urine. (See *Nouvelle Méthode d'extraire la Pierre de la Vessie par dessus le Pubis*, &c. 8vo. Bruxelles, 1779.)

Another modification of the high operation was suggested by Deschamps, who, instead of opening the membranous part of the urethra, as Côme did, perforated the bladder from the rectum, and through the cannula of the trocar effected the same objects which the latter lithotomist accomplished by means of the incision in the membranous part of the urethra. Of the two plans, that devised by Côme is unquestionably the best, because not attended with a double wound of the bladder; a thing which, I conceive, must always be highly objectionable.

Dr. Souberbielle, who practises Côme's method, introduces a silver wire through the cannula of the

sonde à dard, and passes it through the wound made in the linea alba. The wire is then held while the *sonde à dard* is withdrawn, and a flexible gum-catheter is passed by means of the wire into the bladder, through the wound in the membranous part of the urethra. The wire is now withdrawn, and the catheter is fixed with tapes, passed round the thighs and pelvis, and a bladder is tied to it for the reception of the urine. "A piece of soft linen, half an inch wide, and six or eight inches long, is to be introduced, by means of a pair of forceps, into the bottom of the bladder;" the object of which slip of linen is to carry off such urine as may not escape through the catheter. Lint and light dressings are applied, and a bandage round the abdomen. Great care is to be taken to keep the catheter pervious, and, usually, on the third day, the slip of linen may be taken out, and the wound closed with adhesive plaster. (See *Carpue's History of the High Operation*, p. 171, 172.)

Sir Everard Home made trial of Dr. Souberbielle's method in St. George's Hospital, and, though some difficulty and delay occurred in the operation, on account of the stone being encysted, the result was successful. Subsequently to this case, however, Sir Everard invented and practised another method, which, so far as I can judge, is better than that of Côme or the plan formerly adopted by Souberbielle, though its principles are the same. When it is considered, that, in the operation of these last lithotomists, the neck of the bladder was not opened, and the catheter entered this receptacle through the prostatic portion of the urethra, it must be immediately obvious, that the incision in the perineum could not answer any material object, because a tube could be placed in the same position by passing it through the urethra from the orifice in the glans. The retainer, or bracelet, invented for keeping the catheter in the bladder, in cases of enlargement of the prostate gland, seemed to Sir Everard Home peculiarly applicable to the high operation, since it keeps the tube steadily in the natural canal, and renders the wound in the perineum unnecessary. Bracelets, for this purpose, extremely elastic, and producing no irritation, are sold by Messrs. Weiss, of the Strand. They are furnished with small rings, to which the outer end of the catheter is fixed by means of string. In fact, M. Souberbielle, the principal advocate for the high operation, now living, has given up the perineal incision, and uses a tube, or syphon, which is introduced into the urethra for the purpose of letting the urine escape through it, instead of the wound above the pubes. (See *Souberbielle, Sur la Lithotomie*, &c. 1828—1835.)

Sir Everard Home performed his new operation, for the first time, in St. George's Hospital, on the 26th of May, 1820. "An incision was made in the direction of the linea alba, between the pyramidales muscles, beginning at the pubes, and extending four inches in length: it was continued down to the tendon. The linea alba was then pierced close to the pubes, and divided by a probe-pointed bistoury to the extent of three inches. The pyramidales muscles had a portion of their origin at the symphysis pubis detached to make room. When the finger was passed down under the linea alba, the fundus of the bladder was felt covered with loose, fatty, cellular membrane. A silver catheter, open at the end, was now passed

along the urethra into the bladder; and, when the point was felt by the finger in the wound, pressing up the fundus, a stilet, that had been concealed, was forced through the coats of the bladder, and followed by the end of the catheter. The stilet was then withdrawn, and the opening through the fundus of the bladder enlarged towards the pubes by a probe-pointed bistoury, sufficiently to admit two fingers, and then the catheter was withdrawn. The fundus of the bladder was held up by one finger, and the stone examined by the forefinger of the right hand. A pair of forceps, with a net attached, was passed down into the bladder, and the stone directed into it by the finger: the surface being very rough, the stone struck upon the opening of the forceps, and being retained there by the finger, was extracted. A slip of linen had one end introduced into the bladder, and the other was left hanging out of the wound, the edges of which were brought together by adhesive plaster. A flexible gum catheter, without the stilet, was passed into the bladder through the urethra, and kept there by an elastic retainer surrounding the penis. The patient was put to bed, and laid upon his side, in which position the urine escaped freely through the catheter." As no blood had been lost in the operation, twelve ounces were taken from the arm. The next day the slip of linen was withdrawn, as useless and irritating; the catheter, while pervious, preventing any urine from escaping by the wound. Sir Everard thought that, in future, the linen need only be left in the external wound, so as to prevent collections of matter, and carry off any urine which may issue from the opening in the bladder, when the catheter happens to be stopped up. For this operation, Sir Everard particularly recommended catheters, with their insides polished like their outsides, in order that they may better resist the effects of the urine. Suffice it to add, with respect to the above case, that the boy soon recovered, the bladder having resumed its healthy functions in ten days, although the calculus was of the roughest possible kind.

Sir Everard Home repeated his new method on a gentleman, who went out in his carriage with the external wound completely healed, on the 14th day after the operation. The only particulars which need here be noticed, in regard to the latter case, are, that some difficulty was experienced in bringing the point of the catheter forwards toward the pubes, and the slit in the front of the instrument made it so incapable of bearing lateral motion, that the two sides were twisted over one another. (*On Strictures*, vol. iii. p. 359. 8vo. Lond. 1820.) Some other cases, however, which have occurred in St. George's Hospital, have had the effect of satisfying numerous very good judges, that, as a general practice, the high operation ought to be abandoned. I was present when it was attempted there by the late Mr. Ewbank, and the patient sent back to bed without the stone being extracted. This case had a fatal termination.

Whoever follows this method of operating should always be provided with several tubes and stilets, of different lengths and curvatures; for, in the only case in which I have seen the operation attempted, the extremity of the catheter could not be made to project the fundus of the bladder towards the pubes, and, after long protracted endeavours had been made to bring the end of the instrument upwards and forwards, the tube broke,

and the operation was left unfinished. The impression upon my mind was, that no resistance of the bladder could account for what happened, and that the fault lay in the instrument itself, which should have been exchanged for another of more suitable form, as soon as it was found to be inapplicable. And I believe, that if attention be paid to the suggestion of always having at hand a sufficient number of tubes and stilets, of different lengths and curvatures, Sir Everard Home's new method will be the best modification of the high operation yet proposed. The slip of linen, however, I think, is more likely to do harm by its irritation, than any good, as a conductor of the urine or matter out of the wound. At all events, as Sir Everard has observed, it should never be passed into the bladder itself. Whenever I am asked my opinion of the high operation, I always restrict my approval of further trials of it to cases in which the calculus is known beforehand to be of very large size, or the urethra and prostate gland are diseased. The reasons, urged by Mr. Carpcue, in favour of the high operation in most cases, are: 1. Because, it is generally performed in less time; a point, which may be disputed, though it is perhaps not worth contesting, since the danger of an operation cannot always be truly estimated by the length of time which the patient remains in the operating room, slow and gentle proceedings sometimes contributing to his safety. 2. There is less pain; a remark, the justness of which must depend, perhaps, upon the manner in which each operation is performed. 3. There is no fear of a fatal hemorrhage; a consideration which, I admit, is one good reason in favour of the high operation, though the lateral operation is only subject to risk of hemorrhage, when the incisions are directed in a manner not sanctioned in this Dictionary. 4. There is no division of the prostate and inferior part of the bladder: no, but there is one of the fundus; so perhaps on this point the two operations stand upon an equality. As for there being no danger in the high operation of wounding the rectum, it is undoubtedly an advantage, though the accident, so far as I have seen, is not followed by any serious consequences, and can only happen from inattention to rules easily followed. 5. The stone, if of a certain size, cannot be extracted by the lateral operation, but admits of being so by the high operation. Of all the reasons for the latter practice, this appears to me the strongest, with the exception, perhaps, of disease in the urethra and prostate. 6. A small stone is more readily discovered in this method, than in the lateral operation; a point which I consider questionable, and, at all events, not sufficiently important to form a ground for the high operation. Indeed, the long time, during which several patients in St. George's Hospital were subjected to the agony caused by repeatedly groping and fishing for the stone in vain, has filled a great many judicious surgeons with strong aversion to a continuance of the attempts to revive the practice of the high operation. 7. If a stone breaks, the particles can be extracted with more certainty than in the lateral operation; on this question authors differ, and the remarks in the foregoing passage are rather against the correctness of the statement. 8. The high operation enables the surgeon to remove encysted calculi with greater ease; a reason, which may perhaps be generally true, but which is somewhat weakened by the con-

sideration that encysted calculi are not very frequent. Mr. Carpué allows, that the high operation should not be selected when the patient is corpulent, and the bladder is thickened and diseased, so that its fundus cannot be raised above the pubes. (See *Hist. of the High Operation*, p. 173. 8vo. Lond. 1819.)

Although Scarpa thinks the lateral operation unlikely to answer when the calculus exceeds twenty lines in its lesser diameter, he considers the high operation also useless in such a case, and even fatal; because, according to his observations, when the stone is very large, the bladder and kidneys are almost, always, too much diseased for the patient to recover. (*Osservazioni sul Taglio Retto Vesicale*, p. 3. and 48. 4to. Pavia, 1823.) He has only met with two cases to the contrary. However, in another place, in considering the advantages and disadvantages of the high operation, as compared with that performed through the rectum, in cases where the stone is too large to be extracted by the perineum, he gives his decided preference to the former. (P. 47.) The high operation he also considers the only method, by which women can be cured without leaving them afflicted with an incontinence of urine. (P. 49.) However, after the facts related by Sir Astley Cooper, Mr. Thomas and others (*Lond. Med. Chir. Trans.*), and Dr. Hamilton (*Edin. Med. Chir. Trans.* vol. ii. p. 117.), few surgeons would think of having recourse to so dangerous an operation, in preference to the simple and safe plan of dilating the *meatus urinarius*. Three or four years ago, I assisted Mr. Walne, of Bloomsbury Square, in extracting a calculus from the bladder of a girl, about ten years of age. The *meatus urinarius* was dilated with Weiss's dilator. Though the stone was about an inch and a half in diameter, the incontinence of urine, following the operation, soon subsided. By means of the dilator, the *meatus urinarius* may be gradually enlarged in the course of a few hours, so that one or even two fingers may be readily passed into it. I have thus seen long pieces of wax candle, and other substances, taken out. I decline entering into any strict consideration of the inconveniences, to which this method is exclusively subject, especially the greater vicinity of the wound to the peritonæum and small intestines, and the division of that membrane and protrusion of the viscera; accidents, which will be found by any body, who chooses to look over the cases on record, not to have been unfrequent.

In December, 1818, Mr. Kirby, of Dublin, performed the high operation for the extraction of an elastic gum catheter, which had slipped into the bladder through the cannula of a trocar, with which paracentesis had been performed. No contrivance was found necessary for lifting up the fundus of the bladder. The puncture, already made, was enlarged, and, after the operation was finished, a catheter was placed in the wound, but was withdrawn on the 4th day, as the urine passed out by the side of it. The case terminated well. (See *Kirby's Cases*, p. 92. &c. 8vo. Dublin, 1819.) In an example, in which the calculus was lodged in the fundus of a little boy's bladder, aged six years, Dr. Ballingall undertook the high operation, in the expectation that the stone might have been more easily extracted above the pubes, than by the perineum. Great difficulties were experienced, however, in getting it out; and the

peritoneal inflammation which ensued, had a fatal termination. The stone measured more than two inches in one diameter, and one inch and a half in the other; while the space between the tuberosities of the ischium was only two and a half inches. (See *Edin. Med. Chir. Trans.* vol. ii.) Lithotomy, in whatever way performed, when the stone is encysted (a circumstance that unavoidably lengthens the operation and leads to great disturbance of the parts), is generally unsuccessful; and I do not, therefore, consider this example as more against the high than the lateral operation, which might have been attended, as Dr. Ballingall observes, with even greater difficulties.

The high operation has been twice performed by my friend, Mr. Copland Hutchison. It was first performed in the United States by Dr. Gibson, professor of surgery in the University of Pennsylvania; and subsequently by Dr. McClellan, and others. It was preferred, on account of the great size of the calculi. (See *Reese*, in *American edit. of this Dictionary*.) Whoever is desirous of examining further the merits of the high operation, should refer to the accounts of it recently published by Dr. Souberbielle, whose experience in it has been more considerable, and success greater, than those of any other surgeon, who has ever given the general preference to this form of lithotomy.

LATERAL OPERATION.

So named from the prostate gland, and neck of the bladder, being laterally cut.

From some quotations made by Mr. Carpué from the works of Franco, it appears that the latter was not only the inventor of the lateral operation, but that he placed his patients in the position adopted at the present time, used similar instruments to those now employed (excepting that his gorget had no sharp side), and made the same incisions. Now, as this claim of Franco to an invention of such importance had been nearly, or quite forgotten, when Mr. Carpué's work made its appearance, the latter gentleman deserves much praise for reminding the profession of what is due to the memory of an old surgeon, whose name must flourish, so long as the history of the rise and progress of surgery is interesting to mankind. But, though Franco appears probably to have practised the lateral operation, or something very much like it, he never established the method as a permanent improvement in surgery, which measure was left to be completed long afterwards by a priest, who called himself Frère Jacques: he came to Paris in 1697, bringing with him abundance of certificates of his dexterity in operating; and having made his history known to the court and magistrates, he got an order to cut at the Hôtel-Dieu and the Charité, where he operated on about fifty persons. His success, however, did not equal his promises, and, according to Dionis, some loss of reputation was the consequence.

Frère Jacques used a large round staff without a groove, and when it was introduced into the bladder, he depressed its handle, with an intention of making the portion of this viscus, which he wished to cut, approach the perineum. He then plunged a long dagger-shaped knife into the left hip, near the tuber ischi, two finger-breadths from the perineum, and pushing it towards the bladder,

opened it in its body, or as near the neck as he could, directing his incision upward from the anus. He never withdrew his knife, till a sufficient opening had been made for the extraction of the stone. Sometimes he used a conductor to guide the forceps, but more commonly directed the last with his finger, which he passed into the wound after withdrawing the knife. When he had hold of the stone, he used to draw it out in a quick rough manner, heedless of the bad consequences. His only object was to get the stone extracted, and he disregarded every thing else; all preparatory means, all dressings, all after-treatment. (*Allan*, p. 23.)

But although Frère Jacques, totally ignorant of anatomy, and rude and indiscriminate in practice, sunk into disrepute, some eminent surgeons conceived, from a consideration of the parts, which he cut, that his method might be converted into a most useful operation.

The principal defect in his first manner of cutting, was the want of a groove in his staff, and the consequent difficulty of carrying the knife into the bladder. At length, Frère Jacques was prevailed upon to study anatomy, by which his judgment was corrected, and he readily embraced several improvements, which were suggested to him. Indeed, we are informed, that he now succeeded better, and knew more than is generally imagined. Mr. Sharp says, that when he himself was in France, in 1702, he saw a pamphlet, published by this celebrated character, in which his method of operating appeared so much improved, that it scarcely differed from later practice. Frère Jacques had learnt the necessity of attending to the wound after the operation, and had profited so much from the criticisms of Mery, Fagon, Félis, and Hunauld, that he then used a staff with a groove, and had cut thirty-eight patients successively, without losing one. (*Sharp's Operations*.) In short, as a modern writer has observed, he lost fewer patients than we do at the present day, in operating with a gorget. He is said to have cut nearly 5000 patients in the course of his life, and, though persecuted by the regular lithotomists, he was imitated by Maréchal at Paris, Raw in Holland, and by Bamber and Cheselden in England, where his operation was perfected. (*Allan*.)

For a particular history of Frère Jacques, and his operations, see *Bussière's Letter to Sir Hans Sloane*, *Philos. Trans.* 1699; *J. Méry, Obs. sur la Manière de Tailler dans les deux Sexes, pratiquée par F. Jacques*; *Lister's Journey to Paris in 1698*; *Cours d'Opérations de Chirurgie, par Dismis*; *Gurengeot, Traité des Opérations*, t. iii.; *Morand, Opuscules de Chirurgie*, part 2.

Among the many who saw Frère Jacques operate, was the famous Raw, who carried his method into Holland, and practised it with amazing success. He never published any account of it himself, though he admitted several to his operations; but, after his death, his successor Albinus, gave the world a very circumstantial detail of all the processes; and mentions, as one of Raw's improvements, that he used to open the bladder, between its neck and the ureter. But either Albinus, in his relation, or Raw himself in his supposition, was mistaken; since it is almost impossible to cut the bladder in that part upon the common staff, without also wounding the neck. (*Sharp, in Operations and Critical Inquiry*.)

Raw's method was objectionable, even when accomplished, as the urine could not readily escape, and it became extravasated around the rectum, so as to produce terrible mischief. There is little doubt, that Raw's really successful plan was only imitative of Frère Jacques's second and improved method.

The following observation by Dr. Yelloly, respecting Raw, I consider to be important:—"The success which attended Rau's practice, is stated to have been unexampled in the history of surgery; for he is represented as having cut 1547 patients without ever losing one. The account is altogether incredible; but I am surprised that the refutation of it, which is afforded to a certain extent by the celebrated Camper, the successor of Rau and Albinus in the chair of anatomy and surgery at Leyden, has been entirely overlooked by those authors who have had occasion to notice the circumstance: for that distinguished physician informs us, that on examining the register kept at the College of Surgeons of Amsterdam, by order of the magistracy, he found that Rau lost four cases out of twenty-two whom he cut for the stone in that city, or one in five and a half. (*Demonstrationum Anatomico-Pathologicarum Liber secundus*, p. 14.) Camper tells us, that he had no other opportunity of ascertaining, by unquestionable documents, the result of Rau's operations; but this fact is sufficient to show how little dependence was to be placed on Rau's asseverations of his success." (*See J. Yelloly, M.D., in Med. Chir. Trans.* vol. xv.)

Dr. Bamber was the first man in England who made a trial of Raw's method on the living subject, which he did in St. Bartholomew's Hospital. Cheselden, who had been in the habit of practising the high operation, gladly abandoned it, on receiving the account of Raw's plan and success, and, a few days after Bamber, he began to cut in this way in St. Thomas's Hospital.

Cheselden, finding that he lost many patients in imitating Raw, according the directions given by Albinus, began a new manner of operating, which he thus describes:—"I first make as long an incision as I can, beginning near the place where the old operation ends, and cutting down between the musculus accelerator urinae and erector penis, and by the side of the intestinum rectum: I then feel for the staff, holding down the gut all the while with one or two fingers of my left hand; and cut upon it in that part of the urethra which lies beyond the corpora cavernosa, and in the prostate gland, cutting from below upwards, to avoid wounding the gut." A gorget was then passed along the groove of the staff into the bladder, and the forceps over it in the usual way.

Although the method of operating, now adverted to was always preferred by Cheselden, after the trial of others, yet, by an extraordinary mistake in Dr. Douglass's *History of the Lateral Operation*, so clearly exposed by my friend, Dr. Yelloly, (*see Med. Chir. Trans.* vol. xv.), it is represented, that Cheselden's last and most improved plan consisted, after the external incision had been made, in first passing the knife into the groove of the rostrated or straight part of the staff, through the side of the bladder, immediately above the prostate, and bringing its point afterwards along the same groove in the direction downwards and forwards, or towards himself. Cheselden is

ought to have divided that part of the sphincter of the bladder which lay upon the prostate gland, of which he next cut the outside of one-half obliquely, according to the direction and whole length of the urethra within it, and finished the internal incision, by dividing the membranous portion of the urethra, on the convex part of his staff. (See *Appendix to the History of the Lateral Operation*, by J. Douglass, 1731.)

"When he first began to practise this method," continues Douglass, "Cheselden cut the very same parts the contrary way; that is, his knife entered first the muscular part of the urethra, which he divided laterally from the pendulous part of its bulb to the apex, or first point of the prostate gland, and from thence directed his knife upward and backward all the way into the bladder; as we may read in the *Appendix* he lately published to the fourth edition of his book of anatomy. But some time after he observed, that in that manner of cutting, the bulb of the urethra lay too much in the way; the groove of the staff was not so easily found, and the intestinum rectum was in more danger of being wounded." (See *Appendix to Hist. of Lateral Operation*, p. 12. Dr. T. Thomson's ed. p. 30.)

"The least consideration will show," says Dr. Yelloly, "that this account of Cheselden's improved operation is perfectly irreconcilable with that which is given by Cheselden himself, in the *Appendix* to the fourth edition of his *Anatomy*; or by M. Morand, with his sanction and authority. But, as Dr. Douglass's *Appendix*, was published subsequently to Mr. Cheselden's *Appendix*, which gave his own account of the matter, it might be thought that he had, in the mean time, made a change in his plan of procedure: and such Dr. Douglass intimates to have been the case. On examining the point, however, it does not appear that this can be the fact; for M. Morand made his communication to the Royal Academy of Sciences, on the 4th of April of the same year (1731) that Dr. Douglass's *Appendix* was published, and little more than three months before the date of the latter, July 25. (*Morand, Recherches*, p. 144.) It would hence have unquestionably happened, that Cheselden, who, it appears, was in frequent correspondence with M. Morand, would have communicated to him any change which he had made in his operation, subsequent to his visit to this country in the month of May, 1729, and not have departed from the character of liberality and candour which he had so richly merited from M. Morand, and the French nation, by concealing what he had adopted as an important improvement. Any change of plan would have been quite in time for communication; for the volume of the Academy's *Memoirs*, in which Morand's paper appeared, though belonging to the year 1731, was not actually published till two years subsequently, as it bears the date of 1733. Still, however, Morand makes no allusion, in this communication, to any such change; nor does he do so in the *Eloge* on Cheselden, which he published in the *Memoirs of the Royal Academy of Surgery*, though this must have been written more than twenty years afterwards, as Cheselden's death did not take place till the year 1752. (*Eloge de M. Cheselden, Mém. de l'Acad. Royale de Chir.* t. iii. p. 82.) The second part of his *Opusculum* also, which contains some papers on *Lithotomy*, and was not published till the year 1772, is per-

fectly silent on the subject. (*Opusculum de Chirurgie*, 2de partie, p. 113.)

"But if Dr. Douglass's account of Cheselden's operation is a correct one, what shall be said of Cheselden's reiterating, in the edition of his *Anatomy* published in 1740, and again in that of 1750, an account, which is perfectly, or as nearly as possible, identical with that of 1730? It seems to be perfectly clear, therefore, either that Dr. Douglass is inaccurate, or Cheselden disingenuous. If, however, the account given by Dr. Douglass, of Cheselden's supposed operation, is attentively examined, there will hardly be a doubt of an entire misapprehension having existed respecting it, on his part.

"When Dr. Douglass describes Cheselden's improved operation to be that, in which the internal incision commences in the vesical side of the prostate, he states it to have been practised with great applause, and vast success; and that, at the time he wrote (in July, 1731.), Cheselden had 'saved fifty patients out of fifty-two, whom he cut successively in St. Thomas's Hospital.' An important document however exists, in the *Appendix* to Cheselden's fourth edition of his *Anatomy*, to which I have alluded, which shows such representation to be altogether erroneous. This document contains the names of all the patients, forty-six in number, who were operated on by Cheselden, at St. Thomas's Hospital, from the performance of his first improved operation on March 27. 1727, to that of the last which is mentioned in his *Appendix*, of July, 1730, with the date and result of each operation. From this list we learn, that no fewer than thirty-six of these very patients, who are so represented by Douglass to have been operated on by the vesical plan, are incontestable examples of the success of the urethral mode of operating, which it is the object of Cheselden's *Appendix* to describe.

"Dr. Douglass, indeed, admits the urethral plan of operation to have been practised up to the time of the appearance of Cheselden's *Appendix*; which, as the last-mentioned operation took place on the 31st of July, 1730, could not, at the earliest, be before the end of August of that year. But he has totally overlooked the evidence of its success, which the enumeration of Cheselden's cases affords up to this time, and which leaves him even by his own calculation, only six cases, from which any proof can be derived, of the superiority of the vesical plan of operation, which he has thought fit to describe as Cheselden's. It may, it is true, be imagined, that the fifty-two cases adduced by Douglass as proofs of the superiority of the vesical operation, occurred in the period between Cheselden's forty-sixth operation, which was performed on the 31st of July, 1730, and the date of Dr. Douglass's *Appendix*, July 25. 1731. But the possibility of this supposition (even if he were likely to have had fifty-two operations in less than a year) is entirely done away by the information of the Doctor himself, who tells us, that the 'great and uncommon success of Mr. Cheselden's new method, became not only the subject of all conversation here at home, but also very much alarmed the surgeons abroad, particularly those of Paris, from whence M. Morand, of the Royal Academy of Sciences, a most ingenious lithotomist, made a journey to London, on purpose to see Mr. Cheselden cut for the stone.' (*Douglass's Appendix, Preface*, Dr. Thomson's edition, p. 17.)

M. Morand's journey to London was, however, in the month of May, 1729, very soon after Mr. Cheselden had performed his thirty-third public operation. (*Cheselden's Appendix*, p. 11. He saw the performance of the four following operations, during his stay here (*Cheselden's Appendix*, p. 11.; *Morand, Recherches; Morand, Eloge, &c.*); and Cheselden performed nine more in the month of July, making the number forty-six, as above stated. (*Cheselden's Appendix*, p. 11.) It is evident, therefore, that Dr. Douglass, in ascribing the great fame obtained by Cheselden to the vesical operation, alludes to cases occurring previously to the publication of Cheselden's *Appendix* in 1731, and therefore confessedly before the vesical operation was adopted.

"I may remark likewise, that Dr. Douglass's account, both of mortality and numbers operated upon, is incorrect; for, instead of Cheselden losing two only of the first fifty-two cases, or saving fifty patients out of fifty-two, as he expresses it, he lost three of the first fifty, which is one third more. ('Of the first fifty, only three died.'—*Anatomy*, p. 332.) And instead of there being only fifty-two in the whole, up to July, 1731, there were no fewer than sixty-six up to the previous April. We learn this from the communication of M. Morand, of April 3d, in which he states, that he had just received from Mr. Cheselden a list of twenty patients on whom he had operated (still on the original plan), since the publication of the forty-six mentioned in the *Appendix*. ('Je viens de recevoir la liste des malades de M. Cheselden taillés depuis celle qui est imprimée dans son *Appendix*, et j'apprends qu'il en a taillés vingt, dont il en est mort deux.'—*Recherches, &c.*) There is, therefore, the evidence of Mr. Cheselden, as to the first forty-six operations performed by him up to July 31, 1730, and of M. Morand, of twenty more performed by him up to the following April, making sixty-six in four years, during which time, it is clear, that Cheselden made no change in his operation. These accounts were published previously to that of Dr. Douglass, and therefore, totally independent of it; and they are in perfect harmony with the statement made by Cheselden, in the after editions of his *Anatomy*, of his having performed 213 operations, by one uninterrupted and unaltered plan of procedure, of which the above formed the first sixty-six.

"It is very singular, that the reasons given by Dr. Douglass, for Cheselden's alleged change from the urethral to the vesical operation, are either insufficient, or inapplicable. These he states to have been, that, in the urethral plan, 'the bulb of the urethra lay too much in the way; the groove of the staff was not so easily found, and the intestinum rectum was in more danger of being wounded' than in the vesical. But I think I shall have your support in expressing my belief, that no surgeon, with a competent knowledge of anatomy, will have any difficulty in reaching the membranous part of the urethra, without danger to the bulbous; and, indeed, as Dr. Douglass mentions, that the point of the knife is to be directed into the groove of the staff, by the end of the fore-finger of the left hand, in the vesical, as well as the urethral operation, (though it is difficult to see for what reason it is done in the former,) it is clear, that if the one operation is liable to this objection, the other is so likewise. That Cheselden twice wounded the rectum,

early in the practice of the lateral operation, he candidly owns to M. Morand. ('J'avoue naturellement, que dans le commencement, il blessa l'intestin rectum à deux malades que cependant guérirent tous deux, et que cela arriva faute d'attention à la conduite de la sonde.'—*Morand, Recherches*, p. 147.) But it is a mistake to suppose, that he considered this accident as originating in a fault in the operation, and that he therefore changed his mode of operating in consequence. He ascribed it entirely to want of care in the assistant who held the staff, ('faute d'attention à la conduite de la sonde,') which was obviated by greater vigilance; but the operation was continued in precisely the same manner as before such accident happened.

"According to Dr. Douglass, this occurrence must have taken place subsequent to July 31, 1730, the date of the last-named operation of Cheselden's *Appendix*, before which period, the new plan could not have been adopted by Cheselden; and yet it was obviously more than three years before, that is, 'dans le commencement,' that the accident occurred, and the means of obviating it were discovered. So necessary, indeed, did great care always seem to be, in the mind of Cheselden, to avoid the rectum in the operation of lithotomy, that in the first lateral operation employed by him, (that in which injection was used,) he always pressed down the gut with the forefinger of the left hand, to avoid wounding it (*Douglass on the Lateral Operation*, p. 85.); and inculcated the same plan, together with attention to the direction of the knife, both in his instructions to Morand, and in his own descriptions of his operation.

"Dr. Douglass, also, seems entirely to have overlooked the successful performance of the stone operation, as narrated in Cheselden's *Appendix* of 1730; and how little a mortality of only two cases in forty-six (which is the proportion of deaths that had at that time occurred to Cheselden in his public practice) could justify, or be likely to suggest any necessity for a change. The history of Cheselden's professional life shows, that he never either adopted, gave up, or varied an operation, without good reasons; and to imagine, that such a portion of unprecedented success would not satisfy every reasonable expectation, would be to attribute to him a restless hankering after change, which did not all accord with the judgment and equanimity of his character.

"I have thus endeavoured to show (continues Dr. Yelloly), that Cheselden was consistent, faithful, and ingenious, in the accounts which he gave of his improved lateral operation, and that, in these accounts, he is not only confirmed by his friend Morand, but by Dr. Douglass's narration itself.—But if the attention is turned to the anatomy of the parts concerned in Dr. Douglass's assumed operation, I should think it difficult to conceive, that the staff could be felt through the sides of the bladder, *above the prostate*, in such a way as that its groove (which is in the lower or convex part of the staff) should, even when the staff is directed to the right groin, be reached by a distant incision, made *immediately above the prostate*, as directed by Dr. Douglass, and therefore answering to the upper or concave part of that instrument. But if, instead of confining the incision to a part immediately above the prostate, it is made more laterally, I would still

submit, that the incision must be made in a distant point, without guidance, and the scalpel projected into the bladder very much at random, so as to search out the groove of the staff, without any effectual assistance in reaching it. I cannot therefore forbear expressing my belief, that independently of the other circumstances which I have mentioned, nothing could be more unlikely, according to the ordinary principles of judgment, than that Cheselden, after devising, and for four years practising, with unparalleled success, and with a reputation which no surgeon had ever acquired before him, a neat, intelligible, and scientific operation, should all at once, and without any apparent cause, put it aside, and substitute the clumsy, vague, and uncertain one, which Douglass attributes to him.

"This opinion, however, was formed on anatomical considerations alone; and I was desirous of knowing from an expert surgeon, whether the objections which I have just mentioned, were well founded; and whether the difficulties which I imagined to attend the operation, as described by Douglass, were easily capable of being obviated. I therefore requested my friend Mr. Crosse, one of the surgeons of the Norfolk and Norwich Hospital, to perform on the dead body, in my presence, the operation, as described by Dr. Douglass, giving him a copy of the instructions, by which it was directed to be done, without mentioning either my own view of the matter, or from what author the instructions proceeded.

"Mr. Crosse, employed, at my request, a scalpel and staff, very similar in shape and curve to those depicted by Douglass. After making the external incision, then cutting into the groove of the staff in the membranous part of the urethra, and introducing the forefinger of the left hand to keep down the rectum, he carried his knife backwards, and pierced the coats of the bladder close to the prostate gland on the left side. He reached the groove of the staff within the bladder, and made an incision, after the manner directed, in the groove of the staff through the prostate gland, completing the operation by prolonging the incision, so as to join that which was first made in the membranous part of the urethra. He did not enter the bladder immediately above the prostate, according to the literal directions of Douglass, because he considered it to be quite impracticable to reach the groove of the staff, if the bladder were entered in this way.

"On dissection, the bladder was found to be entered by a very small opening, and the left lobe of the prostate divided obliquely, by a clean incision, at about an angle of thirty degrees from the perpendicular, so as to lay open the urethra forward, from its termination in the bladder, to the membranous portion inclusive. The operation was, therefore, I conceive, performed as well as possible; but Mr. Crosse was of opinion, that it would be in the highest degree unwarrantable to attempt such an operation on the living body, from the distance of the incision made in the bladder, and the want of any guide in effecting it, particularly as the left hand was directed to be entirely employed in guarding the intestine. That if the left hand were even liberated, (a circumstance for which the directions do not provide,) so as that the forefinger might accompany the projected point of the scalpel, it would only go a

small way in removing the difficulty, and could give little or no assistance in reaching the groove of the staff within the bladder, which must be got at, as Mr. Crosse thought, entirely by a chance endeavour. That if the operation should ordinarily succeed as well as in the present instance, (and its success Mr. Crosse was very much disposed to consider as accidental,) it would accomplish no more than could be effected, with much greater facility and safety, by taking the urethra as the guide for the scalpel, according to the mode of performing the operation which is described by Cheselden himself.—The defects of the operation seem therefore to be so formidable, both from the anatomical reasons which I have stated, and the practical considerations advanced by Mr. Crosse, as to make it very difficult to believe that it was ever actually performed." (See *Dr. Yelloly's Paper*, in *Med. Chir. Trans.* vol. xv.)

According to Dr. Yelloly, "Heister seems to have been one of the first authors who took Dr. Douglass's representation as demonstrative of what Cheselden's improved operation of lithotomy was; and he gives, by deduction from Dr. Douglass's account, a progression of three different modes of operation employed by Cheselden, which he designates as the *modus primus, alter, and tertius*. The first, was that in which injection was employed; the second, that mentioned in the *Appendix* to the fourth edition of *Cheselden's Anatomy*, and quoted by Morand, and from which, I venture to think, that Cheselden never deviated; the third, that described by Douglass as Cheselden's latest improvement, but which, I presume to conclude, was one that never entered into his contemplation.

"But (as Dr. Yelloly adds) Heister very fairly admits, what it may be thought, should have excited a little further inquiry on his part into the subject, that Morand, whom Cheselden instructed in his operation, and who was therefore the person of all others the best entitled to be acquainted with it, says nothing of the change mentioned by Douglass. 'Morandus nihil adhuc de hac methodo proponit, sed præcedentem, No. 19. descripsit,' (alluding to the mode in which he was instructed by Cheselden) 'pro optima declarat.' (*Heister's Institutiones Chirurgicæ*, p. 977.)

"Sabatier, also, in his *Médecine Opératoire*, t. iv. p. 251., published in 1796, has given a correct exposé of Cheselden's practice, in which he has been since followed by Baron Boyer, in nearly the same words. (*Traité des Maladies Chir.* Tome ix. p. 356.)

For several other interesting facts, I must refer to Dr. Yelloly's valuable paper.

LATERAL OPERATION AS PERFORMED WITH CUTTING GORGETS.

The gorget has the same kind of form as one of the instruments used by F. Colot and others in the performance of the apparatus major, and the common opinion, that the conductor of Hildanus was the first model of it, is not exactly true; but it differs from the instruments employed by these ancient surgeons, in having a cutting edge. Sir Cæsar Hawkins thought, that, if its right side were sharpened into a cutting edge, it might be safely pushed into the bladder, guided by the staff, so as to make the true lateral incision, in the left side of the prostate gland, more easily, and with

less risk of injuring the adjacent parts, than Cheselden could do with the knife; and surgeons were pleased with a contrivance, which saved them from the responsibility of dissecting parts, with the anatomy of which all were not equally well acquainted. (*J. Bell, Allan.*)

As Scarpa observes: To render the execution of the lateral operation easier to surgeons of less experience, than Cheselden, was the motive, which induced Hawkins to propose his gorget. He thought, that two great advantages would be gained by the use of this instrument: one, of executing invariably the lateral incision of Cheselden; the other, of constantly guarding the patient, through the whole course of the operation, from injury of the rectum, and of the *arteria pudica profunda*. The utility of the latter object (says Scarpa) cannot be disputed, as it is evident, that the convexity of the director of the instrument defends the rectum from injury, and that its cutting edge not being inclined horizontally, towards the tuberosity and ramus of the ischium, but, turned upwards in the direction of the longitudinal axis of the neck of the urethra, cannot wound the pudic artery. But, with respect to the first advantage, or that of executing precisely the lateral incision of Cheselden, it must be admitted, that it does not completely fulfil the intention, which he proposed, not only on account of the cutting edge of his instrument not being raised enough above the level of the staff, to penetrate sufficiently the substance of the prostate gland, and consequently to divide it to a proper depth; but, because, being too much turned upwards, at that part of it, which is to lay open the base of the prostate gland, it does not divide it laterally, but rather at its upper part, towards the summit of the ramus of the ischium, and the arch of the pubes; an opening, of all others, in the perinæum, the most confined, and presenting the greatest impediment to the passage of the stone from the bladder. (See also, *Key on Lithotomy*, p. 10.)

Scarpa considers all the modifications of Hawkins's gorget, proposed by B. Bell, Desault, Cline, and Cruikshank, as deteriorations of the original instrument. B. Bell (he observes) has diminished the breadth of the director, but given the cutting edge a horizontal direction. The horizontal direction of the cutting edge is also preferred by Desault, Cline, and Cruikshank; but, they have enlarged the director, and flattened the part, which was previously concave. Aware of the danger of wounding the pudic artery by the horizontal direction of the gorget, they direct the handle of the staff to be inclined towards the patient's right groin, and the gorget to be pushed along it, inclined in such a manner, that its obtuse edge may be directed towards the rectum, and its cutting edge placed at a sufficient distance from the tuberosity and ramus of the ischium to avoid wounding the artery. Scarpa contends, however, that it is difficult to give a proper degree of obliquity to the staff; and that such inclination of the instrument must be inconvenient, arbitrary, and unsettled, in comparison with that position of it, in which the handle of the staff is held in a line perpendicular to the body of the patient, and its concavity placed against the arch of the pubes; on which stability of the instrument (says Scarpa) the safety and precision of the lateral operation depend. According to this eminent professor, the

defects of Hawkins's original gorget arise from the excessive breadth of the director, particularly at the point; the want of sufficient elevation of the cutting edge, above the level of the groove of the staff, and the uncertain inclination of the edge to the axis of the urethra and prostate gland. The cervix of the urethra, in a man between thirty and forty years of age, is only three lines in diameter at the apex of the prostate gland, four lines in its centre, and five near the orifice of the bladder. The apex of the prostate gland is rather more than two lines in thickness, the body or centre four, and the base six and sometimes eight, which surrounds the orifice of the bladder. In an adult of middle stature, from eighteen to twenty years of age, the thickness of the base of the prostate gland is about two lines less, compared with that of a man of forty, and of a large size. The precise line, in which the lateral incision of the prostate gland should be made in an adult (says Scarpa), is found to be inclined to the longitudinal axis of the cervix of the urethra, and of the gland itself, at an angle of 69° . Now, from these data, drawn from the structure of the parts, Scarpa makes the director of his gorget only four lines broad, and two deep; the breadth decreasing at the beak. The cutting edge of the instrument is straight near its point, but gradually rises, and becomes convex above the level of the staff, so that its greatest convexity is seven lines broad. Lastly; the inclination of the cutting edge to the longitudinal axis of the director, is exactly at an angle of 69° ; that is to say, the same as the left side of the prostate gland to the longitudinal axis of the neck of the urethra. (See *Scarpa's Memoir on Hawkins's Gorget*; transl. by Briggs, p. 12. 17.)

For nearly thirty years, the instrument-makers in London have been in the habit of selling a gorget, which Mr. Abernethy invented, and which, in the particularity of its cutting edge turning up at an angle of 45° , bears much analogy to the instrument lately recommended by Scarpa. The cutting edge is straight; and that useless and dangerous part of a gorget, sometimes called the shoulder, is removed. Admitting that the principles of the lateral operation, as inculcated by Scarpa, are correct, it appears to me, that Abernethy's gorget is preferable to that proposed by Scarpa. Its edge is not so immoderately turned up; and it will enter with more ease, and less risk of slipping from the staff, because it has not any projecting shoulder, which, while the staff is firmly held with the beak of the gorget in it, can have no other effect but that of obstructing the passage of the last instrument.

Gorgetts, which cut on both sides, have also been sometimes employed in England; and as a larger opening can be obtained by them, even without trespassing the limits of the incision, fixed by Scarpa, that is to say, without cutting any part of the body of the bladder, they appear to promise utility, especially when the stone is suspected to be large. However, they are less used now, than they were some years ago, when Sir Astley Cooper employed them in Guy's Hospital. The preference more commonly given to the knife, will account for the fact.

Sir A. Cooper, as I think with considerable reason, recommends putting the patient on vegetable diet, for a little while previously to the operation. He disapproves of operating when the

kidneys are diseased, the bladder is ulcerated, and disease in the chest, asthma, or any irregularity of the circulation prevails. He has found the operation generally more successful in the poor and labouring classes, than in the rich and luxurious. Old age is not considered by him as an objection to the operation, which he differs from the generality of surgeons in believing most successful in persons from 61 to 63 years of age. If the patient is loaded with fat, he says the chance of peritoneal inflammation is always great. According to his experience, convulsions having a fatal result, are frequent after operations on children, particularly when much blood has been lost. When a stone of considerable magnitude is accompanied with an enlarged prostate gland, the patient (he says) rarely recovers from the operation.

As inflammation of the bladder and peritoneum is the principal danger of this operation, and, under an equal degree of injury and violence, is most likely to happen in a plethoric subject; it has been a question, whether venesection should not be practised a day or two before the patient is operated upon, supposing that his age and weakness form no prohibition. The chief reason, which prevents the common observance of this practice, is, that a great deal of blood is sometimes lost in the operation itself; and Mr. Key finds, that patients, who have not lost much blood, generally recover better. (See *Guy's Hospital Reports*.) A vegetable diet, for a week or two, before the operation, seems to be a better plan. When, however, the loss of blood in the operation has been inconsiderable, the patient is young and strong, and particularly when the operation has been tedious, and the bladder has suffered a good deal, I am disposed to think well of bleeding the patient as soon as he has recovered from the first depressing effects of the operation. An opening medicine should be given the day before the patient is cut, and a clyster injected a couple of hours before the time fixed upon for the operation, in order to empty the rectum, and thus diminish the chance of its being wounded.

It is generally considered advantageous to let the bladder be somewhat distended, and the patient is therefore directed to retain his urine a certain time before he is cut. Formerly, a jugum penis was sometimes used for confining the urine in the bladder; but, since my entrance into the profession, I have never heard of this contrivance being employed. The presence of urine in the bladder, it is conceived, may lessen the chance of the fundus of that organ being injured by the gorget; but, as the beak of this instrument should always be in the groove of the staff, I am not sure, that the reason for the practice is good. The plan is disapproved of by Sir A. Cooper, who says, that, when the urine collected gushes out, the bladder contracts, and embraces the stone so closely, that it is difficult to get hold of the foreign body with the forceps.

Before the operation, the following instruments should all be arranged ready on a table:—A staff of as large a diameter as will easily admit of introduction, and the groove of which is very deep, and closed at the extremity. A sharp gorget, with beak nicely and accurately adapted to the deep groove of the preceding instrument, so as to glide easily and securely. A large scalpel for making the first incisions. Forceps of various sizes and

forms, for extracting the stone. A blunt-pointed curved bistoury for enlarging the wound in the prostate, if the incision of the gorget be not sufficiently large, as I believe, the parts should never be lacerated. A pair of Le Cat's forceps with teeth for breaking the stone, if too large to come through any wound reasonably dilated. A syringe for washing out clots of blood, or particles of the stone: a practice, however, not considered necessary by Sir A. Cooper; a scoop for the removal of small calculi or fragments. Two strong garters, or bands, with which the patient's hands and feet are tied together.

The curvature of the staff is a matter of considerable importance; because the direction of the incision through the prostate gland and neck of the bladder is partly determined by it. The French surgeons, convinced of the advantage of introducing the gorget in the direction of the axis of the bladder, always use a staff, which is more curved than what English surgeons employ. (See *M. Roux, Voyage fait à Londres en 1814, ou Parallèle de la Chir. Angloise, &c.* p. 319.) But, I am inclined to believe with Scarpa, that, upon the whole, it is best to let the curvature of the staff correspond exactly to that of the axis of the neck of the urethra and prostate gland. (*Opusculi di Chirurgia*, vol. i. p. 39.) The staff is “of the figure of a sound, from which, however, it differs; first, in the handle, which, instead of being smooth and polished, is made rough, in order that it may be more firmly and steadily held; secondly, in having a groove, like that of a director, on its convex side. It is in fact a director, and intended to answer precisely the same purpose.” A staff should be as large as the urethra will admit, without being painfully stretched. A large staff is more easily felt in the perineum, than a small one, and it allows a wider and deeper groove to be constructed in it. Sir C. Bell, Mr. Liston, and some others, prefer a deep groove placed between the lateral and convex aspects. The end of the staff ought to be neatly rounded off, as well as the edges of the groove. (*Sir B. Brodie on Dis. of the Urinary Organs*, p. 269.) After the staff has been introduced, and the stone felt with it to be in the bladder, the next thing is to secure the patient in the most desirable position. He should be placed on the operating table, lying on his back, supported by pillows, with his shoulders somewhat elevated. He should be directed to grasp the outside of each foot with the hand of the same side; and then the hand and foot are to be bound together by several turns of the lithotomy garters, a noose being first made for the reception of the wrist. The patient is then drawn towards the end of the table, with the buttocks projecting rather beyond it. An assistant is required to stand on each side of the patient, in order to hold his feet, hands, and knees, and to keep the limbs well apart. A third assistant is necessary to hand the instruments to the surgeon as soon as wanted; and a fourth to hold the handle of the staff. It is also convenient to have a fifth assistant to support the patient's shoulders. The assistant, who holds the staff, usually stands on the patient's left side, in order that he may take the handle of the instrument in his right hand. (*Sir B. Brodie, Op. cit.* p. 271.)

The assistant, holding up the scrotum with his left hand, is with his right to hold the staff, inclining its handle towards the right groin, so as to

make the grooved convexity of the instrument turn towards the left side of the perinæum. Some operators, also, like the assistant to depress the handle of the staff towards the patient's abdomen, in order to make its convexity project in the perinæum; while others condemn this plan, fearing, that it may withdraw the instrument from the bladder. (*Allan, &c.*)

Scarpa disapproves of inclining the handle of the staff towards the patient's right groin, and he expressly recommends his instrument to be held firmly against the arch of the pubes (also *Liston, in Practical Surgery, p. 410.*), in a line perpendicular to the body of the patient, so that the convex part of the director may be placed towards the rectum, and take the exact course of the axis of the neck of the urethra and prostate gland. (*Opuscoli, &c. p. 40.*) This position of the staff appears to Scarpa the firmest and most commodious; and he maintains, that on such stability of the instrument, the safety and precision of the lateral operation depend. It is observed, however, by Mr. Stanley, that the pressure of the curved part of the staff upwards, is objectionable, as it may lead to the incisions being made into the narrower part of the space beneath the arch of the pubes. "To the pressure of the staff downwards (says he), the objections are, that it may have the effect of withdrawing the point of the instrument from the bladder, and of approximating the bladder and the urethra to the rectum. In an instance, where the assistant pressed the staff downwards, the rectum was wounded by the scalpel in the first stage of the operation; and, in the young subject, the risk of such an occurrence will be greater, on account of the small size and soft texture of the prostate gland." (*On the Lateral Operation, p. 3.*)

On this point, Mr. Liston, who employs a knife, agrees with Scarpa. The staff, he says, "is hooked against the symphysis, and entrusted to an assistant, with directions to maintain the position steadily from first to last; neither to turn it so as to make it bulge in the perinæum, nor to depress the handle, as the knife enters the bladder. The surgeon's left hand is thus left at liberty to guide the knife, and guard important parts from danger." (*On Practical Surgery, p. 410.*) The best surgeons differ, however, with regard to the most advantageous way of holding the staff. Thus Sir Benjamin Brodie, after mentioning, that the surgeon should be seated on a stool before the patient, adds, that "he is first to attend to the position of the staff, taking care that it is held nearly perpendicularly; the handle of it, however, being inclined towards the patient's right groin. This causes the convexity of the instrument to project slightly on the left side of the perinæum." (*On Dis. of the Urinary Organs, p. 271. ed. 2.*)

Sir A. Cooper directs the operator to hold the staff perpendicularly, and to let it rest on the stone; as he has seen many instances, in which the gorget has not entered the bladder, owing to the staff not having itself passed into it, but rested against the prostate gland. It seems, then, that there is no agreement amongst surgeons respecting the best position of the staff; and that the main points are to hold the instrument firmly, taking care that its beak is in the bladder.

"The operation is accomplished by a free inci-

sion of the skin and subjacent fat; by dividing the transversalis muscle and a part of the triangular ligament, and continuing the incision through the left side of the prostate." (See *E. Stanley, Op. cit.*)

The first incision should commence below the bulb of the urethra, about an inch and a quarter in front of the anus, over the membranous part of this canal, at the place where the operator means to make his first cut into the groove of the staff, and the cut should extend at least three inches, obliquely downward, to the left of the raphe of the perinæum, at an equal distance from the tuberosity of the ischium and the anus; or, as some operators prefer, the line of it may be to a point, distant two thirds from the anus, and one from the tuberosity of the ischium. (*Stanley.*) The first cut should descend rather beyond the level of the centre of the anus; for, it is a general rule in surgery to make free external incisions, by which the surgeon is enabled to conduct the remaining steps of his operation with greater facility, and nowhere is it so necessary, as where a stone is to be extracted. (*Allan.*) Callisen lays it down as a rule, that the incision ought not to extend to such parts as can make no impediment to the extraction of the stone; and, therefore, (says he,) the bulb, and that part of the urethra, which is surrounded by the corpus spongiosum, should never be cut. Only those parts ought to be divided, which firmly resist the safe introduction of instruments into the bladder, and the extraction of the stone. Hence, the integuments must be opened by an ample incision, and the membranous part of the urethra, transversus perinæi muscle, levator ani, and prostate gland, be properly divided. (*Systema Chirurgiæ Hodiernæ, pars ii. p. 655.*) Like Scarpa, however, he is fearful of making a free cut through the neck of the bladder, and, in lieu of doing so, prefers a slow and cautious dilatation of the parts. Mr. Martineau used also to introduce the point of the knife into the groove of the staff, as low down as he could, and cut the membranous part of the urethra. (*Med. Chir. Trans. vol. ii.*) The nearer to the prostate gland the urethra is opened, the better, as it lessens the risk of wounding the bulb, or its artery. (*E. Stanley, Op. cit. p. 7.*) When the external cut through the integuments, fat, and superficial fascia, has been executed, the next object is to divide the lower fibres of the accelerator urinae, and transversus perinæi muscle, which stands, like a bar, across the triangular hollow, out of which alone the stone can be extracted. This second cut should also divide the triangular ligament.

Having placed the beak of the gorget in the groove of the staff, the operator takes hold of the latter instrument with his left hand, raises its handle from the abdomen, so that it may form nearly a right angle with the body, and stands up. Before attempting to push the gorget into the bladder, however, he should slide it backwards and forwards, with a wriggling motion, that he may first be sure of its beak being in the groove of the staff. The bringing forward of the handle of the latter instrument, so as to elevate its point, before introducing the gorget into the bladder, is also considered of great importance; for, it is by this means, that the gorget is introduced along the groove of the staff in the only direction, unattended with risk of wounding the rectum.

Attention to this rule is especially necessary, when a staff with a groove not closed at the end is employed. The neglect of it in this case might make the operator cut the bladder with the gorget, in several places, as, according to Mr. B. Bell, has actually happened. But, since the gorget, when introduced as nearly as possible in the axis of the bladder, may transfix and otherwise injure this organ, if introduced either too far, or at all beyond the extremity of the staff, I am decidedly of opinion, that every surgeon, who chooses to perform the lateral operation with a gorget, should employ a staff, the groove of which is closed at the extremity, as is invariably done in France, and is expressly enjoined by Scarpa. (See *Sabatier, Méd. Opératoire*, t. iii. p. 233. ed. 2.; and *Scarpa, Opuscoli di Chirurgia*, vol. i. p. 39.) There can also be no doubt of the prudence of endeavouring to have only a limited length of the staff in the bladder. Scarpa specifies an inch and a half as the proper distance to which the end of the staff should enter the bladder. However, this distinguished Professor was an advocate for a very limited incision, and other operators, who prefer making a freer opening, must use a staff, that reaches into this viscus rather further. Much, however, will depend upon the kind of gorget employed, particularly its breadth; and, if it is to rest against the stone as advised by Sir A. Cooper, of course, the extent to which it passes, will be determined by the situation of the calculus.

As soon as the gorget has been introduced, some operators withdraw the staff, pass the left forefinger along its concavity into the bladder, and then take out the gorget. The gorget should be withdrawn in the same line in which it entered, pressing it towards the right side, in order to prevent its making a second wound. If, however, the operator should prefer passing the forceps into the bladder, along the gorget, the latter instrument must be kept quite motionless, lest its sharp edge do mischief; and, at all events, as soon as the forceps, or finger, is in the bladder, the cutting gorget is to be withdrawn.

Others, calculating on the division of the prostate by the gorget being sufficient, withdraw it preparatory to the introduction of the forceps. "The knife, or the gorget, having been withdrawn, the staff is to be taken in the right hand, and the left forefinger passed along it into the bladder. The staff is then to be withdrawn, and it is to be ascertained by the finger to what part of the bladder the forceps should be directed, that they may immediately touch the stone. On withdrawing the finger, the forceps, with their blades closed, are to be passed slowly through the wound, and inclined upwards as they approach the bladder. Upon the foregoing plan, the staff will be the conductor of the finger into the bladder, and the finger, the conductor of the forceps. The introduction of the finger is useful to ascertain the situation of the stone, and by separating the sides of the incision in the prostate, to facilitate the passage of the forceps. By allowing the staff to remain in the bladder, until the finger has entered its cavity, the beaked or probe-pointed knife can be readily conducted to the bladder, for the purpose of enlarging the incision of the prostate, should this have been inadequately made; and if, from an unusual firmness of the prostate, the sides of the incision through

it do not readily yield, much difficulty may be experienced in discovering the passage to the bladder, when the staff has been withdrawn, and its aid, as a conductor to the finger, is thereby lost." (See *Stanley on the Lateral Operation*, p. 11.) In the prudence of these directions, I entirely concur.

Some operators withdraw the cutting gorget, and introduce a blunt one for the guidance of the forceps; a step certainly unnecessary, as the latter instrument will easily pass, when the incision into the bladder is of adequate size, and direct, as it ought always to be.

Professor Stevens, of the University of New York, always withdraws both the staff and the gorget, immediately after making the incision with the latter, and has never found any difficulty in introducing the forceps, without any other guide, than the forefinger of his left hand. The point of the forceps he directs upwards, to avoid a little pouch, formed by the receding of the loose cellular membrane between the prostate and the rectum. (See *Reese, in Amer. Ed. of this Dictionary*.)

The operator has next to grasp the stone with the blades of the forceps; for which purpose he is not to expand the instrument, as soon as it has arrived in the bladder; but he should first make use of the instrument as a kind of probe, for ascertaining the exact situation of the stone. If this body should be lodged at the lower part of the bladder, just behind its neck, the operator is to open the forceps immediately over the stone, and after depressing the blades a little, is gently to shut them, so as to grasp it. Certainly, it is much more scientific to use the forceps at first, merely for ascertaining the position of the stone; for, when this is known, the surgeon will more surely grasp the extraneous body in a skilful manner, than if he were to open the blades of the instrument immediately, without knowing where they ought next to be placed, or when shut. No man of experience can doubt, that the injury, which the bladder frequently suffers from rough, reiterated, awkward movements of the forceps, is not an uncommon cause of such inflammation of this viscus, as extends to the peritonæum, and occasions death.

If the surgeon cannot readily take hold of the stone with the forceps, he should, with his forefinger passed into the rectum, raise it up, when in general it may be easily grasped. The stone should be held with sufficient firmness to keep it from slipping away from the blades, but not so forcibly as to incur the risk of its breaking.

"The skilful management of the forceps consists in pressing the blades gently against the sides of the wound, first in one direction, then in another, but especially downwards (towards the wider part of the space between the rami of the ischia), and in drawing them out slowly, that time may be allowed for the yielding of the surrounding parts." (See *Stanley on the Lateral Operation*, p. 14.)

For the most part, as Sir Benjamin Brodie has correctly stated, it is better, that the convexity of one blade of the forceps should be turned upwards, and that of the other blade downwards. "Attention to this point is especially of consequence in cases, where there is an enlarged prostate gland, forming a tumour projecting into the bladder. The smooth convex surface of the

blade of the forceps is not interfered with by the projection; whereas, if the forceps are turned in the other direction, the stone, coming in contact with the tumour, becomes as it were entangled by it, and the extraction is rendered difficult." (*On Dis. of the Urinary Organs*, p. 282. ed. 2.)

Sometimes the extraction of the stone is attended with difficulty, owing to the operator having chanced to grasp it in a transverse position; in which circumstance, it is better to try to change its direction, or let it go altogether, and take hold of it in another manner. When the stone is so large, that it cannot be extracted from the wound, without violence and laceration, the surgeon may either break the stone by means of a strong pair of forceps, with teeth constructed for the purpose, or with Earle's, or Jameson's instrument (see *American Med. Recorder*, vol. viii.); or he may enlarge the wound with a probe-pointed crooked bistoury, introduced under the guidance of the forefinger of the left hand. The latter plan is generally the best of the two; for, breaking the stone always creates serious danger of calculous fragments remaining behind.

Sir Benjamin Brodie does not admit the expediency of dilating the wound of the prostate, except where only one side of it has been divided in the first instance; for he sometimes employs a beaked knife, which divides both sides of it; but, when the stone is above a certain size, and the division of one side of the prostate is not sufficient, he introduces a straight probe-pointed bistoury, and makes an incision in the right side of the prostate. (*On Dis. of the Urinary Organs*, p. 284.) And Mr. Stanley considers this plan preferable to extending the incision in the left side, at the risk of cutting the coats of the bladder beyond its neck, which, he agrees with Scarpa, Sir B. Brodie, Mr. Liston, and some others, in believing, would occasion danger of infiltration of urine into the pelvis. (*On the Lateral Operation*, p. 14.) Whatever foundation there may be for this apprehension, however, I see no risk of wounding the pudendal artery or the ureter, if the surgeon cut, as he ought always to do, in the direction obliquely downwards and outwards, parallel to the ramus of the ischium, as Mr. Stanley judiciously recommends.

"In the case of an unusually large stone (says this gentleman), it is better to determine upon the incision of both sides of the prostate, whereby an increase of space will be obtained, which is to be measured, not merely by the extent of the incision, but by the greater facility, with which the neck of the bladder will then yield to the pressure of the forceps, than when one side of the prostate only has been divided." (*Op. cit.* p. 17.) This object may be accomplished with a double-edged gorget, a broad double-edged beaked knife, or Dupuytren's double *bistourie caché*; or by dividing the two sides of the gland in succession with the knife altogether, or with the gorget followed by the latter instrument. Mr. Stanley deems the division of one side of the prostate gland generally sufficient; and he quotes two cases, where calculi of large size had been extracted, though, after death, the side of that gland was found not to have been completely divided. He does not mention, however, whether the operations were easy, or whether the patients were kept long on the table, or died of the consequences of the diminutive opening, and

violence done to the parts. When the calculus is too ample to admit of being safely extracted, he agrees with other surgeons in the prudence of breaking it. (P. 17.) He does not give an exclusive preference either to the gorget or the knife. For a young subject, or a thin adult, the knife seems to him advantageous; but, for a very fat, or an old subject, in whom, by an enlargement of the prostate, or the dilation of the rectum, the bladder is raised much above its natural situation, he considers the gorget better adapted. (P. 19.) When the bladder is much contracted, he uses a sound, the curve of which is short, being the segment of a small circle. The point of such an instrument can be moved freely, so as to touch every part of the inside of the bladder, and, when directed downwards, it can touch a stone situated below and behind the prostate. The part of the staff, along which the beak of the knife, or gorget, passes, he recommends to be very little curved; whereby the introduction of the knife, or gorget, will be rendered more easy. (P. 20.) In imitation of Desault, he prefers a gorget, the handle of which is in the same line with its blade. His favourite gorget is double-edged, the edges being turned downwards at an angle of 45°; and when used, its beak is so placed, that two thirds of the incision of the prostate will be through its left side.

However, as nothing can justify the exertion of great force in pulling out a stone, if the operator should be afraid of making the wound more ample, (it being already large and direct,) he must break the stone, as above described. As many of the fragments are then to be extracted with the common lithotomy forceps, as can be taken away in this method, after which the surgeon should introduce his finger, in order to feel whether any pieces of the stone still remain behind. Perhaps some of these may be most conveniently taken out with the scoop; but, if they are very small, it is best to inject lukewarm water with moderate force into the wound, for the purpose of washing them out.

The surgeon cannot be too strongly impressed with the absolute necessity of using the greatest care not to remove the patient from the operating table, while any calculus, or fragment, remains in the bladder. For, the distressing pain of the disorder has been known to recur upon the healing of the wound, and a second operation become necessary. It is a melancholy truth, however, that a fresh calculus may form again in the short space of a few months. I have seen several patients who have been cut for the stone, more than once; and Richerand mentions the case of a surgical instrument-maker, resident at the gate of La Charité, in Paris, who had undergone the operation three times in the course of a year and a half, although, after each operation, several eminent surgeons carefully examined the bladder, and could not detect a calculus. (See *Nosogr. Chir.* t. iii. p. 549. ed. 4.)

The stone should always be attentively examined immediately it is extracted; because its appearance conveys some information, though not positive, concerning the existence of others. If the stone is smooth on one surface, the smoothness is generally found to arise from the friction of other stones still in the bladder; but, when it is uniformly rough, it is a presumptive sign, that

there is no other one remaining behind. In every instance, however, the surgeon should gently examine the cavity of the bladder with his forefinger; for, it would be an inexcusable neglect to put the patient to bed, with another stone in his bladder.

After the operation, the patient is to be laid in bed on his back; a piece of oil-silk, and some folded napkins, being placed under him for the reception of the urine. His shoulders and loins are to be as much elevated, as they can be without inconvenience, so as to make the wound in the perinæum as depending as possible. (*Brodie*.) With respect to the application of a pledget and bandage, and keeping the thighs closed, I confess that my own ideas lead me to regard them, as Sir A. Cooper, Sir B. Brodie, and many other surgeons do, as disadvantageous: indeed, I believe, the best plan is to leave the wound open, so that the urine may have a free outlet, strict attention being paid to keeping the parts clean. Sir B. Brodie recommends the thighs to be somewhat elevated by a bolster, placed under the hams, and the knees to be a little asunder. (*On Dis. of the Urin. Organs*, p. 287.)

In many cases, where there has been a deep perinæum, and especially where the stone has proved to be of large size, Sir B. Brodie has introduced an elastic gum cannula through the wound into the bladder, and allowed it to remain for the first two or three days; that is, until the surrounding parts have had time to become consolidated by inflammation. "Such a cannula makes an excellent conductor for the urine. It keeps the bladder always empty, and prevents the pain, which otherwise is experienced on the first passage of the urine. It prevents also that obstruction to the flow of the urine, which sometimes occurs after the operation, in consequence of the wound having become plugged by a coagulum of blood. In cases, in which the stone has been of so large a size, as to make it probable that, in the extraction of it, the soft parts have been lacerated beyond the boundaries of the prostate, the cannula will answer another purpose, by lessening the danger of the urine becoming effused in the cellular membrane." (*Sir B. Brodie, Op. cit.* p. 287.) In Edinburgh, I understand, this practice has been common, and Mr. Liston is an advocate for it in all cases, and recommends the tube to be secured by tapes to a band round the waist. One reason, which he gives for the plan, is, that if the oozing from small vessels persists, it can readily be arrested by pushing some pieces of lint with a probe between the tube and sides of the wound. (*See Practical Surgery*, p. 416.) I believe that, in order to avoid the presence of an extraneous body in the wound, it is better to restrict the use of the elastic gum cannula to examples, attended with disposition to hemorrhage, or the circumstances specified by Sir B. Brodie.

An occasional embarrassment is the circumstance of stones in the bladder not being always free and detached: some are tightly embraced by its coats; others are partially engaged in the ureters; they are sometimes fixed in the neck of the bladder; and are not unfrequently found lodged in sacculi accidentally formed. These cysts are of different sizes: some are small, and exist in a considerable number; some are deeper,

with an orifice smaller than their base.⁶⁶ They appear to be formed by a prolongation of the internal coat of the bladder. Other sacculi are occasionally found, which seem to be composed of all the tunics of the bladder, and they are sometimes of such magnitude, that the bladder appears, as if it were divided into two or more cavities, of nearly equal size. Stones, found in these sacculi, sometimes present depressions and irregularities, in which fungi of the bladder have been received. When this happens, a portion of such fungous productions is often extracted with the stone; a circumstance that has deceived some practitioners, and led them to suppose, that the calculi actually adhered to the coat of the bladder. (*See Desault's Parisian Chir. Journ.* vol. ii. p. 386, 387.)

The extraction of encysted stones requires different modes of proceeding from those, which have been related. Litteré conceived, that they might be removed in two ways. When they made only an inconsiderable projection into the bladder, he recommended the introduction of a probe, with which the membrane, covering the calculus, was to be rubbed, a finger being put into the rectum, in order to keep it down, and facilitate the action of the probe in opening the cyst. When the calculi were very prominent, Litteré recommended taking hold of them with a pair of forceps, and contusing and breaking the membranous pouch, with the points and asperities upon the inside of the blades of the instrument. He conceived that suppuration would then destroy the internal parietes of the cyst, and that the stone would fall into the bladder, and admit of being easily extracted. As Sabatier observes, it is plain, that this theory, which is founded on the idea entertained by Litteré of the manner in which stones become encysted, is totally inadmissible in practice.

Garengot ventured to pass a bistoury into the bladder for the purpose of disengaging a calculus lodged in a particular cyst at the fundus of this organ, behind the pubes. The knife had some tape twisted round the greatest part of its length, and was introduced under the guidance of the left index finger, which was passed in as far as it could reach. The patient was not more than ten or eleven years old, and consequently of a size, which favoured the operation. The stone was loosened and taken out, and the child recovered. However, as Sabatier remarks, there are many instances, in which this mode of proceeding cannot be imitated; for, if the calculus should be in a sort of cul-de-sac, as often happens, the entrance of which is narrower than its bottom, and the stone be of considerable size, the incision cannot be made large enough, without risk of cutting through the whole thickness of the bladder, and producing death by effusion of urine in the abdomen.

Other practitioners fancied that the calculus might be taken hold of with the forceps, and turned about in different directions, so as to lacerate its connections, or even that it might be forcibly extracted, without any serious ill consequences. Houstet mentions (*see Mém. de l'Acad. de Chir.* t. ii. p. 307. &c. ed. 12mo.), that Peyronie adopted this method on a patient, thirty-one years of age. The calculus did not resist long, and its surface was found covered

with fleshy substances, which formed the adhesions to the bladder. The operation was painful, followed by considerable hemorrhage, tension of the belly, hiccough, cold extremities, and death.

There are some examples, however, in which this bold practice had better success. In 1730, Le Dran extracted from a woman an enormous stone, adherent to that part of the bladder, which lies upon the rectum. The irritation of the inequalities of the stone had produced ulceration of the bladder, and fungous growths, which insinuated themselves into the substance of the extraneous body. The adhesions readily yielded, and the excrescences came away with the calculus. Ten days afterwards, some thick membranous sloughs were voided. This calculus is engraved in Le Dran's Treatise on the Operations.

Le Dran afterwards extracted similar stones, which adhered by a less extensive surface; and he relates an operation performed by Murechal, who, in 1715, extracted with a pair of forceps, a stone shaped like a calabash, and having its narrow part surrounded by a fungus. In one case, the position of the calculus led Le Dran to suspect, that it was fixed in the extremity of the ureter; he shook it occasionally with a pair of forceps; and, lastly, it fell into the bladder, whence it was extracted without difficulty. It resembled a cucumber in shape, and its large extremity had been lodged in the ureter, from which it could only be gradually removed. Sabatier believes, that a case of this description, which must be very uncommon, is the only one, in which there is any prospect of removing an encysted stone with success. In other examples, he conceives, that it is more prudent to leave the stone, and let the wound heal, than expose the patient to an almost certain death by repeated attempts to extract it. (*Médecine Opératoire*, t. iii. p. 190. 194. ed. 2.) Desault employed a sort of concealed knife, called a *coupe-bride*, for opening the cavity, or cyst; and he has recorded one example, in which he thus successfully extracted from a woman, aged sixty-two, a stone, lodged at the insertion of the ureter into the bladder. The bistoury, used by Garengcot, Desault did not consider a safe instrument, as the stones are round, and the knife may slip, and pierce the bladder; an objection to which, he says, the *coupe-bride* is not liable. No injury can be received from its point, as the blade is concealed, nor can any part be divided, except what the surgeon intends. If the incision should not be completed at first, the blade may be withdrawn, the semicircular notch of the instrument pushed more forward, and the incision prosecuted to any extent. This instrument was invented for the express purpose of dividing membranous bands in the rectum; but, it was afterwards employed with the greatest success for the excision of diseased tonsils, and fungous tumours situated in cavities. The blade is so contrived, that when it passes through the semicircular notch, it firmly fixes the parts which are to be divided: a thing, that cannot be done either with the scissors, or bistoury, as the moveable parts recede, and render the section difficult. (See *Parisian Chir. Journ.* vol. i. p. 33. &c.)

Sir A. Cooper mentions, that when the stone is partly in the cyst, and partly in the bladder, it may sometimes be removed without opening the

latter organ. In the case of a child, he passed his finger into the rectum, and felt the stone, confined in a bag above it. On raising the calculus it struck firmly against the sound. While the finger was in the rectum, the knife was carried through the perinæum above the bowel, the cyst opened, and the stone taken out, without any further opening of the bladder itself.

A stone perfectly encysted would not be expected to produce symptoms equal in severity to those, which arise from an extraneous body actually in the cavity of the bladder, and generally they do not have this effect; yet, in Houstet's interesting dissertation, several cases are recorded, which prove, that encysted stones do sometimes cause the same distressing symptoms, which proceed from the presence of a loose calculus in the bladder. Hence, the patients were sounded, and in consequence of the sacs, or pouches, in which the stones lay, not being entirely closed, the calculi were distinctly struck by the instrument, and lithotomy attempted. It deserves particular remark, also, that, in a large proportion of these cases, the pouches, or cysts, were not single, but numerous, occupying different parts of the bladder. In some dissections, referred to by Houstet, cysts of this kind were found, not containing any stones whatever; a circumstance, that would rather lead one to suspect, that, in general, the formation of these sacs precedes that of the calculi commonly found in them. (*Sec Obs. sur les Pierres Encystées et adhérentes à la Vessie*, par M. Houstet, in *Mém. de l'Acad. de Chir.* t. ii. p. 268. ed. in 12mo.) Many specimens of this kind are contained in University College Museum.

I shall conclude this part of the subject with a few observations on it by Sir Benjamin Brodie. "It very rarely happens, that you meet with an encysted calculus, where you perform the operation of lithotomy: in fact, in the great majority of cases of encysted calculi, the bladder is diseased, so that they are quite unfit for operation: however, such an event happens occasionally. A boy, about sixteen years of age, was admitted into the hospital in the year 1816. He had suffered a long time from stone in the bladder. There were these remarkable circumstances in his case,—namely, that the stone could sometimes be felt distinctly with the sound, appearing to be of large size, while at other times it could not be felt at all; and that sometimes, when the bladder was empty of urine, it could be perceived distinctly with the finger from the rectum, while at other times, when there was urine in the bladder, it could not be detected at all by this mode of examination. In performing the operation, when I had introduced my finger into the bladder, I could at first discover no stone. At last, I felt it on the anterior part of the bladder behind the pubes. It was not lying loose in the cavity of the bladder, but was evidently contained in a cyst, communicating with the bladder by a round opening. By means of a probe-pointed bistoury, I carefully dilated the orifice of the cyst, and then, introducing my finger, separated the membrane of it from the stone, until I was enabled to take hold of the stone with the forceps." It was not only encysted, but adherent, a portion of the lining of the cyst closely attached to it having been extracted with it. (See Sir B. Brodie on *Dis. of the Urinary Organs*, p. 287.)

OF SOME PARTICULAR METHODS AND INSTRUMENTS.

M. Foubert, an eminent surgeon at Paris, devised and practised a plan of his own, which, however, has not been considered by others worthy of being imitated. The patient having retained his urine, so as to distend his bladder, an assistant, with a convenient bolster, presses the abdomen a little below the navel, in such a manner, that, by pushing the bladder forwards, he may make that part of it protuberant, which lies between the neck and the ureter. The operator, at the same time, introduces the forefinger of his left hand up the rectum, and drawing it down towards the right buttock, pushes in a trocar on the left side of the perinæum, near the great tuberosity of the ischium, and about an inch above the anus. Then the trocar is to be carried on parallel to the rectum, exactly between the erector penis and accelerator urinæ muscles, so as to enter the bladder on one side of its neck. As soon as the bladder is wounded, the operator withdraws his forefinger from the anus.

In the upper part of the cannula of the trocar, there is a groove, the use of which is to allow some urine to escape, immediately the instrument enters the bladder, so that the trocar may not be pushed in any further; but its principal use is for guiding the incision. As soon as the urine began to flow, Foubert, retracting the trocar a little, without drawing it quite out of the cannula, introduced the point of a slender knife into the groove in the cannula; and by the guidance of this groove he ran it onwards into the bladder, and was aware of the knife having actually entered this viscus, by the urine flowing still more freely. Then raising the knife from the groove, he made his incision, about an inch and a half in length, through the neck of the bladder, by moving the knife from that point, at which it had entered, upwards towards the pubes. And, finally, by moving the handle more largely than the point of the knife, he opened the outer part of the wound to whatever extent the size of the stone seemed to require, and then, withdrawing the knife, he introduced a blunt gorget to guide the forceps.

An effort was made by Thomas to improve this method, but he failed, and it was never adopted by others. The inability of many bladders to bear distention is an insuperable objection to it; for, without this, the trocar is liable to pass between the bladder and rectum, and even through the bladder into the pelvis. (*Mémoires de l'Acad. de Chir.* vol. i. p. 663. *Le Dran's Parallèle.* *Sharp's Critical Inquiry.* J. Bell's *Principles*, vol. ii.)

In the year 1748, Frère Côme's method of performing the lateral operation began to attract considerable notice. It was performed with a particular instrument, called the *lithotome caché*, by means of which the prostate gland and orifice of the bladder were divided, from within outwards. The *lithotome caché* is entitled to much attention, because it is still generally used in several parts of the Continent, and sometimes in this country, especially in St. George's and the Westminster Hospitals. "In France (says M. Roux), if there is any mode of operating more common than others, and preferred by the majority of practitioners, it is that in which the instrument,

named the *lithotome caché*, is employed." (See *Parallèle de la Chirurgie Angloise, &c.* p. 318.) Frère Côme does not ascribe the invention of this instrument to himself; but acknowledges, that it resembles the knife for operating upon hernia, said to have been devised by a French surgeon of the name of Bienaise. It consists of a handle and the blade part. The latter is slightly curved, about as thick as a quill, furnished with a beak, and excavated so as to form a sheath for a knife of its own length. By means of a kind of lever, the knife can be made to pass out of the sheath, and the distance to which the blade projects also admits of being regulated with precision. For this purpose, the handle is divided into six sides, numbered 6, 7, 9, 11, 13, and 15, and which, according as they are more or less elevated, allow the lever to be depressed in different degrees, and the knife to move out of its sheath in the same proportion. Thus, the surgeon can at his option make an incision through the prostatic portion of the urethra and orifice of the bladder of six different lengths.

When the lithotome caché is to be used, the patient must be placed in the same posture, as in every other mode of practising the lateral operation; and after a staff has been introduced, an oblique incision is to be made, from the raphe of the perinæum, to a point situated rather more towards the anus, than the innermost part of the tuberosity of the ischium. The bulb of the urethra should not be cut, and not too much of the membranous part of the urethra. The fat and transverse muscles having been divided, and the urethra opened, exactly as in the common operation, the scalpel is to be put down, and the beak of the lithotome introduced into the groove of the staff. Of course, the surgeon, previously to the operation, will have settled the distance, to which the blade of the instrument is to pass out of the sheath, and which must necessarily depend upon the age of the subject, and the presumed size of the calculus. When the beak of the lithotome has been inserted in the groove of the staff, the surgeon is to take hold of the handle of the latter instrument with his left hand, and bring it a little towards himself, at the same time pushing the lithotome into the bladder, with the handle depressed as much as possible. The staff is now to be withdrawn, and the surgeon is to try to feel the stone with the sheath of the other instrument, in order to be able to judge of the size of the calculus, and whether the distance, to which the blade of the knife is intended to move out of the sheath, is such as is likely to make an opening of due but not unnecessary magnitude. Things being properly determined, the lithotome is to be held in a position calculated to make a division of the parts parallel to the cut in the integuments, and, by means of the lever, the cutting blade is then to be disengaged from its sheath. The surgeon is next to draw the opened lithotome towards himself, in a perfectly horizontal manner, so as to make the requisite division of the prostate gland and orifice of the bladder.

Sabatier observes, that Frère Côme's method possesses all the advantages of the lateral operation, besides being more easy than Cheselden's plan, and most of the other modes, subsequently proposed, for cutting the prostate gland and orifice of the bladder with perfect smoothness, and to

a sufficient extent to allow the calculus to be removed, without laceration of the parts. (*Méd. Opératoire*, t. iii. p. 199.)

Several objections have been urged against the use of the lithotome caché.

1. Frère Côme made his incision too high, so that an extravasation of urine in the scrotum followed some of his operations; but the above method of operating is free from any objection of this kind.

2. Some surgical writers insist on the danger of cutting the bladder too extensively with the lithotome.

3. The *arteria pudica profunda* and the rectum, which some authors conceive to be endangered, must always be in absolute safety, if the edge of the knife of the lithotome be turned in the direction above recommended.

I think that for a surgeon, who understands the right principles of lithotomy, this is one of the best ways of performing the operation.

When I was at Paris in 1815, I saw Dr. Soubrier operate very skillfully with the lithotome caché. A stone of considerable size was extracted from a gentleman, who was, I should think, not less than 70. No apprehensions were entertained of ill success, as I understood, that this operator hardly ever lost a patient.

M. Roux, when he visited England, seems not to have been informed, that, at the Westminster Hospital, the lithotome caché had been commonly employed for many years past. It was sometimes used at Guy's Hospital by Sir A. Cooper; and it is a favourite instrument with my friend Mr. Keate.

Le Cat, a surgeon of Rouen in Normandy, devised a mode of lithotomy, which would be too absurd to be described, were it less renowned. He thought the neck of the bladder might be dilated, like the wound, and his operation was deformed with all the cruelty of the Marian method, and every error attendant on the infant state of the latter operation. He first introduced a long wide staff; he cut forward with a common scalpel, through the skin and fat, till he could distinguish the bulb, the naked urethra, and the prostate gland. Secondly, with another knife, the urethrotome, having a groove on one side, he opened the urethra, just before the prostate, and, fixing the urethrotome in the groove of the staff, and holding it steady, rose from the kneeling posture, in which he performed the outward incision. Thirdly, holding the urethrotome in the left hand, he passed another knife, the cystotome, along the groove of the urethrotome; and the beak of the cystotome being lodged in the groove of the urethrotome, it was pushed forwards through the substance of the prostate gland into the bladder. Fourthly, drawing the cystotome a little backwards, he gave the staff to an assistant to be held steadily, and lifting a blunt gorget in the right hand, he placed the beak of it in the groove of the cystotome, and pushed it onwards, till it glided from the groove of the cystotome, along the groove of the staff into the bladder. Then, true to the principles of the apparatus major, and never forgetting his own peculiar theory, — *little incision, and much dilatation*, — he forced his fingers along the gorget, dilated the neck of the bladder, and made way for the forceps. (*J. Bell's Principles*, vol. ii.)

In 1741, Le Dran described an operation, the introduction of which has been claimed by several surgeons of a later period. The plan may be understood by the following brief explanation of it:

"The first incision being made, I again pass the point of the knife into the curvature of the staff to the part, where it bears against the perineum, and direct it to be held there by the assistant, who supports the scrotum. This done, I take a large director, the end of which is made with a beak, like that of a gorget, and conveying this beak, upon the blade of the knife, into the groove of the staff, I draw the knife out. I then slide the beak of this director along the groove of the staff into the bladder, and I withdraw the staff by turning the handle towards the patient's belly. The following circumstances will sufficiently satisfy us, that the director is introduced into the bladder: first, if it strikes against the end of the staff, which is closed; secondly, if the urine runs along the groove. I next feel for the stone with this director, and, having found it, endeavour to distinguish its size and surface, in order to make choice of a proper pair of forceps; that is, one of a stronger or weaker make, or of a large or small size, agreeably to that of the stone; after which I turn the groove towards the space between the anus and tuberosity of the ischium, and, resting it there, convey a bistoury along the groove, the blade of which is half an inch broad, and about three quarters of an inch long. I continue the incision, made by the knife in the urethra, and entirely divide the prostate gland laterally, as also the orifice of the bladder. The bistoury being withdrawn, the groove of the director serves to guide the gorget (a blunt one) into the bladder. I then introduce my forefinger along the gorget (which is now easily done, as the urethra and prostate, being divided, do not oppose its entrance), and with it I dilate the passage for the stone, in proportion to the size, of which I discover it to be. This dilatation being made, I withdraw my finger, and use the proper forceps." (*Le Dran's Operations*, ed. 5. 1784. London.)

Pajola, of Venice, was the pupil of Le Cat, and his method resembles that of his master. He is stated to have cut for the stone 550 patients with success; which deserves notice, because his operation has for its principles, dilatation, and no division of any part of the bladder. He makes an incision into the groove of the staff, with a lancet-pointed, double-edged knife, called an urethrotome, the blade of which has upon its centre a groove, that is continued to its point, and serves to guide the beak of another instrument, called the cystotome, into the groove of the staff. As the professed intention of the cystotome is only to cut the prostate gland, its name is ridiculous. It consists of a handle, and very slender blade, which is not connected with the handle, but with its sheath, by means of a little joint, close to the beak. When the cystotome is opened as far as possible, the end of the blade, furthest from the beak, is twelve lines from the sheath. In this position, it is held by a transverse piece of steel, which admits of being pushed more or less out at the option of the surgeon, and can be fixed by means of a screw. Pajola, like Scarpa, considers cutting the neck of the bladder dangerous, and he merely divides the prostate, after which he introduces a blunt gorget, and along this a species of forceps

for dilating the neck of the bladder in all directions. (*X. F. Rudtorffer über die Operation des Blasensteins nach Pajola's Methode.*) As Langenbeck observes, great as the success of this lithotomist has been, his method of operating has little to recommend it; and every thing must be ascribed to his individual skill, and intimate knowledge of the parts. Langenbeck even prefers Le Cat's method, in which there is no need of such a multiplicity of instruments. The blunt gorget and dilator are perfectly unnecessary, as the finger would do the purpose of both.

The danger of the beak of the gorget slipping out of the groove of the staff, is one of the chief objections urged against the employment of the first of these instruments. In order to obviate this inconvenience, the late Sir Charles Blüke had the groove of the staff, and the beak of the gorget, so constructed, that they locked into each other, and continued fixed, except near the extremity of the staff. This contrivance, though ingenious, is not resorted to; for the point of contact between the beak and body of the instrument is necessarily so small, that it is liable to break. It is allowed, however, that this objection might be removed; but another one is still urged, viz. the beak and groove catching on each other, so as to resist the efforts made to introduce the gorget into the bladder. Every operator knows, that much of the safety of the lateral operation, as performed at present, depends on the ease with which the beak of the gorget slides along the groove of the staff. Le Cat, in 1747, devised a similar instrument.

Some operators have a good deal of trouble in dissecting into the groove of the staff. Sir James Earle invented an instrument to facilitate this part of the operation. It consists of a short staff, with an open groove, connected by a hinge with the handle of another staff, of the usual size, shape, curvature, and length, which may be called the *long staff*. The hinge, by means of a pin, is capable of being disjoined at pleasure. The short staff is sufficiently curved to go over the penis and scrotum, and long enough to reach to that part of the long staff which is just below the beginning of its curvature. The end of the short staff, made somewhat like a pen, with the sides sharpened, and finely pointed, is adapted to shut into the groove of the long staff, and its cutting edges are defended from being injured by a proper receptacle, which is prepared for it in the groove of the long staff. When the instrument is shut, the groove of the short staff leads into that of the long one, so as to form one connected and continued groove. The short staff is rendered steady by the segment of an arch, projecting from the long one through it.

The long staff, separated from the short one, is first introduced in the usual manner, and the stone having been felt, the short staff is to be put on the other at the hinge. The incision is then to be made in the usual manner, through the skin and cellular membrane, and a second incision through the muscles, so as nearly to lay bare the urethra. The operator then, being perfectly convinced that the extremity of the long staff is sufficiently within the bladder, must bring the end of the short staff down, and press it against the urethra, which it will readily pierce, and pass into the cavity prepared for it in the groove of the long staff. The two

pieces being now firmly held together by the operator's left hand, nothing remains to be done, except applying the beak of the gorget to the groove of the short staff, and pushing it on till it is received in the groove of the long one; and if this latter be made with a contracted groove, it will just enter where the contraction begins, and thus must be safely conducted into the bladder. (*Earle on the Stone; Appendix*, ed. 2. 1796.) Deschamps describes an instrument, invented by Jarda, surgeon of Montpellier, which bears a resemblance to Earle's double staff, but was more complicated, being designed to support the scrotum, and also press the rectum out of the way.

The late Mr. Dease, of Dublin, and Mr. Muir, of Glasgow, considering that the gorget was more apt to slip from the staff in consequence of the latter being curved, and that its beak never slips from the groove of the staff in operating on women, proposed a method, which in principle resembles that of Le Drau. They introduce, as usual, a curved grooved staff, into the bladder, make the common incisions, and open the membranous part of the urethra; but, instead of introducing a gorget on the curved staff, they conduct along the groove a straight director, or staff, into the bladder, and immediately withdraw the other. The gorget is then introduced. The operation may be performed with a narrow bistoury, as advised by Mr. A. Burns. Mr. Key, who adheres to the valuable principles of Cheselden, but uses a knife, instead of a gorget, is also an advocate for a director, which is straight, except towards its termination,—a part never concerned in guiding the knife,—and which is introduced like a common staff. (*On the Section of the Prostate Gland*, p. 23.)

OF CUTTING TOWARDS THE SYMPHYSIS PUBIS, AND THE BILATERAL OPERATION.

I have already made reference to the plan of dividing both sides of the prostate gland, as practised in 1804, by Dr. Physick, of the United States, and nearly thirty years ago, by Sir Astley Cooper, with a beaked double-edged scalpel, or a double-edged gorget, in cases where the stone was large, and since occasionally adopted by Sir J. Brodie and others. In 1816, Baron Dupuytren made trial of a method, which had, indeed, been suggested at an earlier period by Chaussier and Bichard (*se Velpeau, Nouv. Elem. de Méd. Opér.* t. iii. p. 748.), which consisted in making the first incision, into the membranous part of the urethra, in a line with the raphe of the perinæum, commencing about two inches and a half in front of the anus, and terminating an inch from it. A second incision, made parallel to the first, divided the erector penis, and the adipous cellular tissue, placed between the bulb of the urethra in front, and the rectum behind. In the third stage of the operation, the membranous portion of the urethra was laid open from the bulb to the verumontanum. The lithotome, or bistourie caché, was then introduced along the staff, and the latter withdrawn. The edge of the former was then turned upwards towards the symphysis pubis, and the blade having been made to quit the sheath by pressing on a spring, the instrument was drawn out in this direction, so as to cut the neck of the bladder and part of its anterior parietes; the deepest portion of the upper side of the urethra; the superior part of the

prostate; the cellular tissue between the anterior ligaments of the bladder; and the arterial and venous branches in this situation. (See *Clin. Chir.* t. ii. p. 373.)

This method was soon abandoned: in fact, as the opening was situated in the narrowest part of the arch of the pubes, it must have afforded but little room for the extraction of the calculus. The venous hemorrhage would also be considerable.

In 1824, Baron Dupuytren began to employ his double lithotome, with a staff that did not terminate in any *cul-de-sac*, which frequently impeded the disengagement of the lithotome from the deep groove of the instrument. The patient is placed in the usual position for the lateral operation, and the staff held by an assistant exactly in the vertical direction. While the left hand keeps the integuments of the perinæum tense, the right makes, with a double-edged knife, a semicircular incision, beginning on the right, between the anus and the ischium, and terminating at the corresponding point on the left, the distance to which it passed from the anus forwards being five lines. The subcutaneous cellular tissue, the superficial fascia of the perinæum, and the anterior point of the external sphincter being divided, so as to expose the origin of the membranous part of the urethra, the groove of the staff can be detected with the nail of the left forefinger, which will serve for guiding the point of the knife into it. During all this first stage of the operation, care must be taken to depress the lower edge of the wound with the finger, and to keep the rectum away from the edge of the knife.

After the membranous part of the urethra has been sufficiently opened, the same finger-nail serves as a guide for the lithotome, which, held in the right hand, with the thumb below, and the two fingers next to it above, is applied to the staff with its convexity directed towards the anus. The contact of the two instruments having been clearly ascertained, the surgeon takes hold of the handle of the staff with his left hand, and raising its beak under the symphysis of the pubes, pushes the double lithotome along its groove into the bladder.

The staff is now to be withdrawn, and the lithotome turned, so as to make its concavity face the anus. Its blades are then made to quit the sheath, and it is drawn out, not exactly horizontally, but with an inclination downwards. The left forefinger is then introduced into the wound, so as to ascertain the extent of the incisions made, and to guide the forceps to the calculus. (See *Dupuytren, Clin. Chir.* t. ii. p. 390.)

Baron Dupuytren ascribed the following advantages to the bilateral operation:—

1. The great facility of its performance.
2. The situation of the wound, in the widest part of the lower aperture of the pelvis, and consequently the most favourable for the extraction of large calculi.
3. This method makes a shorter and more direct passage into the bladder, whereby the requisite manœuvring with instruments is facilitated.
4. The readier escape of the urine through the wound, and consequently the removal of any risk of its becoming extravasated in the cellular tissue.
5. An opening is made in the neck of the bladder and the prostate, sufficient for the extraction

of very large calculi, without the wound passing so far on each side as to become dangerous.

6. The ejaculator ducts are conceived by Dupuytren to be more safe from injury, than in the common lateral operation.

7. The method is applicable to both sexes.

The bilateral operation had been performed, about 70 times, in the Hôtel Dieu and other parts of Paris, and only six of the patients died. In that hospital 26 patients were operated upon in succession with complete success. (See *Dupuytren, in Clin. Chir.* t. ii. p. 413.)

The double lithotome is now well constructed in London; and, when the stone is known to be of ample size, the bilateral operation, I think, merits the preference to all ordinary plans.

A posthumous work, illustrative of Dupuytren's bilateral operation, and containing several interesting plates, has been recently published.

Mr. Liston is of opinion, that no complicated machine is requisite to make this bilateral division, and that it is quite time enough to make such division, when the necessity for it has been ascertained. "The single lateral incision affords sufficient room to admit of the removal of the stone, in 19 cases out of 20, and there can be no purpose served, therefore, in always making a cut in both sides of the gland, and thus endangering the emasculation of the individual." (*On Practical Surgery*, p. 414.) I have already explained, that several operators are in the habit of cutting the right side of the prostate gland with a knife, when the stone is above a certain size.

LITHOTOMY WITH A KNIFE.

We have already described how Frère Jacques and Cheselden used to operate with a knife, without any cutting gorget, in the early state of the lateral operation. The success, which attended the excellent practice of the latter surgeon, certainly far exceeds what attends the present employment of the gorget; for, out of 52 patients, whom he cut successively for the stone, he only lost two; and out of 213, of all ages, constitutions, &c., only 20. These facts are strongly in favour of abandoning the use of the gorget, and doing its office with a knife.

The objections to the gorget are numerous and well founded. In the hands of many skilful operators, its beak has slipped out of the groove of the staff, and the instrument has been driven either between the rectum and the bladder, into the intestine instead of the latter viscus, or else between the bladder and pubes. "If I were to be asked (says Sir A. Cooper) how many times I have known the gorget slip, and pass between the bladder and rectum, I should say at least a dozen times, and in each case the most lamentable and fatal consequences ensued; for, the operator now lays hold of the stone and bladder together; the forceps slip; the stone, inclosed in the bladder, is again laid hold of; and, thus, he continues to pull, bruise, and injure the bladder, till the patient is at length carried back to his bed with the stone unextracted, violent inflammation supervenes from the injury done to the bladder, and, in a few days, the patient is no more." Sir James Earle remarks: "I have more than once known a gorget, though passed in the right direction, pushed on so far, and with such violence, as to go through the opposite side of the

bladder." Bromfield, even when operating with a blunt gorget, perforated the bladder and peritoneum, so that the abdominal viscera came out of the wound. (P. 270.) I now know of at least three other instances in which the gorget, slipping from the staff, completely severed the urethra from the bladder; the stone was not taken out; and the patients died.

I will suppose, however, that the preceding dangers of the gorget are surmounted, as they certainly may be, by particular dexterity, seconded by the confidence of experience. The gorget is introduced; but, whatever kind of one has been used, the wound is never sufficiently large for the easy passage of any stone, except such as are below the ordinary size. Camper has noticed this fact: "*Hawkenusius solo conductore, ejus margo dexter in aciem assurgit, idem præstat: omnes plagam dilatant, ut calculum extrahant: dilacerantur igitur semper vesicæ ostium et prostata.*" (P. 114.) Dense says: "In all the trials that I have made with the gorget on the dead subject, I have never found the opening into the bladder sufficiently large for the extraction of a stone of a middling size, without a considerable laceration of the parts. I have frequently taken the largest-sized gorget, and could not find, in the adult subject, I ever entirely divided the prostate gland, if it was any way large; and in the operations that were performed here on the living subject, if the stone was large, the extraction was painfully tedious, and effected with great difficulty, and, in some cases, not at all."

I shall dismiss this part of the subject with referring the reader to the spirited and correct objections to the gorget in Mr. John Bell's *Principles*, vol. ii. part ii. This author seems, however, to have fallen into the mistake of directing the knife to be plunged through the posterior part of the prostate gland into the groove of the staff. (*Op. cit.* vol. cit. p. 197.) So did Mr. Allan Burns, whose plan, therefore, I do not deem it necessary to repeat the description of. (See *Edinb. Med. and Surg. Journ.* No. xiii.)

Sir Charles Pell describes the following method of operating with a knife, instead of a gorget. A staff grooved on the right side, a scalpel with a straight back, and the common lithotomy forceps, are the indispensable instruments. The staff is kept in the centre, and well home into the bladder. The surgeon, making his incision under the arch of the pubes, and by the side of the anus, carries it deeper towards the face of the prostate gland; cutting near to the staff, but yet not cutting into it, and avoiding the rectum by pressing it down with the finger. Now carrying the knife along the staff, the prostate gland is felt. The point of the knife is run somewhat obliquely into the urethra, and into the lateral groove of the staff, just before the prostate gland. It is run on, until the urine flows. The forefinger follows the knife, and it is slipped along the back of it, until it is in the bladder. Having carried the forefinger into the bladder, it is kept there, and the knife is withdrawn. Then the forceps, directed by the finger, are introduced. (*Operative Surgery*, vol. i. p. 361.)

The possibility of the knife wounding the rectum, Dr. Thomson thinks, might be obviated by employing it as follows:—"After having made the external incisions, and divided the membranous

part of the urethra, in the way that is usually done for the introduction of the beak of the gorget, a straight grooved staff is to be introduced into the groove of the curved staff, and pushed along it into the bladder. The curved staff is then to be withdrawn, and the surgeon, laying hold of the handle of the straight staff with his left hand, and turning the groove upwards and a little outwards, presses the back of it downwards towards the right tuber ischii, and holds it steadily in that position. The point of a straight-backed scalpel being now introduced into the groove of the staff, with its cutting edge inclined upwards and a little outwards, is to be pushed gently forwards into the bladder. The size of the scalpel need only be such as will make a wound in the prostate gland and neck of the bladder, sufficiently large to admit the forefinger of the left hand. The scalpel being removed, this finger is to be introduced into the bladder, through the wound which has been made, and the staff may then be withdrawn. With the finger the surgeon endeavours to ascertain the size and situation of the stone. If, after this examination, he judges the incision in the neck of the bladder to be too small for the easy extraction of the stone, he next introduces into the bladder a straight probe-pointed bistoury, with its side close to the fore part of his finger, and its cutting edge upwards. By turning this edge towards the left side, and by keeping the point of his finger always beyond the point of the bistoury, he may safely divide, in the direction of the first incision, as much of the prostate gland, and neck of the bladder, as he shall deem necessary." (See *Obs. on Lithotomy, &c., with a Proposal for a New Manner of Cutting for the Stone.* Edinb. 1808.)

Mr. Allan, who is a strenuous advocate for using the knife instead of the gorget, directs us, after laying bare the urethra, and bringing the staff so as to form a right angle with the patient's body, to feel that the instrument is fairly lodged in the bladder. The operator is to use the forefinger of his left hand as a director in feeling for the groove in the staff, and in distinguishing the prostate gland; and, with this finger, he is to depress the rectum, and direct the deeper part of his dissection. "Feeling the gland, with the point of the forefinger of the left hand, and the groove of the staff in the upper part of the wound, the assistant is desired to steady his hand, and the operator, holding his knife as he does writing pen, his fingers an inch and a half from the point, turns up its edge towards the staff, and strikes its point through the membranous part of the urethra into its groove, half an inch before the prostate gland. He now turns the back of the knife to the staff, slides it a little backwards and forwards in the groove, that he may be sure it has fairly entered; then shifts the forefinger, with which he guides the incision, places it under the knife, and always keeps it before its point, so as to prevent the rectum from being wounded: he then lateralizes the knife, enters the substance of the prostate, is conscious of running the scalpel through its solid and fleshy substance, and judges, by the finger, of the extent of the incision which he now makes. The urine flows out; he slips his finger into the opening, withdraws the scalpel, and gives it to an assistant, who hands him the forceps, which he passes into the bladder, using

the forefinger of his left hand, which is still within the wound, as a conductor. The forceps instantly encounter the staff, which serves to conduct them safely into the bladder, while the finger guides them through the wound, &c." (*Atlas on Lithotomy*, p. 48. Edinb. 1808.)

The staff, used by Mr. Liston, is of large size, and deeply grooved betwixt the lateral and convex aspects. "This instrument (he observes) is easily felt after the first incision, and the urethra opened upon it. It is hooked against the symphysis, and entrusted to an assistant, with directions to maintain the position steadily from first to last, neither to turn it so as to bulge in the perineum, nor to depress the handle as the knife enters the bladder; the surgeon's left hand is thus left at liberty to guide the knife, and guard important parts from danger." The knife "is then entered pretty deeply into the perinæum, about an inch, more or less, behind the scrotum, and it is made to cut downwards and outwards through the skin and superficial fascia, in a line, about midway betwixt the tuberosity of the ischium and the anus, and beyond that orifice, towards the sacro-sciatic ligament. The forefinger of the left hand is then placed in the bottom of the wound, about its middle, and directed upwards; any fibres of the transverse muscle, or of the levator of the anus, that offer resistance, are divided with the knife, its edge being turned downwards. The finger passes readily through the loose cellular tissue, but is resisted by the deep fascia, immediately anterior to which the groove of the staff can be felt not thickly covered. The point of the instrument is slipped along the nail of the finger, and, guided by it, is entered, the back still directed upward, into the groove at this point. The finger, all along, is so placed, as to depress and protect so far the coats of the rectum; and the same knife, pushed forwards, is made to divide the deep fascia, the muscular fibres within its layers, a very small portion, not more than two lines, of the urethra, anterior to the apex of the prostate, together with a part of the prostatic portion of the canal, and the gland to a very limited extent." According to Mr. Liston's views, the external incision should be free; but the internal one very limited indeed, not extending beyond seven lines from the urethra downwards and outwards. The object of this is not to interfere with the reflection of the ileo-vesical or pelvic fascia, from the sides of the pelvis over the base of the gland and side of the bladder. "If this natural boundary betwixt the external and internal cellular tissue is broken up, there is scarcely a possibility of preventing infiltration of urine, which must almost certainly prove fatal. The prostate, and tissues around the neck of the bladder, are very elastic and yielding, so that, without much solution of their continuity, by a very slight incision, and without the least laceration, the opening can be so dilated, as to admit the forefinger readily; still further, the forceps can be introduced upon it as a guide, and removed, along with the stone of considerable dimensions, say from three inches to nearly five inches in circumference in one direction, and from four to six in the largest. The finger follows the knife, which is then withdrawn, and the position and volume of the stone can be at once distinctly ascertained

in the greater number of cases." If the prostate be rigid or very large, or the patient very corpulent, Mr. Liston conceives, that it may sometimes be expedient, after dividing the membranous and prostatic portions of the urethra, to dilate gently with a blunt gorget, as practised by the late Mr. Martineau, Sir B. Brodie, and Mr. Dalrymple, of Norwich. (See *Practical Surgery*, p. 410.) Mr. Liston's use of the elastic gum tube after the operation, has been already noticed. This is not commonly employed in London, and is strongly reprobated by M. Velpeau. (*Nouv. Elém. de Méd. Opér.* t. iii. p. 775.)

In operating with a scalpel, one with a longish blade, or handle, will be found more convenient, than a common one, on account of the depth of the parts requiring division, especially in adults and fat subjects.

I would also beg the attention of surgeons to the modification in the manner of performing Cheselden's operation, proposed by Mr. Key, and executed with a staff of nearly a straight form, and a scalpel that has a slightly convex back near its point, in order that it may run with more facility in the groove of the staff. (*On the Section of the Prostate Gland*, p. 26.)

That the performance of lithotomy with a knife, when the operator has the assistance of a proper staff, cannot be difficult, may be inferred from there being no particular difficulty in the method, even when no staff at all is employed. In the spring of 1814, when at Oudenbosch in Holland, I was requested by Serjeant Ryan, of the 1st Foreign Veteran Battalion, to see his little boy, about four years old, who was troubled with symptoms, which made me immediately suspect, that there was a stone in the bladder. As I had no sound, I introduced a small silver catheter, which distinctly struck against a calculus. Without taking the instrument out again, I determined to perform lithotomy with a common scalpel. Indeed, no other mode could be adopted, as we had neither staff, gorget, nor lithotomy instruments of any kind. After making the external part of the incision in the common way, I found, that the catheter afforded me no guidance. I therefore withdrew it, and dissected deeply by the side of the prostate gland, till the forefinger of my left hand passed rather beyond it. The scalpel was then plunged into the bladder, behind this gland, under the guidance of my left forefinger, and with the edge turned towards the urethra. The necessary division of the prostate and neck of the bladder was then made by cutting inwards and upwards in the direction of the rest of the wound. With a small pair of ordinary dressing forceps, a calculus, rather larger than the end of the thumb, was easily extracted. This operation was performed at the Military Hospital, in the presence of Dr. Shanks, of the 56th regiment, and several other medical officers. Not a single bad symptom ensued, although the army unexpectedly moved into the field three days afterwards, and the child travelled about for some time in a baggage cart, in an exposed and neglected state. The little boy completely recovered.

Many surgeons perform lithotomy with beaked scalpels. Mr. Bizard's knife is one of the best. Its blade is long, straight, and narrow, and furnished with a beak, by means of which it admits

of being conducted along the groove of the staff into the bladder, after the external incisions have been made. The staff is then withdrawn, and the operator has now the power of making the incision through the prostate gland and orifice of the bladder downwards and outwards to any extent, which the parts will allow or the case require. This is one of the principal advantages, which beaked long narrow knives have over gorgets, which, after their introduction, cannot be further used for the enlargement of the wound. The narrow knife will also cut more safely downwards and outwards, than any gorget; nor is it subject to the serious danger of slipping away from the staff, and going we know not where; because, the moment its beak and extremity have entered the bladder, the staff is no longer necessary, as the proper extent of the blade will then readily pass in without the aid of any conductor at all. I need hardly observe, also, that, in this method, we have nothing like the perilous, and violent, thrust of the gorget, which, in the event of a little unsteadiness in the operator's hand, or of any fault either in the position of the staff, or the direction of the gorget, will do irremediable and fatal mischief.

Sir A. Cooper admits, that the operation may be executed very well with a knife in children; but he prefers a gorget, or the *bistour caché*, for old persons, on account of the prostate gland and bladder being frequently so rigid in them, that the scalpel does not easily make an impression upon those parts; and also in adults, in consequence of the unfitness of the common knife to do what is necessary in a deep perinaeum.

A FEW GENERAL REMARKS ON THE BEST MODE OF MAKING THE INCISION IN THE LATERAL OPERATION.

Perhaps, of all the great operations in surgery, lithotomy is that, in which great awkwardness, mortifying failures, and dangerous blunders, are most frequently observed. Many a surgeon, who contrives to cut off limbs, extirpate large tumours, and even tie aneurismal arteries, with *éclat*, cannot get through the business of taking a stone out of the bladder in a safe, much less a masterly, style. This fact is so familiarly known in the profession, and its truth so often exemplified, that I may well be excused the unpleasant task of relating, in proof of it, all the disasters, which have fallen under my own notice. But, I must take the liberty of remarking, that, in this branch of surgery, a great number of individuals do not profit by these instructive lessons of experience. The more they see of lithotomy, the more they are convinced of its dangers; yet, too often, instead of studying the causes of all success, they merely derive, from the examples before them, a suspicion of the unskilfulness of the operator, or some discouraging conjectures about the difficulties of the operation.

The establishment of certain principles to be observed in lithotomy, appears the most probable way of diminishing the frequency of the accidents and failures of this common operation.

After the very opposite principles, and different methods of cutting for the stone, which are explained in the preceding columns, as preferred by different surgeons, I think it may be useful to offer a few general observations on the proper

direction and size of the incision. These points, which are of the highest practical consequence, in regulating the principles to be observed in lithotomy, are far from being settled, as must be plain to every body who recollects that Cheselden, Desault, John Bell, Klein, Martineau, Langenbeck, &c. recommend a free opening; Scarpa, Callisen, and others, a small one; or, as Scarpa objects strongly to my calling his incision small, I will say one extending from the apex of the prostate gland to the orifice of the bladder, no part of which is divided; that Mr. Abernethy and Scarpa employ gorgets, which cut upwards and outwards, at angles of 45° and 69° from the axis of the urethra; and that the gorgets of Cruickshank, B. Bell, Desault, Mr. Cline, and most other surgeons, are intended to cut either directly outwards, or outwards and downwards.

The incision, through the whole of the parts cut in lithotomy, should always be made in a straight, regular, direct manner, from the surface of the skin in the perinaeum to the termination of the wound in the urethra and bladder. In an adult subject, the external wound should commence about an inch above the anus. The impropriety of beginning it higher up has been duly insisted upon by Sharp, Bertrandi, Callisen, and every good writer on the operation. "Il ne faut couper l'urètre que le moins qu'on peut, parce qu'on obtient par ce moyen une meilleure voie pour pénétrer dans la vessie sous l'angle du pubis. C'est avec raison que Sharp dit que l'incision de l'urètre faite au-dessus de cet angle est si peu utile pour l'extraction de la pierre, qu'on n'en retireroit pas plus d'avantage en le coupant presque dans toute sa longueur." (*Bertrandi, Traité des Opérations*, p. 127.) And Callisen lays it down as a maxim: "Ut eae partes haud sectione attingantur, quæ pro calculi egressu nihil faciunt; adeoque bulbus urethrae, et hujus pars corpore spongioso circumdata intacta relinquatur." (*Systema Chirurgiae Hodiernae*, pars posterior, p. 655.)

Extraordinary as it may seem, it is not the less true, that cutting too much of the urethra is one of the most common faults still committed by modern surgeons. The incision in the integuments is to be large, that is to say, at least three inches in length in an adult subject, because a free opening in the skin is not only exempt from danger, but attended with many advantages, especially those of facilitating the other steps of the operation, and preventing any future lodgment and effusion of urine. The external wound ought to be directed towards a point, situated a little way towards the anus from the innermost part of the tuberosity of the ischium, or, as Mr. Stanley recommends, about one third from it, and two thirds from the anus. From the line thus made, the incision should be carried inward and upward, through all the parts between it and the side of the prostate gland. Another line, extending from the inferior angle of the wound to the termination of the cut in the neck of the bladder, forms the precise limits to which the depth of the incisions should reach, and no further.

The great principle of making the axis of the wound as straight and direct as possible, should always be kept in view, whether the surgeon employ a common scalpel, which cuts into the blad-

der, from without, inwards, or other instruments, which divide the prostate gland and neck of the bladder, from within, outwards, like the bistourie caché, beaked knives, and every kind of gorget. In the latter circumstance, the only difference consists in cutting, from the bladder and urethra downwards and outwards towards a point situated between the anus and the tuberosity of the ischium, instead of carrying the incision from this point, upwards and inwards, through the side of the prostate gland and the orifice of the bladder. The following may be enumerated as important advantages of attending to the foregoing principle:—

1. The wound is made in that direction, which affords the greatest room for the extraction of large stones; and the axis of the incision being also as nearly straight as possible, the introduction of forceps, and the passage of the calculus outward, are materially facilitated.

That these are important advantages, I think every surgeon will allow, who knows how much the pain and danger of lithotomy depend upon the injury, which the parts suffer from the force sometimes used in the extraction of the stone, and the repeated introduction of the forceps. Cheselden, one of the most successful lithotomists England ever produced, made the incision nearly as here recommended. The following remarks merit particular attention:—"J'ai vu plusieurs fois, dans les hôpitaux de Paris, que les chirurgiens, coupant trop en haut vers l'angle du pubis, sentoient une grande résistance au périmé, quand ils vouloient retirer le calcul avec les tenettes; on voyoit le périmé se tuméfier par la pression qu'y faisoit la pierre; en ce cas, quelques opérateurs plus sages abandonnoient la pierre, introduisoient de nouveau le gorget, et en tournant en dessous la cannelure de celui-ci, prolongeoient l'incision obliquement vers la tubérosité de l'os ischion; et enfin, à la faveur de cette plus grande ouverture, retiroient la pierre sans causer de déchiremens." (*Bertrandi, Traité des Opérations*, p. 133.) Larger stones may likewise be thus extracted, without being broken, than in any other mode of making the lateral incision, as must be obvious to every practitioner, who recollects the very limited room, afforded at the upper part of the triangular space, between the arch of the pubes, the ramus of the ischium, and the neck of the bladder. This consideration cannot fail to have great weight with all surgeons who feel duly convinced, how unsatisfactory a method it is to break a calculus, in order to get it out of the bladder. The measures, necessary for the removal of all the fragments, protract the completion of the operation, and seriously increase its danger, while the continuance of a single part of the stone behind may cause a renewal of all the grievances, for the cure of which the patient submitted to the operation. By these remarks, however, I am far from meaning to say, that large calculi should not be broken: on the contrary, my only wish is, that the necessity for the practice may be avoided, as much as possible, by making a free incision into the bladder, and even enlarging the opening, if necessary, as far as can be done with safety. In short, instead of breaking the stone, I prefer the practice of the late Mr. Martineau, of Norwich, perhaps the most successful lithotomist that ever lived, as out of 84 patients, whom he cut, two only died; a statement highly

favourable to operating with a knife, and to making an adequate opening. "Should the stone be large or there be any difficulty in the extraction, rather than use much force, while the forceps have a firm hold of the stone (says Mr. Martineau), I give the handles to an assistant, who is to draw them outwards and upwards, while the part forming the stricture is cut; which is easily done, as the broad part of the blade becomes a director to the knife: and rather than lacerate, I have often repeated this enlargement of the inner wound two or three times." (*See Med. Chir. Trans.* vol. xi. p. 411.) The great advantage of the knife over the gorget, and even the necessity of employing it to adapt the size of the opening in the bladder to the magnitude of the stone, or its fragments, are most convincingly exemplified in several cases recently put upon record. Thus, Klein, with the aid of a common scalpel, extracted a calculus, which weighed twelve ounces thirty grains, and the patient recovered. (*Pract. Ansichten Bedeutendsten Operationen*, h. i.) In 1818, Mr. Mayo, of Winchester, operated with a knife, and extracted a calculus, which broke in the forceps, weighing fourteen ounces two drachms avoirdupois, and the patient recovered. (*See Med. Chir. Trans.* vol. xi. p. 54. &c.) Mr. W. B. Dickenson, of Macclesfield, also succeeded, with Mr. Gibson's knife, in taking out of the bladder a calculus, the fragments of which weighed eight and a half ounces, and the patient was saved. (*Vol. cit.* p. 61.) And in the same volume may be seen other instances, in which immense calculi were removed from the bladder with various results, but particularly one which weighed sixteen ounces, and which Sir A. Cooper could not succeed in breaking: he was therefore obliged to enlarge the wound, first made with the gorget "to the sacro-sciatic ligament," when, with the aid of a hook applied to the fore part of the stone behind the pubes, and the simultaneous assistance of the forceps, he succeeded, with considerable difficulty, in removing this immense mass. The patient lived, however, only four hours after the operation. (*See Med. Chir. Trans.* vol. xi. p. 73.)

2. The arteria pudica profunda can never be injured, because the surgeon does not let the knife or gorget approach nearer to the ischium, than a point which is situated some way from the tuberosity of that bone towards the anus; and consequently the edge of the instrument cannot come into contact with the inside of the tuberosity and ramus of the ischium where the great pudic artery is situated.

3. The rectum will not be wounded, because the direction of the axis of the incision downwards and outwards to the above-mentioned point, sufficiently removes the edge of the knife or gorget from the intestine. But, the rectum will be in still greater safety, if it be pressed downward with the forefinger of the left hand in the wound, and the prudent custom of emptying it, by means of a clyster, a short time before the operation, be not omitted; for, no lithotomist should ever forget, that when this bowel is considerably distended with feces, it rises up a little way on each side of the prostate gland.

4. As the seminal duct penetrates the lower part of the substance of the prostate gland, in order to reach the verumontanum, and the knife or other instrument, employed, divides the side of

that gland obliquely outwards and downwards, the duct will not be in danger of being cut.

The judicious Callisen is well aware of the advantages of making a smooth, even, direct incision into the bladder*, but, like Scarpa, Dupuytren, Brodie, Stanley, Liston, and others, he is averse to extending the cut through the neck of that viscus. Indeed, as we shall presently notice, Scarpa does not sanction cutting any portion of the bladder whatever.

Every practitioner, who will take the trouble to look over the history of the lateral operation, will find that the greater number of lithotomists, who have particularly distinguished themselves by their unparalleled success, as Frère Jacques, Cheselden, Côme, Martineau, Souberbielle, &c. made a free incision in the bladder. This fact alone is enough to raise doubts of the goodness of the advice delivered upon this subject by Callisen and Scarpa; especially as neither they, nor any other modern surgeon (with the exception, perhaps, of Pajola, whose individual skill is said by Langenbeck to make amends for the disadvantages of his method), can boast of having cut patients for the stone with a degree of success at all equal to that of the above-mentioned operators. The extraordinary success which characterized Cheselden's practice, we have already detailed. The accounts of the successful operations performed by Frère Jacques, and Côme, are equally remarkable.

Mr. Martineau, as I have noticed, lost but two patients out of 84, on whom he operated, and this without making a selection, as he never rejected any case. His patients were always kept a week in the house before they were operated upon; and this precaution, with a regulated diet, and, perhaps, a dose or two of opening medicine, was the only preparatory treatment. (*Med. Chr. Trans.* vol. xi. p. 409.)

During my stay at Paris, in 1815, I saw Dr. Souberbielle extract a stone of considerable size, on the plan of his well-known ancestor. The incision was ample and direct, so that the calculus was taken out with perfect ease. Now, as the operations of this professed lithotomist are very numerous, and he enjoys the reputation of scarcely ever losing a patient, are we not justified in inferring, that the advocates for a small opening are promulgating the worst advice which can be offered to the practitioner? My own observations certainly tend to such a conclusion, as will be presently explained. The tract published by Scarpa (*Memoir on the Cutting Gorget of Hawkins, &c.*, trans. by Wislart), has for its main objects, the recommendation of a modification of Hawkins's gorget, and the inculcation of the propriety of making a limited incision in the prostate gland, without cutting any part of the bladder. As sufficient room cannot thus be obtained for the extraction of even a stone of moderate size, he is an advocate for the gradual dilatation of the urethra and orifice of the bladder. He observes, that the lateral operation, though executed with the greatest precision, does

not exempt the surgeon from dilating, in a certain degree, the orifice of the bladder and cervix of the urethra; the dilatation of these parts, however moderate, being always necessary, even where the calculus is of middling size. He states, that in the adult, the orifice of the bladder dilates almost spontaneously to the diameter of five lines; and he adds, that the lateral incision, within proper limits, divides the body and base of the prostate gland to the depth of four, or, at most, five lines, forming with the five, to which the orifice of the bladder naturally yields, an aperture of ten lines. But, says Scarpa, in an adult, a stone of ordinary size and oval figure, is sixteen lines in the small diameter, to which must be added the thickness of the blades of the forceps: consequently, even after the incision has been made with the most scrupulous exactness, the stone, though of moderate size, cannot pass out of the bladder, unless the dilatation of the base of the gland and orifice of the bladder be carried to the extent of nearly eight lines, beyond the size of the aperture made with the knife. But, says Scarpa, if, in order to avoid distending the parts to the extent of eight lines, the base of the prostate gland, together with the orifice of the bladder, and a part of its fundus, be divided to a depth equivalent to it, the event would necessarily be an effusion of urine into the cellular membrane, between the rectum and bladder, and consequently suppuration, gangrene, fistula, and other serious evils. (P. 4, 5.)

According to Scarpa, the apex of the prostate gland forms the greatest resistance to the introduction of the forceps and the extraction of the stone, and, therefore, ought to be completely divided (p. 7.); but he contends, that two, and sometimes three, lines of the substance of the base of the gland should be left undivided; which, he asserts, is a matter of great importance, because the untouched portion, around the orifice of the bladder, prevents effusion of urine, and the formation of gangrene, or fistula, between that part and the rectum. (P. 22.)

After this statement of one of the great principles, which Scarpa wishes to be observed in the performance of the lateral operation, a question, or two, naturally arise. Are we then to conclude, that the plan of making a free and direct incision into the bladder ought to be abandoned?

We have seen, that an apprehension of effusion of urine, gangrene, fistula, &c. is the only reason assigned by Scarpa for his aversion to making a complete division of the side of the prostate gland, and orifice of the bladder. But, I would inquire, do we find extravasation of the urine between the rectum and bladder, and gangrene, and fistula, so frequent after lithotomy in England, as to render it probable that these ill consequences can ever proceed from our usual mode of dividing completely, not only the side of the prostate gland, but also the adjoining part of the bladder? Are such bad effects so often experienced in this country, as to constitute a material source of uneasiness in the mind of a surgeon about to undertake lithotomy? Do they form a substantial reason for abandoning the maxim of always endeavouring, as far as circumstances will allow, to make an incision of sufficient size for the easy removal of the calculus? And, would not Scarpa's method of stretching and dilating the wound, in order to get the stone out of the bladder, often

* *Vulnus sit æquale, haud angulatum, conicæ figuræ apicē vesicæ respiciente, externa plaga ampla, et quatuor pollicum longitudine, unde effluxus sanguinis, puris, lotii, arena, facilitatur.* (See *Systēma Chirurgiæ Hodierne*, pars posterior, p. 656, Hafnia, 1800.)

dangerously prolong the operation; lead to much mischief from the repeated use of the forceps; cause serious confusion and laceration of the parts; and, for all these reasons, render inflammation of the bladder and peritoneum very likely to follow?

I have seen the lateral operation performed an immense number of times, either with various kinds of gorgets, beaked knives, the lithotome caché, or common scalpels. In most of these examples, the avowed intention of the surgeon was to make a free opening into the bladder. I do not mean, however, to say, that this was always actually accomplished, since the bad construction of the instruments employed, and other causes, sometimes frustrated the wise design of the operator. But, what was the consequence? Generally speaking, those surgeons who made only a small incision into the bladder, and kept their patients a long while upon the operating table, ere they succeeded in getting out the stone, by the repeated and forcible use of the forceps, had the mortification to see very few of their patients recover; a large proportion of them being carried off by peritonitis, on the third or fourth day after the operation.

On the contrary, when the incision was ample and direct, so that the calculus could be easily and gently removed, the patients were almost always saved.

For the first six or seven years of the long time, during which I enjoyed frequent opportunities of seeing lithotomy performed in St. Bartholomew's Hospital, gorgets were invariably used, most of which made an insufficient opening. The consequence was, that many of the patients were detained a long while upon the operating table, before the stone could be extracted, and some considerable numbers were lost by peritonitis. Afterwards, however, in the same institution, common scalpels and beaked knives were generally used; a freer opening was mostly made; and the proportion of deaths from peritonitis was strikingly lessened.

The following observation, made by Mr. Martineau, is also worthy of particular attention:—"In the first years of my practice," says he, "I was not very successful; and often witnessing many untoward circumstances in myself and others, which appeared to arise from the use of the cutting gorget, I determined to lay that instrument aside, and employ the knife only, and the blunt gorget as a conductor for the forceps." (*Med. Chir. Trans.* p. 405.)

Now, when we remember that this gentleman lost only two out of eighty-four patients on whom he operated, his remarks are of great importance; and his cases, and the other facts, which I have specified, strongly impress my mind with the truth of all that I have urged, respecting the advantages of making a free opening, and in the best direction for the easy passage of the stone outward.

In Mr. Martineau's manner of operating, it is true, he does not make the external wound parallel to that in the bladder, as I venture to recommend, but directs it nearly in a line with the raphe; a circumstance which may, perhaps, account for his continuing the use of the blunt as a conductor for the forceps. Neither is the internal incision carried downwards and out-

wards, as Bertrandi, Desault, and many other judicious surgeons consider most advantageous. But these defects (if I may presume to call them so) are rendered of less consequence by the rule, which Mr. Martineau observes, of making his first incision long and deep, and avoiding all stretching and laceration of the parts. Like Langenbeck, he uses a staff, the groove of which is much wider and deeper than usual, and therefore more easily felt. This instrument his assistant holds, in the way preferred by Scarpa, nearly in an upright straight direction. "After the first incision (says Mr. Martineau), I look if the staff is not altered in its situation, and then feeling for the groove, I introduce the point of the knife into it, as low down as I can, and cut the membranous part of the urethra, continuing my knife through the prostate into the bladder; when, instead of enlarging the wound downwards, and endangering the rectum, I turn the edge of the blade towards the ischium, and make a lateral enlargement of the wound in withdrawing the knife." (*See Med. Chir. Trans.* vol. xi. p. 409.) This description is particularly interesting, as coming from a gentleman who had so much experience and success.

With respect to the degree of importance, which ought to be attached to the fear of effusion of urine, between the bladder and rectum, gangrene, fistula, &c., I believe that they are inconveniences which are not commonly observed after lithotomy in this country. In two or three instances only, I have known the urine come through the wound longer than usual, and these cases ended well. As for the extravasation of urine, and sloughing, I shall merely remark, that although there cannot be a doubt of their occasional occurrence, they have not taken place after any of the numerous operations, with the results of which I have been acquainted.

All these considerations, therefore, incline me to doubt whether the apprehension of effusion of urine, fistula, &c. be sufficiently well founded to make it advisable for surgeons to relinquish the plan of making a complete division of the side of the prostate gland, and a limited one in the neck of the bladder. Nor is it all clear to my mind, that effusion of urine and sloughing are likely to be the effect of practising a free opening. Indeed, whenever they do happen, I believe they proceed from a totally different cause, viz. from the incision in the skin being too small and too high up, and from the axis of the internal part of the incision not corresponding with that of the external wound. Hence the urine does not readily find its way outward, and some of it passes into the neighbouring cellular membrane. (*See Œuvres Chir. de Desault*, t. ii. p. 460, 461.)

I regret that the observations, published by me, relative to Scarpa's method of performing lithotomy, should not have seemed to him a fair account of the subject, and that he should have deemed it necessary to declare my statement of his incision being too small, and inadequate to the passage of any but calculi under the middling size, manifestly false. (*Opuscoli di Chirurgia*, vol. i. p. 52.) He supposes, that Cheselden, Frère Jacques, and Côme, in their successful operations, made the limited kind of incision which he himself recommends, and did not cut the bladder itself; a position, that does not

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appear to me correct. He asserts, that after the side of the prostate gland is divided, the orifice of the bladder is capable of yielding so as to allow the stone to pass out without danger, if this part of the operation be done slowly and gradually; and he supports his declaration on this point by a reference to the safety with which the orifice of the female bladder is dilated for the extraction of calculi of considerable size; a case hardly presenting an analogy,—first, because there is no wound made whatever; and secondly, because lithotomy itself, in women, is a safe measure, compared with what it is in men. The frequent evils of dilating the orifice of the female bladder, however, he frankly acknowledges in another part of his writings, and enumerates as the ground of his disapprobation of the practice. (See *Opuscoli*, &c. vol. i. p. 105.) It does not appear to me, that Scarpa's gorget can make the division of the prostate in a direction corresponding to that of the external parts. This view, he thinks, is not founded on correct principles; and he maintains, that his incision in the prostate does correspond to the outer wound, because, when the bladder is empty, the prostate is naturally placed in a line sloping from the arch of the pubes to the coccyx, and with its posterior surface resting on the rectum, as is represented in *Camper's Demoist. Anat. Pathol.* lib. ii. tab. 3. fig. 2. This explanation is not satisfactory to myself; but I have great pleasure in mentioning it, as it has appeared to Scarpa to amount to a refutation of my observation, that his gorget does not make a division of the prostatic portion of the urethra in a direction corresponding to the axis of the wound of the external parts. (*Opuscoli di Chirurgia*, vol. i. p. 52.)

From conversations, which I have had with Sir Astley Cooper, I know, that he also regards the chances of effusion of urine from a free incision, as much less than apprehended by several practitioners, whose opinions on this point have been already cited. But, as in addition to the names of Le Cat and Scarpa, those of Dupuytren, Sir B. Brodie, Stanley, and Liston, may now be quoted in favour of the plan of not cutting beyond the base of the prostate gland, so as to avoid dividing the fascia, interposed between the pelvic cellular tissue, and that more superficially situated, I admit that this is a point in surgery needing further careful investigation. It can only be settled by a fair comparison of the results of operations conducted on the two opposite principles; by ascertaining the causes of death in a fair number of instances; and, in particular, by observing in the various dissections the real extent of the wound; because, I have some reason to suspect, that some persons who advocate a small internal incision, in truth often make a free one. Sir Benjamin Brodie's observations upon this and all other points of surgery, however, I entertain great respect for, and he assures us, that all that he has been able to observe for many years past has confirmed him in the opinion, that an incision of the prostate, extending into the loose cellular texture surrounding the neck of the bladder, is replete with danger. The peritoneal inflammation, noticed in fatal cases, he observes, is evidently not the primary disease: it is the inflammation and sloughing of the cellular membrane of the pelvis, which has induced inflammation of the adjoining portion

of that membrane. (*On Dis. of the Urinary Organs*, p. 291.)

Thus, while some operators, like Klein, Martineau, &c., refer their extraordinary success, as lithotomists, to the plan of making a free opening, others ascribe a principal source of danger to this very method of proceeding.

LITHOTOMY THROUGH THE RECTUM.

This method may be said to have been first suggested in a work published at Bâle, in the 16th century, by an author who assumed the name of Vegetius:—"Jubet per vulnus recti intestini, et vesicæ aculeo lapidem ejicere," says Haller, in speaking of this writer. (*Bibl. Chir.* vol. i. p. 102.) Frère Côme cites an instance, in which a recto-vesical fistula was kept up by the presence of a calculus, and cured by extracting the foreign body through the rectum. A fistula in the rectum was laid open by Camper, and a splinter of wood thus removed from the rectum. Recto-vesical fistulae were several times cured in the Hôtel-Dieu by Desault, who divided the sphincter so as to form a wound reaching to the perineum. These facts must have been sources of encouragement to the first regular attempts to perform lithotomy from the rectum. According to Clot-Bey, the recto-vesical operation has been practised from time immemorial in Egypt, where he has seen it practised by empirical persons, to whom an acquaintance with the mode of performing it had descended as a species of family property of very ancient inheritance. (See *A. Velpeau, Nouv. Elem. de Méd. Opér.* vii. 3, p. 782.) But the proposal never received much attention in Europe until the year 1816, when M. Sanson, in France, gave an account of this manner of operating, and urged several considerations in favour of it. In that country the operation has been performed about thirty times by MM. Sanson, Dupuytren, Poserat, Castara, Willaume, Cazenave, Dumont, Taxil, and a few others. Dupuytren renounced the practice. It was also advocated by Vacca, Farnèse, Giorgi, Giudetti, and Lancisi. Almost as soon as this method was heard of on the other side of the Alps, it was put to the test of experience by Barbantini in a case, where every other plan of operating appeared hardly practicable. "The connection of the urethra with the rectum, prostate gland, and posterior part of the bladder (says M. Sanson), made me easily perceive, that by dividing the sphincter ani and some of the rectum near the root of the penis, I should expose, not only the apex of the prostate gland, but a more or less considerable portion of this body, and that I should then be able to penetrate into the cavity of the bladder, either at the neck through the prostate, or at its posterior part." It was the latter method, which M. Sanson first tried upon the dead subject. The body was placed in the position usually chosen for the common ways of operating, and a staff was introduced, and held perpendicularly by an assistant. A bistoury, with its blade kept flat on the left fore-finger, was now introduced into the rectum, and the edge being turned upwards, M. Sanson, with one stroke, in the direction of the raphe, cut the sphincter ani, and the lower part of the rectum. The bottom of the prostate gland being thus exposed, the finger was next passed beyond its solid substance, where the staff was readily perceptible through

the thin parietes of the rectum and bladder. While the latter instrument was steadily maintained in its original position, M. Sanson here introduced the knife into the bladder, and, following the groove of the staff, made an incision about an inch in length. At this instant, the flow of urine from the wound indicated that the bladder had had an opening made in it. On examination, the parts divided were found to be the sphincter, the lower part of the rectum, the back part of the prostate, and the adjacent portion of the bladder. Another mode, contemplated by M. Sanson, was, after dividing the sphincter ani, to cut the termination of the membranous part of the urethra along the groove of the staff held perpendicularly, and by the same guidance to extend the incision in the median line through the prostate gland, and neck of the bladder.

In Barbantini's case, the calculus was so large, that it made a considerable prominence in the rectum, where it was felt extending across from one tuberosity of the ischium to the other. On account of its size, its extraction by the lateral operation was considered impracticable; and, as it was not thought advisable or easy to break such a mass, and Barbantini regarded the high operation as more difficult and uncertain in its results, than the common method, it was determined to operate through the rectum. The attempt was delayed some days, by the impossibility of introducing the staff effectually, which was stopped at its entrance into the bladder by the calculus. But, as a grooved instrument was judged to be an essential guide, Barbantini caused a long director to be constructed, which he thought might be passed more conveniently than the staff, into the first incision. He also provided himself with long forceps, the blades of which were very broad, and admitted of being put separately over the stone. A staff having been introduced, the operation was done after M. Sanson's manner, except that a wooden gorget was introduced for the protection of the rectum, and the prostate gland was left undivided at the fore part of the wound. When the bladder had been opened at the lower part of the rectum, as far as the groove of the staff served as a guide, the latter instrument was withdrawn, and the long director introduced into the incision, which, under its guidance, was then enlarged to the necessary extent. With some difficulty the stone was then extracted, and found to weigh nine ounces and a half. For about eighteen days the urine passed away by the anus, only a few drops occasionally issuing from the urethra. As this circumstance gave Barbantini some uneasiness, he introduced his finger into the bladder, the inner surface of which, near the wound, he found covered with encysted calculous matter, which was very adherent. At length, however, it was gradually removed, with a portion of new-formed membrane, by attempts repeated with the finger several days in succession. A catheter was then introduced, through which, at first, almost the whole of the urine flowed. But, the tube being afterwards obstructed with mucus, it became necessary frequently to clear it by injecting tepid water. The cure now seemed to proceed with rapidity. When the feces were hard, none of them passed into the bladder; but, when they were liquid, a part of them was voided with the urine through the tube, though without

any inconvenience. At the end of fifty days, scarcely any urine passed out of the wound; the patient, therefore, went into the country, where, in the course of another month, the cure was complete.

A few years ago, I saw an example, in which a calculus had made its way through the prostatic portion of the urethra, and formed, with the swelling of the soft parts, a considerable prominence within the rectum. If the patient had been under my care, I should certainly have made an incision directly on the tumor just within the sphincter, by which means the calculus might have been removed with great ease, and less risk than dividing the prostate. However, the latter method was followed, and the case had a very favourable termination. In this instance, as the sound, in its passage, only occasionally touched a small point of the calculus, which approached the urethra, and this just at the instant before its entrance into the cavity of the bladder, the exact nature of the case was for some time a matter of doubt to several skilful surgeons who were consulted.

Respecting the merits of lithotomy through the rectum, Scarpa, who decidedly condemns it, acknowledges, that a large calculus may indeed be thus extracted more speedily, and with less risk of injury to important parts, than by the high operation; but, says he, in addition to the consideration, that, in such cases, every mode of operating is contra-indicated by the morbid state of the bladder, it is to be recollected, that, after the recto-vesical method, there is always left an open passage for the feces from the rectum into the bladder, and for the urine from the bladder into the rectum. Of three individuals, within his knowledge, who have been operated upon in this manner for very large stones, two died soon afterwards of sloughing of the bladder, and the third led for some time a miserable existence, discharging fecal urine, and urine mixed with excrement. Instructed by these disasters, some Italian surgeons, not declared advocates for the new method, very laudably endeavoured to obviate them in future; and having ascertained that, for the extraction of a stone of moderate size, such as can be conveniently taken out by the perineum, it is not at all necessary to open the fundus of the bladder, they adopted Sanson's method, viz. that of cutting the sphincter ani from below upwards, and then laying open vertically, from above downwards, the membranous part of the urethra and the prostate gland, so as to let the knife meet the first wound in the sphincter. "In fact (says Scarpa), they really attained the object, namely, that of hindering the feces from entering the bladder after the extraction of the stone. This was, no doubt, of great importance in their operation, yet, as it seems to me, not a consideration that ought to make the recto-vesical preferable to the lateral operation, whenever the stone can be taken out through the perineum: first, because the vertical section of the membranous part of the urethra, and the prostate gland, cannot be executed, without separating the left seminal duct, and sometimes the right one, from the vas deferens and vesicula seminalis of the same side; secondly, because the wound is still exposed to the contact of the feces." (*Sul Taglio Retto-Vesicale*, p. 4. Also, *Opuscoli di Chirurgia*, vol. i.

p. 69.) In reply to Vacca's observations, he urges also against the recto-vesical operation, when the wound must be made extensive enough for the removal of a large calculus, the risk there is of wounding the fold of the peritoneum, which, if the bladder is thickened and contracted, descends lower than is generally supposed. (p. 36.) This accident really happened in one case, which was dissected by Geri of Turin. (*Repert. Med. Chir. de Torino*, No. 18.)

Here we discern a strong reason against Mr. Sleigh's modification of the operation, in addition to the probability of an incurable communication between the rectum and the bladder, as sufficiently proved in the history of the recto-vesical operation. (See *Scarpa's Opuscoli*, vol. i.) The part of the bladder, which Mr. Sleigh proposes to divide, is bounded laterally by the vasa deferentia and vesiculæ seminales; superiorly by the *cul-de-sac* of the peritoneum; and inferiorly by the prostate gland, and the union of the seminal tubes. The chief peculiarity in the plan is that of not dividing the sphincter ani and the prostate gland. Cutting the first part, he conceives, perhaps, without sufficient foundation, must seriously increase the patient's sufferings, while dividing the prostate gland vertically cannot be done without injuring one of the seminal ducts; a point on which he is more correct, and in agreement with Scarpa. In endeavouring to avoid this danger, however, he runs into a still more formidable one, viz. that of wounding the *cul-de-sac* of the peritoneum, and exciting fatal inflammation within the abdomen. (See *Sleigh's Essay on an Improved Method of Cutting for Urinary Calculi; or the Posterior Operation of Lithotomy*: 8vo. Lond. 1824.)

Even when the stone is of extraordinary magnitude, it may be doubted whether the recto-vesical method ought to be preferred either to the high, or the lateral operation; by which last, stones of larger size than that extracted by Barbantini, have been successfully taken out by Sir A. Cooper, Mr. Mayo, of Winchester, Dr. Klein, of Stuttgart, and others. We must agree, I think, with M. Velpeau, that it is quite an error to refer the difficulty of extracting a large calculus to the want of space between the bones; and he, like Scarpa, cannot conceive how, in any method of lithotomy, the lower aperture of the pelvis, if regularly formed, can hinder the extraction of the stone. The embarrassment always arises from the opening in the bladder. In the recto-vesical operation the opening is restricted to the portion of the bladder between the prostate and the *cul-de-sac* of the peritoneum, so that it can be only from twelve to fifteen lines in extent. Where then, inquires M. Velpeau, is the advantage, since in the bilateral operation, an opening may be obtained from fifteen to twenty lines in extent? And, if the surgeon chose to cut the neck of the bladder beyond the base of the prostate, an opening two inches and a half might be formed in the bilateral operation, which, in the recto-vesical method, would be impracticable, without the greatest risk of wounding the peritoneum. (See *A. Velpeau in Nouv. Elem. de Méd. Opér.* t. iii. p. 171.) Another serious consideration is, whether a large incision, forming a communication between the bladder and rectum, will generally heal up, as well, or even more favourably, than

in Barbantini's case. A smaller wound in the same part, it appears, may be soon cured; for, in the instance reported by Sanson, the boy was quite well on the twentieth day. On this point, it must be confessed, modern reports are becoming extremely unfavourable. Of seven patients, operated upon with division of the fundus of the bladder (says Professor Vacca), four were left with a recto-vesical fistula, and the fifth was in danger of one. In four cases operated upon, Professor Geri knew of three such terminations. Besides these facts, observes Scarpa, of which I could increase the number by others within my knowledge, it is to be taken into the account, that in some individuals, the fecal and urinary fistula, after seeming to be closed for some time, has opened again. (*Sul Taglio Retto-Vesicale*, p. 40.) In the School of Practical Surgery, at Turin, out of five operated upon through the rectum, three died, although eleven other patients, cut in the lateral way, all recovered in a short time. Only one had rather severe symptoms, which were ascribed to a wound of the rectum. Dupuytren, who tried the recto-vesical operation in six instances, as performed by Vacca, lost three of his patients of inflammation within the pelvis. The first patient died a fortnight after the operation; and two on the third day. The three others remained with incurable fistulae, through which the urine either continually dribbled, or was partially expelled when the bladder contracted. (See *M. Louis Senn, Parallèle de la Taille*, Paris, 1824; *Scarpa, Opuscoli di Chirurgia*, vol. i. p. 135.) Dupuytren, on being asked one day, if he would still try the plan, made no answer, but shook his head. Barbantini, who first put the operation to the test of experience in Italy, has, after further trials of it, and the mature consideration of Scarpa's objections to it, candidly acknowledged its great disadvantages in comparison with the lateral operation. (See *Scarpa's Opuscoli di Chirurgia*, vol. i. p. 100.) Riberi also saw two children cut by Sanson at Paris; one died a few days afterwards of peritonitis; and the other had been given up before his departure from that city. (*Ragguaglio di tredici Cistotomie*, Torino, 1822; and *Scarpa, sul Taglio Retto-Vesicale*, p. 55.)

Sanson, Des Moyens de Parvenir à la Vessie par le Rectum, 4to. Paris, 1817. *N. Barbantini, Obs. relative à l'Extraction d'un Calcul Urinaire très volumineux, opérée au moyen de la Taille Vesico-Rectale*, 8vo. Lucques, 1819; *Journ. Complém. du Dict. des Sciences Méd.* t. vi. p. 79. 8vo. Paris, 1820; *Dict. des Sciences Méd.* t. xxviii. p. 422, &c. *A. Scarpa, sul Taglio Retto-Vesicale*, 4to. Pavia, 1823, and *Opuscoli di Chirurgia*, vol. i. 4to. Pavia, 1825. *Facca Berlinghieri, Mém. sopra il Metodo di estrarre la Pietra della Vescia Orinaria per la via dell' Intestino Retto*, 8vo. Pisa, 1821. *Mém. 2da. 8vo. Pisa, 1822. Mém. 3da. &c. 8vo. Pisa, 1823. T. Furnari, Esame delle Osservaz. sul Taglio Retto-vesicale per l'Estrazione della Pietra*, &c. 8vo. Milano, 1826. *Blaignère, des Moyens de parvenir à la Vessie par le Rectum*, &c. 8vo. Paris, 1821. *Alf. I. d'Alcan, Nouv. Elem. de Méd. Opér.* t. iii. p. 782, 8vo. Paris, 1832.

LITHOTOMY IN WOMEN.

Women suffer less from the stone than men, and far less frequently stand in need of lithotomy. It is not, however, that their urine will not so readily produce the concretions, which are termed urinary calculi. The reason is altogether owing to the shortness, largeness and very dilatable nature of the female urethra; circumstances, which render the expulsion of the stone with the

urine, the common result. The records of surgery present us with numerous instances, where calculi of vast size were spontaneously voided through the meatus urinarius, either suddenly without pain or after more or less time and suffering. Heister mentions several well-authenticated examples. Middleton has also related a case, where a stone, weighing four ounces, was expelled, in a fit of coughing, after lodging in the passage a week. Colot speaks of another instance, where a stone, about as large as a goose's egg, after lying in the meatus urinarius seven or eight days, and causing a retention of urine, was voided in a paroxysm of pain. A remarkable case is related by Dr. Molineaux in the early part of the *Phil. Trans.*: a woman voided a stone, the circumference of which measured the longest way seven inches and six tenths, and round about, where it was thickest, five inches and three-quarters; its weight being near two ounces and a half troy. And Dr. Yelloly has related an interesting example, in which a calculus, weighing three ounces, three and a half drachms troy, and lodged in the meatus urinarius, was easily taken out with the fingers. (See *Med. Chir. Trans.* vol. vi. p. 577.) Dr. Yelloly also refers to several other remarkable instances, described in the *Phil. Trans.* vols. xii. xv. xvii. xx. xxxiv. xlii. and lv. proving what large stones will pass out of the female urethra, either spontaneously, or with the aid of dilatation and manual assistance. Were any doubts now left of this fact, they would be immediately removed by other histories, especially those contained in the papers published by Sir A. Cooper. (See *Med. Chir. Trans.* vols. viii. and xii.)

Sometimes, after the passage of large calculi, the patient is afflicted with an incontinence of urine; but, in general, this grievance lasts only a short time.

The occasional spontaneous discharge of very large calculi, through the meatus urinarius, led Frederic de Leauson to deliver the advice not to interfere with them, as he thought they would all prevent themselves sooner or later at the orifice of that passage, and admit of being taken away with the fingers. (See *Traité Nouveau pour aisément parvenir à la guérison de plusieurs belles Opérations*, &c. Genève, 1674.)

When surgeons began to consider the magnitude of calculi sometimes spontaneously voided, and the large size, and dilatable nature of the female urethra, they suspected that it might be a good practice to dilate this passage by mechanical contrivances, until it would allow the stone to be extracted, and thus supersede all occasion for cutting instruments. With this view, Tolet first proposed suddenly dilating the passage with two steel instruments, called a male and female conductor, between which, the fingers or forceps were passed for the removal of the calculus. (*De la Lithotomie*, Paris, 1681.) But as it was afterwards judged, that the dilatation would produce less suffering and injury, if more gradually effected, Douglas suggested the practice of dilating the meatus urinarius with sponge or dried gentian root.

Mr. Bromfield published the case of a young girl, in whom he effected the necessary dilatation, by introducing into the meatus urinarius the appendicula cœci of a small animal in a collapsed state, and then filling it with water, by means of a

syringe; thus furnishing a hint for the construction of instruments on the principle of Mr. Arnott's dilator. The piece of gut thus distended was drawn out, in proportion as the cervix vesicæ opened, and, in a few hours, the dilatation was so far accomplished, that the calculus had room to pass out. (See *Chir. Obs. and Cases*, vol. ii. p. 276.)

Mr. Thomas met with a case, in which, after dilating the meatus urinarius with a sponge tent, he succeeded in extracting an earpicker which lay across the neck of the bladder. The passage was so much enlarged, that the left fore-finger was most easily introduced, and (says this gentleman) "I believe, had the case required it, both thumb and finger would have passed into the bladder without the smallest difficulty." After adverting to this and other facts, proving the ease with which the female urethra can be dilated, Mr. Thomas remarks: "If these relations can be credited, and there is no reason why they should not, I can hardly conceive any case in a young and healthy female subject, and where the bladder is free from disease, where a very large stone may not be extracted, without the use of any other instrument than the forceps, the urethra having first been sufficiently dilated by means of the sponge tents. For this purpose the blades of the forceps need not be so thick and strong, as those commonly employed." (See *Med. Chir. Trans.* vol. i. p. 123—129.) Many facts of a similar kind are on record, and one, in which a large needle-case was extracted, is referred to in a modern periodical work. (See *Quarterly Journ. of Foreign Med.* vol. ii. p. 331.)

Some surgeons have extracted stones from the female bladder in the following manner: the patient having been placed in the position commonly adopted in the lateral operation, a straight staff, with a blunt end, is introduced into the bladder, through the meatus urinarius. The surgeon then passes along the groove of the instrument the beak of a blunt gorget, which instrument becoming wider towards the handle, effects a part of the necessary dilatation. The staff being withdrawn, and the handle of the gorget taken hold of with the left hand, the right forefinger, with the nail turned downwards, is now introduced slowly along the concavity of the instrument. When the urethra and neck of the bladder have thus been sufficiently dilated, the finger is withdrawn, and a small pair of forceps passed into the bladder. The gorget is now removed, and the stone taken hold of and extracted. (*Sabatier, Méd. Opér.* t. ii. p. 103.)

This plan, however, has been objected to on account of the dilatation being too suddenly effected, and the practice of gradually expanding the meatus urinarius with the sponge tent preferred. The retention of urine, during the continuance of the sponge, certainly causes great irritation; and, if this method be followed, therefore, I consider Mr. C. Hutchinson's suggestion of placing a catheter in its centre, as mentioned by Sir A. Cooper, worthy of attention. (See *Med. Chir. Trans.* vol. viii. p. 433.)

Sir A. Cooper, who is an advocate for the practice of removing calculi from the female bladder, by dilating the meatus urinarius, now employs for this purpose "an instrument constructed upon the principle of the speculum ani and speculum ori," and which has the advantage of permitting the

urine to escape, whilst it dilates the passage sufficiently for the entrance of the forceps, and the removal of a stone of considerable dimensions. He believes that, "if the stone be small, the dilatation should be accomplished in a few minutes; but, that if it be large, it will be better to dilate only a little from day to day, until the greatest degree of extension is accomplished; carefully avoiding contusion, which is much to be dreaded. (See *Med. Chir. Trans.* vol. xii. p. 240.)

Three or four years ago, I assisted Mr. Walne, of Bloomsbury-square, in extracting a calculus, which was nearly an inch and a half in one of its diameters, from the bladder of a girl, eight or ten years old. The meatus was first gradually dilated with Weiss's dilator: the incontinence of urine, following the operation, after a time subsided. I have also seen a piece of spermaceti candle, five inches long, and of the usual thickness, which had accidentally slipped into the bladder, taken out with the finger, after the meatus had been dilated for two or three hours with the same instrument; and, in this case, no incontinence of urine followed.

Notwithstanding these favourable accounts of the practice of dilating the female urethra, for the purpose of removing calculi from the bladder, there are very good surgeons who deem an incision the best practice. It is certain that some patients have found the method insufferably tedious and painful. But the strongest objection is the incontinence of urine, which occasionally follows a great distension of the urethra and neck of the bladder. Klein, one of the most experienced operators in Germany, states, that he has tried both plans, and that the use of the knife is much less frequently followed by incontinence of urine. And Scarpa declares, that when the calculus is large, and not soft and fragile, the method of extracting it by dilatation is almost always followed by incontinence of urine. (*Sul Tuglio Recto-Vesicale*, p. 49.) On the other hand, Mr. Thomas believes, that this unpleasant symptom is quite as often a consequence of the operation of lithotomy as now usually performed. (*Med. Chir. Trans.* vol. i. p. 127); and Sir A. Cooper expressly states, that the greatest advantage of his mode of extracting calculi with a dilating instrument, is the preservation of the power of retaining the urine. (See *Med. Chir. Trans.* vol. xii. p. 240.) Of the propriety of removing calculi, under a certain size, and also pieces of broken catheter, &c., in this manner, no doubt can be entertained: but, if the foreign body were very large, I should consider an incision the safest and least painful practice.

In females, lithotomy is much more easy of execution, and less dangerous than in male subjects. It may be done in various ways; but the surgeons of the present time constantly follow the mode of making the requisite opening by dividing the urethra and neck of the bladder. Louis employed for this purpose a knife, which cut on each side and was contained in a sheath; Le Blanc, a concealed bistoury, which had only one cutting edge; Le Cat, his gorgereet-cystitome; Frère Côme, his lithotome caché. Of these instruments the best, I think, is that of Frère Côme. But at present every surgeon knows, that the operation may be done, as conveniently as possible, with a common director, and a knife that has a long, narrow, straight blade. A straight staff, or director, is introduced through the meatus urin-

arius; the groove is turned obliquely downwards and outwards, in a direction parallel to the ramus of the left os pubis; and the knife is thus conducted into the bladder, and makes the necessary incision through the whole extent of the passage, and neck of the bladder.

Louis and Fleurant, as I have said, were the inventors of particular bistouries for dividing both sides of the female urethra at once. The instrument of the former effected this purpose, in passing from without inwards; that of the latter, in passing from within outwards. Fleurant's bistoury bears some resemblance, in principle, to Frère Côme's lithotome caché, or to the cutting forceps with which Franco divided the neck of the bladder. The reason assigned as a recommendation of these bistouries, is that they serve to make a freer opening for the passage of large stones, than can be safely made by cutting only in one direction. Dubois adopted a method, which consists in dividing the meatus urinarius directly upwards towards the symphysis of the pubes, dilating the wound, and then taking out the calculus with the forceps. The invention of this method, which has been referred to Dubois, is at least as ancient as the 16th century. Paré assigns the merit of it to Colot, who made a small incision *tout au dessus, et en ligne droite, de l'orifice du col de la vessie, et non à côté.* This plan, as revived by Dubois, is executed either with a director and bistoury, or a lithotome caché. If the first instrument be used, a director, having a deep groove in it, that is closed at its extremity, is introduced into the meatus urinarius, with the groove turned upwards. The surgeon takes hold of the handle with his left hand, and, by means of the director, depresses the fore part of the vagina with a certain degree of force. With the right hand, he introduces along the groove a narrow sharp bistoury, with which the upper side of the urethra is to be divided through its whole extent, and the adjacent textures as far as the subpubic ligament. Thus, (says M. Velpeau,) an opening, six or eight lines long, may be formed, or indeed, one from eight to ten lines in length, when the attempt to draw the stone out is made. However, it appears to him, that it would be dangerous to try to extract in this manner any calculus, the dimensions of which exceed an inch or fifteen lines. However, he saw M. Bougon remove one of this size from a young woman who perfectly recovered; and M. Thomas, of Tours, was equally successful in a similar case. In withdrawing the forceps, it is necessary to press forcibly upon the lower side of the meatus, and to draw out the calculus in a sufficiently low direction; for otherwise it would be pulled against the back of the symphysis pubis. In 1824 this occurrence baffled for a considerable time an excellent operator in one of the hospitals in Paris, though the calculus was not larger than a partridge's egg. On changing the direction of the forceps, it was easily extracted. (See *M. Velpeau, Nouv. Elem. de Méd. Opér.* t. iii. p. 847.) Lisfranc also carries the incision upwards, and a little to one side of the symphysis of the pubes, because this mode of operating he finds less frequently followed by retention of urine than others. When the opening thus made is not large enough, he makes another cut obliquely downwards and outwards. When the stone is known to be very large, Sabatier prefers the apparatus altus.

A case may present itself, in which the posterior part of the bladder, drawn downwards by the weight of the stone, may displace a portion of the vagina, and make it protrude at the vulva in the form of a swelling. Here, there would be no doubt of the propriety of cutting into the tumour, and taking out the foreign body contained in it. Rousset performed such an operation, and Fabricius Hildanus, in a case where the stone had partly made its way into the vagina, enlarged the opening, and successfully extracted the foreign body.

Mery proposed to cut into the posterior part of the bladder, through the vagina, after introducing a common curved staff; but the apprehension of urinary fistulæ made him abandon the project.

Extraordinary circumstances may always render a deviation from the common modes of operating not only justifiable, but absolutely necessary. Thus, Tolet met with a case, where a woman had a prolapsus of the uterus, with which the bladder was also displaced. In the latter viscous, several calculi were felt: an incision was made into it, and the stones having been extracted, the displaced parts were reduced, and a cure speedily followed. (*Sabatier, Méd. Opér.*, t. ii. p. 107.)

Incontinence of urine, consequent to lithotomy in women, is by no means unfrequent. Mr. Hey cut two female patients for the stone, both of whom were afterwards unable to retain their urine, and were not quite well when discharged from the Leeds Infirmary. These cases led him in a third example to endeavour to prevent the evil, by introducing into the vagina a cylindrical linen tent, two inches long and one broad, with a view of bringing the edges of the incision together, without obstructing the passage of urine through the urethra. The plan answered, if it be allowable to make such an inference from a single trial. (See *Hey's Practical Obs. in Surgery*, p. 560. ed. 1810.)

TREATMENT AFTER THE OPERATION.

The position, in which the patient should be placed after the operation, and the plan of leaving the wound uncovered, so as to let the urine readily escape, I have already described. Professor Jameson, of Baltimore, who aims at uniting the wound as far as practicable by adhesion, introduces a moderately large flexible catheter through the wound into the bladder, and secures it by a soft strip of rag to the penis. The patient is laid on his side; his knees brought together, and tied by means of a soft silk handkerchief. No sutures are employed; but the patient must lie quietly on his side for two or three days, so as to obtain the effect of a syphon from the tube. "He may, however, after some hours, if particularly desirous, turn upon his left side, yet never forgetting that the outer end of the tube must be lower than the ---- The patient may be kept comfortably dry by using a cup, or large sponge, to contain the water as it drops from the tube." (See *Amer. Ed. of this Dict.*) A surgeon at Dundee has lately advocated the same practice.

If the internal pudic artery should be wounded, and bleed profusely, the best plan is, if possible, first to take out the stone, and then introduce into the wound a piece of firm sponge, with a large cannula passed through its centre. The expand-

ing property of the sponge, on its becoming wet, will make the necessary degree of compression of the vessel, which mostly lies too deeply to be tied. Sometimes lint, wrapped round the cannula, has answered. Linen, wet with cold water, should at the same time be applied to the perineum and hypogastric region.

I cannot say, that it has fallen to my lot to see any cases (out of the great number which I have seen), in which death could be imputed to hæmorrhage, notwithstanding the bleeding has often been so profuse, and from so deep a source, just after the operation, as to create suspicion, that it proceeded from the internal pudic artery. Such hæmorrhage generally stopped before the patient had been put to bed.

Sir Benjamin Brodie had the misfortune to lose one patient from hæmorrhage. The case was that of an old man, who had an enlarged prostate, and an unusually deep perineum. The blood was venous. If the incisions are made low down, and not too extensive, the chance of hæmorrhage seems to Sir B. Brodie to be but trivial. (*On Dis. of the Urinary Organs*, p. 298.) In one example under this gentleman, where the size of the calculus made it necessary to cut the right side of the prostate, the hæmorrhage would have proved fatal, if an assistant had not pressed the internal pudic artery against the bone with his finger for several hours. In another case, operated upon by Sir E. Home, the bleeding was first suspended by pressure with the finger, and then, as the patient was a thin person, Sir B. Brodie succeeded, with the aid of a small flexible silver needle, in passing a ligature round the trunk of that artery. Dr. Physick, of the United States, once succeeded in tying the internal pudic artery after lithotomy. (See *Reese in Amer. Ed. of this Dict.*) Secondary hæmorrhage sometimes occurs after lithotomy, and probably, as Sir B. Brodie suspects, from the separation of a slough. In one such case, Mr. Earle stopped the bleeding by introducing into the bladder, through the wound, a tent of lint, enclosing an elastic gum catheter.

Mr. Key believes, that the pudic artery itself is rarely wounded; but that, in adults, the artery of the bulb and the superficial perineal branch often bleed profusely. If the incision be made low down in the perineum, he admits that the artery of the bulb may escape; but, from experiments which he has made on the dead subject, he infers, that it is almost always divided. He does not approve of plugging the wound with lint, or sponge, introduced on a catheter. "The cellular membrane is irritated by it, and an unhealthy form of inflammation ensues; while the catheter being soon blocked with coagulum, does not carry off the urine from the bladder. I have, however (he adds), found advantage in checking the bleeding by means of pressure, made upon the upper part of the left side of the perineum by a forked piece of lint fixed to a piece of cork. Pressure in this mode also reaches the deeper branches of the prostate, from which the blood sometimes oozes for a long time after the patient is placed in bed, and distends the bladder with masses of coagula." (See *Guy's Hospital Reports*, vol. ii. p. 19.)

I have seen the rectum wounded in three or four instances; but no serious consequences were

the result. A wound of the bowel, occurring as it does close to the sphincter, does not appear to Mr. Key to be a matter of serious moment.

The majority of patients, who die after lithotomy, perish of peritoneal inflammation. Hence, on the least occurrence of tenderness over the abdomen, copious venesection should be put in practice. At the same time, from twelve to twenty-four leeches should be applied to the hypogastric region. The belly should be fomented, and the bowels kept open with the oleum ricini. The feebleness of the pulse should not deter the practitioner from using the lancet: this symptom is only fallacious, and generally attendant on all inflammation within the abdomen. It is a curious fact, that Mr. Martineau, who lost only two out of eighty-four patients, whom he operated upon for the stone, should *never* have found it requisite to bleed; but it appears to me, that it is a much better argument in favour of the superior safety of operating with the knife, and making a free opening, than reason for discouraging venesection, when inflammation of the peritoneum has come on, which, however, may not be this gentleman's meaning, as he says, "I believe it will be found in adults, that death follows oftener from exhaustion, after a tedious operation, or from despondency, &c. than from acute disease." (*Med. Chir. Trans.* vol. xi. p. 412.); a sentiment which, I am sure, this gentleman would not have entertained, had he been present with me at the opening of the many unfortunate cases, which used formerly to occur in the practice with badly made gorgets in St. Bartholomew's Hospital. Together with the above measures, the warm bath, a blister on the lower part of the abdomen, and emollient clysters, are highly proper. I have seen several old subjects die of the irritation of a diseased thickened bladder, continuing after the stone had been extracted. They had not the acute symptoms, the inflammatory fever, the general tenderness and tension of the abdomen, as in cases of peritonitis; but they referred their uneasiness to the lower part of the pelvis; and instead of dying in the course of two or three days, as those usually do who perish of peritoneal inflammation, they, for the most part, lingered two or three weeks. In these cases, opiate clysters, and blistering the hypogastric region, are the best measures. In some instances of this kind, abscesses form about the neck of the bladder.

I shall conclude this article with the following quotation.—"Some individuals (as Sir B. Brodie observes) are good subjects for the operation, and recover, perhaps, without a bad symptom, although the operation may have been very indifferently performed. Others may be truly said to be bad subjects, and die even though the operation be performed in the most perfect manner. What is it that constitutes this essential difference between these two classes of cases? It is, according to my experience, the presence or absence of organic disease," especially of the kidneys, or bladder. (*Op. cit.* p. 301.) The enlargement of the prostate gland in old men, I believe with Sir B. Brodie, does not increase the danger, though it may the difficulty of the operation. I infer this from a case, which occurred in University College Hospital, and in which the patient recovered without any bad symptoms, though the operation was

excessively long, and a portion of the enlarged gland, which had been sliced off, fell down upon the floor.

With respect to fistula in perinaeo, impotency, and incontinence of urine, as consequences of lithotomy, I have seen two or three examples of the first. Mr. Key has not witnessed fistula as a consequence of the operation for vesical calculus. "The operation of extracting prostatic calculi (he observes) when they are large, and the gland diseased, is sometimes followed by difficulty in healing the external incision, and the formation of a fistula, through which some drops of urine escape. But, in lithotomy, the incision, being made through healthy structures, heals quickly by a healthy process of granulation; and fistula is, therefore, a very uncommon occurrence." Mr. Key has known of one instance, in which impotency was ascribed to the operation. But, according to his experience, incontinence of urine rarely occurs in the adult. "In the young subject, partial incontinence will sometimes occur, if the patient is allowed to leave his bed too soon after the operation, before the neck of the bladder is firmly healed, and the sphincter has recovered its tone. Instances, therefore, are met with, of young boys, who, if they retain their water inconveniently long, find it dribble away as they move about. In bed, the urine is perfectly retained. When they arrive at the age of puberty, the power of retaining it becomes increased." (See *Aston Key*, in *Guy's Hospital Reports*, vol. ii. p. 25.)

*Crispus de Re Medicâ, lib. vii. cap. 26. Simon de Mignelancourt, Remarques sur la Chirurgie de Chauliac, Bourdeaux, 1663. Drelincourt, La Légende du Gascon, Paris, 1665. Van Horne, Opuscula. Marianus, de Lapide Vesicae per Incisionem extrahendo, 1552. G. Fabr. Hildanus, Lithotomia Vesicae, 8vo. Lond. 1640. M. S. Harbottanus, De Lapide Renum: Ejusdem de Lapide Vesicae per Incisionem extrahendo, 4to. Paris, 1540. Le Dran, Parallèle des Différentes Manières de tirer la Pierre hors de la Vessie, 2 vols. 8vo. 1730. Sharp's Oper. ed. 6. 1751. Sharp's Critical Inquiry, 1750. Le Dran's Oper. ed. 5. Lond. 1781. Franco, Traité des Hernies, 1561. Rossetus, de Partu Cesario, 8vo. Paris, 1590. Traité de la Lithotomie, par F. Tolet; Paris, 5ème ed. 1708. Heister's Surg., part. 2. Lithotomia Douglassiana, 1723. J. Douglass's Hist. of the Lat. Oper. 4to. Lond. 1726. Postscript to Hist. of the Lateral Operation, 1726; and Appendix to Hist. of the Lateral Operation, 1731. This work gives an erroneous account of Cheselden's plan as clearly proved by Dr. Yelloly's paper in *Med. Chir. Trans.* vol. xi. and quoted in the foregoing article. Fr. M. Colot, Traité de l'Opération de la Taille, &c. 12mo. Paris, 1727. Morand, Traité de la Taille au haut Appareil, 12mo. Paris, 1728. J. Mery, Obs. sur la Manière de Tailler, &c. pratiquée par Frère Jacques, 12mo. Paris, 1700. Cours d'Opérations de Chirurgie par Dionis. Traité des Opérations par Garengot, t. ii. Morand, Opusculum de Chirurgie. Bertrandi, Traité des Opérations. J. G. Haemann, De Lithotomia Celasiana Praestantia; Helmst. 1745. Le Cat, Recueil de Pièces sur l'Opération de la Taille, part. 1. Rouen, 1749. Casse, Recueil de Pièces Anat. importantes sur l'Opération de la Taille; Paris, 1751—1753. A short Historical Account of Cutting for the Stone, by W. Cheselden, in his own last edition of his Anatomy. Falconet, in *Thes. Chirurg. Haller*, thes. 103. t. iv. p. 196. Traité Historique et Dogmatique de l'Opération de la Taille, par J. F. L. Deschamps, 4. tom. 8vo. Paris, 1796. This last work is a very complete account of the subject, down to the time of its publication, and well merits careful perusal. John Bell's Principles of Surgery, vol. ii. part. 1. A. Burns, in *Edin. Med. and Surg. Journal*, January, 1808. Sir C. Bell's Operative Surgery, vol. 1. 1807. Sabatier, de la Méd. Opératoire, tom. iii. ed. 2. 1810. Dr. John Thomson's Obs. on Lithotomy, *Edin.* 1806. Also an Appendix to a Proposal for a New Manner of Cutting for the Stone, 8vo. *Edin.* 1810. Allan on Lithotomy, *Edin.* 1808. Earle's Practical Obs. on Operations for the Stone, 2d ed. with an appendix containing a description of an instrument calculated to improve that operation, 8vo. Lond. 1803. Wm. Dease, Obs. on Hydrocele,*

&c. to which is added a Comparative View of the Different Methods of Cutting for the Stone, &c. 8vo. Lond. 1798. (Œuvres Chir. de Deault, t. II. *Wm. Simmons*, Cases and Obs. on Lithotomy, 8vo. Manchester, 1808. *C. B. Tyge*, Essay on some of the Stages of the Operation of Cutting for the Stone, 8vo. Lond. 1811. *M. Roux*, Voyage fait à Londres en 1814, ou Parallèle de la Chirurgie Angloise avec la Chirurgie Francoise, p. 315. &c. Paris, 1818. *Schreger*, Chirurgische Versuche, b. 2. von Steinschnitten an Weibern, p. 315, &c. 8vo. Nürnberg, 1818. *C. J. M. Langenbeck*, über eine einfache und sichere Methode des Steinschnittes, 4to. Wurzburg 1802. This work contains an excellent anatomical engraving of the parts in the perineum. *F. X. Rudolff*, Abhandlung über die Operation des Blasensteines nach Pagola's Methode, 4to. Leipzig. 1808. *A. Scarpa*, A Memoir on the Cutting Forget of Hawkins, &c. translated by *J. H. Wislart*, 8vo. Edin. 1816. *H. Mayo*, *W. Dickenson*, *H. Earle*, and *P. M. Martineau*, in Med. Chir. Trans. vol. xi. *J. Yelloly*, M. D. Account of Cheselden's Improved Method of Lithotomy, vol. p. xv. 339, containing a clear exposition of Dr. Douglas's erroneous descriptions. *Klein*, Pract. Ansichten bedeutendsten Operationen, 4to. Stuttgart, 1816. *J. S. Carpine*, Hist. of the High Operation, and An Account of the Various Methods of Lithotomy, 8vo. Lond. 1819. *Sir E. Home*, on Strictures, &c. vol. III. 8vo. Lond. 1821. *A. C. Hutchinson*, Surgical Obs. ed. 2. 8vo. Lond. 1826. Two examples of the High Operation. *Souberbille*, Recueil de Pièces sur la Lithotomie et la Lithotritie, 1828—1835. *A. Scarpa*, Mem. sul Taglio Ipo-gastrico, in Imp. R. Istituto di Scienze ed Arti di Milano, vol. I. and Opuscoli di Chirurgia, vol. I. Pavia, 1825. 4to. *C. A. Key*, A Short Treatise on the Section of the Prostate Gland in Lithotomy, 4to. Lond. 1824. Also in Guy's Hospital Reports, vol. II. *Baron Dupuytren*, Clinique Chir. vol. 2. 8vo. Paris, 1832. *Alf. Felpeau*, Nouv. Elem. Méd. Opér. t. 3me. 8vo. Paris. 1832. *Sir Benjamin Brodie*, on Dis. of the Urinary Organs, 8vo. Lond. 1835. *R. Liston*, on Practical Surgery, 8vo. Lond. 1837. For delineations of the parts concerned in the operation, see *Camper's* Demonstrationes Anatomico pathologicae, lib. II. *J. F. Von Froriep*, über die Lage der Eingeweide an Becken, nebst einer Darstellung derselben, 4to. Weimer, 1815. *Edw. Stanley*, on the Lateral Operation, 4to. Lond. 1829; and *Dupuytren's* Posthumous Work on the Bilateral Operation.

LITHOTRITY.—(From λίθος, a stone, and τρεπεω, I pierce.) *Lithotripsy*, (from λίθος, and τριβω, I break.) The reduction of a calculus in the bladder into small pieces, by means of instruments passed into that organ, through the urethra, so that the fragments may be discharged through the latter tube, and no necessity remain for the performance of lithotomy. Although the history of lithotripsy goes back to a remote period, the practice of it cannot be said to have been established more than a very few years. The idea of breaking calculi to pieces was entertained in the days of Albucasis (*Liber Theor.*, p. 94. 1519.); but, as my friend *M. Leroy D'Etiolles* justly observes, there is no record of the plan having been actually practised at the period alluded to; and Alexander Benedictus, of Verona, who published in 1533, mentions the scheme only to condemn it. If it be admitted, however, that the Egyptians sometimes broke stones in the bladder, it must be granted, that they have left their successors perfectly uninformed about their method, which stood in need of being revived anew. (See *Mem. de la Lithotripsie*, *Mem.* i. p. 113. 8vo. 1836.) The earliest proposal for breaking a stone in the bladder without incision, noticed by Haller, (*Biblioth. Chir.* t. i. p. 313.) was made by Sanctortius. *M. Leroy*, on referring to the text of this author, believes, however, that it relates, not to the use of any instrument like *la pince à trois branches*, with a drill in its centre, but merely to an invention calculated to extract small stones through the urethra. As for the instrument of Fabricius Hildanus, resembling the bullet extractor of Andreas à Cruce, *M. Leroy* con-

ceives, that it can have but an indirect connexion with the history of lithotripsy, since Fabricius only employed it for the removal of calculi lodged in the anterior portion of the urethra; and not for the extraction of those of the bladder.

Thus, down to the beginning of the 19th century, no description of any mode of breaking calculi had yet been published. It is alleged, indeed, that successful attempts had sometimes been made, before this period, by patients on themselves. Thus, a monk of Cîteaux is alleged to have succeeded in breaking a calculus in his bladder, by introducing a rod of iron through the urethra, terminating in a chisel, and striking its outer end with a hammer. Major Martin pulverized his own calculus by means of a file, fixed at the end of an iron rod. (*Marcet on Calculous Disorders*, p. 20. fig. 5.) *M. Leroy* doubts whether any complete cures were truly thus effected; and refers to some later accounts, by which it appears, that Major Martin actually died of stone in the vicinity of Calcutta. Nor does this eminent lithotritist attach more importance to the statement, that Rodriguez, a physician at Malaga, in 1800, broke a stone by striking it with a catheter; or, if this were really done, he infers, that the calculus must have been either very small or brittle; and that few could have been thus broken.

Lithotripsy was first seriously proposed in 1812, as a means of mechanically breaking stones in the bladder, and then only as an auxiliary to the chemical dissolution of them, the practicableness of accomplishing which the writings of Fourcroy and Vauquelin had raised hopes of. The manner of doing it was suggested by Grunthuisen, a Bavarian surgeon. His apparatus consisted of a wide straight tube, through which he passed a noose of copper wire, and a rod ending in a circle of teeth, or a spear point. The calculus was caught hold of, and fixed with the wire, and then the circular saw, which was put in motion by means of a bow, was designed to perforate it. The important fact, first demonstrated by Grunthuisen, is the practicableness of introducing straight catheters of large size through the urethra into the bladder, so as to facilitate the necessary measures requisite for the mechanical destruction of calculi.

Some years afterwards, Mr. Elderton published in the *Edinb. Med. and Surgical Journal* for April, 1817, a description of a curved instrument, which admitted of being opened for the seizure of the stone, and was furnished with a kind of file, that acted by an alternate movement. But the two branches were found insufficient for fixing the calculus, and the bladder was not out of danger of the action of the file. Things had gone thus far, when the sheath forceps with three blades, and a perforator, (*la pince à trois branches, à gaine et à foret*), were invented in 1825, by *M. Leroy*, exhibited by him to the Academy of Surgery, and first tried, and this with success, upon the living subject by *M. Civiale* in the following year. In short, after a formal investigation of the merits of the several parties, who led the way in these improvements, the Academy of Sciences adjudged one prize to *M. Civiale*, for having first performed the operation on the living subject; one to *M. Leroy* for the invention of the process, which first answered in practice; and another to Baron Heurteloup for the improvements made by him in the

operation. (See *Leroy d'Etiolle de la Lithotripsie*, 8vo. Paris, 1836, p. 114.)

An impartial reader, who reflects upon this history, will perceive, then, that lithotritry has attained its present perfection by the talents and ingenuity of many labourers; and that, while the merits of M. M. Leroy, Civiale, and Baron Heurteloup, stand exceedingly high, the originality of the scheme, if not of the practice, is to be traced in ancient writers, and the meritorious inventions of Gruithuisen and Elderton will never be forgotten, though not honoured with the prize or commendation of any public body.

It is not my intention in this edition to describe the many instruments proposed for lithotritry, because I know, that no account of them would be intelligible without plates, and some of them are no longer used. A clear and excellent description of them, illustrated by wood-cuts, has been published by M. Leroy, to which I would particularly refer. (*De la Lithotripsie*, Mem. 8vo. Paris, 1836.)

The necessity for my entering into the particular merits of the very numerous instruments, constructed for pulverizing and crushing calculi in the bladder, appears now indeed to be needless, because the operation, as first performed on the human subject by M. Civiale, with the cannula, three tenacula, and the drill, of M. Leroy, has been nearly superseded by the more simple and expeditious method, first executed by Baron Heurteloup. In this improved operation, the patient is placed upon an operation bed, or table, which admits of being raised into an oblique plane. At the foot of it is an apparatus, which affords a fulcrum to the instrument after its introduction into the bladder. The head of the bed, and consequently the fundus of the bladder, may be depressed to any extent desired, the legs which support it having hinges, and capable of folding. On this couch, the patient is placed nearly in the position usually chosen for the lateral operation. A strap is passed round the shoulders, and buckled to the sides of the table; and the feet are placed in slippers securely fixed at the foot of the bed.

A catheter of the usual length, with a short and rather abrupt curve, is introduced. It serves first as a sound for ascertaining the situation of the calculus, the shortness of the curve facilitating its motions in the bladder. It is furnished with a stopcock. The bladder is next moderately filled with warm water, by means of a silver syringe, furnished with a ring on each side of the syphon, for the insertion of two fingers, so as to render the instrument manageable with one hand. The bladder must not be painfully distended with water, because then its action would be excited, and the fluid would be expelled again. A pair of strong sliding forceps, the opposite surfaces of which are furnished with teeth, are then introduced; and the calculus having been seized, the lower piece of the forceps is fixed to a vice at the foot of the bed, serving as a fulcrum, and the upper piece is struck with a hammer, and the calculus broken. Thus, neither the shock, arising from the concussion, is communicated to the bladder, nor is this organ liable to be injured by the fragments being forcibly projected against its internal surface. The instruments are then withdrawn, and the fragments are afterwards voided with the urine. If any fragments remain, inca-

pable of being thus discharged, the operation is repeated from time to time, as often as may be necessary.

On the subject of the comparative advantages of lithotomy and lithotritry, it is somewhat difficult to form at present a definitive judgment, because the advocates for one or the other proceeding seem to be too much under the influence of prejudice; and, in France, a degree of animosity has mingled itself with the question, seriously interfering with any just conclusion. When the practice of lithotritry and lithotripsy first began, a few years ago, it was extolled as perfectly free from danger, and capable of superseding lithotomy altogether. This representation is incorrect. M. Velpeau declares, that lithotritry is generally a longer and more painful business than lithotomy; and that he has known some patients, who had been cut for the stone by M. Souberbielle, after having tried lithotritry under the care of M. Civiale, confess, that one sitting for the latter was more painful than all the requisite proceedings in lithotomy. From what I have seen of lithotritry, as practised by Baron Heurteloup, I should say, that lithotritry, with some few exceptions, is infinitely less painful than lithotomy; and that many patients, after its performance, follow their common occupations as usual. Two or three years ago, the Baron was kind enough, at my request, to exhibit his skill on three patients, in the Anatomical Theatre of University College, in the presence of all the students, and many visitors. The manœuvres were executed with surprising precision and quickness. These patients, who had undergone some previous sittings, seemed to feel little pain; and, I should say, appeared to submit to a repetition of the operation with the most cheerful readiness. Still, it is not an operation always free from great suffering and danger; nor is it applicable to all cases of stone.

According to the researches of M. Velpeau, one third of the patients, who undergo lithotritry, experience bad symptoms, and it sometimes proves fatal, as we are well aware of in Great Britain. Baron Heurteloup has proved, that M. Civiale lost 8 patients in 48; and M. Leroy 3 in 28; and M. Velpeau alleges, that an inquiry into the results of lithotritry, in all parts of the world, will not make the average success of lithotritry greater. M. Velpeau adds, that if all the calculous patients be taken into the account, who have undergone lithotritry, and on whom lithotomy might have been practised, the result is still less favourable; for of 82, spoken of by M. Civiale, 31 died within a year after the operation, and 19 did not recover, without having experienced severe symptoms. Of 40, M. Leroy only radically cured 25. Of 10, M. Bancal could only operate upon 2. Hence M. Velpeau infers, that at least 1 dies out of every 10 or 12, who submit to lithotritry, but that, if a considerable number of individuals, taken promiscuously, were to be subjected either to lithotomy or lithotritry, the average number of deaths would comprise at least $\frac{1}{3}$ or $\frac{1}{2}$ of the whole of such individuals.

Yet M. Velpeau admits, that, on the whole, lithotritry is a less dangerous operation than lithotomy. On this point, I entertain with him a full conviction, in reference to the mere operation. Who can indeed set down the manœuvres required

in lithotrity, according to the best mode of performing it, as generally to be compared in regard to danger with the operation of cutting into the bladder? But, this does not settle the question; for, though the operation itself may be infinitely less dangerous, the less radical nature of it, the fragments left behind, and their irritation of the bladder, which is often in a very unfavourable state to bear the continuance of such irritation; the greater chances of relapse, &c. are weighty considerations, which cannot be overlooked. Another fact, very necessary to be remembered in forming a judgment of the merits of the two operations, is, that the individuals, most fit for lithotrity, are exactly those, on whom lithotomy would prove most successful; while those, to whom lithotrity is not suitable, would have a bad chance of cure from lithotomy. I would not go so far, however, as M. Velpeau, who states, that they would have an inferior chance (*Nouv. Elem. de Méd. Opér.* t. iii. p. 994.), because I apprehend, that where the bladder is diseased, or its lining affected with chronic inflammation, promptly taking away the stone altogether is better than breaking it, inasmuch as leaving the fragments of it behind, to keep up irritation for a time, must be particularly disadvantageous. Even were lithotrity proved to be decidedly less dangerous in its results than lithotomy, generally speaking, it is certainly not applicable to all cases. It is quite unfit for calculi formed upon extraneous substances, which serve as nuclei; for encysted, or adherent calculi; for such as are excessively hard, like some of those composed of oxalate of lime; for calculi above a certain size; for patients, whose urethræ, from malformation or disease, will not allow the proper instruments to be introduced. If there be several calculi, an enlarged prostate gland, or a diseased bladder, M. Velpeau pronounces lithotrity to be at least as dangerous as lithotomy. Its general advantages, however, under other circumstances, he deems incontestable, except in children; and, though more liable to be followed by relapse, on account of the fragments sometimes eluding the most careful examinations, he gives the preference to lithotrity, if two, three, four, five, or even six repetitions of it promise to be effectual. (See *Velpeau, Nouv. Elem. de Méd. Opér.* t. iii. p. 904.)

Lithotrity, as practised by Baron Heunteloup, appears to Sir Benjamin Brodie to have several advantages over lithotomy. It is less formidable to the patient. It requires little or no confinement; and many individuals will be induced to submit to it at an early age, who would not muster courage to submit to lithotomy, until their sufferings had become excessive, and circumstances arisen to render the operation dangerous. This is a point likewise insisted upon by M. Jéroy, Mr. Aston Key (*Guy's Hospital Reports*, vol. ii.), and many other writers on lithotrity. There is no danger of hemorrhage, nor of those ill consequences, which arise from an incision or laceration extending into the cellular texture around the neck of the bladder. (*On Dis. of the Urinary Organs*, p. 316. ed. 2.)

The following appear to Sir B. Brodie to be the principal disadvantages of lithotrity. The patient does not obtain a cure at once; and, in many instances, the process, by which the stone is crushed, requires to be repeated several times.

As the smallest fragment which remains behind, will form the nucleus of a new stone, a recurrence of the disease is more likely to take place after the lithotriptic operation, than after lithotomy, especially in those cases, in which, in consequence of an enlargement of the prostate gland, the patient is unable completely to empty his bladder. The operation is only adapted to calculi of moderate size; and, when applied to larger, is either impracticable, or difficult, tedious, and painful. When the stone is large, the sharp irregular fragments, lying in the bladder, induce inflammation of its lining membrane, attended with severe local suffering, and much disturbance of the general system, either retarding the cure, or terminating in death. The complications of disease in the kidney, or bladder, or ulcerated prostate, which render lithotomy hazardous, make lithotrity also hazardous. As for the comparative pain, it is so different in different examples of each practice, that there is difficulty in forming an opinion on this point. In general, after either of the operations, the patient says, that he suffered less than he expected, that is, if the bladder is healthy, and the operation proceeds favourably. If the bladder be inflamed, or any thing occurs to render the operation difficult and tedious, the patient undoubtedly suffers severely, whether the stone be crushed, or extracted by incision. Sir B. Brodie then adverts to the sliding forceps shown to him about the year 1824, by Mr. Weiss, which were intended to crush calculi in the matter by means of the pressure of a screw, instead of a hammer; and (says he) as it is now constructed, it seems capable of doing all that can be done with the hammer, unless the calculus be very large, and then the propriety of having recourse to lithotripsy in any form is very problematical. The forceps, invented by Mr. Weiss, are highly deserving of notice, not only on account of their usefulness, but their priority to the percussor, and some other means for crushing calculi in the bladder. It will be also found convenient, when the stone is small enough to admit of being drawn a certain way into the urethra, and crushed there. For this purpose, a pair of sliding forceps may be used first without a screw, but to which it may be adapted in the course of the operation. (See *Brodie on Dis. of the Urinary Organs*, p. 348.)

Previously to puberty, lithotrity is more difficult of execution, than in the adult, in consequence of the narrowness of the urethra, the unmanageableness of the patient, and the exquisite sensibility of the parts. Instruments of more than two lines, or two lines and a half in diameter, cannot be introduced, and, on this account, they cannot possess much strength. (See *Velpeau, Nouv. Elem. de Méd. Opér.* t. iii. p. 893.) However, that lithotrity is practicable on children under the age of six years, is sufficiently proved by some cases recorded by M. Segalas (*Revue Méd.* Aout, 1834), and by other examples, in which that very distinguished lithotrist M. Jéroy was the operator. Yet, in one instance, under him, a piece of the forceps broke off, which, however, he succeeded in extracting a few days afterwards by means of another forceps. But, a fragment of the calculus now passed into the urethra, and at first could not be pushed back. Afterwards it was reduced into the bladder by Dupuytren, who then performed the bilateral operation for its extraction.

(See *M. Leroy, de la Lithotripsie, Mem.* 8vo. Paris, 1836, p. 237.) The reason why cutting into the bladder was here preferred by Dupuytren to merely dividing the urethra for the removal of the stone, I do not understand. It is only justice to my friend M. Leroy to state, that he candidly admits, that for children lithotripsy should not be preferred to lithotomy, unless the calculus be known to be of small size. In them, lithotomy is attended with little risk of dangerous bleeding, effusion of urine, peritonitis, or cystitis, and the operation is completed in a very short time. In infancy, amongst other considerations against lithotripsy, — 1st, the high situation of the bladder in the pelvis, which greatly increases the curvature of the posterior third of the urethra; and, 2ndly, the encouraging chances of success from lithotomy at this tender period of life. For a corroboration of the doctrine, that lithotomy is preferable for children, I refer also to the arguments of Mr. Aston Key. (See *Guy's Hospital Reports*, vol. ii.) One of this gentleman's inferences is, that lithotomy should be generally preferred in children and elderly subjects.

In some persons, the condition of the prostate gland pushes the urethra up behind the symphysis pubis, and renders lithotripsy very difficult. For obviating this impediment, M. Leroy invented a contrivance (*redresseur de l'urethre*) for rendering the passage straighter. It consists of an elastic gum catheter, which is first introduced curved, and then straightened by means of a rod (*mandrin*) which is slowly propelled into it from before backward with a screw. But, as M. Velpeau observes, there is danger of centusing the verumontanum with this instrument, or of lacerating the posterior side of the urethra. Another instrument of this kind, invented by M. Tanchou, seems to M. Velpeau safer, as the third of it towards the bladder consists of little pieces articulated together, so that the instrument admits of being first introduced curved, and then straightened. (*Nouv. Elem. de Méd. Opér.* t. iii. p. 894.) But, now that the breaking of calculi in the bladder is usually effected with the sliding forceps acted upon by a screw or the hammer, and such instrument is necessarily curved, these inventions for facilitating the introduction of straight instruments are of less importance than they were a few years ago.

Amongst the occasional ill consequences of lithotripsy, the severity of the pain is sometimes dwelt upon, though, as I have already stated, the pain complained of varies in different individuals for reasons already hinted at. Until lately, much of the pain frequently depended upon the action of straight instruments, which forcibly stretched the subpubic portion of the urethra; and, as M. Velpeau remarks, the use of curved instruments will remove this cause of suffering.

In some cases, each application of lithotripsy is followed by a paroxysm of fever. It is an accident that may follow the most simple use of a catheter, or bougie: it often renders it necessary to prolong the intervals between the repetitions of the operation. In many cases, the spermatic cord and testicle swell, owing to the contusion and irritation of the verumontanum, and terminations of the common seminal ducts. Lacerations of the urethra, urinary extravasation, and abscesses in the perineum and scrotum, have also

been occasionally noticed. I know of one case myself, in which the patient died of effusion of urine.

In some instances, cystitis, peritonitis, and fatal nervous disorder, arise from injury of the bladder with the forceps, or the irritation caused by the sharp angular fragments. I know of two, or three instances, in which the patients were seized with violent universal spasms directly after the operation, and expired in the course of a very short space of time after their removal from the table. In other cases, incontinence of urine, or paralysis of the bladder, has ensued. In many instances, the fragments enter the urethra, and cause retention of urine, accompanied by severe suffering.

M. Breschet witnessed an instance, in which the bladder was perforated, and I have heard of a similar accident in London; though, as M. Velpeau justly observes, such an occurrence ought to be exceedingly rare with a circumspect operator.

The pinching of the bladder, another accident, may in general be avoided with tolerable certainty by not suddenly closing the lithotriptor, until the calculus has been felt to be grasped by it, and the instrument has been first drawn a little way towards the vesical orifice of the bladder. The last accident, and not the least serious, to which lithotripsy is liable, is the breaking of the instrument in the bladder, or such a bending of it, that it cannot be withdrawn through the urethra. In the first case, lithotomy becomes indispensable; in the second, it may become necessary to cut down to the instrument in the perineum, and divide it with a file, before it will admit of removal. I know of instances, in which such things have been exemplified.

Edinb. in Edinb. Med. and Surgical Journ. 1817. *Cruvel, in Nouv. Considérations sur la Rétention d'Urine*, 8vo. Paris, 1823; *Lettres sur la Lithotritie*, Paris, 1827-33. *Compte rendu du Traitement des Calculs à l'Hôpital Necker*, Journ. Univ. Hebdom. de Méd. 1831. t. 2me. *Baron Heurteaux*, Lettre à l'Acad. Royale des Sciences, 8vo. Paris, 1827. *Principes de Lithotritie*, 8vo. Lond., 1837. Also *Mém. sur la Lithotritie par percussion*, et sur l'instrument appelé percuteur courbe à marteau, 8vo. Paris, 1833. *Fournier*, Lithotritie Perfectionnée; 8vo. Paris, 1829. *J. Leroy*, d'Etolles, Exposé des divers procédés employés jusqu'à ce jour pour guérir la Pierre. &c. 8vo. Paris, 1825. *Tableaux Hist. de la Lithotritie*, Paris, 1836. in fol.; also *Mém. de la Lithotripsie*, 8vo. Paris, 1836. *Rigal*, de la Destruction Mécanique de la Pierre, &c. 8vo. Paris, 1829. *P. S. Ségalas*, Obs. de Lithotritie, 8vo. Paris, 1826. *F. Ph. Blandin*, Lithotritie par un procédé nouveau, in Journ. Hebdom. de Méd. t. lii, 1829, et t. vi, 1830. *Tanchou*, Nouv. Méthode pour détruire la Pierre, &c. 8vo. Paris, 1830. *Aff. Velpeau*, Nouv. Elem. de Méd. Opér. t. 3me. p. 860, 8vo. Paris, 1832. *Sir B. C. Brodie*, on Diseases of the Urinary Organs, Ed. 2, 8vo. Lond. 1835, p. 311. *Souberville*, Recueil de Pièces sur la Lithotomie et la Lithotritie, 8vo. Paris, 1824-1835. *Annuaire*, Table Synoptique de la Lithotripsie et de la Cystostomie Hypogastrique &c. Paris, 1832. *C. Aston Key*, in *Guy's Hospital Reports*, vol. ii. *A. Benveniste*, Essai sur la Lithotritie; 8vo. Paris, 1833. *Francis L'Estrange*, Description of the Calculo-Fractor, Dublin Journ. of Med. Science, vol. v. p. 440: in principle similar to that invented by Weiss.

LOTIO ALUMINIS. — R. Aluminis purif. ʒss. Aquæ distillatæ ℥j. Miscæ. — Sometimes used as an astringent injection; sometimes as an application to inflamed parts.

LOTIO AMMONIÆ ACETATIS. — R. Liq. ammon. acetatis; Spirit. vin. rectific.; Aquæ distillatæ; sing. ʒiv. Miscæ. — Properties discutient.

LOTIO AMMONIÆ MURIATIS. — R.

Ammon. muriatis 3 j. Spirit. rosmarini lb j. — Has the same virtues as the preceding. Justamond recommended it in the early stage of milk abscess.

LOTIO AMMONIÆ MURIATIS CUM ACETO.—R. Ammon. mur. 3 ss. Aceti, Spirit. vinos. rectif. sing. lb j. Misce. This is one of the most efficacious discutient lotions. It is, perhaps, the best application for promoting the absorption of extravasated blood, in cases of ecchymosis, contusions, sprains, &c.

LOTIO AMMONIÆ OPIATA.—R. Spiritus ammon. comp. 3 iuss. Aquæ distillatæ 3 iv. Tinct. opii 3 ss. Misce. — Applied by Kirkland to some suspicious swellings in the breast, soda and bark being also given internally.

LOTIO BORACIS.—R. Boracis 5 j. Aq. simplicis 3 iuss. Spir. vinos. 3 ss. Misce. — This lotion is recommended by Sir Astley Cooper as one of the best applications to sore nipples.

LOTIO ACIDI PYROLIGNEI.—R. Acid. pyrologn. 5 ij. Aq. distillat. 3 vj. Misce. — This is injected into the meatus auditorius by Mr. Buchanan, for the purpose of improving the secretion within the passage, and stopping morbid discharge from it. (See his *Illustrations of Acoustic Surgery*, 8vo. Lond. 1825.) In particular cases, attended with much irritability, he uses the following formula:—R. Plumbi acet. gr. x. Acid. pyrologn. mxx. Aq. distillat. 3 vj. Misce.

LOTIO CALCIS COMPOSITA.—R. Lij. calcis lb j. Hydrargyri Chloridi 5 j. Misce. — The common black wash.

LOTIO GALLÆ.—R. Gallarum contusarum 3 ij. Aquæ ferventis lb j. To be macerated one hour, and strained. This astringent lotion is sometimes used with the view of removing the relaxed state of the parts, in prolapsus ani, prolapsus uteri, &c.

LOTIO HYDRARGYRI AMYGDALINA.—R. Amygdularum amararum 3 ij. Aquæ distill. lb j. Hydrarg. Bichloridi 3 j. Rub down the almonds with the water, which is to be gradually poured on them; strain the liquor, and then add the bichloride of mercury. This will cure several cutaneous affections.

LOTIO HYDRARGYRI OXYMURIATIS.—Vel Bichloridi. R. Hydrargyri oxymuriatis gr. ijs. Arabici gummi 3 ss. Aquæ distillatæ lb j. Misce.

LOTIO HYDRARGYRI OXYMURIATIS COMPOSITA.—Vel Hydrargyri Bichloridi, Comp. — R. Hydrarg. oxymur. gr. x. Aq. distillat. bullientis 3 iss. Tinct. canthar. 3 ss. Misce. — Applied by Dr. H. Smith to scrofulous swellings.

LOTIO HELLEBORI ALBI.—R. Decocti hellebori albi lb j. Potassæ sulphureti 3 ss. Ol. Lavand. miv. Misce. — Occasionally applied to tinea capitis, and some other cutaneous diseases.

LOTIO PLUMBI ACETATIS.—R. Lij. plumbi acet. 5 ij. Aq. distill. lb j. Spirit. vinos. tenuioris 3 ij. The first and last ingredients are to be mixed before the water is added. The common white wash; an application universally known.

LOTIO POTASSÆ SULPHURETI.—R. Potassæ sulph. 5 ij. Aquæ distill. lb j. Ol. Lavand. miv. Misce. — Used in cases of porrigo, psoriasis, lepra, &c.

LOTIO OPII.—R. Opii purif. 3 jss. Aquæ distillatæ lb j. Misce. — A good application to irri-

table painful ulcers. It is best to dilute it, especially at first.

LOTIO PICIS.—R. Picis liquidæ 3 iv. Calcis 3 vj. Aquæ ferventis lb ij. — To be boiled till half the water is evaporated. The rest is then to be poured off for use. This application is sometimes employed in tinea capitis; and for the removal of an extensive redness, frequently surrounding old ulcers of the legs, in persons whose constitutions are impaired by copious porter drinking, gluttony, and other forms of intemperance.

LOTIO ZINCI SULPHATIS.—R. Zinci sulphatis 3 j. Aq. ferventis lb j. Misce. Sometimes used in lieu of the lotio plumbi acet. It forms a good astringent application for a variety of cases. When diluted with one additional pint of water, it is the common injection for gonorrhœa.

LUES VENEREA. See VENEREAL DISEASE.

LUMBAR ABSCESS. *Psoas Abscess. Chronic Psotus.* By these terms are understood chronic collections of matter, which form in the cellular tissue of the loins, behind the peritonæum, and descend in the course of the psoas muscle. According to professor Gibson, this disease, which is remarkably common in Europe, is rarely met with in the United States. In the course of thirteen years, during which he has been connected with extensive hospitals, he has seen only four cases; and Dr. Physic had never attended an instance of psoas abscess in America, unconnected with disease of the spine. (See *Gibson's Institutes, &c. of Surgery*, vol. i. p. 214. 8vo. Philadelphia, 1824.) This remark is curious, because psoas abscess takes place mostly in scrofulous individuals, who, I believe, abound in some parts of the United States, as well as in other countries. Patients, in the incipient stage of the disease, cannot walk so well as usual: they feel uneasiness about the lumbar region, but in general, no acute pain, and this sometimes, even though the abscess may have acquired such a size as to form a large tumour, protruding externally. The psoas abscess is one of the best instances, which can possibly be adduced, in order to illustrate the nature of those collections of matter, which are called chronic, and which form in an insidious manner, without serious pain, or any other attendant inflammation. Sometimes, however, the patient experiences severe and acute pains in the loins and back long before the abscess produces any external swelling.

The abscess sometimes forms a swelling above Poupart's ligament; sometimes below it; and frequently the matter glides under the fascia of the thigh. Occasionally, it makes its way through the sacro-sciatic foramen, and assumes rather the appearance of a fistula in ano. When the matter gravitates into the thigh, beneath the fascia, Mr. Hunter would have termed it a disease *in*, not *of*, the part. The uneasiness in the loins, and the impulse, communicated to the tumour by coughing, evince that the disease arises in the lumbar region; but, it must be confessed, that we can hardly ever be sure of the existence of the disorder, until the tumour, by presenting itself externally, leads to such information. The symptoms are commonly of the following kind: pain in the lumbar region, shooting to the groin and thigh, and stiffness and pain in the course of the

spine; which symptoms are exasperated by extension of the thigh. The patient cannot stand well on the foot, and either limps in walking, or cannot walk without stooping. Any effort causes an increase of pain. Sometimes the inguinal glands are enlarged. According to Dr. Kyll, of Wesel, the disease admits of being discriminated from others, even in its early stage, by the following circumstances: the patient cannot walk in the upright position; he always leans a little forward; he can only straighten himself to a certain point, and he is stopped by a tearing pain, which is felt at the same instant in the groin and loins. The patient can go up stairs more easily than he can come down, because, in the latter movement, he is obliged to hold himself up. These symptoms are usually preceded for several weeks or even months, by dull pain in the lumbar region.

Lumbar abscess may be mistaken for rheumatism, affections of the kidney, coxalgia, lumbago, hemorrhoidal pains, glandular swellings, and hernia. I have known the latter mistake frequently made, when the abscess had formed a small swelling below Poupart's ligament. The points of difference are noticed in the article HERNIA.

I have attended several patients, each of whom had a double lumbar abscess. Two such cases were lately under me, in University College Hospital, and ultimately recovered. In the same hospital, we have seen patients, whose thighs were drawn into complete contact with the belly, from the effects of lumbar abscess; yet after the discharge of the matter, the limbs gradually resumed their proper position and use. The lumbar abscess is sometimes connected with diseased vertebrae, which may either be a cause, or an effect, of the collection of matter. The disease, however, is frequently unattended with this complication.

Chronic abscesses perpetually form in the loins without vertebral disease, and get well with ordinary care. (*Mayo, Outlines of Human Pathology*, p. 124.)

The generality of lumbar abscesses, and others in the iliac fossa, are not accompanied by disease of the hip; but now and then such a case presents itself. They are more commonly associated with and dependent upon disease of the vertebrae.

The disease of the spine, we may infer, is not of the same nature as that treated of by Pott, as there is usually no paralysis. When the bodies of patients with lumbar abscesses are opened, it is found that the matter is completely enclosed in a cyst, which, in many cases, is very extensive. If the contents of such abscesses were not circumscribed by a membranous boundary in this manner, we should find that they would spread among the cells of the cellular tissue, just like water in anasarca. The cyst, which, in its texture, bears some resemblance to a mucons membrane, is both a secreting and an absorbing surface, as is proved by the great quantity of matter, which soon collects again, after the abscess has been emptied, and by the occasional disappearance of large and palpable collections of matter of this kind, either spontaneously, or in consequence of means which are known to operate by exciting the action of the absorbents. In fact the cyst becomes the suppurating surface, and suppuration is mostly believed to be a process, similar to glandular secretion. While the abscess remains unopened,

its contents are always undergoing a change, fresh matter is continually forming, and a portion of what was previously in the cyst is undergoing the necessary removal by the absorbents. This is not peculiar to lumbar abscesses; it is common to all abscesses, both chronic and acute, and to every bubo. It is true, that, in acute abscesses, there often has not been time for the formation of so distinct a membrane as the cyst of a large chronic abscess; but their matter is equally circumscribed by the cavities of the cellular tissue being filled with a dense conglobulated lymph, or fibrine; and though it generally soon makes its way to the surface, it also is sometimes absorbed.

When a common abscess, the result of acute inflammation, is small, and tending to burst quickly, without any disposition to spread under the integuments, or under a fascia, the surgeon may often suffer the abscess to break of itself, by an ulcerative process. But, in chronic abscesses, the matter has not that strong tendency to make its way outward; its quantity is continually increasing; the cyst is, of course, incessantly growing larger and larger; in short, the matter, from one ounce, often gradually increases to the quantity of a gallon. When the disease is at length opened, or bursts by ulceration, the surface of the cyst inflames; and its great extent, in this circumstance, is enough to account for the terrible constitutional disorder, and fatal consequences, which too frequently soon follow the evacuation of the contents of such an abscess. Hence, in chronic suppurations of every kind, and not merely in lumbar abscesses, it is frequently the surgeon's duty to observe the opposite rule to that applicable to acute cases; and he may be called upon to open the collection of matter, as soon as he is aware of its existence, and its situation will allow it to be done.

The practice of opening abscesses, connected with the larger joints, is considered by Dr. M'Dowel to be in general decidedly objectionable; but, says he, "when we consider the fatal consequences, which may result from the unchecked progress of the deep iliac abscess, and take into the account the very great sufferings of the patient from pressure of the anterior crural nerve and its filaments, I believe this to be a case, in which surgical interference is called for. The puncturing of this abscess, however, requires much caution. In superficial purulent collections in the iliac fossa, the peritoneum is detached, and pushed upwards and inwards sufficiently to permit the incision above Poupart's ligament being made with perfect safety: not so in the deep collections; there is then no separation of the peritoneum, and the opening must be made below Poupart's ligament, and of course with great caution." (See M'Dowel, in *Dublin Journ. of Med. Science*, vol. iv. p. 13.) Sir Astley Cooper's doctrine respecting the practice of opening abscesses, connected with large joints, I have noticed in the article, JOINTS, DISEASES OF THE.

This view of the principle, on which the treatment of a lumbar abscess should be conducted, is not, however, adopted by all surgeons. Kirkland believed, that the patient had the best chance of recovery, when the abscess was allowed to burst spontaneously, and the matter to be gradually discharged through a small opening (*Kirkland's Medical Surgery*, vol. ii. p. 199.); and Mr. Pearson,

in comparing the results of his own experience, declares them to be in favour of the same practice. The generality of modern surgeons, in this country, differ on this point from Kirkland and Pearson; yet, while they advocate the utility of an early puncture, they admit the danger of suddenly discharging the contents of the abscess through a large one, which is afterwards left unclosed.

Certainly, it would be highly advantageous to have some means of ascertaining whether the vertebrae are diseased; for, as in this instance, the morbid bones would keep up suppuration, until their affection had ceased, and there would be no reasonable hope of curing the abscess sooner, it might be better to avoid puncturing it under such circumstances. The propriety of this conduct seems the more obvious, as issues, which are the means most likely to stop and remove the disease of the spine, are also such as afford the best chance of bringing about the absorption of the abscess itself. However, if the collection cannot be prevented from discharging itself, and ulceration is at hand, it is best to meet the danger, make an opening with the lancet, in a place at some distance from where the pointing threatens, and afterwards heal it, in the way which will be presently detailed.

Though I have recommended generally opening chronic abscesses while small, the deep situation of the lumbar one, and the degree of doubt always involving its early state, unfortunately prevent us from taking this beneficial step in this particular case. But still the principle is equally praiseworthy, and should urge us to open the tumour as soon as the fluctuation of the matter becomes distinct, and the nature of the disease is evident. For this purpose Mr. Abernethy employed an abscess lancet, which made an opening large enough for the discharge of those flaky substances so frequently found blended with the matter of lumbar abscesses. Such flakes seem to consist of a part of the coagulating matter of the blood, and are very commonly secreted by the peculiar cysts of serofulous abscesses. The puncture must be of a certain size, in order to allow the clots of blood, occasionally mixed with the matter, to escape. Mr. Abernethy considered the opening of a lumbar abscess a very delicate operation. Former surgeons used to make a large opening in these cases; let out the contents; and leave the wound open: the usual consequences of which were, great irritation and inflammation of the cyst; immense disturbance of the constitution; putrefaction of the contents of the abscess, in consequence of the entrance of air into its cavity; and too often, death. While such practice prevailed, very few, afflicted with lumbar abscesses, were fortunate enough to escape. The same alarming effects resulted from allowing the abscess to attain its utmost magnitude, and then burst by ulceration. If then a more happy train of events depend upon the manner, in which lumbar abscesses are punctured, the operation is certainly a matter of delicacy.

Until the collection has been opened, or burst, the patient's health is usually little, or not at all impaired; indeed, we see in the faces of many persons with such abscesses, what is usually understood by the picture of health. Hence, how likely our professional conduct is to be arraigned,

when great changes for the worse, and even death, occur very soon after we have let out the matter, seemingly, and truly, in consequence of the operation. Every plan, therefore, which is most likely to prevent these alarming effects, is entitled to infinite praise; and such, I conceive, is the practice recommended by Mr. Abernethy.

This gentleman's method was to let out the matter, and heal the wound immediately afterwards by the first intention. He justly condemned all introductions of probes, and other instruments, which only irritate the edges of the puncture, and render them unlikely to grow together again. The wound is to be carefully closed with sticking plaster, and it will almost always heal.

These proceedings do not put a stop to the secretion of matter within the cavity of the abscess. Of course, a fresh accumulation takes place; but, it is obvious, that the matter, as fast as it is produced, will gravitate to the lower part of the cyst, and, consequently, the upper part will remain for some time undistended, and have an opportunity of contracting.

When a certain quantity of matter has again accumulated, and presents itself in the groin, or elsewhere, which may be in about a fortnight after the first puncture, the abscess is to be punctured again, in the same manner as before, and the wound healed in the same way. The quantity of matter will now be found much less, than what was at first discharged. Thus the abscess is to be repeatedly punctured at intervals, and the wounds as regularly healed by the first intention, by which method, irritation and inflammation of the cyst will not be induced, the cavity of the matter will never be allowed to become distended, and it will be rendered smaller and smaller, till the cure is complete.

In a few instances, the surgeon may, perhaps, be unable to persevere in healing the repeated punctures which it may be necessary to make; but, after succeeding once or twice, the cyst will probably have had sufficient opportunity to contract so much, that its surface will not now be of alarming extent. It is also a fact, that the cyst loses its irritability, becomes more indolent, and less apt to inflame, after the contents have been once or twice evacuated in the above way; and its disposition to absorb becomes also stronger.

The knowledge of the fact, that the cysts of all abscesses are absorbing surfaces, should lead us not to neglect other means, which Mr. Abernethy suggested, as likely to promote the dispersion of the abscess, by quickening the action of the absorbents. Blisters kept open with svine cerate, issues, electricity, occasional vomits of the sulphate of zinc, are the means most conducive to this object. When the vertebrae are diseased, issues will often prove serviceable, more especially before the abscess has been opened, or when the discharge is not very copious.

In the latter complication, the case is always dangerous. If an opening be made in the abscess, the cyst is at first more likely to be irritated than when the bones are not diseased, and the affection of the spine is rendered much less likely to undergo any improvement, in consequence of the mere formation of an outward communication. The same bad effect attends necrosis; in which case, the absorption of the dead bone is always re-

tarded by the presence of unhealed fistulae and sores, which lead down to the disease.

Mr. Crowther succeeded in dispersing some large lumbar abscesses without opening them. Large blisters applied to the integuments covering the swelling, and kept open with the savine cerate, effected the cure. When this gentleman punctured such collections of matter, he used a small trocar, which he introduced at the same place as often as necessary. He observes, that the aperture so made does not ulcerate, and allows no matter to escape after being dressed. I cannot, however, discover any reason for his preferring the trocar to the abscess lancet, except that the cannula enables the surgeon to push back with a probe any flakes of lymph, &c. which may obstruct its inner orifice. But, this is scarcely a reason, because the opening, made with an abscess lancet, is large enough to allow such flakes to be discharged; and when they stop up the aperture, a probe may be employed to push them back. A wound made with a cutting instrument will, *carteris paribus*, always unite more certainly by the first intention, than one made with such an instrument as a trocar. Mr. Crowther may always have succeeded in healing the aperture; but, I do not believe, that other practitioners would experience equal success. Were the tumour not very prominent, on account of the quantity of matter being small, suddenly plunging a trocar into the swelling might even endanger parts the wounding of which might lead to fatal consequences.

Some surgeons open lumbar abscesses with a seton. The matter being made to form as prominent a swelling as possible, by pressing the abdomen, and putting the patient in a position, which will make the contents of the abscess gravitate towards the part where the seton is to be introduced, a transverse cut is first made in the integuments down to the fascia. A flat trocar is next to be introduced within the incision, which should only be just large enough to allow the instrument to pass freely under the skin, for at least three quarters of an inch; when the hand is to be raised, and the trocar pushed obliquely and gently upwards, till the cannula is within the lower part of the sac. The trocar must now be withdrawn, and the matter allowed to flow out gently, stopping it every now and then for some minutes. The assistant must now withdraw his hand, to take away the pressure, and place the thumb of his left hand, upon the opening of the cannula, holding it between his fore and middle fingers. It must then be pushed upward, nearly to the top of the tumour, where its end may be distinctly felt with the fore-finger of the right hand. As soon as it can be plainly felt, it must be held steadily in the same position, and the trocar is to be introduced into it again, and pushed through the skin, at the place where it is felt, and the cannula along with it. The trocar being next withdrawn, a probe with a skin of fine soft silk, dipped in oil, must be passed through the cannula, which being now taken away, leaves the seton in its place. A pledget of mild opium is then to be applied over the two openings, the more completely to exclude the air. A fresh piece of the silk is to be drawn into the abscess, and that which was in before, cut off, as often as necessary. (See *Lancet's Surgery*, vol. iii. p. 307.) Decker, who wrote in 1696, discharged a large abscess in a gradual manner, with a trocar, the

cannula of which was not withdrawn, but stopped up with a cork, and the matter let out at intervals. B. Bell also advises the cannula not to be taken out.

I cannot quit this subject without mentioning a remarkable case of lumbar abscess, which I saw, many years ago, in Christ's Hospital, under the care of the late Mr. Ramsden. The tumour extended from the ilium and sacrum below; as high up as the ribs. The diameter of the swelling from behind, forward, might be about six or eight inches. It was attended with so strong a pulsation, corresponding with that of the arteries, that several eminent surgeons in this city, considered the case to be an aneurism of the aorta. After some weeks, as the tumour increased in size, the throbbing of the whole swelling gradually became fainter and fainter, and at length, could not be felt at all. The tumour was nearly on the point of bursting. Mr. Ramsden suspected that it was an abscess, and determined to make a small puncture in it. The experiment verified the accuracy of his opinion; a large quantity of pus was evacuated at intervals; but as the boy's health declined, he went to his friends at Newbury, and I did not afterwards hear the event. I have never seen any popliteal aneurism, whose pulsations could be more plainly seen and strongly felt, than those of the abscess we have just been describing.

A singular case is related by Mr. Wilmot, of a psoas abscess, the matter of which was at length absorbed, and its cavity filled with air, attended with a considerable increase in the size of the tumour, a conical elongated shape, and elastic feel, instead of a fluctuation, previously quite evident, and the subsidence of all the hectic symptoms. A complete dispersion of the swelling was effected by a handage and compress wet with a strong decoction of oak bark and alum.

In an example of iliac abscess, which occurred in the Richmond hospital, Dublin, ulceration took place in a portion of the ileum, adhering to the cyst of the abscess; and the contents of the bowel, after having passed into the abscess, escaped through a fistulous opening near the spine of the ilium. Ulceration also of the external iliac artery followed, about an inch and a half above Poupart's ligament, and sudden death resulted from the blood escaping in large quantity into the cavity of the abscess. The parts are preserved in the Museum of Richmond hospital. (See *M'Donnel in Dublin Journ. of Med. Science*, vol. iv. p. 912.)

In December, 1837, I visited, with Mr. Heale, of Staines, a farmer's son, at Stanwell, whom I had seen with the same gentleman eight or ten months previously. It was a case, in which a soft and partly reducible tumour presented itself below Poupart's ligament, and was mistaken by another practitioner for a hernia. Having examined the swelling, I recommended it to be opened, as it appeared to me from the symptoms to contain matter, and to be an abscess connected with the loins. A puncture was made, and about a pint of matter discharged. A copious evacuation of pus continued for a good while afterwards; and at length matter presented itself at another point, which was also opened. This was behind the quadratus lumborum of the side, not corresponding to that of the original swelling. Then ulcerated openings, five or six inches long, formed over each crista of the ileum and from these now project two large oblong

fungous masses of the same length, and three inches in height and breadth, which appear to extend to a considerable depth, as if proceeding from a cyst or diseased surface within the pelvis. The skin around them is also extensively undermined. The fungous growths are not very sensible, nor do they bleed in any material degree. In addition to all this mischief, the slightest motion causes severe agony, and there is sloughing and ulceration over the sacrum. The patient, though suffering from hectic, still retains his appetite. I have never seen another case corresponding to this, which, I apprehend, will soon prove fatal.

See *Kirkland's Med. Surgery*, vol. II. Trans. of the King's and Queen's College of Physicians in Ireland, vol. II. p. 26, &c. 8vo. Dublin, 1818. *F. Schoenmelz*, Obs. de Musculis Psoa et Iliaco suppuratis, Frank. Def. Op. V. R. Beckwith de Morbo Psosideo. Edinb. 1784. *Abernethy's Surgical and Physiological Essays*, parts I and 2. *Crouther*, on White-Swelling, &c. 1808. *Latta's Surgery*, vol. III. *Callisen's Systema Chir.* Hodierna, vol. I. p. 370. *Pearson's Principles of Surgery*, p. 102. edit. 2. *Richter's Anfangsgründe der Wundarzneykunst*, b. 5. 113. Göttingen, 1801. *John Litzars*, Case of Double Psoas Abscess, Edinb. Med. Surg. Journ. No. 84. *A. Copland Hutchison's Practical Obs. in Surgery*, ed. 2.

LUNAR CAUSTIC. (NITRATE OF SILVER.)
(See SILVER.)

LUPUS. (See NOLI ME TANGERE.)

LUXATION. (See DISLOCATION.)

MAMMA, DISEASES OF. Various causes combine to render the female breast peculiarly liable to disease. Its situation exposes it to frequent variations of temperature, to painful confinement or pressure from the dress, and to accidental injuries. It is an organ powerfully influenced by emotions of the mind; and it is connected by close links of sympathy with the whole apparatus of reproduction. To these causes of its liability to disease, must be added the alternating states of long continued activity and repose, in which it is placed as an organ of secretion. (See *Cunin*, in *Edinb. Med. and Surg. Journ.* vol. xxvii. p. 225.)

Inflammation of the Mamma is either *acute* or *chronic*. In the former of these shapes, it is a disease of frequent occurrence during lactation; and it usually terminates in the formation of matter, varying in quantity and situation. This is the case termed the *mammary* or *milk abscess*, which, as my friend, Mr. James, of Exeter, observes, since it depends upon a peculiarity of state and function, ought to stand alone. Women, who have never been pregnant, are also liable to mammary abscesses, depending upon derangement of the health, gastric or uterine disorder; and even men, now and then, have abscesses of the breast.

"Mr. Hey also describes a deep-seated abscess, to which this gland is liable, of rather a chronic character, and is the same, perhaps, as that which Dr. Kirkland has described as the encysted. Dr. K. describes also two others, under the titles of chronic and encysted." When the breast inflames, attended with risk of suppuration, the part enlarges, becomes tense, heavy and painful. The integuments of the breast sometimes assume an uniform redness; sometimes they are only red in particular places. The inflammation may affect the mammary gland itself, or be confined to the skin and surrounding cellular substance. In the latter case, the inflamed part is equally tense; but, when the glandular structure of the breast is also affected, the enlargement is irregular, and seems to consist of one or more large tumours, situated in the substance of the

part. The pain often extends to the axillary glands. The secretion of the milk is not always suppressed, when the inflammation is confined to the integuments, and suppuration is said to come on more quickly, than in the affections of the mammary gland itself. When the symptoms of inflammation continue to increase for four or five days, suppuration may be expected; unless the progress of the inflammation be slow, and its degree moderate, in which circumstances, resolution may often be obtained, even as late as a fortnight after the first attack. Acute inflammation of the breast is generally attended with more or less sympathetic inflammatory fever. Sir Astley Cooper describes the inflammation as adhesive in the first stage, suppurative in the second, and ulcerative in the third. Swelling is followed by a blush of inflammation upon the surface of the breast, and throbbing very acute pain. "A particular prominence and smoothness are observed at one part of the tumour, with a sense of fluctuation from the presence of matter. The constitution is also highly irritated, which is evinced by the occurrence of shivering, succeeded by heat and profuse perspiration. Over the most prominent part of the swelling, the cuticle separates, ulceration follows in the cutis, and the matter becomes discharged through the aperture thus produced." (*Illustrations of Diseases of the Breast*, p. 7.)

Women are most liable to mammary abscesses within the first three months after parturition; but they are also much exposed to the disorder so long as they continue to suckle.

The most common causes of mammary abscess, as enumerated by writers in general, are, repressing the secretion of milk at an early period, mental disturbance, fright, &c.; exposure to cold, moving the arms too much while the breasts are large and distended, and external injuries. The causes are not always obvious. In Sir Astley Cooper's opinion, the principal cause of acute inflammation and suppuration of the breast, is "the rush of blood, which takes place each time the child is applied to the bosom, and which by nurses is called the *draught*, and is the preparatory step to the secretion of milk." He also adverts to the frequent exposure of the bosom in suckling, and the active exertions of the child in sucking, as promoting the origin of the complaint. The nurse, he says, often produces these abscesses immediately after the lying-in, by not putting the child soon enough to the breast, and, by giving the mother strong drink. (See *Illustrations of the Diseases of the Breast*, p. 8.)

The matter is sometimes contained in one cyst, or cavity; sometimes in several; but the abscess generally breaks near the nipple.

As all inflammations of the mamma are attended with considerable induration, they should be carefully distinguished from other swellings of a more incurable kind. Scrofulous tumors of the mamma, which have existed a long while, often disappear after the occurrence of a milk abscess.

In the early stage, resolution should be attempted. The following are the principal means for this purpose:—venesection, leeches; purges of castor oil, or sulphate of magnesia; low diet, keeping the inflamed breast from hanging down; resting the arm in a sling; fomentations; having the milk tenderly sucked out at proper intervals; saturnine applications, containing spirit of wine;

or lotions of the muriate of ammonia. "If the patient suffer from the cold, produced by the evaporation of the spirit, a simple tepid poultice may be substituted for it, occasionally applying leeches, and still recollecting that the chief dependence is upon purging." (See *A. Cooper on Dis. of the Breast*, p. 9.)

For the purpose of bringing about resolution, Mr. Earle prefers warmth, "during the application of which the milk will often flow off in great abundance. A convenient and simple mode of applying warmth is to immerse a wooden bowl in hot water, and having wrapped some flannel around the breast, place it in the bowl. By this means, an effectual and equable warmth may be kept up for a considerable length of time." (See *Lond. Med. Gaz.* vol. x. p. 153.)

When matter cannot be prevented from forming, an emollient poultice is a good application; or the surgeon may apply "fomentations of poppy decoction, and poultices made with the same decoction, mixed with bread," which last should be renewed three or four times a day. In order to lessen the patient's sufferings, Sir Astley Cooper prescribes opium combined with the liquor ammoniac acetatis, or simple saline draughts with small doses of sulphate of magnesia. Some practitioners think, that the abscess should be allowed to break of itself, unless it be rather chronic, in which case it may be opened in a depending part with a lancet. Much difference of opinion prevails respecting the practice of opening abscesses of the breast. I consider Sir Astley Cooper's directions good and practical. "If (says he) the abscess be quick in its progress, if it be placed on the anterior surface of the breast, and if the sufferings, which it occasions, are not excessively severe, it is best to leave it to its natural course. But if, on the contrary, the abscess in its commencement be very deeply placed, if its progress be tedious, if the local sufferings be excessively severe, if there be a high degree of irritative fever, and the patient suffer from profuse perspiration, and want of rest, much time is saved, and pain avoided, by discharging the matter with a lancet." (See *Op. Dis. of the Breast*, p. 10.) The same experienced surgeon disapproves, however, of introducing the lancet through a thick covering of the abscess, as the opening will not procure a free discharge of the matter, but will heal by adhesion, after which the accumulation of matter will continue. The opening, he says, should be made where the matter is most superficial, and the fluctuation is distinct, and its size should be in proportion to its depth. Sinuses sometimes form, and will not heal till freely opened with a director and curved bistoury. When the cavity of the abscess begins to be filled up with granulations, the poultice may be left off, and superficial dressings applied.

Perhaps, as a general rule, the surgeon should never wait for an abscess of the breast to approach the surface, but make an opening as soon as the slightest degree of fluctuation is perceptible; for if this be not done, and the abscess be not very superficial, the matter will spread and form sinuses in different directions. Thus, the extent of the disease may be seriously increased, and the cure greatly impeded.

For dispersing the considerable induration, which sometimes continues a long while after the abscess has been cured, the most effectual plans

are friction with camphorated mercurial ointment, the iodine ointment, or the soap liniment with 3j of the tinct. iodine to each ounce of it, and the occasional exhibition of purgative medicines, with tonics, or the compound calomel pill, according to the state of the constitution.

If the abscess be small, Sir Astley Cooper allows the child to suck the affected breast as well as the other; but, if much of the mamma be involved in the disease, he lets the infant suck the other breast, and directs the mother to draw the other herself by means of the glass tube constructed for the purpose. At all events, if the abscess be large, it will generally be necessary to remove the child from the breast, and, as Mr. Earle remarks, in some cases, from both breasts, "as the flow of milk, induced by the suckling at the sound breast, induces a sympathetic determination to the other." When the abscess is less extensive, however, he approves of the trial of other means, as those of keeping a free outlet for the matter, and brisk purging, in order to lessen the secretion of pus. When the child is prevented from sucking by excoriations, or ulcers of the nipple, the milk accumulates in large quantity, and inflammation is excited. Here Sir Astley also also recommends the breast to be drawn; but, he thinks, that the sooner the child can be restored to it, the better. A simple mode of drawing the breasts is to procure a wide-mouthed gooseberry bottle, and expel the air from it by immersing it in hot water. When applied to the breast, a vacuum is formed, and the milk flows abundantly. (Earle, in *Lond. Med. Gaz.* vol. x. p. 153.) Sir Astley Cooper deems a solution of a drachm of borax in three ounces and a half of water, and half an ounce of spirit of wine, the best application for a sore nipple. Many practitioners use diluted brandy, lotions of zinc, or alum, or that of calomel and lime-water. Sir Astley finds that ointments do not generally agree with the part; but, if used, he prefers that of bismuth, or zinc, or simple cerate. (See *NIPPLE*.)

Sometimes, when the swelling is opened, a considerable quantity of milk is discharged: in this case, Sir A. Cooper recommends a sponge tent to be introduced into the puncture, by which means the adhesive inflammation and obliteration of the cavity will be produced.

Mr. Hey describes a very deep-seated abscess of the breast, not of frequent occurrence, and not confined to pregnant, nor suckling women. Its situation renders all superficial applications ineffectual. The inflammatory stage is tedious; and when the matter has made its way outward, the discharge continues, and there is no tendency to healing. Sometimes the matter lodges behind the mamma, as well as in the substance of the gland, and breaks out in different places, the intermediate parts of the breast feeling as if affected with a scirrhus hardness. Numerous sinuses run in different directions, and, when opened, a soft purple fungus appears within them. The disease goes on in this state, for a long while, keeping up hectic symptoms. At this present time, Nov. 1837, an interesting example of this deep kind of mammary abscess is to be seen in a young woman under my care in University College Hospital. It commenced so gradually, and with so much hardness, that at first no suspicion of abscess was entertained. At length a blush presented

itself at one point of the surface, and, after a very deep incision had been made, the nature of the disease became apparent. It has been necessary to follow up this first incision by several others, and the case now promises soon to be brought to a termination.

Mr. Hey's practice was to trace the course of all the numerous sinuses, and lay them open, and, he asserts, that unless this be done, with respect to every one of them, the cure cannot be accomplished. If he found any two sinuses running in such directions, that when fully opened, they left a small part of the mamma in a pendulous state, he removed such part entirely. As the sinuses are filled with fungus, their continuations present no visible cavity, and can only be detected by the greater softness of parts of the wound, where, on breaking down the fungus, the orifice of the collateral sinus may be found. Mr. Hey has found, that, even in the most unfavourable subjects, the wounds heal quickly, and the natural shape of the breast is preserved.

The foregoing treatment, it must be confessed, is severe; and, if milder measures will answer, they should be preferred. Instead of laying all the sinuses open, Sir Astley Cooper injects them with a lotion composed of rose water and two or three drops of strong sulphuric acid to each ounce of it, folded linen, wet with the same application, being also laid over the breast. When a deep-seated abscess forms between the ribs and the posterior surface of the breast, and bursts, so as to be attended with a sinus, and a tedious exfoliation of the ribs, Sir Astley Cooper considers the injection of diluted acids the best practice; for, unless the dead bone be loose, no advantage can result from the division of the sinus. (*Illustrations of Dis. of the Breast*, p. 11.)

The breast is also liable to chronic abscesses, the formation of which is sometimes so slow and free from pain, that the cases are mistaken for fleshy solid tumors. The treatment, recommended by Sir A. Cooper, consists in letting out the matter, and giving tonic medicines; but, if the disease be in an early stage, and matter should not yet have been formed, the pil. hydrarg. submur. comp. may be prescribed, with bark and soda, or the compound infusion of gentian with soda and rhubarb. To the tumour itself the emplastrum ammoniaci cum hydrargyro, or a lotion, containing muriate of ammonia and spirit of wine, may be applied. (See Sir A. Cooper's *Illustrations of Dis. of the Breast*, p. 14. &c.)

The lacteal, or lactiferous tumour, as it is named by Sir Astley Cooper, though attended with fluctuation, is very different from an abscess, and should never be confounded with it. The cause of this swelling is a chronic inflammation and obstruction of one of the lactiferous tubes near the nipple. When the distension is excessive, ulceration sometimes takes place, and the milk is discharged through a small aperture; and, when the infant sucks, most of this nutritious food is lost to it. The following treatment is advised by Sir Astley Cooper:—if the child can be weaned, a simple puncture will suffice; but, if suckling be continued, a larger opening must be made, and the milk suffered to escape through it whilst the infant is sucking. Relief may thus be obtained, until the child is weaned, and the secretion of milk has been stopped by

means of purgatives. (See *Illustrations of the Dis. of the Breast*, p. 16.)

Volpi, in his Italian translation of Richter's *Anfangsgründe*, has recorded an example of lacteal tumour, where not less than 10 pints of milky fluid were evacuated by puncturing the swelling. This morbid dilatation of a lactiferous tube is observed by Dr. Cumin to approach somewhat to the natural structure of the mamma of one species of goat, of which there is a preparation in Dr. William Hunter's Museum. In this animal, the nipple forms but one large tube, about the size of the finger, and an inch and a half in length. This tube enlarges into a bag, capable of containing an orange; and, on the sides of the bag, a great many short thick tubes open. (See *Edinb. Med. and Surgical Journ.* vol. xxvii. p. 226.)

Sir A. Cooper describes two forms of hydatid or encysted swelling of the breast; one containing a fluid like serum, in cells; the other, being a globular hydatid, such as is found in the liver and other parts. In fact, both *serous cysts* and *true globular hydatids* have been found in the mamma, and in the adipous substance surrounding it. The breast gradually swells, and in the beginning is entirely free from pain or tenderness. It becomes hard; no fluctuation can then be discovered in it; and it continues to grow slowly for months, and even for years. The part is painful only just before the period of the menses. After a time, some points of the swelling feel as if they contained fluid, while the rest continues firm. The skin is quite free from discolouration, except immediately before it begins to ulcerate. The constitution suffers no particular disturbance except when ulceration commences, and then it is only slight. Sir A. Cooper has never seen an instance of this disease being cured by a natural process: it remains for months and years; the cysts breaking one after another, and the breast wasting, till little of it remains. He has seen more cases of this complaint between the ages of 15 and 25, than at other periods of life; but he has also sometimes met with it in older subjects, and one case was in an individual more than 60. The disease sometimes acquires an extraordinary magnitude, and one instance is related by Sir Astley Cooper, in which the tumour weighed 13 pounds. The tumour is extremely moveable upon the pectoral muscle, and very pendulous. It never requires to be removed on account of any malignancy in its character; but the operation is performed to relieve the patient from its inconvenience, and to satisfy her mind. Although the whole breast should be involved in the disease, and the swelling discharge largely, put on a formidable appearance, and even become of enormous size, the glands in the axilla remain entirely free from disease; or, if one be slightly enlarged, it is merely from simple irritation, and it disappears when the complaint in the breast is removed. There is no danger of the disease extending by absorption, or of its producing any mischief beyond the breast; nor has Sir Astley Cooper ever known it attack both mammae at the same time. But, though such is the unmalignant nature of the disease, all the tumour and induration must be removed if an operation be necessary; for otherwise, any hydatid cyst left behind will continue to grow, and the hydatid swelling of the breast to enlarge. (*Illustrations of Diseases of the Breast*, p. 22—26.) When the cyst has

been single, Sir A. Cooper has sometimes let out the fluid with a lancet, and the adhesive and suppurative inflammation, thus excited, has terminated in a cure.

The disease, in its first stage, resembles simple chronic inflammation; but it may be distinguished from it by the absence of tenderness on pressure; and the perfect health in which the patient remains, marks it as quite a local disease. In its second stage, when it fluctuates, its nature is indicated by the several distinct seats of the fluctuation; but, as Sir Astley Cooper adds, the best criterion is afforded by the puncture of the cyst, whereby a clear serum is let out, and not a purulent fluid. (*Illustrations of Diseases of the Breast*, p. 24.) It is distinguished from scirrhus by its freedom from the occasional acute darting pains, and great hardness of the latter affection, and by the health being undisturbed. Sir Astley Cooper, however, has seen a case, in which a scirrhus was complicated with hydatids; and so has the author of this work. In such examples, of course, the disease is attended with the usual lancinating pains, and all the other evils of a carcinomatous tumour.

With regard to *serous cysts*, and *true globular hydatids* of the breast, though neither of these formations is of itself dangerous, Dr Cumin suspects, that they occasionally give rise to other morbid changes of a very serious nature. The contents of the cysts consist at first of a straw-coloured fluid; but, in time, this may acquire a greenish colour, and sometimes a fetid odour. Such changes of the fluid do not appear to Dr. Cumin, however, to be any proof of the disease having assumed a carcinomatous nature. "In general, the puncturing of such cysts is not followed by any troublesome consequences; but in one case (he observes) the cyst sloughed, an indolent unhealthy ulcer succeeded, and the whole mamma became indurated. The safest practice is to remove the cyst, and should it be thickened, and the tumour attended with shooting or gnawing pain, a portion of the sound parts around should be dissected out along with it." Sometimes, when the mamma has been removed, its structure near the cyst is found to be altogether changed, so as to resemble boiled udder, or liver, or soft cartilage, and rounded masses of the same substance are occasionally seen projecting into the cavity of the cyst, which covers them with its smooth membrane. In some cases, firm bands extend across the cysts, so as to keep them expanded, after they have been cut across. The first progress of this form of disease is usually slow, and the health nearly throughout the case unimpaired. The mamma becomes much enlarged, and seems to divide into lobes; a large cavity is felt filled with fluid; the weight of the breast causes turgescence of the veins; the part is more or less painful; and sometimes, though rarely, the axillary glands swell under these circumstances. Dr. Cumin deems extirpation of the part proper. A tumour, described by this gentleman, and which was removed, consisted of a number of smaller ones, with a cavity in the centre filled with a serous fluid, into which many of the tumours projected. Most of them presented the firm cartilaginous texture and membranous bands of scirrhus; others resembled boiled liver, and two or three vesicles filled with amber-coloured fluid, were seen half sunk in the scirrhus-like substance.

The swelling removed weighed 57½ ounces, besides two ounces of sound mamma. The size of the tumour, and the freedom of the patient from relapse, several years after the operation, are considerations which seem to me to be against the inference, that the disease was really scirrhus. Dr. Cumin is undecided on this point; but suspects that if ulceration had occurred, fungous growths would have been thrown out, and that the ulcer would have assumed the same character as in cases Nos. 2. and 3., detailed by Mr. Hey under the head of fungus hamatodes. (See *Pract. Obs. in Surgery*, p. 260—265.)

Besides hydatid swellings of the breast, and scirrhus and fungous hamatodes (see *Cancer and Fungus*), Sir A. Cooper notices the case named by him *Simple Chronic Tumour of the Breast*. It is generally met with in persons from seventeen to thirty years of age, and of healthy appearance, is exceedingly moveable, more diffused in the surrounding substance than scirrhus, and has a lobulated feel, like that of a fatty swelling. It is a disease which never becomes cancerous, or never, unless it continue till the period of life, when the uterine secretion terminates (*On Dis. of the Breast*, p. 63.), though it may attain a large size, and be attended with pain at the period of menstruation. Its ordinary size is from that of a filbert to that of a billiard ball. In some cases both breasts are similarly affected; and I have known the disease occur in one lady between 40 and 50, and though both breasts were affected the disease underwent such improvement, that all idea of an operation was renounced. It does not usually admit of being dispersed by medicine, but can easily be taken away by incision. It seems to grow on the surface of the breast, rather than from its interior; and it therefore appears to be very superficial, unless when it arises from the posterior surface of the mammary gland, in which case, it is deeply seated, and its peculiar features less clear.

The characters, distinguishing this from a carcinomatous affection, (besides that of age), are well marked. This tumour is more superficially placed, being rather on the surface, than within the mamma. It is very moveable in every direction, excepting towards the surface of the mammary gland, to the edge of which it is attached. At its commencement, it feels like one of the lobes of the mammary gland, converted into an indurated structure; and, as it proceeds, other lobes seem to become gradually involved, and combined in one swelling. It is generally confined by its attachment to one side of the mammary gland, though, in a few instances, it has no connection with it. Sometimes, there seems to be a communicating band between the tumour and the gland; and, if traced at this point, the swelling appears to be lost in the substance of the gland. When examined with a light hand, it presents a peculiar irregular surface, not so indurated as that attendant upon carcinoma, nor yet possessing the elasticity which characterises the encephaloid tumour. (See Earle, in *Lond. Med. Gaz.* vol. x. p. 151.)

This chronic mammary tumour may continue nearly stationary for many years, and then gradually diminish. Sir Astley Cooper has known a gland enlarge in the axilla, and I have seen a similar change; but it is considered a rare occurrence, and merely the result of irritation. (See *Illustrations of Diseases of the Breast*, p. 53.)

The same experienced surgeon regards the disease as sympathetic with the state of the uterus; and although he does not think the case much within the power of medicine, he prescribes, if the digestive functions be disordered, the compound calomel pill to be taken at night, and the infusion of calumba with rhubarb and the carbonate of soda, twice a day. When the uterine secretion is defective, he exhibits small doses of the blue pill and colocynth with steel medicines. As local applications, he prefers the emplastr. ammon. cum hydrargyro, and the iodine ointment. I have known the disease so benefited in several instances, by the internal and external employment of iodine, that the patients never afterwards experienced any trouble from it. I believe, that surgeons frequently remove this swelling by the knife without any real necessity: if the disease were painful, very obstinate, and disposed to attain much size, the operation would be proper. The disease rarely yields till the uterine excitement ceases, or the part is required to furnish its own natural secretion. Hence, Sir Astley Cooper deems the complaint no objection to matrimony, as it is likely to be benefited by it. (Vol. cit. p. 57.)

Hypertrophy of the mamma consists in an extraordinary increase of the part, independently of any morbid change of structure, or any distinct tumour or lump in the breast. It is the case which Sir Astley Cooper terms the morbid growth of the breast, or large pendulous state of it. In some cases, indeed, it acquires a uniform increase of size, so as to become at last altogether monstrous. In the early stage, heat, uneasiness, and signs of increased flow of blood in the part, may be noticed; but this is not generally the case. The disease most frequently commences soon after puberty, and in many cases the breast obtains such magnitude, that its extirpation becomes absolutely necessary. (See *Hey's Surgery*; *Pearson on Cancer*; *Sir A. Cooper's Lectures*, by Tyrrell; *Cumin, in Edinb. Med. and Surg. Journ.*, vol. xxvii. p. 227.)

Hypertrophy of the breast is alleged to be always connected with a suppressed or disordered state of the menstrual function. Mr. Hey mentions the case of a girl, who menstruated when only twelve years old, but, shortly afterwards, the menses disappeared, in consequence of damp clothes being worn during the period. The breasts increased in size, and her left breast attained the enormous weight of eleven pounds four ounces. After its removal, the menses returned, and the right breast diminished.

I fully concur with my friend Mr. Earle, respecting the propriety of giving a fair trial to iodine in cases of this kind, before resorting to an operation. But I fear, that the difficulty of finding the principal arteries supplying the tumour, will prove an obstacle to putting in practice his other suggestion of tying them, so as to cut off some of the flow of blood to the part. (See *Earle, in Lond. Med. Gaz.*, vol. x. p. 152.)

Atrophy, or absorption of the mammary gland, usually takes place in advanced life, commencing after the catamenia have ceased; and it has been observed to be produced by the administration of iodine. (*Coludet, in Memoirs transl. by Johnston, p. 20.*) Dr. Cumin is not aware, that it ever occurs as a consequence of that tumefaction of the mamma, which succeeds *cynanche parotidea*, although the analogy of the testicle would lead us to

expect it. (See *Edinb. Med. and Surg. Journ.*, vol. xxvii. p. 227.)

Sir Astley Cooper has described a form of disease, which he calls the *Irritable Tumour of the Breast*, and which is sometimes named by others *mastodynia*, or *neuralgia of the mamma*. As the occurrence of partial tumefaction seems to be rather an accidental than an essential symptom, Dr. Cumin prefers the latter names. This author represents mastodynia as consisting in increased sensibility of the mamma, which is sometimes so great, that exposure to cold, touching it even gently, or the weight of the bedclothes, causes excruciating pain. In the simplest form of this painful affection, the breast often presents no perceptible change whatever, and the disease is wholly confined to the nerves of the breast, and other parts affected with it; but, on other occasions, one of the lobes of the mamma becomes slightly swollen, and peculiarly tender when touched. (*Cumin, in Edinb. Med. and Surg. Journ.*, vol. xxvii. p. 226.) It occurs in persons aged from 15 to 25, a period of life scarcely liable to cancer; the part is so extremely sensible, that the patient starts on its being touched, and, although it is commonly painful, yet, just before the time of the menses, the agony from it is almost incredible, the pain extending from the breast to the arm down to the fingers' ends, and even sometimes affecting the sight. The removal of the breast, on account of this affection, is completely unnecessary.

The treatment consists in lessening the irritability of the system, diminishing the pain, and restoring menstruation. As local applications, Sir Astley Cooper recommends a plaster composed of equal parts of soap plaster and extract of belladonna, or a poultice with solution of belladonna and bread. Oilskin, or hare-skin, worn upon the breast, he also deems useful. When the pain is excessive, he sanctions the employment of leeches; but thinks them productive of weakness and of an increase of irritability, when too often used. As constitutional remedies, he gives the submuriate of mercury with opium and conium; or, for lessening the irritability of the part, a pill composed of two grs. of the extract of conium, two grs. of the extract of poppy, and one-half of a gr. of the extract of stramonium, two or three times a day. For restoring the uterine secretion, he prescribes the carbonate of iron, ferrum ammoniatum, or the mixture ferri comp. Each of these may be combined with aloes. He also recommends a hip-bath of sea or salt-water, heated to 100 or 105°. (See *Illustrations of Diseases of the Breast*, p. 79.) A great deal of valuable information, on the subject of mastodynia, is to be found in the writings of Justamond, who appears to have been often successful in its treatment. (See *Tracts*, 4to. pp. 380. *et seq.*) By systematic writers on the diseases of females, it is usually considered with those of gestation. (See *Cumin, ib.*)

Scrofula of the mamma is described by this intelligent and correct writer, as appearing under different shapes, and as being in its earlier stages "not always easily distinguished from diseases of a much more formidable description. Sometimes a hard lump forms in the mamma, and remains nearly quiescent for several years; at other times, the whole gland is affected with scrofulous enlargement. But, in all cases of this disease, its

tendency is to suppuration; and the purulent matter discharged is always more or less mingled with those curdy flakes, which form the principal diagnostic of scrofula. Mr. Lloyd relates a remarkable instance, in which the whole of the tumour seemed to have been converted into this curdy deposit." In strumous diseases of the mamma, the part is always enlarged, not contracted, as in one form of carcinoma. The tumour is tender when grasped, never possesses the stony hardness observed in the latter disease, nor, so far as Dr. Cumin's experience goes, is it ever attended with retraction of the nipple. (*Op. et vol. cit. p. 227.*)

The treatment of scrofulous tumours of the breast is like that of the generality of other strumous swellings. It is considered in the writings of Pearson (*On Cancer*), Lloyd (*On Scrofula*), and Sir A. Cooper (*Illustrations of Dis. of the Breast*).

The breast is also liable to adipose tumours, and to cartilaginous and bony transformations, as well as to some other diseases described in the articles CANCER, FUNGUS, HÆMATODES, and TUMOUR. In the *Miscellanea Naturæ Curiosorum*, Dec. ii. An. vi. is a case of complete ossification of both mammae. It occurred in a nun, who suffered much from distressing dyspnoea. The mammae were as hard as stone, and the skin stretched over them like hoops round a barrel. After death, the mammae were found transformed into hemispheres of bone, so hard as completely to resist the scalpel. M. Bayle describes ossification as the last stage of those tumours of the breast, which he denominates *fibrinous*. (See *Dict. des Sciences Méd. t. xxx. p. 401.*; and *Cumin, in Edinb. Med. and Surg. Journ. vol. xxvii. p. 233.*)

MAMMA, AMPUTATION OF, OR EXTIRPATION OF.

Many swellings and indurations of the breast it would be highly injudicious and unnecessary to extirpate, because they generally admit of being dispersed. Such are many tumours, which are called *Scrofulous*, from their affecting patients of this peculiar constitution, cases in which the trial of iodine internally and externally may very properly be made. (See *IODINE*.) Such are nearly all those indurations, which remain after a sudden and general inflammatory enlargement of the mamma; such are most other tumours, which acquire their full size in a few days, attended with pain, redness, &c.; and of this kind, also, are the hardnesses in the breast, occasioned by the mammary abscess.

In the removal of all malignant or cancerous tumours, their nature makes it necessary to observe one important caution in the operation, viz. not to rest satisfied with cutting away the tumours just at their circumference, but to take away also a considerable portion of the substance in which they lie, and with which they are surrounded. In cutting out a cancerous breast, if the operator were to be content with merely dissecting out the disease, just where his eyes and fingers might equally lead him to suppose its boundary to be situated, there would still be left behind white diseased bands, which radiate from the tumour into the surrounding fat, and which would inevitably occasion a relapse. In a vast proportion of the cases also, in which cancer of the breast unfortunately recurs after the operation, it is found,

that the skin is the part in which the disease makes its reappearance. Hence the great prudence of taking away a good deal of it in every case suspected to be a truly scirrhus or cancerous disease. This may also be done so as not to prevent the important objects of uniting the wound by the first intention, and covering the whole of its surface with sound integuments. So frequently does cancer recur in the nipple, whenever it does recur any where, that many of the best modern operators always make a point of removing this part in every instance, in which it is judged expedient to take away any portion of the skin at all. The surgeon, indeed, would be inexcusable, were he to neglect to take away such portion of the integuments covering scirrhus tumours as is evidently affected, appearing to be discoloured, puckered, and closely attached to the diseased lump beneath. Nor should any gland in the axilla, at all diseased, nor any fibres of the pectoral muscle, in the same state, be ever left behind. There is no doubt, that nothing has stamped operations for cancers with disrepute, so much as the neglect to make a free removal of the skin, and puts surrounding every side of the tumour. Hence, the disease has frequently appeared to recur, when, in fact, it has never been thoroughly extirpated; the disease, though perhaps yet in its local stage, has been deemed a constitutional affection, and the operation frequently rejected as ineffectual and useless.

But, strongly as I have urged the prudence, the necessity of making a free removal of the skin covering, and of the parts surrounding, every cancerous or malignant tumour, the same plan may certainly be regarded as unnecessary, and, therefore, rashly severe in most operations, for the removal of simple, fatty, fleshy, or encysted tumours, to which the breast, and almost every other part, is liable. However, even in the latter cases, when the swelling is very large, it is better to take away a portion of skin; for, otherwise, after the excision of the tumour, there would be a redundancy of integuments, the cavity of which would only serve for the lodgment of matter. The loose superfluous skin also would lie in folds, and not apply itself evenly to the parts beneath, so as to unite favourably by the first intention; nor could the line of the cicatrix itself be arranged with such nice evenness as it might have been, if a part of the redundant skin had been taken away at the time of operating.

The best method of removing a diseased breast is as follows: The patient is usually placed in a sitting posture, well supported by pillows and assistants; but the operator will find it equally convenient, if not more so, to remove the tumour while his patient is in a recumbent position; and this posture is best whenever the operation is likely to be long, or much blood to be lost, which circumstances are very apt to bring on fainting. I remember that Mr. Abernethy, in his lectures, used to recommend the latter plan; which, however, without the sanction of any great name, or authority, possesses such obvious advantages, as will always entitle it to approbation.

If the patient be in a sitting posture, an assistant should hold the arm back, by which means, the fibres of the great pectoral muscle will be kept on the stretch, the most favourable state for the dissection of the tumour off its surface. When I

was a student at St. Bartholomew's, the plan of confining the arm back with a stick placed across between it and the trunk, was usually followed; but it is now abandoned as an unnecessary proceeding.

When the tumour is not large, and only a simple sarcoma, free from malignancy, it will be quite unnecessary to remove any of the skin, and of course, this need only be divided by one incision, of a length proportionate to the tumour. The cut must be made with a common dissecting knife; and as the division of the parts is chiefly accomplished with the part of the edge towards the point, the instrument will be found to do its office best when the extremity of the edge is made of a convex shape, and this part of the blade is turned a little back, in the way in which dissecting knives are now often constructed. The direction of the incision through the skin should be made according to the greatest diameter of the tumour, by which means it will be most easily dissected out.

The direction of the incision is various with different practitioners; some making it perpendicular; some obliquely downwards and forwards, and others transverse. In general, the shape of the tumour must determine which is the best. It has been said, that when the incision follows the last direction, it heals more expeditiously, because the skin is more extensible from above downward, than laterally, particularly towards the sternum, and consequently allows the sides of the wound more readily to be placed in contact; and that the action of the pectoral muscle tends to separate the edges of the wound when it is perpendicular. On the other hand it is allowed, that more the wound inclines downwards, the more favourable it is for the escape of the discharge, if suppuration occur. (See *Œuvres de Desault*, p. 312. t. ii.) When circumstances offer the choice, I generally direct the external incision, or incisions from the axillary side of the tumour, obliquely downwards and forwards.

The cut through the skin should always be somewhat longer than the tumour; and as it is, perhaps, the most painful part of the operation, and one attended with no danger whatever, it should be executed with the utmost celerity, pain being more or less dreaded, according to its duration, as well as its degree. The fear, however, of giving pain, has probably led many operators to err, in not making their first incision through the integuments large enough, the consequence of which has often been, that there was not sufficient room for the dissection of the tumour with facility; the patient has been kept nearly an hour in the operating room, instead of five minutes, and the surgeon censured by the spectators as awkward and tedious. It is clear, also, that besides the larger quantity of blood lost from this error, than would otherwise happen, the vessels being commonly not tied till all the cutting is finished, the avoidance of pain, that fear which led to the blunder, is not effected, and the patient suffers much more, and for a much longer time, in consequence of the embarrassment and obstacles in the way of the whole operation.

At all events, when the disease is of a scirrhus or malignant nature, the skin covering the tumour should be in part removed. As I have said before, all that portion which is discoloured, puckered,

tuberculated, or otherwise altered, should be taken away. Some must also be removed, in order to prevent a redundancy, in all cases in which the tumour is large. I have said too, that in scirrhus, and cancer of the mammary gland itself, the nipple is a dangerous part to be left behind; but, if the tumour be not of that gland, and away from the nipple, the excision of this part would not be called for. For the purpose of removing the necessary portion of skin, the surgeon must obviously pursue a different mode from that above described; and, instead of one straight incision, he is to make two semicircular cuts, one immediately after the other, and which are to meet at their extremities. The size of these wounds must be determined by that of the disease to be removed, and by the quantity of skin which it is deemed prudent to take away; for the part, which is included in the two semicircular cuts, is that which is not to be separated from the upper surface of the swelling, but taken away with it. The shape of the two cuts together may approach that either of a circle or an oval, as the figure of the tumour itself may indicate to be most convenient. The direction of the incisions is to be regulated by the same consideration.

In the above ways, the first division of the integuments is to be made in removing tumours of every description, covered with skin. The same principles and practice should prevail in all these operations; and whether the swelling be the mamma, or any other diseased mass, whether situated on the chest, the back, the head, or extremities, the same considerations should always guide the operator's hand.

The incision, or incisions, in the skin having been made, the next object is to detach every side of the tumour from its connexions, and the separation of its base will then be the last and only thing remaining to be done. In dissecting out a diseased breast, the best plan, after having detached it from its lateral connexions, is to begin separating its base at the side towards the axilla, and then carry the dissection downwards and forwards, till the swelling has been perfectly detached from all its subjacent connexions. When the tumour is a scirrhus, or other malignant disease, the operator must not dissect close to the swelling, but make his incisions on each side, at a prudent distance from it, so as to be sure to remove, with the diseased mass, every atom of morbid mischief in its vicinity. But when the tumour is only a mere fatty, or other mass, perfectly free from malignancy, the cellular bands and vessels forming its connexions, may be divided close to its circumference. It is astonishing with what ease fatty tumours are removed, after the necessary division has been made of the skin; they may almost be turned out with the fingers, without any cutting at all. When they have been inflamed, however, they are considerably more adherent to the surrounding parts.

Thus the first stage of the operation of removing a tumour, is the division of the skin; the second, the separation of the swelling from the surrounding parts on every side; the third and last, the division of the parts to which its under surface, or base is attached. The latter object should be accomplished by cutting regularly from above downward and forward, till every part is divided.

It is common to see many operators constantly

embarrassed and confused, whenever they have to remove a large tumour, on account of their having no particular method in their proceedings. They first cut a few fibres on one side; then on another; and, turning the mass of disease now to this side, now to that, without any fixed design, they both prolong the operation very tediously, and present to the bystanders a complete specimen of surgical awkwardness. On the contrary, when the practitioner divides the cutting part of the operation into the three methodical stages, above recommended, in each of which there is a distinct object to be fulfilled, he proceeds with a confidence of knowing what he is about, and soon effects what is to be done, with equal expedition and adroitness.

Having taken out the tumour, the operator is immediately to tie such large vessels as may be pouring out blood; indeed, when the removal of the swelling will necessarily occupy more than three or four minutes, it is sometimes better to tie the largest arteries as soon as they are divided, and then proceed with the dissection. This was Desault's plan, and it is often deserving of imitation, not only because many subjects cannot afford to lose much blood, but also because the profuse effusion of this fluid keeps the operator from seeing what parts he is dividing. For the same reasons Mr. Morgan's plan of compressing the subclavian artery from above the clavicle, during the operation, so as to prevent hemorrhage, is entitled to praise, especially when the tumour is large, the patient already debilitated, and the operation likely to be tedious. However, if the tumour will admit of being promptly taken out, or if only two or three considerable vessels bleed, an assistant may put his fingers over their mouths until the operation is finished: in this way the completion of the dissection is not at all retarded. The other plan, of tying the vessels as the operation is proceeding, is chiefly applicable in cases in which the vessels are large, or the tumour is of considerable size.

The largest arteries being tied, the surgeon should not be immediately solicitous about tying every bleeding point which may be observed. Instead of this, let him employ a little while in examining every part of the surface of the wound, in order to ascertain that no portion of the swelling, no hardened lump, nor diseased fibres remain behind. Even if any part of the surface of the pectoral muscle should present a morbid feel, or appearance, it must, on every account, be cut away. Also, if any of the axillary glands should be diseased, the operator ought now to proceed to remove them. After the time spent in such measures, many of the small vessels, which bled just after the excision of the swelling, will now have stopped, the necessity for several ligatures will be done away, and, of course, the patient saved a great deal of pain, and more of the wound be likely to heal by the first intention.

Some information may be derived, respecting whether any of the tumour is left behind, by examining its surfaces, when taken out, and observing whether any part of them is cut off; for, if it is, it may always be found in the corresponding part of the wound.

The axillary glands may invariably be taken out, without the least risk, if the plan pursued by M. Velpeau, in France, and the late Sir Charles and other surgeons in this country, be

adopted. The method alluded to, is, after dividing the skin covering the gland, and freeing the indurated part from its lateral connexions, to tie its root, or base, by which it is connected with the parts on the side towards the cavity of the axilla. Then the indurated gland itself may be safely cut off, just above the ligature. Were the gland cut off in the first instance, the artery which supplies it with blood would be exceedingly difficult to tie, on account of its deep situation; and by reason of its shortness and vicinity to the heart, it would bleed almost like a wound of the thoracic artery itself. In this way there is also not the least hazard of injuring the axillary vein. M. Velpeau mentions an instance, in which this vessel was wounded by M. Roux, in the removal of some diseased glands; but the bleeding was readily stopped by compression. (See *Nouv. Elem. de Méd. Opér.* t. ii.) It would be a great improvement in the mode of operating for the removal of diseased axillary glands, if surgeons were always to make the patient lie down, with the arm placed in such a position as would let the light fall into the axilla. How much the steps of the operation would be facilitated in this way, I need not attempt to explain.

The above directions will enable a surgeon to remove tumours in general. They apply also in a great measure to *encysted tumours*; but a few additional rules will be found in the article *TUMOURS*. One half of each ligature is always to be cut off before the wound is dressed. The edges of the incision are to be brought together with strips of adhesive plaster; and, before this can be done with ease, the arm must be brought forward, so as to relax the pectoral muscle, and integuments of the breast. Sutures I regard, not only as useless, but painful and irritating. The wound being closed with sticking plaster, and a pledget of simple cerate, a compress of folded linen may be put over the dressings; these are to be secured with a broad piece of linen, which is to encircle the chest, be fastened with pins, or stitches, and kept from slipping down by two tapes, one of which is to go from behind forward, over each shoulder, and be stitched to the upper part of the bandage, both in front and behind. The arm on the same side as that on which the operation has been done, should be kept perfectly motionless in a sling; for every motion of the limb must evidently disturb the wound, by putting the great pectoral muscle into action, or rendering its fibres sometimes tense, sometimes relaxed.

The removal of a diseased breast rarely proves fatal of itself, unless the parts cut away extend to a considerable depth, and occupy a very large space, or the patient is much reduced before the operation. However, I have known one or two patients in St. Bartholomew's Hospital die, without any very apparent cause, very soon after the operation; and Schmucker has recorded an instance, in which the operation was followed by tetanus. (*Wahrnehmungen*, b. ii. p. 80.) I remember one case that terminated fatally from a similar cause, in St. Bartholomew's. Erysipelas sometimes follows the operation, and I lost one patient from this cause, about two years ago, in University College Hospital.

With respect to the average success, following the removal of cancerous diseases, this is a topic noticed in the article *CANCER*. The statement,

made by Boyer, is exceedingly unfavourable; for, in one hundred cases, in which he removed the diseased parts, only four or five of the patients continued radically cured. (*Mal. Chir.* t. vii. p. 237. 8vo. Paris, 1821.)

Pearson's Principles, chap. 3., and on Cancer. *Hey's Practical Obs.* p. 504. *Kirkland's Inquiry into Medical Surgery*, vol. ii. p. 161. *Justamond's Tracts*, 4to. *Callicien, Syntema Chirurgia Hodiernae*, vol. i. p. 332. *Gibbons, De Mulierum Mammis et Morbis quibus obnoxie sunt*, 8vo. Edinb. 1775. *J. Clubbe*, on the Inflammation of the Breasts peculiar to Lying-in Women, &c. 8vo. Ipswich, 1799. *M. Underwood*, on Ulcers, Mammary Abscess, &c. 8vo. Lond. 1783. *J. H. James*, on Inflammation, p. 171. 8vo. Lond. 1821. *Boyer*, *Mal. Chir.* t. vii. p. 211. &c. 8vo. Paris, 1821. *Richter's Ansangsgr. der Wundarzn.* b. iv. c. 16. *Sir Astley Cooper's Illustrations of Diseases of the Breast*, 4to. Lond. 1829. *Dr. Cumms's* interesting paper in *Edinb. Med. and Surgical Journal*, vol. xxvii. art. 1. *A. E. Lloyd*, on Scrofula, 8vo. *John Abernethy*, on Tumours, 8vo. 1804. *H. Earle*, in *Lond. Med. Gazette*, vol. x. 8vo. Lond. 1832.

MAMMARY, or MILK-ABSCESS. See MAMMA.

MAXILLARY BONES, REMOVAL OF. See BONES, EXCISION OF.

MELANOSIS, derived from *μελας*, black, is a term employed to signify substances, occasionally developed in or upon the textures of the animal body, and characterised by their black colour.

Although references to melanosis of the lungs and liver may be traced in the writings of Bonetus, Morgagni, and Haller, the first very careful descriptions of the disease were given by MM. Dupuytren, Bayle, and Laennec. The name of *melanosis*, which was first adopted by Laennec, who published the earliest particular account of the disease (see *Bulletin de la Soc. de l'Ecole de Méd.* 1806. No. 2.), is still generally retained. Professor Carswell uses the term *melanoma*. Our knowledge of the disease has been of late years much extended by the researches of Breschet, Trousseau, Leblanc, Carswell, and some eminent veterinary surgeons in France.

Under the title of *melanoma*, Dr. Carswell includes all melanotic formations, black discolourations, or products, described by Laennec and other authors; but, for the purpose of marking the difference in their nature, he arranges them in two groups; the first being distinguished by the appellation of *true melanosis*; the second by that of *spurious melanosis*. "Thus (says he) when these formations or products depend (as is the case with some of them) on a change taking place in that product of secretion, whence the natural colour of certain parts of the body is derived, or, in other words, when they constitute what is called an idiopathic disease, I shall consider them as belonging to the first group; and when, as in the case with others (they originate in the accumulation of a carbonaceous substance introduced into the body from without, the action of chemical agents on the blood, or the stagnation of this fluid, I shall include them in the second group. There are several black discolourations, which might also have been included in the present systematic arrangement, such as those observed in tissues affected with mortification, that have been subjected to the action of intense heat, or powerful escharotics of various kinds; but as they have never been confounded with any of the forms of melanosis, I shall not take any further notice of them in this place." Dr. Carswell then proceeds to describe,

1. *True melanosis*, of which there is only one kind.—2. *Spurious melanosis*, of which there are

three kinds:—1. From the introduction of carbonaceous matter. 2. From the action of chemical agents on the blood; and 3. From stagnation of the blood. (See *Illustrations of the Elementary Forms of Disease, Fasc. on Melanoma*.) According to Dr. Carswell's definition, *true melanosis* consists in the formation of a morbid, unorganised product of secretion of a deep brown or black colour, and the form and consistence of which present considerable variety, solely in consequence of the influence of external agents.

Melanosis is more frequently observed in the cellular tissue than any other, and perhaps it is in consequence of that tissue entering into all the common structures and organs of the body, that melanosis is sometimes noticed in most of them. Thus, Andral describes examples of melanotic formations in a great number of the elementary tissues, where it may either exist singly, or in union with other organic disease. (See *Précis d'Anat. Pathol.* t. i. p. 459.) Melanotic productions may also be met with simultaneously in various textures and organs. M. Martin Solon relates the case of a woman, in whose right inguinal glands, thighs, and breasts, melanotic tumours had formed. (See *Dict. de Méd. et de Chir. Pratiques*, t. xi.) M. Alibert gives another case, where the skin, different regions of the cellular tissue, the mediastinum, the mesentery, omentum, many lymphatic glands, the thyroid gland, and the lungs, all contained melanotic deposits.

In the cellular tissue, the most frequent seat of true melanosis, the melanotic matter is formed after the manner of secretion, accumulates in the cells of that structure, and gradually acquires the form of tumours of various sizes. A similar mode of formation is still more conspicuous in loose cellular tissue, and particularly on the surfaces of serous membranes, like those of the pleura and peritoneum.

The next variety, noticed by Professor Carswell in the seat and mode of formation of melanotic matter, is that of its deposit in the substance or molecular structure of organs, after the manner of nutrition. Lastly, he adverts to the detection of melanotic matter in the blood, chiefly that contained in the venous capillaries, and under circumstances which prove, that it must have been formed in these vessels. (See *Illustrations of the Elem. Forms of Dis. Fasc. on Melanoma*.)

There are four varieties of true melanosis. (See *Andral Précis d'Anat. Pathol.* t. ii. p. 446.) The following names have been applied to them:—

1. The *punctiform* (*melanose infiltrée*) is that in which the melanotic matter presents itself in minute points or dots in the texture of an organ. It is principally noticed in the lungs and liver.

2. *Tuberiform melanosis* (*concretions mélaniques, melanose en masse*) is the most common variety of it, and is occasionally met with in most of the organs of the body, and sometimes on the surfaces of serous membranes. "In the former situation (says Dr. Carswell) the tumours are generally globular, and in the latter not frequently pyriform. They are most frequently found single in organs, and aggregated in cellular and adipous tissues, and have, perhaps, never been found limited to one organ, the deposition of the melanotic matter taking place simultaneously or successively in a great many organs, or in the cellular tissue of the different regions of the body. The melanotic tumours

are most numerous in the cellular and adipous tissues, and from their aggregation produce lobulated or irregularly shaped masses of great bulk." Melanotic tumours are sometimes bounded by cysts, but more frequently have no cysts (see *Andral, Anat. Pathol.* t. i. p. 451.), but are in immediate contact with the texture in which they are produced. Laennec, indeed, divided melanosis into the encysted, and non-encysted. According to the researches of Dr. Carswell, melanosis is perhaps never found encysted in compound tissues, or organs, as the brain, lungs, liver, and kidneys; whereas it is always so in the cellular and adipous tissues, and sometimes on the surface of serous membranes.

3. *Stratiform melanosis* (mélanose membrani-forme) is represented by Dr. Carswell to be formed only on free surfaces, though M. Blandin states, that it is occasionally produced on the adherent surfaces of serous membranes. As the name leads us to understand, the melanotic matter is deposited in the form of strata, or layers, or of a pseudo-membrane. Its consistence generally resembles that of jelly, and is inclosed either in a soft spongy cellular tissue, or fine transparent serous membrane of new formation, so that, when pressed, it feels pulpy, but is not removed by the finger, or a scalpel passed over it, unless some force is employed.

4. *Liquiform, or Fluid Melanosis*, was not described by Laennec, which, as Andral remarked, is not surprising inasmuch as he regarded melanosis as a tissue or texture. M. Breschet has applied this name to certain liquids of a dark colour, which seemed to him to arise from morbid secretion. In some individuals, M. Andral found in the cavity of the abdomen, after chronic peritonitis, a black fluid which he regards as liquiform melanosis. Dr. Carswell remarks, that "the appearance of true melanosis in a liquid form has in general been confined to natural or accidental serous cavities. Among the former, the cavities of the pleura and peritoneum furnish almost the only examples in which the liquid melanotic matter has been observed, and that too in very small quantity. I have never seen it in man as a product of secretion, but have met with it in consequence of the destruction of melanotic tumours, and the effusion of their contents into serous cavities, the walls of which they had perforated. The accidental serous cavities, in which it has been found, are those which constitute cysts, particularly in the ovaries." MM. Trousseau and Le Blanc met with a fibrous cyst, as large as the fist, situated above the kidneys of a horse, and containing about eight ounces of black liquid.

Breschet, Andral, and Cruveilhier, in describing liquiform melanosis on mucous surfaces, especially that of the stomach, have confounded it with the black discolouration of effused blood, produced by the action of the gastric juice upon it. (*Carswell*.)

The largest melanotic masses are found in the loose cellular tissue behind the peritoneum, and these are always composed of many smaller ones. The largest single tumours are noticed in the liver. In the horse, masses of true melanosis have been found in the former situation, weighing from twenty to forty pounds. (*Id.*) It is further explained by Dr. Carswell, that the consistence of true melanosis is determined by the texture and form of

the part in which it is deposited. "Thus, it is never found solid in serous cavities, for the plain reason, that its diffusion is not limited by dense unyielding tissues. Even in tumours attached to the serous covering of these cavities, it is for the same reason either perfectly fluid, or not more dense than animal jelly. Loose cellular tissue is also occasionally filled with the black matter in a fluid state. In the dense texture of the cutis, on the contrary, even the smallest tumours may be as hard as cartilage, and are generally as firm as the pancreas. In the lymphatic glands, and in the brain, the melanotic tumour acquires only a medium degree of consistence, although it is generally firmer in the former than in the latter, in consequence of the capsule of the glands acting as a compressing cause.

Melanotic tumours are susceptible of a softening process, especially when situated near the surface. The skin becomes thin, ulcerates, and a fishy blackish matter, characterising the disease, is discharged. This is what M. Blandin saw take place in an old woman, who was afterwards admitted into La Salpetriere, and whose case is recorded by M. Breschet. (See *Magendie, Journ. de Physiologie Experim.* t. i. p. 354.)

Melanotic tumours, attacked by ulceration, or the knife, pour out blood as well as a blackish fluid. They may also throw out granulations, suppurate and heal, as was exemplified in the horse operated upon by M. Damoiseau, the particulars of which were published by M. Trousseau. (*Archives*, Juin, 1828, p. 180.) In ordinary cases, melanosis is not productive of much disorder in the economy. In the liver and the cellular tissue it may attain an enormous magnitude without giving rise, during life, to the slightest functional disturbance leading to the suspicion of its existence, provided it does not cause any mechanical oppression. When melanotic tumours exhibit any inflammatory action, or disposition to hemorrhage, it is the cellular tissue in their structure, that is the seat of those changes, just as it is the seat of cancer, which sometimes invades melanotic tumours. (*Blandin*, in *Dict. de Méd. et de Chir.* t. xi. p. 392.)

Dr. Carswell and M. Andral differ from Laennec in believing the melanotic matter to be deposited first in a fluid state, and afterwards to acquire greater consistence from the cellular tissue in which it becomes enveloped. At an indefinite period of its formation, however, Dr. Carswell admits that the solid melanotic tumour loses its consistence, and softens; yet this change does not appear to him nor to M. Andral, as it did to Laennec (*Précis d'Anat. Pathol.* t. i. p. 450.), to be a vital process, originating in the melanotic matter itself, but to depend upon the destruction of tissues, which surround, or are contained in, the melanotic tumour, and upon the simultaneous effusion of serosity. Inflammation rarely accompanies the softening process, and, when ulceration and sloughing occur, they appear to be chiefly owing to the melanotic matter compressing or obliterating the blood-vessels of the tissues in which it is contained. (*Carswell*, *Op. cit.*)

The texture of the melanotic matter is homogeneous, void of smell, opaque, and a fluid exudes from it, which stains the fingers black; and it is not itself organised. In vain (says M. Andral) should we look for any trace of organisation. It is

merely a homogeneous substance, sometimes divided into lobules, or layers, by cellular tissue, which pervades it, without belonging to it. There are neither cavities, areolæ, nor fibres in it: no vessel, no nerve, is distributed in it. No characters exist entitling it to be called a texture.

As Professor Carswell observes, "when a number of melanotic tumours are grouped together, they are included in a common capsule, and separated from one another by their respective coverings and portions of cellular tissue, contained in the angular spaces sometimes left between them. It is in these filamentous and cellular tissues alone, that blood-vessels or nerves are to be seen. Minute arteries and veins may be observed ramifying in both, but they never pass beyond the limits of these tissues. Large branches, and even trunks of arteries and veins are sometimes found passing over the surface, or included in the aggregated masses of melanotic tumours." (See *Carswell's Elem. Forms of Dis. Fasc. on Melanoma.*)

With respect to the chemical composition of melanosis, M. Thenard detected carbon in it; M. Clapion, albumen and a peculiar black colouring matter; and M. Barruel ascertained, that this last is analogous to the colouring matter of the blood. He also made out the presence of a particular modification of fibrine in it, and the existence of phosphate of iron in it; elementary ingredients also in the blood. M. Foy made a comparative analysis of medullary or encephaloid, scirrhus, and melanotic formations, and he detected in these different substances albumen, fibrine, and salts, the basis of which were soda, potassa, lime, and oxide of iron, in rather less proportion in the two first formations than in melanosis; and in this latter a highly carbonised principle, composing nearly one third of it. These various researches thus all tend to prove a close analogy between the elements of melanosis and those of the blood.

Melanosis is not restricted to man. It is more frequently noticed in white and grey horses than in those of any other colour; MM. Rodet and Breschet have met with it also in horses of a light bay colour; and dogs, cats, rabbits, mice, and rats, are all subject to it. In horses, melanotic swellings form especially under the tail, and thence extend to a greater or lesser distance within the pelvis. They may often be removed from this situation with success.

Though melanosis may occur at any period of life, and even in the foetus, as a melanotic formation on the cerebellum exemplified in a preparation in University College Museum would tend to prove, yet it is more common in adults and aged persons than very young individuals.

Melanosis was regarded by Laennec as a species of cancer. (*Auscult.* t. ii. p. 33.); but in its appearance and progress, it is very different from the latter. The white resplendent hue and the lardaceous texture of scirrhus, which yields a grating noise as the knife passes through it, present no resemblance to melanosis. The lancinating pains of cancer; the characters of the encephaloid tumour; the tendency of these formations to be reproduced after having been extirpated; the hectic fever and other derangements of the health to which they give rise; are circumstances sufficiently marking the differences between melanosis and cancer. The only examples likely to have occasioned such mistake, are those in which melanosis

and cancer are united together. The same remark applies to tubercular disease. The *carcine melanée* of Alibert, and the *cancer anthracine* of Jurine, seem to have differed from simple melanosis in their tendency to be reproduced in other parts after extirpation, and in their disposition to soften and be accompanied by ulceration, and all the evils peculiar to cancerous diseases. At all events, then, it would seem as if there are modifications of melanosis, which are of malignant character, whether we adopt the doctrine or not, that they are combinations of cancer and melanosis together.

The fact of melanosis taking place chiefly in white, grey, or light bay horses, is a curious one, seeming to prove that the black matter of this accidental production is deposited in internal organs, as it were, in consequence of such colouring matter not being secreted by the skin. Perhaps, however, as M. Andral observes, there has been too much disposition to generalise on this point; for M. Rodet has published instances of melanosis in horses of all colours. (See *Anat. Pathol.* t. i. p. 475; and *Rodet, in Journ. de Méd. Vétérinaire*, par M. Dupuy, t. ii. p. 273.)

Simple melanosis is not of itself dangerous: it causes no particular disturbance of the health, unless from its size it happen to press upon organs and produce functional disturbance. It may also be combined with cancer, or it may be attended with inflammation and ulceration of the textures, directly connected with it. By its pressure on important vessels, it may also give rise to dropsy.

Surgery possesses no means of dispersing a melanotic tumour, the only plan of cure being that of removing the new production with a knife. The practicableness and propriety of this will depend upon the situation and extent of the disease, and the inconveniences experienced from it.

See *Laennec*, *Bulletins de la Soc. de Ecole de Méd.* 1806. No. 2. et *Traité de l'Auscultation*, t. i. (*Gibbert Breschet*, sur une Altération Organique, appelée *Dégénérescence Noir*, *Melanose*, &c. 8vo. Paris, 1821. *Cullen* and *Carswell*, in *Edinb. Med. Chir. Trans.* vol. i. 8vo. 1821. *M. M. Trousseau*, et *Le Blanc*, *Archives de Méd.* Juin, 1828. *London Med. Repository*, 1823. *M. Chomel*, *Nouv. Journ. de Méd.* t. iii. *M. Andral*, *Précis d'Anat. Pathol.* t. i. p. 446. 8vo. Paris, 1829. *Robert Carswell*, *Illustrations of the Elementary Forms of Disease; Fasc. on Melanoma*. *David Williams*, in *Trans. of Med. and Surg. Assoc.* vol. i. p. 244. 8vo. 1836.

MELICERIS (from *μελι*, honey, and *κηρος*, wax.) A tumour of the encysted kind, filled with a substance resembling wax or honey, in consistency. (See *TUMOURS, ENCYSTED.*)

MENINGOPHYLAX. (from *μηνιγξ*, a membrane, and *φυλασσω*, to guard.) An instrument, used by the ancients for guarding the dura mater and brain from injury, in their mode of trepanning.

MERCURY. (*Quicksilver*, *Mercurius*, *Hydrargyrum*.) The medicinal virtues of this mineral were almost totally unknown to the ancients, who considered it as a poison. It was first employed for purposes of medicine by the Arabians, who made use of it in the form of ointments for the cure of certain diseases of the skin. From the writings of Theophrastus, it appears, that mercury was employed in the practice of medicine and surgery as early as the thirteenth century. But, its use in venereal cases was first mentioned in a tract by Almenar, published in 1516. (See *Thomson's Dispensatory*, p. 205. ed. 2.) In modern times, it is one of the most important articles of the materia medica; and perhaps, though recent investigations will not strictly allow it to be regarded as a specific

for the venereal disease, which may be cured by other means, or sometimes even spontaneously, while mercury, so far from being always a certain cure, is sometimes highly detrimental, yet notwithstanding these facts, mercury still retains the character of being generally the most expeditious and permanent means of relief. The possibility of curing the venereal disease without mercury, by no means establishes the propriety of abandoning this remedy, any more than its unfitness for certain states of the same disease ought to be a reason for not availing ourselves of its superior utility in others.

Mercury, taken into the stomach in its metallic state, has no action on the body, except what arises from its weight or bulk. It is not poisonous, as was vulgarly supposed, but perfectly inert. But, in its various states of combination with sulphur, iodine, chlorine, cyanogen, oxygen, and acids, it produces potent effects on the human frame. It is a powerful and general stimulant, quickening the circulation, and increasing all the secretions and excretions. According to circumstances, the habit of the patient, the temperature in which he is kept, the nature of the preparation, and the quantity in which it is exhibited, its effects are, indeed, various. Sometimes it more particularly increases one secretion; sometimes another; but its most characteristic effect is the increased flow of saliva, which it generally excites, if given in sufficient quantity.

It has been said, that the efficacy of mercury in curing the venereal disease was an accidental discovery; but it seems more probable, that the good effects which it produced in cutaneous diseases, first led to the trial of it in venereal cases, which, being frequently attended with eruptions, ulcers, &c., seemed to present an analogy to the affections, in which mercury had already been found successful.

In the times, immediately following the supposed origin of the venereal disease, practitioners only ventured to employ this remedy with timorous caution, so that, of several of their formulæ, mercury scarcely composed a fourteenth part; and either on this account, or some difference in the disease itself at that period from what is now remarked, few cures were effected. On the other hand, the empirics, who noticed the little efficacy of these small doses, ran into the opposite extreme, and exhibited mercury in quantities so large, and with so little care, that most of their patients were suddenly attacked with violent salivations, frequently attended with very dangerous, and even fatal symptoms; or such as after making them lose their teeth, left them pale, emaciated, exhausted, and subject, for the rest of their lives, to tremblings, or other more or less dangerous affections. From these two very opposite modes of practice, there originated such uncertainty, respecting what could be expected from mercury, and such fears of the consequences, which might result from its employment, that every plan was eagerly adopted, which offered the least chance of cure, without having recourse to this mineral.

A medicine, however, so powerful, and whose salutary effects had been watched by attentive practitioners amidst all its inconveniences, could not sink into oblivion. After efforts had been made in vain to discover an equally efficacious substitute for it, a medium was pursued between the timid methods of those practitioners who had first ad-

ministered it, and the inconsiderate boldness of empirics. Thus the causes, from which both parties failed, were avoided; the character of the medicine was revived in a more durable way, and from this period, its reputation has always been maintained.

The renowned Paracelsus first taught practitioners, that mercury might be given internally, with safety; for, before he set the example, it had only been employed in the form of an ointment or liniment; a plaster; or fumigation.

Of these three methods only the first is at present in common use, and even this is considerably modified. It was found, not only, that mercurial plasters caused heat, redness, itching, and disagreeable eruptions, but that they were exceedingly slow and uncertain. Hence, plasters are now only used as topical discutient applications.

Fumigations, considered as the only means of cure, fell also into discredit, because, although they formed a method of applying mercury in an active manner, they were, as anciently managed, liable to several objections. In this way, it was next to impossible to regulate the quantity of mercury used, which varied according to the greater or lesser activity of the fire, the position of the patient, and other circumstances. The effect of the vapour on the organs of respiration also frequently proved oppressive; and mercury, applied in the way of fumigation, more frequently occasioned tremblings, palsies, &c., than in any other manner.

Frictions with ointment have usually been regarded as the most efficacious. They have undergone considerable change, and by being rendered more simple, have been greatly perfected. All warm aromatic substances have been retrenched from the ointment, not only as useless, but as irritating and inflaming to the skin. In modern times, the proportion of mercury to the fat has also been very much increased.

GENERAL REMARKS ON THE ADMINISTRATION OF MERCURY, ITS OCCASIONAL CONSEQUENCES, ETC.

With regard to the preparations of the medicine, and the modes of applying it, we are to consider two things; first, the preparation and mode attended with the least trouble, or inconvenience, to the patient; and secondly, the preparation, and mode of administering it, calculated most readily to convey the necessary quantity into the constitution. Mercury is carried into the constitution in the same way as other substances, either by being absorbed from the surface of the body, or that of the alimentary canal. It cannot, however, in all cases, be taken into the constitution in both ways; for, sometimes the absorbents of the skin will not readily receive it, at least no effect is produced, either on the disease, or constitution, from this mode of application. In this circumstance, mercury must be given by the mouth, although the plan may be very improper in other respects, and often inconvenient. On the other hand, the internal absorbents sometimes will not take up the medicine, or, at least, no effect is produced on the disease, or the constitution.

In such cases, different preparations of the medicine should be tried; for sometimes one succeeds, when another will not. In some cases, mercury seems to have no effect, either applied outwardly, or taken into the stomach. Many surfaces seem to absorb mercury better than others: such are

probably all internal surfaces and sores. Thirty grains of calomel, rubbed into the skin, have not more effect, than three, or four, taken by the mouth. Dressing small ulcers with red precipitate sometimes causes a salivation. (See *Hunter on the Venereal Disease*, p. 335, 336.)

Besides the practicableness of getting the medicine into the constitution in either way, it is proper to consider the easiest for the patient, each mode having its convenience and inconvenience, depending on the nature of the parts, to which it is applied, or on certain situations of life at the time. Hence, it should be given in the way most suitable to such circumstances.

In many, the bowels can hardly bear mercury at all, and it should then be given in the mildest form possible, conjoined with such medicines, as will lessen, or correct its violent local effects, although not its specific ones on the constitution.

When mercury can be thrown into the constitution with propriety by the external method, Mr. Hunter deemed it preferable to the internal plan, because the skin is not nearly so essential to life as the stomach, and, therefore, is capable in itself of bearing much more than the stomach. The constitution seemed to him also to be thus less injured. Many courses of mercury (he thought) would kill the patient, if the medicine were only given internally, because it proves hurtful to the stomach and intestines, when given in any form, or joined with the greatest correctors. Every one, however, has not opportunities of rubbing in mercury, and is therefore obliged, if possible, to take it by the mouth. (*Hunter*, p. 338.)

Notwithstanding these doctrines rest upon such high authority, they can scarcely be said now to maintain their ground: for, mercurial frictions are much less commonly employed for the cure of syphilis, than the blue pill, and other preparations for internal exhibition. The uncleanness of frictions, however, and not their inefficacy, is the reason of their being relinquished by many modern surgeons, as the ordinary method of treatment.

Mercury has two effects: one as a stimulus on the constitution and particular parts; the other as a specific against a diseased action of the whole body, or of parts. The latter action can only be computed by the disease disappearing.

When mercury is given in venereal cases, the first attention should be to the quantity, and its visible effects in a given time, which, when brought to a proper pitch, are only to be kept up, and the decline of the disease to be watched; for by this we judge of the invisible, or specific effects of the medicine, and know what variation in the quantity may be necessary. The visible effects of mercury affect, either the whole constitution, or some parts capable of secretion. In the first, it produces universal irritability, making it more susceptible of all impressions. It quickens the pulse, increases its hardness, and occasions a kind of temporary fever. In some constitutions, it operates like a poison; while, in others, it produces a kind of hectic fever, that is, a small quick pulse, loss of appetite, restlessness, want of sleep, and a sallow complexion, with a number of consequent symptoms; but, such effects commonly diminish, on the patient becoming a little accustomed to the medicine. Mercury often produces pains like those of rheumatism, and nodes of a scrofulous nature. (*Hunter*, p. 339, 340.)

The quantity of mercury to be thrown into the constitution, for the cure of any venereal complaint, used to be proportioned to the violence of the disease. However, surgeons were guided by two circumstances, namely, the time, in which any given quantity was to be thrown in, and the effects it had on some parts of the body, as the salivary glands, skin, or intestines. For, mercury may be thrown into the same constitution in very different quantities, so as to produce the same ultimate effect; but, the two very different quantities must also be in different times; for instance, one ounce of mercurial ointment, used in two days, will have more effect upon the constitution, than two ounces used in ten. The effects of one ounce, used in two days, on the constitution and diseased parts, are considerable. A small quantity, used quickly, will have equal effects, to those of a large one employed slowly; but, if these effects are principally local, that is, upon the glands of the mouth, the constitution at large not being equally stimulated, the effect upon the diseased parts must be less, which may be known by the local disease not giving way in proportion to the effects of mercury on some particular part. If it is given in very small quantities, and increased gradually, so as to steal insensibly on the constitution, a vast quantity at a time may at length be used, without any visible effect at all. (*Hunter*, p. 341.)

These circumstances being known, mercury becomes a much more efficacious, manageable, and safe medicine, than it was formerly thought to be; but, unluckily, its visible effects upon the mouth and the intestines are sometimes much more violent, than its general effect upon the constitution at large. These parts must therefore not be stimulated so quickly, as to hinder the necessary quantity of mercury from being used.

The constitution, or parts, are more susceptible of mercury at first, than afterwards. If the mouth is made sore, and allowed to recover, a much greater quantity may be thrown in, a second time, before the same soreness is produced. However, anomalous cases occur, in which, from unknown causes, mercury cannot at one time be made to produce any visible effects; but, afterwards, the mouth and intestines are all at once affected. (*Hunter*, p. 342.)

Mercury occasionally attacks the bowels, and causes violent purging, and even discharge of blood. This effect is remedied by discontinuing the use of the medicine, and exhibiting opium. At other times, it is suddenly determined to the mouth, and produces inflammation, ulceration, and an excessive flow of saliva. To obtain relief in this circumstance, purgatives, nitre, sulphur, gun-arabic, lime-water, camphor, bark, the sulphuret of potass, blisters, &c. have been advised. Mr. Pearson, however, does not seem to place much confidence in the efficacy of such means, and besides the discontinuance of the mercury, he recommends the patient to be freely exposed to a dry cold air, with the occasional use of cathartics, peruvian bark, and mineral acids, and the assiduous application of astringent gargles. "The most material objection (says Mr. Pearson) which I foresee against the method of treatment I have recommended, is the hazard, to which the patient will be exposed, of having the saliva suddenly checked, and of suffering some other disease in consequence of it.

"That the hasty suppression of a ptyalism may

be followed by serious inconveniences, has been proved by Dr. Silvester (*Med. Obs. and Inq.* vol. iii.), who published the cases of three persons, who had been under his own care; two of whom were afflicted with violent pains; and the third scarcely retained any food in her stomach for the space of three months. I have seen not only pains, but even general convulsions, produced from the same cause. But, this singular kind of metastasis of the mercurial irritation does not appear to me to owe its appearance to simple exposure to cold and dry air; because I have known it occur in different forms, where patients continued to breathe a warm atmosphere, but used a bath, the water of which was not sufficiently heated. Cold liquids taken in a large quantity into the stomach, or exposure of the body to cold and moisture, will also prove extremely injurious to those who are fully under the influence of mercury; whereas breathing a cool air, while the body is properly covered with apparel, has certainly no tendency to produce any distressing or dangerous consequences.

"It however, a suppression of the pythiam should be occasioned by any act of indiscretion, the remedy is easy and certain; it consists only in the quick introduction of mercury into the body so as to produce a soreness of the gums, with the occasional use of a hot bath." (*Pearson on the Effect of various Articles in the Cure of Lues Venerea*, edit. 2. p. 163, 164.)

Mercury, when it affects the mouth, produces, in many constitutions, violent inflammation, which sometimes terminates in mortification. In these habits, great caution is necessary. The ordinary operation of mercury does not permanently injure the constitution; but occasionally the impairment is very material; mercury may even produce local disease, and retard the cure of chancres, buboes, and certain effects of the lues venerea, after the poison has been destroyed. (*Hunter*, p. 342.)

From mercury occasionally acting on the system, as a poison, quite unconnected with its agency as a remedy, and neither proportionate to the inflammation of the mouth, nor the actual quantity of the mineral absorbed, Mr. Pearson noticed that one or two patients in general died suddenly every year in the Lock Hospital. The morbid state of the system, which tends to the fatal event, during a mercurial course, is named by Mr. Pearson, *erethismus*, and is characterized by great depression of strength, a sense of anxiety about the præcordia, irregular action of the heart, frequent sighing, trembling, a small, quick, and sometimes an intermitting pulse, occasional vomiting, a pale contracted countenance, a sense of coldness; but the tongue is seldom furred, and neither the vital, nor natural functions, are much disordered; a statement, however, according to my notions, not very consistent with the alleged irregular action of the heart. They, who die suddenly of the mercurial erethismus, have frequently been making some little exertion just before. To prevent the dangerous consequences of this state of the system, the use of mercury must be discontinued, whatever may be the stage, extent, or violence of the venereal symptoms. The patient should be directed to expose himself freely to a dry and cool air, in such a manner, as shall be attended with the least fatigue, and he should have a generous diet. In this manner patients often recover sufficiently in

ten or fourteen days, to resume the use of mercury with safety. In the early stage, the mercurial erethismus may often be averted by leaving off the mercury, and giving the *mistura camphorata* with large doses of ammonia. When the stomach is unaffected, *sarsaparilla* sometimes does good. (*Pearson*, p. 154. &c.)

Occasionally, the use of mercury brings on a peculiar eruption, which has received the several names of *hydrargyria*, *mercurial rash*, *eczema mercuriale*, *eczema rubrum*, *lepra mercurialis*, *mercurial disease*, and *erythema mercuriale*.

"Eruptions of various kinds are very common symptoms of syphilis, but a very unusual effect of mercury. Therefore, until the real nature of this erythema was lately discovered, whenever it occurred in patients undergoing a mercurial course for syphilitic complaints, it was naturally enough considered, as an anomalous form of lues venerea. The mercury was consequently pushed to a greater extent in proportion to the violence of the symptoms, and from the cause of the disease being thus unconsciously applied for its removal, it could not fail to be aggravated, and hurried on to a fatal termination. The observation of this fact, conjoined with another, of less frequent occurrence, namely, that a similar eruption did sometimes appear in patients using mercury for other complaints, and in whom no suspicion of syphilis could be entertained, at last led some judicious practitioners in Dublin to the important discovery, that the eruption was entirely an effect of mercury, and not at all connected with the original disease. This discovery was not published till 1804." (*McMullin*, in *Edinb. Med. and Surgical Journ.* No. 5.) Mr. Pearson states, however, that he had been acquainted with the disease ever since 1781, and had always described its history and treatment in his lectures since 1783.

The eruption is attended with more or less indisposition, is not confined to either sex, or any particular constitution, and seems to be equally produced by mercury applied externally, and by any of its preparations taken inwardly. Mr. Pearson has never seen it in subjects above 50; and he says its occurrence is more common about eight or ten days after the beginning of a mercurial course. (*P.* 166.)

Dr. McMullin has described three distinct stages of the erythema mercuriale. "The first stage commences with languor, lassitude, and cold shiverings; these symptoms are succeeded by increased temperature of the body, quick pulse, nausea, head-ach, and thirst. The patient is troubled with a dry cough, and complaints of difficult respiration, anxiety, and sense of stricture about the præcordia. The tongue is usually moist, and covered with a white glutinous slime: it sometimes appears clean, and brightly red in the centre, whilst the margins remain foul. The skin feels unusually hot and itchy, with a sense of prickling, not unlike the sensation experienced from the application of nettles. The belly is generally costive; but a diarrhoea is often produced by very slight causes.

"On the first or second day, an eruption most commonly shews itself, the colour of which is either dark or bright red; the papulæ are at first distinct and elevated, resembling very much those in *rubeola*. Sometimes, but rarely, the eruption appears like *urticaria*, and in such instances the disease is ob-

served to be very mild. The papulæ very speedily run together in such a manner as to form a suffused redness, which disappears on pressure. In most cases, it begins first on the scrotum, inside of the thighs, forearm, or where mercurial friction has been applied, and the integuments of the parts affected become much swollen. There have also been observed instances, where an eruption of a purplish colour, and unaccompanied by papulæ, has diffused itself suddenly over the entire body. This, however, may be considered as uncommon. In every instance, which came under my observation, it was confined at first to a few places, and from thence gradually extended, until the different portions of the eruption had united, and the papulæ were also rough. But in those cases, which resemble urticaria, a number of minute vesicles, which contain a serous fluid, appear, from the commencement, interspersed among the papulæ. Contrary to what happens in most diseases accompanied with cutaneous affections, the febrile symptoms are much aggravated, and continue to increase after the eruption has been completed. The pulse in general beats from 120 to 130 in a minute, the thirst continues urgent, and the patient, extremely restless, seldom enjoys quiet sleep. When the eruption has continued in this manner for a certain period, the cuticle begins to peel off in thin, whitish, scurfy exfoliations, not unlike those observed in *rubeola*. This desquamation has not been attended to by Dr. Moriarty or Mr. Alley, if they have not by giving the same name to the decrustation which occurs in the last stage, confounded both together. It commences in those places where the eruption first made its appearance, and in this order spreads to other parts. About this period the fauces become sore, the tongue swells, and the eyes appear somewhat inflamed.

"The duration of this stage is very various; sometimes it continues from ten to fourteen days, and, in other cases, it terminates in half that time. When the disease has appeared in its mildest form, the patient recovers immediately after the desquamation, a new cuticle having formed underneath; but, if severe, he has only experienced the smallest part of his sufferings, and the skin now assumes a new appearance, which I have considered as the second stage.

"The skin at this period appears as if studded with innumerable minute vesicles, which are filled with a pellucid fluid. These vesicles may be expected, if the patient, at the close of the first stage, complains of increased itching, and sense of burning heat, in those parts from which the cuticular exfoliations have fallen. They remain sometimes for a day or two, but are most commonly burst, immediately after their formation, by the patient rubbing them, in order to relieve the troublesome itchiness with which these parts are affected. They discharge a serous, acrimonious fluid, which possesses such a very disagreeable odour as to induce nausea in the patient himself, and those who approach near his bed-side. The odour is so peculiar, that it can easily be recognized by any person who has once experienced it.

"This fluid is poured out most copiously from the scrotum, groin, inside of the thighs, or wherever the skin forms folds, and the sebaceous glands are most numerous. The serous discharge from these minute vesicles forms, with the cuticle, an

incrustation, which may be considered as the third or last state.

"These crusts are generally very large, and, when detached, retain the figure of the parts from which they have fallen. Their colour is yellowish; but sometimes appears dark and dirty. This period of the disease might be termed, I think, with much propriety, the stage of *decrustation*, in order to distinguish it more fully from the *desquamation*, which has been already noticed. From the use of the two last terms indiscriminately, those who have described the disease have introduced into their descriptions a degree of confusion which has caused its progress not to be well understood. When this stage appears, the fauces become more affected, the eyes intolerant of light, and the tarsi tender, inflamed, and sometimes inverted. The crusts formed on the face, as in other parts of the body, before falling off, divide asunder, so as to leave cracks and fissures, which produce a hideous expression of countenance; and the eyelids are also, from the general swelling of the face, completely closed. The back and hairy scalp are last affected, and even in very severe cases, these parts are sometimes observed to escape entirely. The patient, whilst in this state, is compelled to desist from every kind of motion, on account of the pain which he experiences on the slightest exertion, and which he describes as if his flesh were cracking. The crusts also fall off in such abundance, that the bed appears as if strewed with the cones of hops. Whilst the eruption is only making its appearance in one place, another part may have arrived at its most advanced form; so that all the different stages of the disease may be present at one time in the same individual. It is attended with typhus through its entire course; but it is very curious to observe that the appetite for food in most cases remains unimpaired, and sometimes is even voracious. This circumstance was particularly remarkable in a patient who laboured under the disease, in its worst form, for the space of three months, in the Royal Infirmary of Edinburgh; for double the usual hospital allowance of food was scarcely sufficient to satisfy his hunger. When the catarrhal symptoms have continued during the progress of the complaint, they are at this advanced period particularly aggravated: the anxiety and pain of the breast are also very severe, attended with cough, and bloody expectoration, and the patient always feels languid and dejected. The pulse becomes frequent, feeble, and irregular, the tongue black and parched, and, at length diarrhœa, delirium, convulsions, gangrene of the surface of the body, and death, supervene. In its mild form, it only goes through the first stage, and terminates, as we have already stated, in a few days, by a slight desquamation. But when severe, it is often protracted more than two months, every stage of the eruption continuing proportionably longer; and when, in this manner it has run its course, it repeatedly breaks out on the new surface, and passes through the same stages." (*M'Mullin, in Edinb. Med. and Surg. Journal, No. 5.*)

The remote cause is the employment of mercury. Dr. M'Mullin is inclined to believe with Dr. Gregory, that the application of cold to the body, while under the action of mercury, is absolutely necessary for its production; an opinion strengthened by the constant prevalence of catarrhal symptoms. However, Mr. Pearson thinks,

MERCURY.

that cold has no concern in bringing on the complaint in patients under the influence of mercury. At the same time it merits particular attention, that the disease is not exclusively occasioned by mercury, either in its general, or more partial attacks; it has been observed to follow exposure to cold, and to recur in the same individual, at irregular intervals, without any obvious or adequate cause. (*Bateman's Synopsis*, p. 256. ed. 3.; *Rutter*, in *Edin. Med. and Surg. Journ.* vol. v. p. 143.; *Marcet*, in *Med. Chir. Trans.* vol. ii. art. 9.)

In the early stage, Mr. Pearson recommends small doses of antimonial powder, with saline draughts, or the acetate of ammonia. A gentle purgative should be given every three or four days, and opium to procure sleep. The latter medicine sometimes does most good, when joined with camphor, or Hoffman's anodyne liquor. Sarsaparilla and bark may be given when the discharge is no longer ichorous, and the tumefaction has subsided. Diluted sulphuric acid has seemed to give relief. The diet may be light and nutritive, without fermented liquors, however, till the desquamation has somewhat advanced. Frequent use of the warm bath, and often changing the patient's linen and sheets, which soon become stiff and rough with the discharge, afford much benefit. If the warm bath cannot be had, Mr. Pearson advises washing the body very tenderly with warm water gruel; he also covers parts, from which the cuticle is detached, with a mild cerate, and renews the application twice a day. (P. 178.)

Dr. M'Mullin advises the immediate discontinuance of mercury; the removal of the patient from wards, where this mineral is in use; emetics and diaphoretics; but on account of the very irritable state of the bowels, he says antimonials are hardly admissible, and that when purgatives are indicated, only the mildest ones, such as olivine, sulphate of magnesia, &c. ought to be given. He advises mucilaginous draughts with opium for relieving the soreness of the fauces. In the second stage, the cold infusion of bark with aromatics and opium, or, what is more praised, wine, porter, &c. To relieve the ophthalmia tarsi, the unguentum oxidii zinci, and to appease the painful sensation of the skin cracking, the linimentum calcis, which should be liberally applied as soon as crusts appear.

Consult Essay on a Peculiar Eruptive Disease, arising from the Exhibition of Mercury, by *G. Alley*, M.D. Dublin, 1804: also Obs. on the Hydrargyria, or that Vesicular Disease arising from the Exhibition of Mercury, 4to. Lond. 1810. A Description of the Mercurial Lepa, by *Dr. Moriarty*, 12mo. Dublin, 1804. *Spens* and *M'Mullin*, in *Edinburgh Med. and Surgical Journal*, Nos. 1. and 5. *Pearson* on *Lues Venerea*, ed. 2. *Bateman's Synopsis*, p. 256, &c. ed. 3.

Frictions with Mercurial Ointment.

No metal acts in its pure metallic state: it must first be more or less combined with oxygen, sulphur, iodine, chlorine, cyanogen or acids. The mercury, contained in the unguentum hydrargyri, becomes in a certain degree oxydated, or converted into the protoxide, when triturated for the purpose of blending it with the fat. The metal, however, in mercurial ointment is in the most simple, and least combined form of all its preparations, and hence, it is often suspected not only generally to operate with more mildness on the system, but with more specific effect on the disease. Various salts of mercury, when given internally, operate

more quickly than mercurial frictions; yet the old practitioners, erroneously, I believe, did not confide in them for curing the venereal disease, particularly when the virus had produced effects in consequence of absorption. Rubbing in mercurial ointment is the mode of affecting the system with mercury, which has been generally considered to agree best with most constitutions, and to act with most certainty on the venereal disease. The plan, however, on account of its uncleanness, is now frequently abandoned for other methods.

Mercurial Fumigations.

I have mentioned this method, as being one of the most ancient plans of affecting the constitution with mercury, and Lalouette and Abernethy stated circumstances in its favour, which seemed to them to make it occasionally an eligible mode. The latter was of opinion, that if the peculiar advantages of mercurial fumigations were generally known to practitioners, they would be much more frequently employed. The advantages of the method consist in its affecting the constitution, when other means fail, and in producing its effects in a much shorter time, than any other mode. This celerity of operation when venereal ulceration was making great ravages in the palate and throat, was particularly insisted upon, as a most desirable circumstance. For patients who had not strength to rub in ointment, and whose bowels would not bear the internal exhibition of mercury, fumigation was also deemed highly advantageous.

"In the year 1776, the Chevalier Lalouette, a physician at Paris, laid before the public an account of a new mode of mercurial fumigation, free from the inconveniences of former ones, and which, in the space of thirty-five years, he had successfully employed in more than four hundred cases that had resisted all the ordinary methods of cure. His method consisted in inclosing the patient, previously undressed, in a kind of box resembling a sedan-chair, with an opening at the top to let out the head, and another at the bottom, to which was fitted a small grate or furnace, having in it a heated iron for converting the mercurial remedy into fume. The preparation he made use of was a kind of calomel, which by repeated sublimation from iron filings, was so far deprived of its muriatic acid, as to be in part reduced into running quicksilver; and, while it possessed considerable volatility, was perfectly unirritating. Some of this powder, being strewed upon the hot iron placed below, was immediately converted into smoke, which surrounded the patient's body, and after some time settled on his skin in the form of a white and very fine calx of quicksilver: a complete dress, having its inner surface fumigated with the same powder, was then put on.—The remedy being thus generally applied to the mouths of the cutaneous absorbents, soon got admission into the circulating fluids, and the constitution became thereby more speedily affected, than by any other process known before." (*Abernethy's Surgical and Physiological Essays*, part iii.)

As the fumigating powder used by M. Lalouette was very operose, and consequently an expensive preparation, and appeared to have no advantage over one made by abstracting the muriatic acid from calomel by means of ammonia, Abernethy employed the latter, which was prepared in the following manner: Two drachms of liquor am-

mopie are added to six ounces of distilled water, and four ounces of calomel are thrown into this liquor, and shaken up with it; the powder is afterwards separated by a filter, and dried.

The powder thus obtained is of a grey colour, and contains a good deal of quicksilver in its metallic state, which of course is extremely volatile, but becomes oxydated when raised into fume, and afterwards condensed into a white subtle powder.

In local disease of the joints, such, for instance, as a thickened state of the synovial membrane, and in sarcomatous enlargements of the breast in women, the late Mr. Sharp and Sir C. Blinck were accustomed to direct fumigated stockings, or under-waistcoats, to be worn; by which these complaints were relieved, and the constitutions of the patients affected, without the trouble and unpleasantness arising from the use of the common mercurial ointment. (See *Abernethy's Surgical and Physiological Essays*, part iii.)

Mr. Pearson procured Lalouette's machine, and made a considerable number of experiments to determine the comparative advantages of this method, and mercurial frictions. He found that the gums became turgid and tender very quickly, and that the local appearances were sooner removed, than by the other modes of introducing mercury into the system; but that it soon brought on debility, a rapid and premature salivation, and of course, that the medicine could not be steadily continued. This gentleman concludes, that when checking the progress of the disease suddenly is an object of great moment, when the body is covered with venereal ulcers, or when the eruptions are large and numerous, so that there scarcely remains a surface large enough to absorb the ointment, the vapour of mercury will be advantageous. But he thinks it extremely difficult thus to introduce a sufficient quantity of mercury into the system to secure the patient from a relapse, and therefore the plan by no means eligible as a general practice. The vapour of mercury, he says, is singularly efficacious, when applied to venereal ulcers, fungi, and excrescences; but this plan requires an equal quantity of mercury to be given in other ways, as if the local application itself were not a mercurial one. (*Pearson on Lues Venerea*, p. 145. &c.) This last observation is not likely to be correct. The cure by fumigation is now rarely adopted, because it requires an apparatus—is on the whole a troublesome process, not admitting of secrecy; and, in truth, not called for by the reasons alleged in its favour; since, if a person be so reduced as to be incapable of using mercury in any other form, we may safely conclude, that he is not in a state to be benefited by it in any way. If mere quickness of mercurial action be desired, the exhibition of calomel, joined with opium, will produce it.

For the purpose of fumigating sores, either the grey oxide, or the bisulphuret, is commonly used. Ulcers and excrescences about the pudendum and anus in women are benefited in this way; and, in these cases, the fumes are most conveniently applied by placing a red-hot heater at the bottom of a night-stool pan, and after sprinkling on it a few grains of the red sulphuret of quicksilver, placing the patient on the stool. On other occasions, a small apparatus, sold at the shops, is used, which enables the surgeon to direct the fumes through a funnel against the ulcer in any situation.

PREPARATIONS FOR INTERNAL EXHIBITION.

At present, the hydrargyrum cum creta is only prescribed for the cure of the venereal disease, in children, or where a weak mercurial influence is all that is desired, and the patient cannot bear more active preparations. It is frequently prescribed as a mild alterative, in doses of from gr. v. to gr. x. twice a day, blended with any viscid substance.

The oxymuriate of mercury, now termed the bichloride (corrosive sublimate), was a medicine highly praised for its antiaphilic virtues by Van Swieten; and, indeed, there is no doubt that, like other preparations of mercury, it possesses such qualities. It still retains great reputation, and, probably, will always do so. However, it often deranges the stomach and bowels. Some surgeons are also reluctant to give it the same degree of confidence, in respect to its power over syphilis, as they give to mercurial frictions. Mr. Pearson remarks, that "when the sublimate is given to cure the primary symptoms of syphilis, it will sometimes succeed; more especially when it produces a considerable degree of soreness of the gums, and the common specific effect of mercury in the animal system. But it will often fail in removing even a recent chancre; and where the symptom has vanished during the administration of corrosive sublimate, I have known a three months' course of that medicine fail to secure the patient from a constitutional affection. The result of my observations is, that simple mercury, calomel, or calcined mercury, are preparations more to be confided in, for the cure of primary symptoms, than corrosive sublimate. The latter will often check the progress of secondary symptoms very conveniently, and I think it is peculiarly efficacious in relieving venereal pains, in healing ulcers of the throat, and in promoting the desquamation of eruptions. Yet, even in these cases, it never confers permanent benefit; for, new symptoms will appear during the use of it; and, on many occasions, it will fail of affording the least advantage to the patient, from first to last. I do sometimes, indeed, employ this preparation in venereal cases; but it is either at the beginning of a mercurial course, to bring the constitution under the influence of mercury at an early period, or during a course of inunction, with the intention of increasing the action of simple mercury. I sometimes, also, prescribe it after the conclusion of a course of frictions, to support the mercurial influence in the habit, in order to guard against the danger of a relapse. But, on no occasion whatever, do I think it safe to confide in this preparation singly and uncombined, for the cure of any truly venereal symptom." (*Pearson on Lues Venerea*.)

Modern surgeons commonly avoid the bichloride of mercury in the treatment of the primary symptoms of syphilis, not, I believe, on account of its inefficacy, but because it is a more active preparation, than the circumstances ordinarily demand. In the more advanced stage of the disease, it is often prescribed.

The dose is from $\frac{1}{4}$ to $\frac{1}{2}$ of a grain.

The following is a common mode of ordering it: R Hydrargyri bichloridi, gr. i. Aquæ Nucis Moschatæ, ℞ij. Misce. Dosis uncia dimidia. The submuriate, or chloride, of mercury (calomel) is not very much used by British surgeons for the cure of the venereal disease. It is often

prescribed, however, abroad for this purpose; and in this country, employed in cases where it is desirable to bring the system quickly under the influence of mercury, as in *iritis*, *laryngitis*, *synovitis*, and various other urgent forms of inflammation. In such examples, from two to four grains are given twice, thrice, four times, or oftener, in the 24 hours; sometimes joined with $\frac{1}{4}$ of a grain of opium, to prevent disturbance of the bowels. It is extensively given as a purgative and an alternative. It generally proves actively purgative, when more than two or three grains are given.

The *pilulæ hydrargyri* are the most simple of the internal formulæ, being merely mercury triturated with mucilaginous or saccharine substances. They are commonly employed for the cure of the incipient form of the venereal disease, that is, while a chancre is the only complaint. From five to ten grains are the usual dose. When they purge, opium will sometimes prevent this effect. (See *VENEREAL DISEASE*.)

The red oxide, or *binoxidum hydrargyri*, is now rarely prescribed. The average dose is gr. j. and generally joined with opium, to prevent griping and purging. The ioduret of mercury, in small doses of $\frac{1}{4}$ or $\frac{1}{2}$ of a grain, is occasionally prescribed in old syphilitic and some scrofulous cases; but my experience with it does not enable me to pronounce any opinion respecting its advantages.

MEROCELE, (from *μερος*, the thigh, and *κελη*, a tumour. A femoral or crural hernia. (See *HERNIA*.)

MEZERTON was recommended by Dr. A. Russell for a particular class of venereal symptoms, in the following terms: "The disease, for which I principally recommend the decoction of the mezereon root as a cure, is the venereal node that proceeds from a thickening of the membrane of the bones. In a thickening of the periosteum, from other causes, I have seen very good effects from it; and it is frequently of service in the removal of those nocturnal pains, with which venereal patients are afflicted; though, in this last case, excepting with regard to the pain that is occasioned by the node, I own, I have not found its effects so certain, as I at first thought I had reason to believe. I do not find it of service in the cure of any other symptom of the venereal disease." *Med. Obs. and Inq.* vol. iii. pp. 194, 195.) Mr. Pearson, however, asserts unequivocally, that mezereon has not the power of curing the venereal disease in any one stage, or under any one form; and if the decoction should ever reduce the venereal node, yet there will be a necessity for taking mercury in as large quantity, and for as long a time, as if no mezereon had been exhibited. Cullen found this medicine of use in some cutaneous affections, but excepting an instance or two of lepra, Mr. Pearson very seldom found it possessed of medicinal virtue, either in syphilis, or the sequelæ of that disease, scrofula, or cutaneous affections. (Pearson on *Lues Venerea*, pp. 55—59.)

As the possibility of curing most forms of the venereal disease, not only without mercury, but without any internal medicines whatever, is now well established, it is difficult to know what degree of importance to attach to observations, declaring certain articles of the *materia medica* efficient or inefficient in the cure of that disease; because, if it admit of a spontaneous cure, but will not get well when mezereon, or any other particular

medicine, is exhibited, we are necessarily obliged to suppose, that such medicine is worse than useless.

MOLLITIES OSSIUM. A morbid softness of the bones, which become preternaturally flexible, in consequence either of the inordinate absorption of the phosphate of lime, from which their natural solidity is derived, or else of this matter not being duly secreted into their texture. The bones affected become specifically lighter. (*Saillant, Hist. de la Soc. Royale de Méd.* t. viii.) Dr. Bostock made some experiments, with the view of ascertaining the proportion of earthy matter in bones affected with mollities: he examined a dorsal vertebra of a woman, whose bones were found soft and flexible after her decease. In one part of the diseased bone, he found, that the quantity of earthy matter only amounted to one fifth of its weight, and in another, only to one eighth, while the proportion in healthy bones amounted to more than one half of their whole weight. (See *Med. Chir. Trans.* vol. iv. and *Wilson on the Bones and Joints* p. 253.) In rickets, the bones yield and become distorted only by slow degrees, and retain their natural inflexibility; but, in the present disease, they may be at once bent in any direction, and frequently admit of being readily divided with a knife. Preternatural brittleness and flexibility of the bones appear to Mr. Mayo, as they did to Boyer, to be the results of different degrees of the same cause. "One degree of atrophy produces brittleness; a greater degree flexibility, with greater brittleness. The disease, in which these features are shown in the highest aggravation, is one which attacks adults, but is of very rare occurrence. It is named *mollities ossium*." (See *Outlines of Human Pathology*, p. 19.) The causes of this extraordinary disease are buried in obscurity. It is supposed, however, to depend upon some peculiar state of the constitution, and the individuals, attacked by it, have been remarked to be mostly about, or rather beyond, the middle period of life (*J. Wilson*, vol. cit. p. 252), and generally women. (*Neumann, in Abhandl. der K. A. Josephs Acad.* b. ii. p. 173. *Portai Cours d'Anatomie*, t. i. p. 16.) One instance, however, is reported, in which the patient was a young man, seventeen years of age. (*Thomassin, in Journ. de Méd.* t. xlii. p. 222.) The only instance which, I believe, has been met with in this metropolis, of late, was in the London Hospital, and the patient a male. In the present place, I shall merely describe pure mollities ossium, or that disorder of the bones in which they become completely flexible, and lose all their natural firmness. And in order to give an idea of the disorder, I shall quote the case of Madame Supiot. In the year 1747 she had a fall, which occasioned her to keep her bed for some time, and left great pain and weakness in her loins and lower extremities. In about a year and a half afterwards, she began to perceive her left leg particularly affected. Along with this weakness, she had violent pains over her whole body, which increased after a miscarriage, and still more after a natural delivery, in the year 1751. She was now seized with startings, great inquietude, and such violent heats, that she was almost continually in a sweat, and could not bear the least covering even in the coldest weather, and while her pains continually increased, she took notice that her urine precipitated a white sediment. Her pains abated on the appearance of the sediment, but she now ob-

served that her limbs began to bend, and from this time the softness of them gradually increased till her death. In the month of April, 1752, the trunk of the body did not exceed 23 inches in length, the thorax was exceedingly ill formed, and the bones of the upper part were very much distorted; those of the lower part were considerably bent. At length, the thigh-bones became so pliable, that her feet could easily be laid on each side of her head. The right side did not, till after some time, become so deformed as the left; but it was surprising to observe the alterations which daily took place, and the different figures assumed by the limbs, in consequence of the increased softness of the bones; so that when the sediment in the urine was considerable, the disease of the bones seemed to be at a stand, increasing considerably when it was suppressed. Besides this, she had violent pains, startings, difficulty of breathing, spitting of blood, and lastly, a fever, with convulsions. She died in the beginning of Nov. 1752, and on dissecting her body, the following appearances were observed: 1. The muscles in general were of a very soft and pale consistence; the vastus externus, sartorius, quadriceps, biceps, and external parts of the gracilis, were much shorter than in their natural state, and more firm and tense; while those on the opposite side were much elongated, thin, and very tender; in short, the whole muscular system had suffered more or less, according to the action of the muscles in her lifetime. 2. The bones were entirely dissolved, the periosteum remaining unhurt, so that they exhibited only the form of a cylinder. 3. The heart and principal blood-vessels, both veins and arteries, contained large black polypi, of a viscid consistence, and very unlike those usually found in dead bodies.

A case of softness of the bones is related by Mr. Gooch, but considerably different from the above, as it was attended with a remarkable fragility of them before they became soft. It likewise began with pains through the whole body, attended with feverish symptoms; but, after some weeks, these pains were confined chiefly to the legs and thighs, and they were not increased by pressure. This fragility of the bones does not appear to have been the case with Madame Supiot. In the month of June, 1749, Mr. Gooch's patient broke her leg in walking from her bed to a chair, and heard the bone snap. No callus was formed, though the fracture was instantly reduced, and treated by one of the best surgeons in her part of the country; but, instead of this, the bones began to grow flexible, and, in a few months, were so from the knee to the ankle. The disease still continued to increase, so that, in a short time, the other leg and thigh were affected in the same manner, after which both legs and thighs became cedematous, liable to excoriations, and discharged a thin yellow ichor. Scorbatic symptoms began to appear in the winter after the leg was broken, and her gums began to bleed. Tonic medicines were exhibited without any success, except that her menstruation was more regular, and her appetite and digestion were improved; but, towards the end of her life, her breathing became difficult, the spine distorted, and a pain in the loins took place upon every motion of the vertebræ; and as her limbs were now quite useless, she was obliged to sit upright in bed. At last, the ends of the

bones, on which she sat, having become also very soft, spread much, and the ends of her fingers and thumbs, by frequent endeavours to raise herself, became also very broad and the phalanges crooked. The flexibility of the bones gradually increased, and became more general, attended with a wasting of the flesh, and excessive difficulty of breathing. The menstrual flux totally ceased four months before her death; her legs, which were very anasarcaous, and excoriated almost all over, became erysipelatous; but she retained her senses to the last. She expired suddenly, having talked in a composed manner, concerning her miserable situation and approaching end, only a few moments before her death.

On examining the body, she was found to have lost two feet two inches of her natural stature. The heart and lungs appeared sound, but had been much confined, principally by the liver, which was enlarged in an extraordinary degree; it was not, however, scirrhous, nor in any other way diseased. The spleen was very small, and the mesentery had one large scirrhous gland. All the bones, except the teeth, were softened, so that scarcely any of them could resist the knife; but those of the lower extremities were the most dissolved, being changed into a kind of parenchymous substance, like soft dark-coloured liver, without any offensive smell. So completely, indeed, were they decomposed, that the knife met with less resistance in cutting through them, than sound muscular flesh, though some bony lamellæ were here and there to be met with, but as thin as an egg-shell. The most compact bones, and those which contained the greatest quantity of marrow, were the most dissolved; and it was observable, that the dissolution began internally, for the bony laminae remained here and there on the outside, and nowhere else. The periosteum was rather thicker than ordinary, and the cartilages thinner; but not in a state of dissolution. The bones were found to contain a great quantity of oily matter and little earth. No cause could be assigned for the disease; and in the case of Madame Supiot, the one assigned, viz. that of her eating too much salt, seems totally inadequate to explain the origin of the disorder. All the cases of mollities ossium on record have proved fatal, and no means of cure are yet known.

In the Museum of the College of Surgeons in London, there is a humerus, the cortex of which is as thin as a wafer, and the interior filled with a substance that looks like tallow. Towards the lower part, the bone is occupied by a vascular membranous sac. In the Museum of the London Hospital are specimens of bones similarly affected, taken from the body of a woman, who died at the age of 72, after having been confined four years to her bed by paralysis of the lower extremities. (See *Mayo's Human Pathology*, p. 19.)

For additional observations, connected with this subject, refer to *Fragilitas Ossium* and *Rickets*. Boyer and Richerand treat of mollities ossium, and rickets, as one and the same disease. But, as Mr. Wilson observes, the first differs from rickets, in attacking people of middle age, or rather older, and not particularly children; and it differs also in the change, produced in the bones themselves, which, when dried, do not appear as if they had been long steeped in weak acid, with their animal part nearly unchanged; but

both the phosphate of lime and the animal matter appear to have been absorbed, so as to leave mere shells, which are also softer than natural bone of the same thickness. Large cavities are met with in the substance of the bones, and sometimes communicate with the soft parts surrounding them. In some of these cavities is contained oily matter, like boiled marrow; and in others, masses of conglutated blood, and a soft inorganic animal substance. (*J. Wilson on the Bones, &c. p. 253.*)

Arcet, Diss. Descriptionem et Casus aliquot Osteomalacis sistens; Upsal, 1788. *Morand*, in Journ. des Savans, 1792, et Mém. de l'Acad. des Sciences, 1752. *Morand*, junr., in Mém. de l'Acad. des Sciences, 1764, p. 206. See also *T. Lambert*, Relation de la Maladie de Bernard d'Armagnac, sur un Ramollissement des Os; Toulouse, 1700. *Ferneticus*, in lib. de alditis rerum causis. *Th. Bartholinus*, Hist. Anat. cent. 4. *Petit*, Hist. de l'Acad. des Sciences, 1722. *Hoin*, ibid. 1764. *Gagliardi*, Anatomies Ossium, Rome, 1789. *C. G. Ludwig*, Programma, quo observata in sectione Cadaveris Femine cujus Ossa emollita erant proponit; Lips. 1757. *Fries*, Dissert. de Emollitione Ossium; Argentor. 1775. *Thomson*, in Med. Obs. and Inquiries, vol. v. p. 259. *Chir. Obs. and Cases*, by *Wm. Brongfield*, vol. ii. p. 50. &c. *Boyer*, Traité des Maladies Chir. t. iii. p. 607, &c. Paris, 1814. We meet with cases of Mollities Ossium in the Philosophical Transactions; Act. Haiflens; Ephem. Nat. Cur.; *Savard's* Obs. Chir.; the writings of *Favustus*; *Gogek's* Chir. Works, vol. ii. pp. 353-359, ed. 1792, &c. *J. Wilson*, on the Structure and Physiology of the Skeleton; and on the Diseases of the Bones and Joints, p. 252, &c. 8vo. Lond. 1820. *Good's* Study of Med. vol. v. p. 334, ed. 4. *J. Houshup*, in Edin. Med. Chir. Trans. vol. ii. p. 137; *Herbert Mayo*, Outlines of Human Pathology, sect. 3. 8vo. Lond. 1835.

MONOCULUS, (from *μονος*, single, and *oculus*, the eye). A bandage for the eye, consisting of a single-headed roller, the end of which is put on the back of the neck, and one turn made over the forehead, so as to meet the extremity of the bandage. The roller is then to descend under the ear of the side affected, and to pass obliquely over the cheek underneath the eye, and next over the root of the nose, and the parietal bone, to the nape of the neck. The third turn of the roller is to overlap the second a little; the third, the fourth; making what the French call *doloires*; and the bandage is completed by a few circles round the head.

MORBUS COXARUS. (See **JOINTS**, **DISEASES OF**.)

MORTIFICATION is of two kinds; the one, without any or much inflammation; the other, preceded and accompanied by it. To this last species of mortification, the terms, *inflammatory humid*, or *acute gangrene*, are often applied; while the second, or that which is preceded by little or no inflammation, has been distinguished by the epithets, *dry*, or *chronic*, and sometimes *idiopathic*, when no external cause for the origin of the disease can be assigned. The expression *hot gangrene* has also been applied to mortification attended with inflammation; and *cold*, to that which seems scarcely to be connected with it, at least in its commencement. According to Mr. Hunter, inflammation is an increased action of that power, which a part naturally possesses; and, in healthy inflammations, at least, it is probably attended with an increase of power. In cases, however, which are to terminate in mortification, there is no increase of power; but, on the contrary, a diminution of it. This, when joined to an increased action, becomes a cause of mortification, by destroying the balance, which ought to subsist between the power and action of

every part. There are, besides, cases of mortification, preceded by inflammation, which do not arise wholly from that, as a cause: of this kind, are the carbuncle and the slough formed in the small-pox pustule. (*Hunter*.)

The first general division of mortification, therefore, is into two kinds; the *inflammatory, humid*, *hot*, or *acute*; and the *dry, cold*, or *chronic*. But the disorder is also subdivided into many species, which are determined by the nature of their particular exciting causes. By Professor Carswell, these are all referred to the three following heads: 1. Mortification from cessation of the circulation. 2. From the violent operation of mechanical, chemical, and physical agents. 3. From the deleterious influence of certain poisons. This seems a very correct view.

It is remarked, that acute, or rapid mortifications are not necessarily humid, as the slough from the application of caustic potassa proves, and the converse also is true in some cases of sphacelus senilis. (*James on Inflammation*, p. 96.) Mr. Guthrie also asserts, that mortification from wounds and external injuries may be either humid, or dry, or of both kinds together, where the circumstances are particular. (*On Gunshot Wounds, &c. p. 122*, ed. 2.) The doctrine that any case of mortification is entirely without inflammation, has sometimes been deemed questionable; and Mr. James expresses his belief, that the disorder is generally preceded by inflammation, and invariably accompanied with some degree of it. And, says he, "whether mortification be a consequence of inflammation, or not, it may, perhaps, with reason be considered, as standing in the same relation to inflammation, as adhesion, suppuration, or ulceration; they may all be preceded by a high degree, or it may be scarcely sensible." (*Ip. 84, 85.*)

When any part of the body loses all motion, sensibility, and natural heat, and becomes of a brown, livid, or black colour, it is said to be affected with *sphacelus*, that is, complete mortification. So long as any sensibility, motion, and warmth, continue, the state of the disorder is termed *gangrene*. This word is here made use of to signify only a degree of sphacelus, or rather the process by which any local disorder falls into the state of complete mortification. Frequently the terms are used synonymously; but it is to be observed, that gangrene does not invariably end in sphacelus; nor is the latter always preceded by the former. (*Richter, Anfangsgr. der Wundarzn. b. i. kap. 3.*) There are other writers, who make the distinguishing circumstance of sphacelus to be the extension of the disorder to the bones, as well as the soft parts. (*Jassus Pathologie Chir. t. i. p. 30*, ed. 1809.)

At present, however, this last application of the term sphacelus is never made; for, as Mr. Pearson has rightly observed, the distinctions, "which are founded merely upon the parts that suffer, or upon the profundity to which the disease has penetrated, seem inadequate and useless." (*Principles of Surgery*, p. 115, ed. 2.) The manner, in which Dr. J. Thomson views the subject, may be considered as coinciding with the general sentiments of the best modern surgeons: "I shall employ the term *gangrene* (says he), to express that state of mortification in inflamed parts, which precedes the death of the part; a stage, in which

there is a diminution, but not a total destruction, of the powers of life; in which the blood appears to circulate through the larger vessels; in which the nerves retain a portion of their sensibility; and in which, perhaps, the part affected, may still be supposed to be capable of recovery. The word *sphacelus*, I shall use to denote the complete death, or mortification of a part; that state, in which the powers of life have become extinct; in which the blood ceases to circulate; and in which the sensibility of the nerves is lost, whether the dead or mortified part has, or has not, become actually putrid, or shown any tendency to separate and fall away from the living and sound parts. Putrefaction, or the spontaneous process, by which animal bodies are decomposed, is an accidental, and not a necessary, effect of the state of mortification. It takes place at very different periods, after the death of particular parts; and these periods, it may be remarked, are always regulated, not only by external circumstances, such as the humidity and temperature of the atmosphere, but, also, by the peculiar structure, and morbid conditions of the animal texture, or organ, in which the putrefaction occurs. The term *sphacelus*, has, I know, been employed to express, that a part is not only completely dead, or mortified; but, also, that that part has become putrid, and is in a state of separation from the surrounding and living parts. But, as putrefaction is not a necessary, or immediate, consequence of mortification, or partial death in animal bodies, this use of the term *sphacelus* is obviously improper." (*On Inflammation*, p. 504.)

It is an interesting observation, made by one of the greatest pathological anatomists of the present time, that "as the descriptive characters of mortification were originally drawn from the appearances which this disease presents, when it attacks the external parts of the body, they have ever since been employed by the pathologist, as the means of enabling him to detect it in internal organs after death. It may, however, be fairly questioned, whether the application of the term mortification has not been too restricted, and whether parts, deprived of their vitality, and separated from the living tissues, should not be designated by the same appellation, as those which, similarly circumstanced, differ from them only in point of colour, and perhaps smell. Softening of the cerebral substance, of the mucous, and frequently of the serous membranes, constitutes a state of positive death; but, the softened substance, in those instances, presenting neither the peculiar colour, nor odour of external parts, when mortified, it has been considered proper to distinguish softening from mortification by a term expressive of its principal character—that of softness." (See *Carswell's Illustrations of the Elementary Forms of Disease*, Fasc. 7.)

The causes of mortification are either *internal* or *external*. It is commonly taught in the medical schools on the Continent, that the internal causes probably operate after the manner of a deleterious substance, which being introduced into the circulation, occasions a *putrefaction of the fluids*. (*Lassus*, op. et loc. cit.)—Boyer professes a similar notion, (see *Maladies Chir.* t. i. p. 140,) as well as Larrey in his account of *traumatic gangrene*; a statement, which has drawn forth the criticisms of Mr. Guthrie. The

doctrine is supported by no sort of proof, and may be considered as entirely hypothetical, if not decidedly erroneous. There are, indeed, as Boyer has noticed, some spontaneous mortifications, the primitive cause of which is not always well understood: an inflammation, apparently slight, may become gangrenous immediately it has made its appearance. In scorbutic, venereal, and small-pox cases, we have daily instances of this fact. Other internal causes, without any very evident pre-existing disease, sometimes destroy persons, by gangrenous mischief, who are but little advanced in years. (*Saviard*, *Obs.* 16. *Haller*, *Disput. Chir.* t. iv. p. 551.) Certain poisonous, acrid, caustic substances taken inwardly, or introduced under the skin, may have the same effect, by annihilating the vital action, or destroying the texture of the parts. (*Lassus*, *Pathologie Chir.* t. i. p. 31.) But, though these observations may all be entirely correct, they by no means justify the conclusion, that the internal causes of mortification ever act by inducing a *putrefaction of the fluids*.

Under the head of *mortification from the deleterious influence of certain poisons*, Dr. Carswell notices that arising from the bite of the *cobra di capello*, the rattle-snake, and viper; another produced by a deleterious agent, generated during the decomposition of animal substances; a third, known by the term *hospital gangrene*; a fourth, exemplified in the malignant pustule; a fifth, in the carbuncle of plague; and a sixth, in the mortification caused by eating various grain in a state of disease.

This last specimen of *mortification from an internal cause*, proceeds from eating bread made of *bad black wheat*, or *spurred rye*. Besides occurring as an original idiopathic disease, and from obstruction of arteries, chronic, or dry gangrene (observes Dr. Thomson) may be induced by the action of substances taken into the stomach, which seem to produce it as a specific effect in parts remote from the source of the circulation. The most singular example, which we have of this, is in the gangrene produced by the eating of a particular kind of unsound or diseased rye. This species of mortification has been rarely observed in England; but it has been frequently seen on the Continent, where it has been repeatedly known to prevail in some districts, where rye forms a principal article of food, as an endemic disease. It occurs, however, in such districts only after wet seasons, in which that grain is affected with a particular disease, well known in France by the name of the *Ergot*, or cockspur rye. In this disease, the grains of rye grow to a large size, acquire a black colour, and have a compact horny consistence. The species of mortification, produced by eating this substance, was first particularly described by Dodard. (See *Journ. des Savans*, an. 1676.) The part affected became at first insensible and cold, and, in the progress of the disorder, dry, hard, and withered. In very malignant cases, there was delirium. Dodard's description of the complaint was very imperfect; but he has mentioned a circumstance, tending strongly to prove, that the disease actually arose from the alleged cause; viz. that fowls, fed with cockspur rye, are killed by it. Saviard informs us, that he saw this disease in the year 1694, at the Hôtel-Dieu of Orleans. It attacked

the upper and lower extremities, which were rendered, in the course of the disorder, as dry as touchwood, and as emaciated as the limbs of Egyptian mummies. In 1710, Noel, surgeon to the Hôtel-Dieu at Orleans, transmitted to the Royal Academy of Sciences at Paris an account of this peculiar mortification. About fifty people, men and children, had come that season into the hospital, with the affliction. According to Noel, the disorder always began in the toes, and extended itself gradually along the foot and leg, till it sometimes rose to the upper part of the thigh. He had never seen any of the female sex affected with it, and had observed only one instance of it in the upper extremities. The Academy received the history of one case, in which the lower extremities were separated from the body in the articulations of the thigh-bones with the acetabula; the first example (Dr. Thomson believes) of this separation upon record; and it was the occurrence of this, and of similar cases, that probably first suggested the operation of amputation at the hip-joint. (See *Thomson on Inflammation*, p. 541.) As Noel's patients did not come under his care, till after the disease had existed some time, he could not describe from his own observation the early symptoms; but the patients had often told him, that the disease generally began in one, or both feet, with pain, redness, and a sensation of heat, as burning as the fire; and that at the end of some days, these symptoms ceased, as quickly as they had come on, when the extreme sensation of heat, which they had formerly felt, was changed into cold. The part affected (adds Noel) was black, like a piece of charcoal, and as dry as if it had passed through the fire. After some time, a line of separation was formed between the dead and living parts, like that which appears in the separation of a slough produced by the cautery; and the complete separation of the limb was, in many cases, effected by nature alone. In others, Noel was obliged to have recourse to amputation.

This disease appeared in Switzerland in 1709 and 1716, and its symptoms and progress in that country have been accurately described by Langius in a dissertation, entitled, "*Descriptio Morborum et Esu Charorum Spedaliorum.*"

Gassaud, physician in Dauphiny, where this disease appeared also in 1709, states, that many of the patients were affected with swellings of the feet and legs, and of the hands and arms, which degenerated into a gangrene, that penetrated to the bone, and produced a separation of the affected limb. The disorder was attended with different symptoms in different individuals. Some suffered very violent pain, accompanied by an insufferable sensation of heat, although the part affected often felt cold to the touch. In other patients, redness, with much swelling, supervened, attended with fever and delirium. Other patients were without any fever, or delirium, though they seemed to suffer equal pain. In some patients, the parts affected became withered, dry, and black, like charcoal. The separation of the dead parts from the living took place with the most excruciating pain, and a sensation resembling that produced by the direct application of fire. This sensation was sometimes intermittent; and, in other instances, it was succeeded by an equally harassing sensation of cold.

According to Bassau, surgeon to the hospital of St. Antoine, in Dauphiny, the cases, which he saw, were not all of the dry kind, the limb sometimes becoming putrid, and maggots being generated. He says, that the disease was not infectious, and it attacked indiscriminately men, women, and children.

The degree of fatality, caused by this species of mortification, seems to have been extremely various. In the *Memoirs of the Royal Academy of Sciences* for 1748, M. Duhamel mentions, that of 120 persons afflicted, scarcely four or five recovered with their lives. According to Langius, it was equally fatal in Switzerland.

Dr. Thomson believes that the preceding sort of gangrene has never occurred in this country, excepting, perhaps, the cases recorded by Dr. Charlton Woolaston, in the *Phil. Trans.* for 1762; and which proceeded from eating unsound wheat, not rye. (See *On Inflammation*, p. 548.)

Dr. Carswell considers it not easy to say in what manner eating these poisonous articles operates so as to produce mortification. "One thing, however, is certain, that it is not by an inflammatory process in the parts which become the seat of the disease. That cessation of the circulation, loss of the sensibility and motion of the limb, observed to take place at an early period of the disease, are not the consequences of inflammation, is clearly proved by the characters of the local, if not the general symptoms. All the local changes appear to be produced as direct consequences of the spurred rye, acting through the medium of the blood, or nervous system, or both at the same time; for, we have seen, that the dead parts are separated without hemorrhage, and it is stated, that the blood, when taken from a vein, is dark, and so very thick, that it only oozes out from the orifice of the wound." Dr. Carswell admits, however, that the morbid anatomy of this disease is extremely imperfect. (See *Illustrations of the Elem. Forms of Disease*, Fasc. 7.)

The external causes of mortification, which are manifest, and act mechanically or chemically, are burns; excessive cold; the application of caustics; the presence of any ichorous, urinary, or fecal matter effused in the cellular substance; violent contusions, such as are produced by gunshot wounds, or bad fractures; the strangulation of a part, as in cases of hernia, or when polypi, or other tumours are tied; a high degree of inflammation; and, lastly, every thing, that has the power of stopping the circulation and nervous energy in parts. (*Lassus, Pathologie Chir.* t. i. pp. 34, 35.)

Inflammation is one of the most frequent causes of mortification. But, as I have already remarked, the death of a part may take place without any well-marked appearance of previous inflammatory disorder; and the latter, even when present, has frequently less share in the mischief, than other incidental circumstances, and is, in reality, only an effect of the very same cause which produces the sphacelus itself. It is often a matter of doubt, whether actual inflammation precedes the occurrence, or not; for a part, before it mortifies, is in certain instances only affected with pain, and with no degree of preternatural redness. Lastly, when mortification is, unquestionably, preceded by inflammation, there are so many varieties of the dis-

order, depending on incidental causes, that these latter demand more attention than the inflammation. (*Richter, Anfangsgr. b. i. kap. 3.*)

Mr. James enumerates the following circumstances, as capable of influencing, in a very great degree, the disposition of inflammation to terminate in mortification: 1. The powers of the part, in which the inflammation occurs, being naturally weak, as in fibrous membranes, the scrotum, &c. 2. The remote supply of blood, or nervous energy, as in the lower extremities. 3. Obstruction to the return of blood. 4. To the supply of blood. 5. Disease in the heart, or vessels. 6. Debility from age, habits of life, disorder of the digestive organs, or fever. 7. Poor living, foul air, improper food, scurvy, &c. 8. Impairment of organization from external injury. 9. Of the nervous power, by poisons. 10. Undue excitement of weakened parts. 11. Depressing remedies. 12. Pressure and tension. 13. Excessive violence of inflammatory action. 14. Peculiar disposition in the constitution. (*James on Inflammation, p. 102.*)

Healthy phlegmonous inflammation seldom ends in mortification, except when it is unusually violent and extensive.

With the exception of carbuncles and boils, which are essentially gangrenous diseases, phlegmonous erysipelas is, of all inflammatory complaints, that which most frequently terminates in gangrene. It demands the prompt employment of active antiphlogistic means, and early free incisions, when the cellular tissue is threatened with gangrene, or is actually gangrenous.

The symptoms of mortification from inflammation take place variously, yet generally, as follows:—The pain and sympathetic fever suddenly diminish, the part affected generally becomes soft, and of a livid colour, losing, at the same time, more or less of its natural warmth and sensibility. In some places, the cuticle is detached; while, in other situations, vesicles arise, filled with a clear or turbid fluid. Such is the state to which we apply the term *gangrene*, and which stage of the disorder too often rapidly advances to *sphacelus*, when the part becomes a cold, black, fibrous, senseless substance, called in technical language a *slough*.

It merits notice, that, “in cases, in which gangrene immediately succeeds inflammation, these two morbid states, may, in some measure, be regarded as stages, or periods, of the same disease. They pass insensibly into one another; nor is it possible to say precisely where the one state ends, and the other commences. The symptoms of inflammation, in these cases, do not disappear before those of gangrene come on; but seem rather to undergo a gradual and almost imperceptible change, or conversion, into one another. *The redness acquires a deeper tinge, and spreads farther, than formerly; the swelling increases and becomes more doughy*; and, in this incipient stage, the gangrene, particularly when it attacks the cutaneous texture, often bears a considerable resemblance to erysipelas.” It is to be observed, also, that, “the part of the body, which becomes affected with gangrene, does not immediately lose its sensibility, for the pain, on the contrary, is often very much aggravated by the approach of this state. *The blood also still continues to circulate, at least, in the larger vessels of the part, but perhaps, with less force*; and from the resistance which it

meets with in passing through the capillaries, in less quantity than formerly. The serous effusion into the cellular membrane continuing to increase, and the action of the absorbent and sanguiferous vessels to diminish, the part becomes at length incapable of being restored to its former office in the animal economy. It is, therefore, in its earlier stages only, that gangrene is to be considered as an affection admitting of cure; for there are limits, beyond which, if it pass, recovery becomes impossible. These limits it may not, in every instance, be easy to define; but they form the boundaries between incipient gangrene and the ultimate termination of that state in sphacelus.” (*Thomson on Inflammation, pp. 506, 507.*)

Mortification often arises from a mechanical obstacle to the circulation of the blood. Thus the blood may be hindered from arriving at, or returning from, the part. “In both cases, mortification is the consequence of the cessation of the function of nutrition, either from a deficiency of the arterial, or the stagnation of the venous blood. A deficiency of the arterial blood may be occasioned by ligature of the principal artery of a limb; by coagulated blood; organized, or unorganized fibrine, occupying the entire calibre of such an artery, or its larger branches; by ossification of the walls of these vessels: or their conversion into into a solid fibrous, or ligamentous tissue.” (*Carswell, op. cit.*)

When inflammation is about to terminate in gangrene, the inflammatory redness assumes a darker tint; it becomes deep purple, livid, or almost black; but, as Dr. Carswell observes, its consistence does not always diminish, but, on the contrary, may be increased by the presence of accumulated fluids. The sensibility of the part, however, is lessened, and the seat of the pain, which accompanies the inflammation is transferred to the more deeply seated textures. When the “modifications of colour, consistence, temperature, and sensibility, continue to increase, and terminate in sphacelus, the part thus affected, assumes a still deeper tint, or becomes of a dirty brown, or black colour, sometimes grey, greyish, yellow, or greenish. The vesicles, or phlyctena, become more numerous and larger, or the whole of the epidermis, covering the sphacelated part, may be completely separated, raised in the form of a large blister filled with bloody serum, or ruptured and lying in wrinkles on the denuded and discoloured cutis. The skin and cellular tissue, beneath the epidermis, are swollen and puffy, and crepitate when pressed; or they are soft, flaccid, and cold; and may be cut, pinched, or otherwise stimulated without pain, or feeling of any kind being induced; and lastly, the sphacelated part emits a strong cadaverous odour. When these latter appearances present themselves, but more particularly when the peculiar odour of gangrene is perceived, they may be regarded as positive signs, not only of complete death of the part to a certain depth, but also that putrefaction has already taken place. The local emphysema, and fetor of putrefaction, produced during life, constitute, therefore, signs of great value in mortification. Their absence, however, furnishes no proof, that local death may not have taken place; for putrefaction, or chemical decomposition, of an organ, may not follow as the consequence of the cessation of those powers, by means of which it was enabled to resist the injurious influence of external agents,

until some time has elapsed, the length of which will depend on various circumstances, but more especially on the quantity of fluids contained in the affected organ, and the degree of temperature to which it is exposed." (See *Carswell*, in *Elem. Forms of Disease*, Fasc. 7.) The state of the blood and vascular system in mortification from inflammation, has been elsewhere described. (See *INFLAMMATION*.) In a foregoing column, I have adverted to Dr. John Thomson's view of gangrene, in which the nerves are represented as yet retaining a portion of their sensibility. On this point, writers do not precisely agree. Thus, Dr. Carswell observes, that the state of the vessels and of the blood, which precede the physical signs of mortification, may be regarded as representing that state of a part, which we call gangrene. The blood has ceased to circulate; it is even conglutinated. The application of artificial stimuli to the neighbouring tissues, furnishes us evidence of their possessing sensibility, or contractility. Yet as, under these circumstances, we know that actual death may not have taken place, that the blood may resume its fluidity, and circulate anew, and sensibility and contractility again return, the state, alluded to by Dr. Carswell, seems to him to be that presenting the anatomical and physiological characters of gangrene. (*Elem. Forms of Disease*, Fasc. 7.)

The causes which produce mortification by impeding the return of blood from the part affected. for the most part operate by making pressure on the trunk, or principal branches of a vein. In these instances, there is always an accumulation of blood in the part which first swells, becomes of a dark livid colour, tense, and very painful. Soon afterwards, vesicles arise, and the part becomes soft, oedematous, cold, insensible, emphysematous, black, and fetid. Such are the circumstances, which happen in strangulated hernia, in tied polyp, and in a limb, in which the veins have been so compressed by any hard swelling, such as the head of a dislocated bone, as to excite mortification. In hernia, the bowel assumes a dark brown, and sometimes nearly a black colour, from stagnation of the venous blood.

Mortification from a mechanical obstacle to the return of the venous blood is not only well exemplified in strangulated hernia, but also in intussusception of the intestines. "When the superior portion of the intestine passes into the inferior, it carries along with it that part of the mesentery to which it is attached. If it does not suffer much compression, the invaginating process may go on to a great extent; but, if it is compressed to such a degree, that the return of the venous blood is obstructed, this stage of the disease is arrested, on account of the congestion of all the tunics of the invaginated portion. The congestion is not the consequence of inflammation; it is produced by compression, and in the following manner: when the mesentery is put on the stretch, by the descent of the superior into the inferior portion of the intestine, the veins belonging to it are compressed between the walls of both portions, just at the point where the invagination terminates superiorly. If adhesive inflammation take place at this point, the peritoneal surface of both portions become united, and the veins obliterated. As the arteries are much less affected by pressure than the veins, they continue to pour their blood into the invagi-

nated portion. This fluid accumulates, and produces an extreme degree of congestion of the mucous and submucous coats, giving to them a deep red, or almost black colour." From gangrene, the disease may advance to sphacelus of the whole of the invaginated portion, which may be discharged in the form of irregular shreds, of a dirty ash-grey, brown, or black colour. (See *Carswell's Elem. Forms of Disease*, Fasc. 7.) In the same invaluable work will be found perhaps the best description yet extant, of another variety of mortification from impediment to the venous circulation, depending upon disease of the heart, and manifested in the lower extremities. It begins with slight oedema round the ankles, and afterwards the serosity becomes more widely and deeply diffused; the feet, legs, and thighs becoming swollen, and the skin smooth and pale. When discolouration of the skin takes place, it depends on the presence of subcutaneous veins, which increase in bulk and number, coalesce at several points, and communicate a slightly mottled aspect to the limb, of a dull red, or purple colour. On one or more of these points, where the congestion is greatest, phlyctenæ, or large bullæ are formed, and when these burst, the subjacent cutis presents a dark red, or brown colour, and is soon converted into a dirty yellow, or ash-grey slough. The separation of the slough is sometimes preceded by an increase of redness in the surrounding cutis, which is obviously of an inflammatory nature. In other instances this redness is very slight, and plainly owing to venous congestion. The quantity of serosity effused, causes by its pressure further obstruction to the venous circulation, and in the early stage conceals the venous congestion itself. (See *Carswell*, op. cit. Fasc. 7.)

Other causes operate by preventing the entrance of arterial blood. The application of a ligature to an artery, as practised in various surgical cases, and all external pressure that closes the artery, or arteries, on which a part entirely depends for its supply of blood, have this effect. Mortification does not, however, always take place, when the trunk of an artery is rendered impervious, because nature furnishes the necessary supply of blood, through collateral ramifications. But, when the disorder does happen, the part commonly first becomes pale, flaccid, and cold, and soon afterwards shrinks, loses its sensibility, grows black, and perishes.

It has sometimes been observed, that the pulse has been suddenly and permanently lost in one part of the body, while it has continued to be distinct in other parts; and, in some cases of this kind, on examination after death, it has been found, that an obliteration had taken place of a portion of the tube of the artery, in which the pulse could not be felt during life. The late professor John W. Turner first drew attention to this subject by the publication of a series of interesting examples of it. In one of these cases, after the brachial artery had become suddenly obstructed, followed by loss of the pulse, a similar change occurred in one of the popliteal arteries, and mortification of the leg, terminating fatally, was the consequence. After death, the brachial artery at the elbow was found embedded in a hardened mass, composed of the surrounding cellular tissue, veins, and nerves, which adhered firmly to one another and the artery. When the last was slit open, it was found

to be impervious, immediately before dividing into the radial and ulnar branches. At this part, it was much contracted and filled with a cylindrical clot of firm lymph, which adhered firmly to its inner surface. The orifice of a large branch was situated immediately above this clot. The radial and ulnar arteries were also obstructed at their commencement. The coats of the arteries in the obstructed places were hard, thickened, and of a whiter colour than natural. In the popliteal artery, an ovoid sac was formed, filled with solid lymph, and directly above it the artery was obliterated to the extent of half an inch. For some way below it, the vessel was also blocked up with lymph. The inner layers of the sac consisted of the coats of the artery, with the exception of the internal one, which had disappeared. After detailing several other interesting particulars, Professor Turner adds, "The obstruction to the supply of blood to the leg produced important effects on the functions of the nerves of the foot; for, it was ascertained very soon after, that the skin of the foot was insensible, and apparently the muscles had lost their power of contracting. At the same time a burning pain, and feeling, as if crushed, were induced in the foot. The progress and appearances of mortification, from sudden deficient circulation, were well exhibited. They seem to confirm the opinion, that even in mortification from deficient circulation, a certain degree of re-action, or inflammation, precedes the complete death of the part, as was shown by the vascular congestion, the swelling, the increase of heat, and the tense vesications, which took place on the foot and leg." (See *Edinb. Med. Chir. Trans.* vol. iii. p. 105.) This paper is remarkably valuable, as containing a true explanation of the circumstances which prevent lacerated arteries from bleeding; a subject, according to Dr. J. Thomson, (*On Inflammation*, p. 512,) first noticed by Dr. Jones, and, as Professor Turner proves, still more completely described by Hodgson and Beclard. (See *Additions à l'Anatomie Gén. de X. Bichat*, p. 95.)

It would appear that, in the cases recorded by Professor Turner, the arteries became permanently and suddenly obstructed from laceration of their inner coats. In most of these instances, he observes, it seems necessary to suppose some predisposition in the coats of the arteries to laceration, as this took place in the ordinary motions of the limbs, and affected different arteries of the same individual. In some cases, marks of disease in the arteries were conspicuous; but, in others, no evidence of this kind was apparent. In several a considerable degree of constitutional affection and fever, preceded and accompanied the obstruction of the arteries. When the obstruction takes place, the lower part of the limb may yet receive sufficient blood by the anastomoses, as happened in several of the cases published by Turner; but, in five others, mortification was the result. In one, the patient was greatly debilitated by previous illness.

In some cases, mortification proceeds not simply from the interruption of the course of the blood through the principal artery, or arteries, but its occurrence is promoted by great violence done to the limb, and in particular, by the injection and distension of the cellular tissue with effused blood. No doubt all these causes operated in the fatal example of mortification, which followed a fracture

of the thigh, attended with laceration of the femoral artery, as related by Sir A. Cooper, in his lectures, as well as in the example, recorded by me, of gangrene of the leg, from the rupture of an aneurism in the deeper part of the ham. (See *Med. Chir. Trans.* vol. xvii.)

Parts deprived of all connection with the sensorium, by the division, or paralytic state of their nerves, do not perish on this account. But, as their functions are carried on with less vigour, and their vitality is weakened, the same causes, which sometimes produce mortification in parts differently circumstanced, must much more readily occasion it in them. Among the causes of the present species of mortification, may be mentioned great debility; extreme old age; a thickening and ossification of the coats of the arteries, and a consequent diminution of their capacity, and of their muscular and elastic power.

Cowper, the anatomist, was one of the earliest writers, who took notice of this ossification of the arteries of the leg, in persons who had died of mortification of the feet and toes. (See *Phil. Trans.* vol. xxiii. p. 1195, and vol. xxiv. p. 1970.) A similar case was remarked by Mr. Becket, of which he has given an account in his *Chirurgical Observations*. The occurrence was also mentioned by Naish. (See *Phil. Trans.* vol. xxxi. p. 226.) Dr. J. Thomson has seen one example of a very complete ossification of the arteries of the leg, accompanying a mortification of the feet and toes. (*On Inflammation*, p. 537.) Speaking of the same subject, Mr. Hodgson remarks: "Experience has proved this condition of the arteries to be at least a constant attendant upon one species of gangrene, to which the extremities of old subjects are liable; and I have found the three principal arteries of the leg nearly obliterated by calcareous matter in two fatal cases of this disease. But our knowledge of the power of collateral circulation, in every part of the body, will not allow us to admit the obliteration of the trunks as a sufficient cause of mortification, from a deficient supply of blood. It is therefore necessary for us to remember, that the same disease may probably exist in the collateral branches, upon which it has produced similar effects. But if an extent of vessel be converted into a calcareous cylinder, it loses its elasticity and organic powers, so as to be unable to afford any assistance to the propulsion of the blood; and the existence of parts, supplied by vessels in this state, constitutes a strong argument against the agency of the arteries in the circulation of the blood. The above observations, on the cause of this species of gangrene, at once expose its incurable nature; and this state of the blood vessels renders the danger of amputation very considerable, unless fortunately the disease in the arteries does not extend to the part, at which the ligature is applied." (See *Hodgson on Diseases of the Arteries and Veins*, p. 41.) However, although the ossified state of an artery must certainly be unfavourable to its healing, it does not constantly prevent this desirable event. (See *Case in Medico-Chir. Trans.* vol. vi. p. 193.)

The preceding facts are particularly entitled to attention, because, as we shall presently find, the opinion that the mortification of the toes and feet arose from an ossification of the arteries was considered by Mr. Pott as destitute of foundation.

I believe, however, that generally, other causes

are concerned; for nothing is more certain, than that mere ossification of arteries, at least within certain limits, will not cause mortification. There must either be at the same time, obstruction of them with fibrine or other matter; or great constitutional debility, and a languid circulation; or some organic changes, interrupting the free passage of the blood through the heart, or at a point near the source of the circulation, or through the trunk of the artery leading to the mortified parts. The fundamental fact, ascertained with respect to this form of mortification, as Cruveilhier remarks, is the obliteration of the arteries in a degree adequate to interrupt the supply of arterial blood to the part; and hence, instead of calling the disorder *gangræna senilis*, or *spontaneous gangrene*, he thinks it would be better to call it *gangrene from obliteration of the arteries*. Several years ago he adopted the doctrine, that ossification of the small arteries is a cause of *gangræna senilis*. (*Ex-sai sur l'Anat. Pathol.* t. ii. p. 57, 8vo. Paris, 1816.) He joins Dupuytren, however, in regarding arteritis as the most usual cause of this species of mortification; but adds, that neither arteritis, nor ossification of the arteries, will bring on the disorder, unless the course of the blood be completely intercepted by it. In two interesting cases, reported by him, some of the arteries of the leg were blocked up with lymph, and calcareous deposits, found extending even to the small ramifications of them. (See *Anat. Pathol. Livr. xxvii. fol. Paris, 1836.*)

"Nothing, (remarks M. Cruveilhier,) is more subject to variety, than the extent of obliteration in gangrene from arteritis. Thus, in a case, communicated to the Anatomical Society by M. Maisonneuve, the lower part of the aorta, the common iliac arteries, and the external and internal iliac, the popliteal, tibial, and fibular, were completely obliterated, and yet the mortification was exceedingly limited. In another instance recorded in this work (*Anat. Pathol. Livr. xxvii.*), the obliteration was restricted to the posterior tibial and fibular arteries, the anterior tibial being quite pervious. How does it happen, that though the anterior tibial was free, the circulation in the posterior tibial and fibular arteries was not re-established? For this plain reason: the means of communication between these different orders of vessels were intercepted. Had the posterior tibial and fibular arteries themselves been pervious, gangrene would have taken place not the less from the obliteration of the small arterial divisions. Obliteration of the small arteries is inherent in spontaneous gangrene: the obliteration of the larger ones is only an accessory circumstance. If the published cases of *gangræna senilis*, or spontaneous mortification be read, not two of them will correspond in respect to the extent of the obliteration of the large arteries. Thus, in the case above cited, the end of the aorta, and the two common iliac arteries were obstructed with clots, and yet the mortification was confined to some of the toes of one limb. In other examples, the great and middle-sized arteries are perfectly free; but as numerous lesser ones are obliterated, the mortification is very extensive. Sometimes the clots are very dense, and their loss of colour, and intimate adhesion to the sides of the artery prove their long standing; while in other instances, clots so recent are met with in the great arteries, that they cannot be

looked upon as the cause of the disease, but as produced in the final stage of it, and perhaps in the last moments of life." Cruveilhier considers the acute pains experienced in the artery some time previously to the appearance of spontaneous gangrene, and the hardness of the vessel, which feels to the finger like a tense cord, as proofs, that the clot precedes the mortification. He takes this same pain as an argument, that the obliteration of the vessels is the result of inflammation. (*Anat. Pathol. livr. xxvii. fol. Paris. 1836.*)

In every case of *gangræna senilis*, which Professor Carswell has examined after death, the arteries of the limb were obliterated to such an extent, as to interrupt the circulation of the blood. The obstructing cause consisted, in five or six cases, of a fibrous tissue, formed either in the walls, or cavities of the arteries, and which had converted these vessels into nearly solid cords of ligamentous consistence. This state was traced from the toes more than half way up the leg: it was always connected with ossification of the larger branches and trunks of the thigh, and other parts of the body. In two other cases, the obstruction depended on extensive ossification of the principal arteries of the limb; and, in several others, it was produced by solid fibrine formed around spicula of bone, projecting from the internal surface of the arteries. Connecting these states of the arteries, with the external appearances of the mortification, there cannot, as Dr. Carswell conceives, remain a doubt, that this form of the disease is the immediate consequence of a deficient supply of arterial blood, from a mere mechanical obstacle to the circulation of this fluid.

Professor Carswell does not adopt, however, the view advanced by Dupuytren, (see *Clin. Chir.* t. iv.) and espoused by Cruveilhier, that the mortification originates from arteritis. "Whether, (says he) the inflammation, which is supposed to give rise to the disease, be considered as of an idiopathic, or symptomatic kind, is of no import in the decision of the question. For, in the first place, the obstructing cause, viz. fibrous, fibro-cartilaginous, and osseous tissue, could not owe its origin to inflammation in a space of time so short as that which often marks the duration of the disease; and, in the second place, the presence of these accidental tissues in the arteries is no proof, that inflammation had ever existed in these vessels. Stagnation of the blood, from mechanical, or physical causes, is sufficient to give rise to the formation of these tissues by means of the fibrine of this fluid." (See *Carswell's Illustrations of the Elem. Forms of Disease, Fasc. 7.*)

Fabricius Hildanus mentions a fatal case of mortification of the feet and legs, where the patient was in the vigour of life, and apparently of good constitution. After death, a scirrhous tumour was found surrounding and compressing the inferior vena cava, and aorta, near their bifurcation, so as to prevent the free circulation of the blood in the lower extremities. Mortification of the extremities also sometimes occurs from deficient circulation, in the progress of diseases of the heart. In a case of dropsy of the chest, Sir A. Cooper has seen a small spot on the leg become all at once black, without any appearance of inflammation.

Mortification from debility is another variety of it. Here, a previous state of disease, of local,

or general debility, constitutes an essential feature in the case. "The physiological and physical properties of the fluids and solids, are so modified; that every function in the economy is slowly, ineffectually, and imperfectly performed. Innervation and nutrition, in particular, are so circumstanced, that even those agents, on which the varied phenomena of health and life, more or less immediately depend, now become the cause of disease, and of death." Cessation of the circulation seems in this species of gangrene to be the immediate cause of it, as well as of some others already described. (See *Carswell's Elem. Forms of Disease, Fasc. 7.*)

The mortification arising from long continuance in the same posture, is chiefly attributable to debility and the unremitted pressure which parts sustain, and which obstructs the circulation. Surgeons have frequent occasion to see melancholy examples of this kind of mortification, particularly in cases of fractures, paralysis from disease of the vertebra, injuries of the spine or pelvis, &c. The mischief most readily occurs where the bones have the least flesh upon them, and, consequently, where all external pressure has the greatest effect; as, for instance, about the os sacrum, os ilium, spines of the scapulae, &c. The disordered part first becomes soft, livid, red at the circumference, and œdematous, afterwards losing its sensibility, and acquiring a black appearance; at length, it is converted into a foul sloughing ulcer.

In mortification from debility, Dr. Carswell describes a local accumulation of blood, as constituting in general the first perceptible change in the part, which is about to be deprived of its vitality. "This may take place from the part being submitted to pressure merely from its own weight, or that of the body; from slight friction; puncture, or other similar causes. In some of these cases, the blood accumulates partly from the influence of gravitation, and partly from compression of the veins; as, for example, in mortification of the soft parts covering the sacrum, heels, elbows, &c. of persons, recovering from typhoid fevers, and who are left in that state of prostration, which precludes the possibility of changing the position of the body. It is, perhaps, still more conspicuous in some patients, similarly confined with paraplegia from injury of the spinal cord." (See *Carswell's Illustrations, &c. Fasc. 7.*)

Though long continuance in the same posture is the grand cause of this kind of mortification, yet incidental circumstances are frequently combined with it, and have great influence over the disorder. These are, great debility, the same state of the system, as exists in typhus fever, impure air, unclean bedding, &c. According to Sir A. Cooper, some fevers have a greater tendency than others, to produce gangrene, as is the case with scarlatina. In slight cases of this disorder, he says, the most horrible effects will sometimes arise from gangrene. The tonsils will slough to a great extent; parts of the Eustachian tube, and even the tympanum will separate, and large portions of bone exfoliate. He also adverts to the dangerous sloughing frequently brought on in the measles by the application of large blisters to the chests of children, and points out the disposition to sloughing, occasioned by

the immoderate use of mercury, or by whatever tends to weaken the constitution.

There are some causes, which produce death in a part at once, by the violence of their operation. A very powerful blow on any portion of the body may destroy its vitality in this sudden manner. Lightning, strong concentrated acids, and gunshot violence, sometimes act in a similar way. When a ball enters parts with great force and rapidity, many of the fibres, which are in its track, are frequently killed at once, and must be thrown off in the form of sloughs, before the wound can granulate and heal. (See *Hunter on Gunshot Wounds.*)

Cold is often another cause of mortification, and, when parts which have been frozen, or frost-bitten, are suddenly warmed, they are particularly apt to slough.

I find in Baron Larrey's valuable publication, some interesting observations on the gangrene from cold. He acquaints us, that after the battle of Eylau, one of the most grievous events, to which the French soldiers were exposed, was the freezing of their feet, toes, noses, and ears: few of the vanguard escaped the affliction. In some, the mortification was confined to the surface of the integuments of the toes, or heels; in some, the skin mortified more deeply, and to a greater or lesser extent; while, in others, the whole of the toes, or foot, was destroyed. (See *Programma quo frigoris acrioris in corpore humano effectus expendit. Haller, Disp. ad Morb. Lips. 1775.*)

"All the writers on this species of mortification (says Larrey) have considered cold as the determining cause; but, if we attend to the period when the complaint begins, and the phenomena which accompany it, we shall be convinced, that cold is merely the predisposing cause. In fact, during the three or four exceedingly cold days, which preceded the battle of Eylau (the mercury having then fallen to 10, 11, 12, 13, 14, and 15 degrees below zero of Reaumur's thermometer), and until the second day after the battle, not a soldier complained of any symptom depending upon the freezing of parts. Nevertheless, they had passed these days, and a great portion of the nights of the 5th, 6th, 7th, 8th, and 9th of February in the snow and the most severe frost. The imperial guard especially had remained upon watch in the snow, hardly moving at all for more than four-and-twenty hours, yet no soldier presented himself at the ambulance*, nor did any one complain of his feet being frozen. In the night of the 9th and 10th of February, the temperature suddenly rose, the mercury ascending to 3, 4, and 5 degrees above zero. A great quantity of sleet, that fell on the morning of the 10th, was the forerunner of the thaw, which took place in the course of that day, and continued in the same degree for several days. From this moment, many soldiers of the guards and the line applied

* The ambulances of the French army are caravans, furnished with an adequate number of surgeons, and every requisite for the dressing of wounds, and the immediate performance of operations, upon which last circumstance, in particular, the life of the wounded soldier often depends. They follow the most rapid movements of the army, and are capable of keeping up with the vanguard.

for succour, complaining of acute pain in the feet, and of numbness, heaviness, and prickings in the extremities. The parts were scarcely swollen, and of an obscure red colour. In some cases, a slight redness was perceptible about the roots of the toes, and on the back of the foot. In others, the toes were destitute of motion, sensibility, and warmth, being already black, and, as it were, dried. All the patients assured me, that they had not experienced any painful sensation during the severe cold, to which they had been exposed on the night watches of the 5th, 6th, 7th, 8th, and 9th of February, and that it was not till the night of the 10th, when the temperature had risen about 18 or 20 degrees, that they felt the first effects of the cold." It is further noticed by Larrey, that such patients as had opportunities of warming themselves in the town, or at the fires of the night watches, suffered in the greatest degree. (See *Mémoires de Chirurgie Militaire*, t. iii. p. 60—62.)

Sometimes mortification seems to depend either upon the operation of some infectious principle, or, at all events, upon causes which simultaneously affect numerous individuals; for instances have been known, in which almost all the ulcers and wounds in large hospitals became nearly at the same time affected with gangrenous mischief. (See *HOSPITAL GANGRENE*.)

Mortification is frequently occasioned by the injury which parts sustain from the application of fire, and heated substances to them. When the heat is intense, the substance of the body is even decomposed, and of course killed at once. On other occasions, when the heat has not been so violent, nor sufficiently long applied, inflammatory symptoms precede the sloughing.

Cutaneous texture is that in which we have the best opportunity of observing the phenomena and progress of gangrene. When it occurs as a consequence of inflammation, the colour of the skin changes from the florid red to a darker shade; and in the progress of the disease it acquires a livid hue. The cuticle often separates at certain points from the skin, and the vesications, termed *phlyctena*, are formed, which usually contain a bloody-coloured serum. As sphacelus comes on, the livid hue disappears, and a slough is formed, which is sometimes ash-coloured; sometimes black. It is not always easy to judge of the extent of mortification from the appearance of the skin; for, when the subjacent cellular tissue is affected, the disorder may occupy a greater extent internally, than upon the surface.

In a spreading gangrene, the red colour of the affected skin is insensibly lost in the surrounding integuments; but, when gangrene, followed by sphacelus, stops, a red line, of a colour more lively than that of gangrene, is generally perceptible between the dead and living parts. It is at the inner edge of this inflamed line, where we usually see the ulcerating process begin, by which the separation of the dead from the living parts is effected. (See *Thomson on Inflammation*, pp. 511, 512.)

Cessation of the circulation in a part of the body, one of the three general circumstances, to which Professor Carswell ascribes mortification, may be produced:—1st. by inflammation; 2ndly, by mechanical causes, which obstruct the passage of the blood; and, 3dly, by local, or general de-

bility. "There is no tissue, nor organ of the body, which may not become affected with mortification, as the immediate or mediate effect of inflammation. Mortification is, however, much more frequently observed in those organs, in which the vascular system predominates, or in which an inordinate accumulation of blood is readily produced, on account of their greater sensibility, and their direct exposure to the influence of those causes, which give rise to inflammation. Hence, the reason, why gangrene and sphacelus occur more frequently in the skin and cellular tissue, mucous membranes and lungs, than in any other tissues and organs of the body, as immediate effects of inflammation; and why they are so rarely observed in serous and fibrous tissues, which contain few or no blood vessels. Not only is mortification rarely observed in serous and fibrous tissues, but it may also be said never to occur in them as an immediate effect of inflammation; for, they are never found in a state of gangrene, or sphacelus, unless the cellular tissue, with which they are in contact, and from whose vascular system their nutrition is derived, has previously been diseased. Such also is the case in death of bone, as a consequence of inflammation of the periosteum, and medullary membrane." (See *Carswell's Illustrations of the Elementary Forms of Disease*, Fasc. 7.)

The red line appears in the form of a narrow circle, indicating the boundary between the dead and living parts, and the commencement of the adhesive inflammation, which nature employs to stop the progress of the disorder. Ulceration then takes place along the internal border of the inflamed skin, and a separation is thereby effected between the living and dead tissues, the latter falling off in the form of what is termed a *slough*. A groove is first formed by the ulcerative process on the surface, and, advancing by degrees more and more deeply, at length accomplishes the perfect separation. The loss of substance, as Dr. Carswell observes, which is thus occasioned, is repaired to a greater or less extent, by means of coagulable lymph, (fibrine,) which is thrown out on the denuded surface, and which, becoming organized, assumes a membranous, or granular form, according to the situation of the part, or the nature of the tissue to be repaired, and constituting ultimately, what is denominated, a *cicatrix*. (See *Elem. Forms of Disease*, Fasc. 7.)

Mortification then frequently takes place in cellular texture. The skin, covering dead cellular tissue, generally has a dark red, or livid appearance, and may afterwards either ulcerate, or slough,—as is so often exemplified in phlegmonous erysipelas of the lower extremities. But, besides the *diffuse* form of gangrene and sphacelus of the subcutaneous cellular tissue, there is also a circumscribed form, which is observed in funiculus, carbuncle, or anthrax. "The great accumulation of blood, and the still greater and rapid effusion of serosity, which takes place in these circumscribed acute inflammatory affections, produce a state of extreme induration of the cellular tissue, a greater or less portion of which being thus, as it were, strangulated, dies from want of nutrition, becomes separated from the living parts, and is expelled in the form of a grey, or straw-coloured spongy, or pulpy mass, through an opening made in the skin by a similar

process, or a surgical operation." (See *Carswell's Illustrations of the Elem. Forms of Disease, Fasc. 7.*) In some cases, the portion of sphacelated cellular texture is extensive, as in carbuncle. In erysipelas phlegmonoides, the cellular tissue connecting the muscles, tendons, nerves, blood-vessels, &c. often perishes to a great extent. Here large portions of skin are frequently destroyed by sloughing, or ulceration, so that muscle, blood-vessel, tendon, nerve, &c. are exposed to view, quite denuded of their proper coverings, and in different states of disease. In truth, the cellular tissue is, not only more frequently the seat of mortification, but it is also more extensively, and more rapidly destroyed by it, than any other tissue of the body. This fact is important to be remembered in the operation of amputation, when called for by mortification, because it dictates the prudence of beginning the incision higher up, than the mere appearance of the skin would indicate.

Artery is the texture, endowed with the greatest power of resisting its own destruction by mortification. "I have (says Dr. Thomson) in various instances of erysipelas phlegmonoides, seen several inches of the femoral artery laid completely bare by the gangrene, ulceration, and sphacelus of the parts covering it, without its giving way before death. The arteries in these, and other similar instances, in which I have seen them laid bare in the neck and arm, by abscess terminating in mortification, had the appearance of raw flesh, and were obviously thicker and more vascular than natural. The blood circulated through them, and assisted in supplying with nourishment the parts upon which they were distributed." (P. 523.) I have often seen the truth of the foregoing statement plainly illustrated in cases of sloughing buboes, by which several inches of the femoral artery were exposed. I have seen the throbbing brachial artery denuded for more than a month, nearly its whole extent along the inside of the arm, by the ravages of malignant and phagedenic ulceration, attended with repeated sloughing; and yet hemorrhage had no share in carrying off the unfortunate patient.

The blood coagulates in the large arteries, which lead to a mortified part. This occurrence takes place for some distance from the slough, and is the reason why the separation of a mortified limb is seldom followed by hemorrhage.

The same occurrence also affords an explanation, why, in the amputation of a mortified limb, there is sometimes no hemorrhage from the vessels, although the incisions are made in the living part. This fact was first particularly pointed out by Petit, the surgeon. (See *Mém. de l'Acad. des Sciences, 1732.*) "When a gangrened limb (says this celebrated surgeon) is cut off in the dead part, no hemorrhage occurs, because the blood is coagulated a great way in the vessels." He adds, "We have several examples of limbs amputated, on account of gangrene, in which no hemorrhage occurred, although the amputation was made a considerable way in the living parts; because the clot was not confined in these cases to the dead part, but was continued forwards into the living, as far as the inflammatory disposition extended."

According to Dr. Thomson, cases, in confirmation of the foregoing statement, are recorded by other practical writers, especially Quesnay, and

Mr. O'Halloran. In one of the cases, mentioned by the latter gentleman, and in which no hemorrhage followed the removal of the limb, the incisions were made four inches above the division of the dead from the living parts. Dr. Thomson has seen a still longer portion of femoral artery closed up with coagulated blood, after a mortification of the foot and leg; and, in one example, where the mortification began in the thigh, he saw the coagulation of the blood in the external iliac, extending up to the origin of this vessel from the aorta. "So common, indeed, is this coagulation of the blood in the limbs affected with mortification that it has been supposed to be a necessary and constant effect of this disease. This opinion, however, does not appear to be well founded; for I have now seen several instances in which a limb has mortified and dropped off, without hemorrhage having occurred from the vessels divided by nature; and yet, in examining the vessels of the stumps of these patients after death, I have not been able to find any clots, either of coagulated blood, or of coagulable lymph. In the cases to which I allude, the adhesive inflammation, occurring in the line of separation between the dead and living parts, had extended to the blood-vessels, and their inner surfaces being inflamed and pressed together by the swelling which occurs, had adhered so as to close up their extremities. It is in this way we shall find, that the common ligature acts, which is applied to the divided extremities of arteries and veins; and it is this obliteration by the process of adhesion of the extremities of the arteries and veins in the neighbourhood of the sphacelated parts, that in reality prevents the occurrence of hemorrhage, when the mortified limbs fall off, or are removed by the knife. The coagulation of the blood in the canal of the vessel is not always sufficient. It may tend, in the cases in which it occurs, for a time to restrain hemorrhage; but it is by the obliteration by adhesion, of the canal in the extremities of the arteries and veins, that the occurrence of hemorrhage can be securely and permanently provided against. Indeed, to me it seems doubtful, whether the coagulation of blood, which takes place in mortified limbs, ever takes place in the canal of the vessel, till its extremity and lateral communications have been plugged up by the coagulating lymph, which is extended during the state of the adhesive inflammation." (See *Thomson on Inflammation, p. 554.*)

It is to the obliteration of the blood vessels alone, that immunity from hemorrhage is to be ascribed. "The presence of coagulable lymph, its organization, and union with the parts, into which it has been effused, constituting what is called adhesive inflammation, contributes, no doubt, to prevent hemorrhage during the process of separation of the dead part, or sloughing. But (says Dr. Carswell) I am disposed to believe, that it is the prevention of hemorrhage from the smaller vessels alone, that is secured by the adhesive inflammation, while that from the larger ones is prevented by the previous coagulation of the blood within them." In noticing amputations, followed by little, or no hemorrhage, he observes, that, in such cases, there is no adhesive inflammation, and gangrene is apt to follow, in consequence of the vessels not having been divided above the point, at which they are obliterated. (*Elem. Forms of Dis, Fasc. 7.*)

If hemorrhage occur in mortification, the vessels, of course, must be pervious, and Dr. Carswell has found them filled with fluid, or imperfectly coagulated blood; and the cellular and other tissues pervaded by serosity, bloody serum, or puriform fluid.

If gangrene and sphacelus happen to any extent, the patient is usually troubled with an oppressive hiccough; a symptom well known to the surgeon of experience, and often an indication of the mischief, when external signs are less instructive. The truth of this remark is frequently seen in strangulated hernia.

The constitution also suffers immediately a considerable dejection. The patient's countenance suddenly assumes a wild cadaverous look; the pulse becomes small, rapid, and sometimes irregular; cold perspirations come on, and the patient is often affected with vomiting, diarrhoea, and delirium.

As Dr. Thomson observes, the constitutional symptoms "form fevers, which partake in individual cases, more or less, of an inflammatory, typhoid, or bilious character. But, the degree of these fevers varies, in every particular case, from their almost total absence to the highest degree of intensity. The skin is usually hot, and dry at the commencement of the attack; the tongue is without moisture, brown and hard; the pulse is quicker, and less full and strong, than in inflammation; and this state of the pulse is often attended by flattering intermissions, and a considerable degree of subsultus tendinum. The fever has, in general, more of the asthenic than of the sthenic character; or it is more of the typhoid, than of the inflammatory type; a circumstance of great importance in the constitutional treatment of mortification. The fever in gangrenous affections is often accompanied with great uneasiness and restlessness, dejection of spirits, wildness of the looks; and, in severe cases, with almost always more or less delirium. In the progress of the disease, cold sweats, palpitations, and convulsions, sometimes occur; a hiccough, accompanied with nausea, often comes on, and proves a most distressing symptom to the patient. Frequently, this hiccough is the forerunner of death. Some patients die comatose; others, after suffering severe pains, spasms, and delirium. But, in some, a slow, in others, a sudden, abatement of the constitution; all symptoms takes place, accompanied also with the amelioration of the local affection. The gangrenous inflammation stops, and a red line is formed by the adhesive inflammation in the extreme verge of the living parts; the dead part separates, and granulations form; and when the constitution has strength to sustain the injury it has received, recovery takes place." (*On Inflammation*, p. 509.)

It is an erroneous supposition, that mortification, arising from an external local cause, is more easily stopped and cured, than that originating from an internal cause. The local cause is sometimes exceedingly difficult, or even incapable, of removal; and a sphacelus, which is at first entirely local, may afterwards become a general disorder, by the universal debility, and derangement of the system, resulting from the complaint. Hence, it is obvious, that a sphacelus may easily extend beyond the bounds of its outward local cause. On the other hand, a mortification may be reduced to one of a nature entirely local, though it arose at first

from constitutional causes. Sphacelus from extreme debility, or from such a state of the system, as attends the scurvy, typhoid, fevers, &c. is constantly perilous, because these causes are very difficult to remove. It is also a fact, that, when numerous causes are combined, it is an unfavourable occurrence, not merely because the surgeon is apt to overlook some of them, but because there are in reality more obstacles to the cure.

Humid gangrenes, which are frequently accompanied with emphysema of the cellular tissue, usually spread with great rapidity. (See *James on Inflammation*, p. 96.)

Sometimes a mortification spreads so slowly, that it does not occupy much extent at the end of several months, or even a whole year. A case is recorded by M. Le Groux (*Thèse*, 1827), where a man, aged 66, was attacked with gangræna senilis, which made such very slow progress, that the patient did not die till the expiration of nearly a twelvemonth from the first attack on one of the toes. (See *Cruveilhier, Anat. Pathol. livr. xxvii.*) The case, however, is, often not the less fatal on this account. The danger is never altogether over, until the dead part has completely separated. The entrance of putrid matter into the circulation (says Richter) is so injurious, that patients sometimes perish from this cause, long after the mortification has ceased to spread. (*Anfangsg. der Wundarzn.* b. i. kap. 3. pp. 78, 79.)

This last circumstance is very much insisted upon, by all the modern continental surgeons; but the doctrine has never gained ground amongst English surgeons, who entertain little apprehension of the bad effects of the absorption of putrid matter in cases of mortification; and the opinion of Mr. Guthrie may be more correct, that nature receives the shock through the nervous system, and not through the absorbents. (*On Gunshot Wounds*, p. 123. ed. 2.)

The idea of a deleterious principle being absorbed was long ago well refuted by Mr. J. Burns, who pointed out, that the impression upon the constitution was in no degree commensurate with the size of the slough, and consequently with the quantity of putrid matter, as the effects produced by a small slough of intestine, or cornea, will exemplify. But when the sloughs are of equal size, and in the same parts, the differences of constitutional sympathy, as Mr. James observes, may depend upon the nature of the surrounding inflammation, which, however, he conceives, may itself be affected by the quantity of putrid irritating fluids. (*On Inflammation*, p. 98.)

The danger of sphacelus materially depends upon the size and importance of the part affected, and upon the patient's age and constitution. The indications, already specified, of the stoppage of mortification, must also considerably influence the prognosis, especially the red line at the edge of the living parts, and the incipient separation of the dead from the living parts.

Sphacelus implies the total loss of life in the part affected, the destruction of its organisation, the abolition of all its functions, and an absolute inability to resume them again. However, even when we see the surface of a part manifestly sphacelated, we must not always conclude, that the entire destruction of its whole substance or thickness is certain; for, in many cases, the disorder only affects the skin and cellular substance. In

this state, the integuments frequently slough away, leaving the tendons, muscles, and other organs perfectly sound.

TREATMENT OF MORTIFICATION.

In the treatment, the surgeon must always have one thing under consideration; viz. whether the case before him is one of acute mortification, attended with inflammation and inflammatory fever; or whether it is a chronic mortification, beginning without fever, or attended with a fever of a typhoid nature and great prostration of strength? By making up his mind upon this point, the practitioner will establish a useful general principle for his guidance, especially in the commencement of the treatment.

1. When mortification is acute, and seems to depend on the violence of inflammation, the first indication is to moderate the inordinate action of the sanguiferous system, by the prudent employment of such means as are proper for counteracting inflammation. In short, relief is to be sought in the antiphlogistic regimen, which consists in the employment of blood-letting, purgatives, diaphoretics, and diluents, and in abstinence from all vegetable, or animal substances, which have a tendency to excite, or to augment the febrile action. This regimen must be pursued so long as inflammatory fever continues. It is only in cases in which the fever, from the first, assumes a typhoid character, or where the mortification takes place without the previous occurrence of fever, that any deviation from the antiphlogistic regimen can be allowed.

Dr. Thomson, from whom I have borrowed the foregoing passage, also notices the present common aversion to bleeding in compound fractures, erysipelas, carbuncle, hospital gangrene, burns, and frost-bite; cases in which the patient, it is said, can seldom bear with impunity any considerable loss of blood. "In many instances of these injuries and affections (says he) blood-letting, I know, is not required; but I am doubtful, even if it were generally employed, whether it would produce all the mischiefs, which have of late years been ascribed to it. I believe it to be the most efficacious of any of the remedies that can be employed, in all cases of inflammatory fever threatening to terminate in gangrene, and that its use in such cases ought never to be omitted in the young, strong, and plethoric." (See *Lectures on Inflammation*, p. 559.) Yet, it is to be employed with a great deal of circumspection; for, should it be injudiciously resorted to, from the true state of the system not being understood, the error may be followed by the most fatal consequences. Owing to the constitution being generally broken by intemperance or enfeebled by an impure atmosphere, Sir A. Cooper considers it rarely safe in this metropolis to take blood from the arm, with the view of checking gangrene; though he acknowledges, that the removal of a few ounces of blood is a practice, which sometimes answers in the country. It should also be well remembered, that however strongly bleeding may be indicated, the moment is not far off, when it is totally inadmissible. If the mortification has already made progress, this evacuation is never justifiable.

In acute mortification, after as much blood has been taken away as may be deemed safe or proper, and this measure must be adopted with extreme

circumspection, the other parts of the antiphlogistic regimen must be continued, so long as any increased action of the heart and arteries continues. "The use of purgatives seems to be particularly required in those cases, in which the local inflammatory affection is accompanied with derangement of the digestive and biliary organs. Antimonial diaphoretics are those, from which I should be inclined to expect most advantage in the commencement of the attack; but after the inflammatory action has been subdued, opiates, either alone, or combined with antimony, or what is still better, with ipecacuanha, as in Dover's powder, are frequently of singular service, not only by diminishing pain, but also by inducing a soft and moist state of the skin." (Thomson, p. 560.) A strict regimen, which may have been useful and even necessary, during the inflammatory stage, will have a very bad effect, if continued too long, by diminishing the patient's strength, which on the contrary should be supported by the most nourishing food.

Sir A. Cooper recommends two or three grains of the chloride of mercury at night, in order to restore the secretions of the intestinal canal and liver; and the liquor ammoniæ acetatis, with a few drops of the tinct. opii. several times a day, with the view of lessening irritability, and tranquillizing the system.

A vegetable diet, as Dr. Thomson observes, is to be preferred in the commencement both of acute gangrene with inflammatory fever, and of chronic gangrene with a fever from the first of a typhoid nature. Wine and animal food given too early in diseases, which have a tendency to gangrene, increase the febrile heat and frequency of the pulse, oppress the stomach, render the tongue foul, the patient restless and delirious, and his situation dangerous, if not hopeless. In the transition from gangrene to sphacelus, an abatement of the symptomatic fever usually takes place in almost all cases, which have ultimately a favourable termination. Dr. Thomson believes, that *this is the first period, at which it is safe to allow vinous liquors or diet, chiefly animal.* (P. 561.)

I next come to a second very essential and important indication to be fulfilled, as soon as the symptoms, announcing the existence of the inflammatory state, abate, and the patient begins to be debilitated. This indication is to prevent excessive weakness by the suitable employment of cordials, and, particularly, of tonics. These same means also contribute to bring the system into a proper state for freeing itself from the mortified parts, or, in other words, for detaching them. For inflammation is the preparatory step, which nature takes to accomplish the separation of mortified parts from the living ones, and this salutary inflammation cannot take place, if the energies of life be too much depressed.

In order to fulfil the above indication, it is necessary to prescribe a nourishing diet, with a certain quantity of good wine, proportioned to the patient's strength, and the symptoms of the complaint. This diet is generally productive of more real benefit, than the whole class of cordial and stimulating medicines. However, when the patient is much weakened, the mortification of the part affected is complete, and the disorder is spreading to others, some of the following remedies may be ordered: ammonia, aromatic confection,

æther, &c. In general, however, wine is better, and especially sherry.

Of all the medicines, hitherto recommended for the stoppage of mortification, none ever acquired such a character for efficacy, as the Peruvian bark. It is said, that this remedy often stops, in a very evident and expeditious manner, the course of the disorder. Being a very powerful tonic, it is thought to operate by strengthening the system, and thus maintaining in every part the necessary tone for resisting the progress of mortification. But, whatever may be its mode of acting, the advocates for this medicine contend, that it ought to be employed in almost all cases of mortification, as soon as the violence of the inflammatory symptoms has been appeased.

It was Mr. Rushworth, a surgeon at Northampton, who first urged this doctrine in the year 1715. Amyand and Douglas, two surgeons in London, soon afterwards confirmed the virtue of the remedy. Mr. Shipton, another English surgeon, also described in the *Philosophical Transactions*, the good effects which he saw produced by it. In the *Medical Essays of Edinburgh*, Drs. Monro and Paisley published several cases, illustrative of its efficacy. We are there informed, that when its exhibition was interrupted, the separation of the eschars was retarded, and that, on the medicine being resorted to again, the separation went on again more quickly. Since this period, all practitioners, in England and elsewhere, have employed bark very freely in the treatment of mortification; and the exaggerated statements of its effects led to its exhibition in all cases of this nature, without discrimination of the varying states of the general health and local disorder, in the different stages of the complaint, and without any reference to its causes and nature, which are subject to variety.

We cannot indeed doubt, that bark has frequently had the most salutary action, in cases of mortification, though sometimes it may probably have had imputed to it effects, which were entirely produced by nature. The following observation, made by Dr. Thomson, is highly worthy of recollection: "In attending to the effects supposed to result from the operation of the external and internal remedies, which are duly employed for the cure of mortification, there are two facts, well ascertained, which appear to me to be peculiarly deserving of your regard. The first of these is, that mortification often stops spontaneously, without any assistance whatever from medicine; the second, that it often begins, and continues to spread, or even, after it has stopped for a while, recommences and proceeds to a fatal termination, in spite of the best directed efforts of the healing art." (See *On Inflammation*, p. 557.)

It is quite wrong to prescribe bark, in every instance; for there are many cases, in which it is unnecessary; some, in which it does harm; and others in which it is totally inefficacious. It is a medicine obviously of no service, when mortification arises from an external cause, and is the only complaint, in a healthy, strong constitution. It is equally unnecessary, when the sphacelus is of the dry sort, and has ceased to spread, at the same time, that the living margin appears to be in a state of inflammation, without any universal debility. But it deserves particular notice, that the circumstances of each individual case are

liable to such variety, that though bark may be at first unnecessary, it may afterwards be indicated.

When mortification is complicated with serious disorder of the functions of the abdominal viscera, a frequent case, bark is manifestly pernicious. Here, the indication is to correct the state of the stomach and bowels, with mild opening medicines, and especially calomel. When this has been done, if bark should be indicated by any of the circumstances, already pointed out, it may be safely administered.

Sometimes, mortification is accompanied with a low typhoid kind of fever, which, whether the cause, or the consequence of the local mischief, may require the exhibition of bark.

However, mortification may be attended with common inflammatory fever, and then the living margin is generally inflamed and painful. This is particularly the case, when mortification is the consequence of genuine acute inflammation, or of an external injury, in a healthy subject. Here, bark must obviously be injurious. Still, it is wrong to regard this medicine as invariably hurtful, whenever sphacelus is the effect of inflammation. It has already been observed, that the inflammation frequently has less share in the origin of the disorder, than some incidental cause, which may require the exhibition of bark. Even when mortification is the pure effect of inflammation, great prostration of strength may subsequently arise, and indeed does mostly take place at a certain period of the disorder. In this circumstance, the voice of experience loudly proclaims the utility of bark, though its exhibition would have been at first useless or hurtful. While genuine inflammatory fever, and local inflammation, are coexistent with mortification, mild antiphlogistic means are useful; but great caution is requisite, since, in humid gangrene, the inflammatory state soon changes into one, in which the great feature is prostration of strength.

When there is mere prostration of strength, without any symptom of gastric disorder, or of inflammation, or typhoid fever, bark is evidently proper, though seldom effectual alone; diaphoretic and nervous medicines being also necessary, opium, wine, camphor, ammonia, brandy, &c.

We meet with one species of mortification, in which the patient experiences severe pain in the part, unpreceded by any appearance of inflammation. Here bark is never of use, and opium is the medicine, in which we should principally confide.

Bark sometimes occasions purging, and then it must be immediately discontinued, unless that hurtful effect can be prevented by the addition of a few drops of laudanum to each dose, or by employing the sulphate of quinine, instead of the common preparations. Bark frequently disagrees with the stomach; in which case I should say, that it ought not to be continued at all; though, in this circumstance, the usual plan is to give, instead of the decoction, the infusion, or the powder finely divided, and mixed with wine, or what is yet better, the sulphate of quinine.

Several years ago I published a critique on the indiscriminate employment of bark in cases of mortification, and my remarks were inserted in the article *Gangrene* in Dr. Keen's *Cyclopaedia*. Many of them were introduced into the 2d edition of this Surgical Dictionary, printed in 1813. (See CINCHONA.) Since this period, I am happy to find, that the blind enthusiasm, with which bark

was prescribed, is beginning to subside, and that, on this subject, some eminent surgeons have of late publicly avowed sentiments, which entirely coincide with my former statements. "I think (says Dr. Thomson) I have frequently seen it prove hurtful, when administered in cases of mortification, by loading the stomach of the patient, creating a dislike to food, and sometimes by exciting an obstinate diarrhoea. *I believe it to be, in mortification, a medicine completely inert and inefficacious.*" (See *Lect. on Inflammation*, p. 563.) By this expression, Professor Thomson does not mean, that bark can never be useful in cases of mortification, but only that it has no specific power in checking the disorder, as many have erroneously inculcated.

"Bark (says Boyer) has been considered by several distinguished English practitioners, as a true specific against gangrene in general, and especially against that which depends upon an internal cause; but, subsequent observations to those published in England have proved, that it has no power over the immediate cause of gangrene, and that it only acts as a powerful tonic in stopping the progress of the disorder, and promoting the separation of the mortified parts." (See *Maladies Chir.* t. i. p. 151. Paris, 1814.) Boyer also particularly objects to bark being given while inflammatory fever prevails; but, whenever he prescribes bark in cases of mortification, he seems to entertain the old prejudice of expecting benefit in proportion to the quantity which can be got into the stomach. On the contrary, Mr. Guthrie declares, that he has not found bark useful, "further than as a tonic, and given in such quantities as not to overload the stomach," (*On Gunshot Wounds*, p. 148. ed. 2.), a plan which I have always recommended. For further observations on bark, the reader is referred to CINCIONA.

Sometimes sulphuric acid may be advantageously given with bark, or quinine; and the citric, muriatic, and nitric acids, are occasionally prescribed.

Carbonic acid gas is another remedy of great use in chronic mortification. The patient may take, if he pleases, soda, Selzer, and other waters, impregnated with this gas, as his common beverage, with wine, brandy, or other stimulants, if they are indicated.

Hospital gangrene is a case, for which bark has been recommended. The best mode of treating this particular case, however, has been detailed in a separate article. (See *HOSPITAL GANGRENE*.)

A third indication, which should be observed together with the second, or which should even precede it in many instances, is to *lessen the irritability and sufferings of the patient, by the use of opium*. Attention to this desideratum frequently contributes more than any thing else, to stop the progress of the disorder, and is often indispensable, in order to promote the operation of other remedies. In all cases of mortification, every thing which heats, irritates, or adds to the patient's sufferings, appears, in general, to augment the disorder, and increase the rapidity of its progress. On the other hand, every thing which tends to calm, assuage, and relax, frequently retards the progress of mortification, if it produce no greater good. The pain also, which is a constant mark of too much irritation, contributes of

itself to increase such irritation, and, in this double point of view, we cannot do better, in the majority of cases, than endeavour to appease it by the judicious and liberal use of opium. When the inflammatory stage evidently prevails, this medicine may be conjoined with antiphlogistic remedies, such as the nitrate of potash, antimonials, &c. In other instances, attended with debility, it may be given with bark and cordials.

Mr. Pott describes a species of mortification, for which he sets down bark as ineffectual, and opium the remedy which ought to be chiefly depended upon. The case here alluded to is very unlike the mortification from inflammation, that from external cold, from ligature, or bandage, or from any ordinary cause, and this, as well in its attack, as in its progress. In some few instances, it makes its appearance with little or no pain; but, in the majority of the cases, the patients feel great uneasiness through the whole foot and joint of the ankle, particularly in the night, even before these parts show any mark of distemper, or before there is any other, than a small discoloured spot on the end of one of the little toes. It generally makes its first appearance on the inside, or at the extremity, of one of the smaller toes, by a small black or bluish spot; from this spot the cuticle is always found to be detached, and the skin under it to be of a dark red colour. If the patient has lately cut his nails, or corn, it is most frequently, though very unjustly, ascribed to such operation. In some patients, it is slow and long in passing from toe to toe, and from thence to the foot and ankle; in others, its progress is rapid, and horribly painful: it generally begins on the inside of the small toe, before it is visible either on its under or upper part; and when it makes its attack on the foot, the upper part of it first shows its distempered state, by tumefaction, change of colour, and sometimes by vesication; but wherever it is, one of the first marks of it is a separation or detachment of the cuticle.

The progress of this variety of mortification is denoted beforehand by uneasiness, numbness, and a remarkable coldness, and paleness of the part. The loss of temperature is not, according to Dupuytren, like that of a dead subject, and which only happens because the mortified part acquires an equilibrium, in respect to heat, with that of the surrounding atmosphere. He says, that it is an icy coldness, lower than the degree indicated by the thermometer, exposed to the air, or even immersed in water. On this subject, Dupuytren made numerous experiments, and found that when the thermometer was applied to the parts about to perish, it always fell lower, than the media above specified. Moreover, he noticed, that where the heat was deficient, the sensibility was lost, and gangrene near at hand. Pain, and even acute, intolerable, tearing pain, accompanied by uneasy tinglings, are frequently experienced in this complaint. These phenomena are soon followed by slight swelling, and violent discolorations, which are dark-coloured, low down the limb, and of a less deep shade further up, while still higher up, the discoloration is only in patches, or in the form of a mottled appearance. But, in other instances, there is no swelling, and the parts are pale, shrivelled, and, as it were, shrunk within themselves. Phlyctenæ often form, and underneath them is a slough; but on

other occasions, there are none, and then black spots suddenly appear, and are converted into sloughs; the sensibility of the parts is lost, and a shrivelling, drying, and mummification of them ensues, in proportion as the disorder invades the toes or fingers. (See *Dupuytren, Chir. t. iv. p. 493.*) The mention of fingers reminds me that, though this species of mortification is only described by Pott, as seated in the lower extremities, I have seen it attack the upper; and one remarkable example of this occurred about three years ago, in an old woman under Mr. Liston, in University College Hospital. A line of demarcation formed a little below the axilla, and the living soft parts having separated from the dead down to the bone, the latter was sawn through, the stump healed up, and the patient recovered. Other examples of spontaneous gangrene of the upper limbs, are given by Dupuytren and Cruveilhier.

It is very certain, that, in many of these cases, the pulse becomes imperceptible, or ceases entirely, while, in the course of the artery, a hard round cord is felt; and, by the cessation in the pulsations, and the ascent of the cord up the limb, the progress and limits of the mischief may be calculated. Dupuytren declares, that this chronic form of mortification is not essentially connected either with old age, or ossification of the arteries. In its commencement, it appears to him to be sometimes quite a local affection; the respiration, circulation, intellectual and digestive functions, being all carried on at first with regularity. He admits, however, that hard drinking and disease of the valves of the heart, are generally concerned as exciting causes of arteritis; and that such arteritis may take place, producing coagulation of the blood, and obstruction in the diseased arteries of old subjects, as well as in the sound ones of young persons. (See *Dupuytren, Op. et vol. cit. p. 492.*)

Even when the whole of the foot has mortified, and all below the upper third of the leg is intensely cold, the motions of the ankle are performed, which, as Dupuytren observes, is explicable by the fact, that most of the muscles of the foot ascend to the neighbourhood of the knee, a point to which the disorder has not yet reached.

For one female, in whom Pott had met with this form of mortification, he had seen it in at least twenty males. He had much more often found it in the rich and voluptuous, than in the labouring poor; more often in great eaters, than in teetotalers. It frequently happens to persons advanced in life, but it is by no means peculiar to old age. It has, by some, been supposed to arise from an ossification of vessels; but, for this opinion, Pott never could find any foundation but mere conjecture.

In this article, I have already stated the observations of Cowper, Thomson, Hodgson, Cruveilhier, and Carswell, upon the ossified state of the arteries in this species of mortification. The facts, recorded by these writers, at least prove, that the opinion is founded, not upon mere conjecture, as Mr. Pott alleges, but upon actual observation and experience. It is true, that Dupuytren, who ascribed the disorder to obstruction of the arteries from arteritis, only looked upon ossification of them as a mere coincidence; observing that ossification alone will not materially interfere with the course of the blood in them. (See *Elem. Chir. t. iv. p. 482.*) We find, as it

appears to me, in this species of mortification, an illustration of the high value of pathological anatomy, which here at once leads us to the cause of the disorder, and informs us why medicines, and local remedies, are of such little service. Cruveilhier's more correct view, however, of the influence of such ossification, and its different degrees, combined with other causes, I have already noticed.

Many instances of this species of gangrene in females are now upon record, though, so far as my observations go, its greater frequency in the male sex, as stated by Pott, is unquestionable. Dupuytren adverts to its occurrence in children only ten years old, and in women of twenty, and forty. The particulars of some of these cases are also given by him. (See *Lectures Orales, &c. t. iv. p. 485.*) Other instances of it in females are described by Cruveilhier. (*Anat. Pathol. t. ii. livr. 27.*) I attended the late Mrs. W., of Guildford-street, for this species of mortification, which proved fatal to her. In this instance, it began on the heel, and extended so slowly, that it had not reached further than the ankle at the end of nine months, when the lady died. Sir B. Brodie saw this patient, with me, about a fortnight previous to her death. There is great variety then in the rate at which this gangrene advances. Cruveilhier relates one case, in which the patient lived nearly a year with it. Mrs. W., whom I attended, lived nine months; a gentleman, whom I attended in Gray's Inn, with Mr. Hughes, of Holborn, lived about six weeks; and another patient, whom I attended, with Mr. Baker, of Staines, was destroyed by it in ten days; the disorder, in this short time, having reached from the toes some way up the leg.

In this particular kind of mortification, Mr. Pott found bark, used internally or externally, by itself, or joined with other medicines, completely ineffectual.

His plan was generally to give one grain of opium every three or four hours; but never less than three or four grains in the course of four-and-twenty hours. However, he did not propose opium, as a universal infallible specific; but only as a medicine, which would cure many cases, not to be saved by bark.

M. Dupuytren, who espouses the doctrine, that this species of mortification depends upon obstruction of the vessels by arteritis, advises it to be treated by means of venesection and opium. By this plan, he affirms, that he has saved two-thirds, or even three-fourths of his patients. In this country, I should say, that not more than one patient in twenty is saved, who is attacked with this species of gangrene, and consequently, that if Dupuytren's practice were truly as successful as alleged, the means employed by him should be employed everywhere without hesitation. They have already been tried in this metropolis; but without any encouraging results. Nor does M. Cruveilhier, though a believer in arteritis being the cause of what is called *gangræna senilis*, give any confirmation of the efficacy of general bleeding, as practised by his distinguished friend Baron Dupuytren. "The doctrine (says he) of arteritis being the cause of this mortification, has entirely changed the treatment of it; and for tonics, employed in every form, externally and internally, Dupuytren substituted venesection. But, though

more rational, *I do not know, that this method has had advantageous results.* The good effects of local bleeding in phlebitis, has induced me to prefer them to general bleeding in the treatment of arteritis. The agonizing pain, attendant on this disorder, seems to me to render opium indispensable, which was first given by Pott, in a case where he saved his patient." (*Anat. Pathol.* t. ii. livr. 27.)

The observations of Pott on the local treatment of these cases are of great practical importance. "I have found (says he) more advantage from frequently soaking the foot and ankle in warm milk, than from any spirituous, or aromatic fomentations whatever; that is, I have found the more capable of alleviating the pain, which such patients almost always feel, than the other; which circumstance I regard as a very material one. Pain is always an evil, but, in this particular case, I look upon it as being singularly so. Whatever heats, irritates, stimulates, or gives uneasiness, appears to me always to increase the disorder, and to add to the rapidity of its progress; and, on the contrary, I have always found, that whatever tended merely to calm, to appease, and to relax, at least retarded the mischief, if it did no more."

Sir A. Cooper generally recommends a poultice, composed of port wine and oatmeal, or that made with stale-beer grounds; but, in one case, which I attended with him in private practice, and which will be presently mentioned, a camphorated lotion, fomentations, occasionally a solution of the chloruret of soda, and emollient poultices, were all tried in vain. Indeed, the very nature of the disease, as already described, leaves little hope of essential good from topical applications. All that can be expected from the best of them is, some diminution of pain, and from the worst of them, an increase of it, with a more rapid extension of the gangrenous mischief.

In Greenwich Hospital, I understand that gangrana scenilis, is not unfrequent amongst the old pensioners, and that one of the surgeons of that establishment finds enveloping the foot and leg with lamb's wool, or other soft materials, calculated to maintain its temperature and circulation, better than the usual applications. The practice seems rational, with reference to the pathology of the disease. For this information I am indebted to Sir Benjamin Brodie.

When the toes are, to all appearance, perfectly mortified, and seem so loose as to be capable of being easily taken away, some surgeons remove them. But, however loose they may seem, if they be violently twisted off, or the parts, by which they hang, be divided, a very considerable degree of pain will most commonly attend such operation, which therefore had much better be avoided; for Pott had seen the pain, thus produced, followed by fresh mischief of the gangrenous kind. If the patient does well, these parts will certainly drop off; if he does not, no good can arise from removing them.

Dr. Kirkland observes, that we must be careful not to force the doses of opium, especially at first; and that the medicine does more harm than good, when its soporific effects go so far as to occasion delirium, take away the appetite, or cause affections of the heart. I may state, however, that the patient should in this, as well as in other examples of mortification, be kept con-

tinually under the influence of opium, by a proper repetition of the doses from time to time, as directed by Pott. The acetate, or muriate of morphia, is at present often preferred to other preparations of the medicine. Sir A. Cooper joins opium with subcarbonate of ammonia, and in a case, which I lately attended with him, he also prescribed musk, and wine and porter were allowed. So far as I could judge, the medicines which seemed to have most effect in prolonging the patient's existence were opium, the sulphate of quinine, and castor oil, with other mild aperients.

Some authors recommend camphor. Pouteau attributes considerable efficacy to it, when given in the dose of five grains, with a double quantity of nitre, every four hours.

Few surgeons of the present day believe, that opium possesses as much power in the preceding cases as Mr. Pott represented. While Dr. Thomson allows, that opium is much more entitled to the attention of practitioners than bark, in the treatment of mortification, yet, (he observes,) "I would not by any means have you to place the same reliance on its powers for stopping, even the mortification of the toes and feet in old people, which appears to have been done by Mr. Pott. From the trials, which I have made, and which I have seen made by others, I cannot allow myself to believe, that its powers in stopping this particular sort of mortification are greater, than in stopping any other form, or variety of the disease. It is obvious, however, from Mr. Pott's account, that his mind was strongly impressed with a very different opinion. His opinion seems to me to have been formed from the results of a very small number of cases, and in complete forgetfulness of the invaluable observations of his preceptor Mr. Sharp, with regard to the frequent spontaneous stoppage of mortification in cases, in which no medicines whatever are used." (See *Thomson's Lectures on Inflammation*, p. 568.)

This species of mortification rarely attacks both feet. One example of mortification of both feet, supposed to have been mainly induced by want of the common necessaries of life, presented itself a year or two ago in a woman in University College Hospital. The patient was a female about 30; the mortified parts of the feet separated, and she recovered. This case was not, perhaps, the kind of gangrene now under consideration. But one unequivocal instance of such disorder attacking both feet, I attended, in the summer of 1828, with Mr. Hughes, of Holborn; and the gentleman, who was the subject of the disease, was also visited by Sir Astley Cooper. Both feet and legs were attacked, and gradually destroyed nearly up to the knees. The patient lived a month after the commencement of the disorder. During most of this time the pulse was from 100 to 130; and the stomach so little disturbed, that the patient used generally to eat a mutton chop for dinner, until the last two or three days preceding his death. Until the final stage, there was scarcely any delirium. Two circumstances were particularly noticed; first, that the disease never extended itself, without being preceded by violent pains in the parts about to be destroyed, so that a judgment could always be formed beforehand from the degree of suffering, whether the spreading of the disorder would be considerable, or not. Secondly,

that the process of mortification, and its appearances in one leg, were totally different from those exhibited in the other. In the left, the disorder began on the inside of one of the toes, and followed the course described by Pott; in the right, a general diminution of the temperature of the foot and leg was the first thing noticed, without any discoloration of the skin, or any vesications, or spot on the toes. The coldness, after increasing very much, was followed by total loss of sensibility in the parts, and the cessation of the circulation and every other action in them; the flesh being little more changed in its appearance, than that of the limb of a dead subject. The parts, as the French surgeons would say, were *mummified*.

The term *gangrene*, does not seem to Cruveilhier to be perfectly applicable to this case, which is not attended with any signs of putrid decomposition; no change of colour. The name of *cadaverization* appears to him more appropriate. In one case, recorded by him, he was struck with the extreme rapidity with which the dead parts dried. "One may conceive (says he) that, on the one hand, the arteries no longer conveying blood into the limb; and, on the other, the veins and lymphatics, still retaining for a time their state of integrity, these latter pump, as it were, all the fluids out of the destroyed textures, and dry them up with excessive quickness. The great influence, which the state of the veins must exercise over the mode of decomposition, is very manifest, as likewise that, if the venous and lymphatic circulations are prevented, if the blood and serosity are very copious, active putrid decomposition will take place; but, on the contrary, if the venous and lymphatic circulations are not interrupted, there will be *mummification*." (See Cruveilhier, *Anat. Pathol.* t. ii. livr. 27.)

2. With respect to the external, or local treatment of mortification, the first indication consists in removing, if possible, such external causes, as may have occasioned, or kept up the disorder; as the compression of bandages, ligatures, tumors; all irritating substances, &c.

When mortification arises from inflammation, which still prevails in a considerable degree, it is evident, that the dead part itself only claims secondary consideration, and that the principal desideratum is to prevent the mortification from spreading to the living circumference, by lessening the inflammation present.

However eligible the employment of cold applications may be in theory, in mortification attended with inflammation, fomentations and emollient poultices are commonly preferred in practice. Besides bread and water and linseed meal poultices, there are several others, which have acquired celebrity. Of this kind are the cataplasma carbonis*, cataplasma cerevisiæ†, and the cataplasma effervescentes‡.

* Prepared by mixing about $\frac{3}{4}$ j. of finely powdered wood charcoal with half a pound of the common linseed poultice.

† Prepared by stirring into the grounds of strong beer as much oatmeal as will make the mass of a suitable consistence.

‡ Prepared by stirring into an infusion of malt as much oatmeal as will render the substance of a proper thickness, and then adding about a spoonful of yeast.

With respect to stimulating, and spirituous applications, such as brandy, spirit of wine, balsams, resins, and aromatic substances, which have been recommended by a vast number of authors, they are nearly abandoned by modern practitioners. Though such things are indeed really useful in preserving dead animal substances from becoming putrid, a very little knowledge of the animal economy is requisite to make us understand, that they cannot act in this manner on parts still endued with vitality; but, on the contrary, that they must have highly prejudicial effects, in the cases under consideration, by reason of the violent irritation, which they always excite, when applied to the living fibres. It may indeed be justifiable now and then to apply spirituous applications to the dead parts themselves, with a view of diminishing the fetid effluvia, which, by contaminating the air, have some share in injuring the patient's health: but the greatest care is requisite to keep these stimulants from coming into contact with the living surfaces around, and beneath, the sloughs.

A few surgeons, however, still place confidence in stimulating applications. "In the less acute and more chronic cases of gangrenous inflammation, as in malignant erysipelas and carbuncle, in the gangrene of the toes and feet of old people, in the sphacelating state of hospital gangrene, and in severely contused wounds, in which gangrene and sphacelus have supervened, the emollient poultice, which is applied to promote the separation of the dead parts, may have an addition made to it of a greater or less quantity of the unguentum resinosum, or even of oil of turpentine itself. In the more severe of these cases, where we have reason to dread the extension of the sphacelus, warm dressings, as they have been termed, which are formed by dipping pledgets of charpie in a mixture of equal parts of the unguentum resinosum and oil of turpentine, may be applied, of a temperature as hot as the patient can bear without pain; and over these we may lay an emollient poultices of a large size and soft consistence.

"After the sphacelus stops, and the process of ulceration begins in the inflamed line of contact between the dead and living parts, it will often be found, that the turpentine dressings are too stimulating, and occasion a considerable degree of pain. When this happens, we must either diminish the quantity of the turpentine in the dressings, or remove it altogether, according to circumstances. Besides the pain, a considerable extension of the ulceration would be, in general, the effect of continuing these applications after they begin to produce uneasiness. The ulcerating surface is, in the progress of separation, liable to pass under every mode of treatment, into the state of a painful and irritable ulcer; and in this state, it may require to be treated with decoction of poppy heads, or with the application of the turnip, carrot, fresh hemlock leaf, stale beer, fermenting poultices, &c." (See Thomson's *Lectures*, pp. 577, 578.)

Hospital gangrene is undoubtedly a case, that requires powerful applications, like the liquor arsenicalis diluted with an equal quantity of water, or the undiluted mineral acids; and, in Guy's Hospital, phagedenic sloughing ulcers were commonly treated by Sir Astley Cooper with the nitric acid lotion, 50 drops to a pint of water, and the internal exhibition of the subcarbonate of ammonia. He speaks also of a port-wine poultice as

an excellent application. The cases, termed sloughing phagedæna by Mr. Welbank, and considered by him as analogous to hospital gangrene, may be cured by dressing them with the undiluted nitric acid. (See HOSPITAL GANGRENE.) I conceive, that it has only been in hospital gangrene, and other cases of sloughing phagedenic ulcers, that various acids, diluted, or undiluted, other caustic substances, and the actual cautery, have proved really serviceable. The muriatic acid, diluted with six times its quantity of water, was particularly recommended by Van Swieten, who applied it after making scarifications. In this manner, he stopped a sloughing disease extending all over the scrotum and penis. This author strongly recommends the same topical application to the gangrenous state of the gums in cases of scurvy. In this kind of case, he mixed the muriatic acid with honey, in various proportions; sometimes he even employed the pure acid itself for touching the parts which were likely to slough. It is also by supposing, that the diseases, referred to, were of a phagedenic character, that I account for the good effects, imputed by Dr. Kirkland and others, in cases of mortification, to another still more active caustic, namely, a solution of mercury in nitrous acid, with which the edges of the living flesh were touched.

On the Continent liquid caustics are sometimes used as topical applications to gangrenous diseases, more especially, however, in cases of hospital gangrene, and malignant carbuncle. Of this last disorder, Larrey has recorded a very dangerous example, in which he effected a cure by first cutting away as much of the sloughs as possible, and then applying to the disorganized surface liquid caustics. Under the use of emollients, two persons had already fallen victims to the disease in the same family. (See *Mém. de Chir. Militaire*, t. i. p. 53.)

With respect to the actual cautery, Celsus recommended it to be applied to the line, which separates the dead parts from those which are still living, whenever medicines, and, particularly, topical emollient applications, failed in stopping the progress of the disorder. Pouteau ventured to revive this practice, which had been entirely exploded from modern surgery, and he was of opinion, that the method would have the most beneficial effects, in cases of erysipelatous gangrene, which is so often seen in hospitals, in consequence of wounds. For this purpose, he recommends cauterizing chiefly the edges of such parts as are of a dark red colour, and are on the point of perishing; and he advises this to be done with a heated iron, or boiling oil, and to repeat the cauterizing of the dead parts, at every time of dressing them, until the sensation of heat is even felt with a certain degree of force in the sound parts. The whole of the affected part is afterwards to be covered with a large emollient poultice.

We are informed by Dr. Reese, that Dr. Physick of the United States, first suggested the application of blisters in strips over the sound parts of a limb, next to those which are gangrenous, and he adds, "its success in this country and in Europe is a matter of notoriety." (See *Amer. Ed. of this Dict.*)

Pouteau relates a case of anthrax, which took place on a woman's cheek, and which he cured with

the actual cautery. The tumour, which, on the third day, was quite black, and as large as a walnut, was accompanied by an erysipelatous oedema, which extended over the whole cheek, eyelids, and front of the neck. Pouteau, after having opened the tumour in different directions with a lancet, introduced the red hot cautery, and repeated the application several times, until the heat was felt by the sound flesh. The patient felt herself very much relieved immediately after this had been done; an oppressive headach, and a very afflicting sense of strangulation, which she had before experienced, were got rid of, and in ten days more, the slough was detached on the occurrence of suppuration. (*Encyclopédie Methodique, Partie Chirurgicale, Art. Gangrene.*)

But, perhaps, of all the species of mortification, hospital gangrene is that, for which the use of caustics and the actual cautery itself, has had the most numerous and respectable advocates. The heated iron has been employed by some of the first surgeons of Paris for this particular case. (See *Sketches of the Medical Schools of Paris*, by J. G. Cross, p. 84. and *Hospital Gangrene.*)

The liquor sodæ chlorinatæ; that is Labarraque's soda disinfecting liquid, has been of late years, extensively employed as an application to gangrenous parts. I believe, that it answers best in phagedenic sloughing diseases, than common mortification. It is to be diluted with from five to eight parts of water. I have seen it sometimes used, either blended with the camphor mixture, or strengthened with the addition of from ʒj. to ʒij. of potassa fusa to each pint of it. Kreosote I have known employed with good effect in similar cases. From six to twelve drops of it to an ounce of distilled water will make an eligible application for some cases; but, in particular forms of phagedenic disease, it has been employed undiluted. (See KREOSOTE.)

Dr. Reese notices the use of pyroligneous acid as a topical application, in cases of mortification and sloughing ulcers. For many ulcers (says he) it is preferred by Professor Stevens to the nitric acid, or yeast poultice. (See *Amer. Ed. of this Dictionary.*)

In the gangrene, produced by pressure and weakness in persons who are compelled by diseases and injuries to lie for weeks and months in one posture, the mode of treatment is a matter of extreme importance, and frequently makes the difference of life, or death, to the poor sufferers. This affection usually has its seat in parts which are but thinly covered with muscular flesh. It occurs towards the latter stages of long continued febrile diseases, as after typhus, or hectic fever, attended with tedious suppuration; or even without these fevers, as in paralysis, and in bad compound fractures. However, as Dr. Thomson observes, there are two forms of disease, arising from pressure, which have not always been accurately discriminated. One of these is the preceding sort of sloughing; the other is a chafed, excoriated, and ulcerated state of the parts.

Sometimes uncleanness tends to cause this sort of mortification, that is, when the urine wets the patient's clothes. When this is the case, such irritation must be prevented by every possible means. If the skin be excoriated and broken, the powder of tutty, or lapis calaminaris, should be sprinkled over the part; or if an ointment be re-

quired, says Dr. Thomson, those which contain zinc or lead, are the best. But, when the ulceration threatens to extend, these remedies are to be laid aside, and an emollient, hemlock, carrot, or fermenting poultice used. (P. 580.) I have seen in the irritable state of such ulceration, the solution of opium under a common linseed poultice do more good, than any other application.

Sir A. Cooper recommends the application of turpentine. Sometimes he uses a mixture of vinegar and camphorated spirit.

But no topical remedies will in any of these cases avail, unless the chief cause of the disorder be removed. This is to be effected by change of position, and laying pillows and cushions of the softest materials in convenient places under the patient; not directly under the disease itself, but in situations where they will tend to raise the parts affected from the contact of the bedding. A circular hollow pillow will often accomplish this important object; but, when possible, an entire change of posture is to be preferred. In these instances, I must not forget to recommend the water bed, for which the public are indebted to Dr. Arnott, and which acts by nicely equalizing the pressure on every point of the body, on which the patient lies, so that he may experience no greater pressure on any one part, than if he were floating on the surface of water.

When sphacelus succeeds to gangrene from pressure, I have often seen camphorated spirit applied; but not with decided advantage. A common emollient poultice, and in very bad cases, the topical use of the solution of opium along the living margin, are the means, upon which I place most reliance, care being taken to improve the general health, without which grand indication, neither the removal of the pressure, nor the virtues of any dressings will answer. Dr. Thomson speaks most highly of the fermenting poultice, which I believe to be in these cases an excellent application. He confesses, however, that he has sometimes found it too stimulating, and been obliged to substitute the simple emollient, carrot, or turnip poultice. (P. 580.)

When mortification arises from cold, every sort of warm emollient application must at first be avoided, and cold water, or even snow, or ice, employed. (See CHILBLAINS.)

The gangrenous affection of the pudenda, to which female children are liable, was successfully treated by Mr. K. Wood by applying the liquor plumbi acet. dilutus in a tepid state, and bread poultices made with the same lotion. As soon as the ulcers became clean, they were dressed with the unguentum zinci. (See *Med. Chir. Trans.* vol. vii.) Other cases, which also ended well, have been dressed with lint, dipped in camphorated spirit, and covered with a poultice; or, at first, poultices made with the opium lotion, and, after the separation of the sloughs, the ulcer was dressed with port wine and decoction of bark in equal proportions. In some cases, however, mild stimuli proved injurious. (*James on Inflammation*, p. 243.)

Deep scarifications in the integuments. The majority of authors who treat of mortification recommend this plan in all cases. They even advise the incisions to be made down to the sound parts, in order to facilitate the application of topical stimulants, and to favour the operation of the

supposed antiseptic qualities of these dressings. But, with the exception of cases, in which the gangrenous parts lie under an aponeurosis, or others in which the integuments which have escaped destruction, cover a mixture of matter and sloughy cellular tissue, either in consequence of foregoing inflammation, or any other cause, such as extravasation of urine in the scrotum, all scarifications, which penetrate to the living parts, are often productive of the most serious mischief, instead of advantage. Such incisions cannot be practised, with it occasioning a great deal of pain, and producing inflammation, which often makes the mortification spread still further. But, as parts which are in a complete state of sphacelus, are absolutely extraneous substances, in regard to those which still retain their vitality, all such portion of them as is already loose should be removed. By lessening the size of the putrid mass, the necrotic action is diminished. An outlet may sometimes be made for the escape of a great deal of matter and discharge, which, being confined, might have a bad effect on the neighbouring living parts; and the latter are enabled to free themselves more easily from the rest of the sloughs.

The too common practice of accelerating, with a cutting instrument, the separation of the mortified parts, previously to the completion of the process, by which nature breaks the connexion between them and the living flesh, in general ought to be strongly reprobated, as causing unnecessary pain, and mutilation, and creating the risk of a renewal of the sloughing. So far as my experience goes, gangrenous phlegmon and is the only instance, in which it seems useful to remove the sloughs, before they are loose, so as to let the topical applications extend their action without delay to the subjacent living surface. (See *Hospital at GENEVA*.) Pott's sentiments, with respect to the danger and inutilty of cutting the tendons and ligaments, in the mortification of the toes and feet, are well known.

If the surgeon prudently let nature work, without disturbing her, the separation of the mortified from the living parts will soon follow the establishment of inflammation and suppuration at the edges of the slough.

But when the whole thickness of a limb is affected with mortification, ought the surgeon to leave things to nature? or ought he to have recourse to amputation?

In general, the performance of amputation is indispensable; not that nature would not in many instances detach the sphacelated part; but, because a great length of time would be required for the completion of the process, and a serviceable stump would rarely be left.

Another important question then arises—should the surgeon amputate, while the mortification is in a spreading state? Or, ought he to defer the operation until the line of separation begins to form between the dead and living parts?

In the mortification of the toes and foot, in old persons, Sir A. Cooper forbids amputation whether there be healthy granulations or not, and he declares that if the operation be done, mortification of the stump, and the patient's death, will certainly follow.

"Amputation (says a distinguished professor) was long regarded as one of the most effectual means which could be employed to prevent the

extension of gangrene. This practice, however, has not received the sanction of experience; on the contrary, it has been generally found, wherever it has been practised, in either acute or chronic gangrene, to accelerate much the progress of the disease; and in this way to hasten the death of the patient. The parts, which were divided in amputation, though at a distance from a spreading gangrene and from sphacelus, were found speedily to assume the appearance of the affection, for which the operation had been performed. *Till, therefore, the adhesive inflammation comes on, and a distinctly marked separation of the dead from the sound parts takes place, amputation is, in few, if in any cases of mortification admissible.* We never know previously to this, where a gangrene, or sphacelus, is to stop, nor whether the powers of the constitution be sufficient to sustain the injury that the mortification has inflicted. Even when the adhesive inflammation comes on, it is in most cases best to allow some time to elapse before we operate, partly with a view to give time for the constitutional symptoms to abate; in other instances, to allow the patient's strength to be recruited by nourishment and cordials; and partly also with a view to learn whether the constitution of the patient be indeed capable of so great a shock, as that which amputation must necessarily occasion." (See *Thomson's Lectures*, p. 382.)

A different doctrine and practice are now sanctioned. "Writes on gangrene, or sphacelus of the extremities (says Larrey), indiscriminately recommend the amputation of a sphacelated limb never to be undertaken before the mortification is bounded or limited by a reddish circle, forming a true line of separation between the dead and living parts. This circumstance can only occur in a case of spontaneous gangrene from an internal cause; or if it happens, as is very unusual, in a case arising from a wound, its progress is different, and it would be exceedingly imprudent to wait for it. *The gangrene from external injuries almost always continues to spread; the infection becomes general; and the patient dies.*" (*Mém. de Chir. Militaire*, t. iii. p. 142.) Respecting the want of foundation for this hypothesis of infection, I need here offer no remarks, having already expressed my opinion upon it. On the other hand, Larrey asserts, that, in the dry, or spontaneous gangrene, absorption takes place with more difficulty, and it is not uncommon to see the sphacelated parts separate from the living ones by the powers of nature alone, without the general functions being impaired. He argues that there is a manifest difference between what he terms the *traumatic* and the *spontaneous* gangrene, or, in other words, between the *humid* gangrene from an external cause, and the *dry* gangrene, which ordinarily proceeds from an internal cause. (P. 148.)

In cases of mortification, arising from external injuries, Larrey maintains, that, "notwithstanding any thing that writers and practitioners may allege to the contrary, we should not hesitate about promptly performing amputation, as soon as the necessity for the operation is decidedly established. There is no reason to apprehend, that the stump will be seized with gangrene, as in the spontaneous mortification, which has not ceased to spread, because the *traumatic* gangrene, after having arisen from a local cause, is only propagated by absorption, and a successive

affection of the texture of parts by continuity of the vessels. Amputation performed in a proper situation, stops the progress and fatal consequences of the disorder.

"Supposing, then, the lower half of the leg should be affected with sphacelus, in consequence of a gunshot injury, attended with a violent concussion of the part, and a forcible concussion of the vessels, nerves, and ligaments, if the skin is elsewhere uninjured, the operation may be done in the place of election, without any fear of the stump becoming gangrenous, notwithstanding the cellular tissue of the upper part of the member may be already affected. But, when the skin of the whole leg is struck with mortification, the operation must be done on the thigh, and no time should be lost. The same practice is applicable to the upper extremities. We must be careful not to mistake a limb, affected with stupor, for one that is actually sphacelated. In the first case, warmth, motion, and sensibility are still retained, although the skin may be blackish and the parts may be swollen. Besides, if there were any doubt, it would be proper to try at first tonic repellent applications, and cordial medicines, &c." (See *Mém. de Chir. Militaire*, t. iii. pp. 152, 153.)

When amputation has been practised, this author recommends the exhibition of bark, good wine, tonics, &c. in order to promote the good effects of the operation. (P. 154.)

In Larrey's memoir there are many cases recorded in favour of what he endeavours to prove, viz. that, in cases of mortification from external injuries, if the patient's life be in danger, amputation ought to be performed, although the sloughing may yet be in a spreading state. In the course of many years, Mr. Porter, surgeon to the Meath Hospital, has seen but one patient recover from traumatic gangrene, to whom the operation had been proposed, but rejected. (See *Dublin Journ. of Med. Science*, vol. iv. p. 220.) These facts are highly important; they tend to subvert a doctrine, and to prove the error of a practice, which have been urged in forcible terms by most of the distinguished surgeons of modern times. The sentiments of Sharp are rendered questionable; and the truth of the positive assertions of Pott is yet a matter to be examined. The latter, it is well known, tells us, that he has often seen the experiment made of amputating, while a mortification was spreading, but never knew it answer. Are we to conclude, that all these cases which Pott alludes to, were mortifications from an internal cause? Or, are we to suppose, that the operation failed from having been delayed too long? Or, must we imagine, that the nature of the human constitution has been changed, between the era of Pott, and that of Larrey?

It should be remarked, that the practice of amputation, in cases of spreading mortification, has generally had some partisans for many years past; but the weight of authorities has unquestionably been against it, and few surgeons in this country have ventured to deviate from the advice of Sharp and Pott. It is curious, however, that Mebee, a writer, who wrote for the express purpose of declaring his disapprobation of the early performance of amputation in gunshot wounds, should have admitted of only one case, in which the operation is proper, namely, *gangrene succedens* the wound made by a cannon shot. Here he

thinks, that amputation ought to be performed on the first appearance of the gangrene, in order to prevent it from spreading up the limb. (See *Traité des Plaies d'Armes à feu*. Paris, 1799.) It appears that about the year 1809, Mr. A. C. Hutchison performed with success two amputations in cases of spreading gangrene from gunshot wounds. (See *Practical Obs. on Surgery*, p. 72.) After the battle of Waterloo, I followed the same practice.

My friend Mr. Lawrence has successfully amputated at the shoulder joint in a spreading mortification of the arm, the consequence of external violence. "The skin of the amputated limb was greenish and livid; but the cuticle not yet detached. The cellular substance was distended with air, and with a discoloured offensive sanies; its appearance was not quite natural, where the incision took place; it was yellowish and anasarcaous. Small effusions of blood were observed here and there in the course of the nerves; even as high as the amputated part. No coagulation of blood in any of the arteries, even down to the ulnar and digital branches. All the soft parts were discoloured, dark red, and livid, and a frothy reddish fluid issued on incision." This case had the most favourable termination, and it clearly proves, that the *humid* kind of gangrene, which occurs in a healthy subject from severe local injury, which so rapidly affects a whole limb, and reaches the trunk in a few hours, must constitute an exception to the general maxim, that amputation should never be done, before a line of separation is established between the dead and living parts. Mr. Lawrence, however, would not be understood as meaning to recommend the practice in all instances of mortification from local injury. He conceives, that a gangrene may arise, in an unsound constitution, from a comparatively slight accident; so that it may be regarded as the result of constitutional disposition, rather than of the local cause. Amputation would be hopeless under such circumstances. It is particularly in mortification, following very severe injury, in a subject otherwise healthy, that Mr. Lawrence believes the operation to be proper. (See *Medico-Chir. Trans.* vol. vi. p. 184.) He also reports another instance, in which he saw the operation succeed, though the mortification was in a spreading state.

I was once consulted in private practice about the propriety of amputating at the shoulder in a spreading mortification of the arm from external violence. The operation was performed, and the patient, who without it would certainly have perished in a few hours, lived a fortnight; at one time he had a fair prospect of recovery, but afterwards died, not of gangrene of the stump, but in consequence of a large abscess over the scapula.

The following are views adopted by Mr. Porter: "If amputation is determined on, it should be performed with the least possible delay, because the gangrene may spread with such rapidity as to cause the operation to be performed very high up, and consequently involve an unnecessary loss of a greater portion of the limb; and also because the constitutional symptoms, attendant on mortification, are not such as a patient can long endure, and their continuance even for a few hours may render the success of any operation very precarious. This latter consideration is of great

importance; for, although I have seen the incision made in a part where the skin was discoloured, and the cellular tissue loaded with a semigelatinous kind of serum, without preventing recovery afterward; yet I am not aware of a case proving fortunate, where the system had previously been materially engaged. Of course, however, where it can be done, it will obviously be most prudent to perform the operation in a sound part, and even if possible, to interpose a joint between it and the apparent boundary of the disease." Mr. Porter recommends leaving large flaps both of integument and muscle. He considers, that, in such cases, no expectation of union by the first intention can be entertained. On the contrary (says he) there are usually abscesses and sinuses formed in the stump, discharging from time to time masses of ragged sloughy, cellular tissue, with profuse suppuration, and general wasting of the remnants of the muscles, so that, on being eventually healed, the stump is much smaller in size than the corresponding part of the other limb. During the progress of the cure, it will be necessary to support the patient's strength with extraordinary care, and to give wine in liberal quantities.

Mr. Porter concludes his interesting paper with a statement of the particulars of several cases where gangrene was extending at the time the operation was performed. Several of the patients recovered; and where the result was not fortunate, it was not from mortification of the stump, but from circumstances which might have occurred after amputation, performed for the removal of any other disease. (See *Dublin Journ. of Med. Science*, vol. iv. p. 222.)

Amongst the experienced approvers of Larrey's advice, I must not omit to mention Dr. Hennen, who repeatedly amputated, under the circumstances above pointed out, without waiting for the line of separation; "and (says he) although I certainly was not uniformly successful, I have no reason to imagine, that death was occasioned by a departure from the rule so generally laid down by authors." (*On Military Surgery*, p. 243. ed. 2.)

There are even some cases in which amputation has been performed with success, though the mortification did not arise from an external cause. I amputated the thigh of Mr. Lucas, organ-builder in the Waterloo Road, on account of a spreading mortification from the bursting of a popliteal aneurism under the skin, and the stump healed up in the most favourable manner. (See *Med. Chir. Trans.* vol. xvi. p. 321.) Mr. Porter informs us, that "a limb has been removed with the best results, in cases of mortification occurring two or three months after the artery has been tied for the cure of aneurism; and again, where it has originated in a fungoid tumour of the periosteum, both of which may be regarded as instances nearly of idiopathic disease. Nay, I am in possession of a case, which occurred in an hospital in this city (Dublin), where amputation succeeded, although many would have regarded it as a specimen of Pott's gangrene of the toes and feet." (See *Porter*, in *Dubl. Journ. of Med. Science*, vol. iv. p. 219.) A similar case was successively operated upon by M. Amussat, though the gangrene was spreading. (See *Archives Gén.* Jan. 1835.)

In the article AMPUTATION, notice has been

taken of a sloughing, which commences in the foot, and extends up the leg, and sometimes follows gunshot injuries of the thigh, which involve the femoral artery: this is a case particularly instanced by Mr. Guthrie, as requiring the very early performance of amputation. Sir Astley Cooper also refers to cases, in which the rule was successfully deviated from, of not amputating, before limits are set to the spreading of mortification; the instances in question arose from injury of blood vessels, and other local violence, in patients of a healthy constitution. In such cases, it is admitted by this very experienced surgeon, that the practice should be different from what is usually pursued in mortification from constitutional causes. (*Surgical Essays*, part. ii. p. 186.)

With regard to the early performance of amputation, where the substance of a limb perishes after exposure to cold, I find some difference of sentiment between two very high authorities. Thus Schmucker observes: 'The mortification which comes on after a part has been frozen, increases so rapidly, if the limb be exposed to warmth, that in the space of twenty-four hours, its vitality and organization are quite destroyed, and nothing will now avail in restoring its sensibility. Here the speedy performance of amputation is the only means of preservation to be depended upon. In mortification from an internal cause, the case is different.' (See *Vernischte Chirurgische Schriften*, b. 1. p. 15. 8vo. Berlin, 1785.) According to Larrey, however, this species of gangrene at length stops, and a line of separation forms between the dead and healthy parts. If the disorder be superficial, the sloughs are usually thrown off between the ninth and thirteenth days, leaving an ulcer of proportionate extent, that soon heals up. If the whole of the limb be sphacelated, nature cannot of herself effect a cure, or but very rarely; the patient mostly falling a victim to the effects of absorption, when the sloughs are detached, and the mouths of the lymphatics are opened on the occurrence of suppuration. Larrey assures us, that he has seen numerous patients carried off by this cause, while the examples of a spontaneous cure were exceedingly few, and, in these, the stump was left irregular, and unfit for bearing the pressure of a wooden leg. He agrees, therefore, with the generality of surgeons, that, in these instances, it is advantageous to amputate the mortified portion of the limb, but not before the extension of the gangrene has ceased, and the mischief is bounded by an inflammatory line. (See *Mém. de Chir. Mil.* t. iii. pp. 65—72.)

Fabretti, *Hildani* Tract. Methodicus de Gangrena et Sphacelo. *Quesnai*, Traité de la Gangrene, 12mo. Paris, 1749. Encyclopédie Méthodique, Partie Chirurgicale, art. Gangrene. *Kirkland* on Gangrene, and on the Present State of Medical Surgery. *Richter*, Anfangsgr. der Wundarzn. b. 1. kap. 3. Various parts of *Theater* on Inflammation, &c. *Sharp's* Critical Inquiry into the present state of Surgery, chap. 8. *Richerand*, Nosographie Chir. t. i. p. 215, &c. edit. 4. *Lassus*, Pathologie Chir. t. i. p. 30, &c. edit. 1809. *Leveillé*, Nouvelle Doctrine Chir. t. iv. p. 321, &c. Paris, 1812. *Larrey*, Mémoires de Chirurgie Militaire, t. iii.; particularly the Mém. sur la Gangrène de Congelation, p. 60. and that sur la Gangrène Traumatique, p. 141. *Calhoun*, Systema Chirurgiæ Hodiernæ, vol. ii. p. 374, edit. 1800. *Dr. J. Thomson's* Lectures on Inflammation, p. 501. Edinb. 1813. *O'Halloran* on Gangrene and Sphacelus, 8vo. Dublin, 1768. *Pott's* Obs. on the Mortification of the Toes and Feet in his Chirurg. Works, vol. iii. *J. Kirkland*, Thoughts on Amputation, &c. with a short Essay on the Use of Opium in Mortification, 8vo. Lond. 1780.

J. A. Murray, in *Gangrenam Seroti*. Obs. (Frank Del. op. 10.) C. *White*, Observations on Gangrenes and Mortifications, accompanied, &c. with convulsive spasms, 8vo. 1790. *Pearson's* Principles of Surgery, p. 114. edit. 2. *Lawrence* in Med. Chir. Trans. vol. vi. p. 184, &c. *Delpech*, Mémoire sur la Complication des Plaies et des Ulcères, connue sur le Nom de Pourriture d'Hôpital; also, Précis Élémentaire des Maladies réputées Chirurgicales, t. i. p. 73, &c. Paris, 1816. *Bogey*, Traité des Maladies Chir. t. i. p. 105, &c. Paris, 1814. *John Bell's* Principles of Surgery. *Himly's* Abhandlung über der Brand der Weichen und harten Theile, Güt. 1800. For an account of the dry gangrene, see particularly the writings of *Hildanus*, *Tulpius*, *Quesnai*, *Mém. de la Soc. Royale de Médecine*, t. i. Opere di *Bertrandi*; *Medical Museum*, &c. For a description of the mortification caused by eating cockspur rye, see *Odard's* letter in *Journal des Savans*, 1676. *Noël*, in *Mém. de l'Acad. des Sciences*, 1710. *Langruss*, "Descriptio Morborum ex Essi Clavorum Secalorum." *Duhamel*, in *Mém. de l'Acad. des Sciences*, 1748. *Dr. C. Wollaston*, in *Philosophical Trans.* 1762. *Tessier*, in *Mém. de la Société Royale de Médecine*, t. i. and ii. &c. *O. Prescott*, A Dissertation on the Natural History and Medicinal Effects of the Secale Cornutum, or Ergot, 8vo. Lond. 1813. *D. P. Haffter*, Doctrina de Gangræna breviter Exposita, 4to. Lips. 1807. *C. L. Leisegang*, De Gangræna, 4to. Göt. 1811. *Hennen's* Principles of Military Surgery, p. 241, &c. ed. 2. 8vo. Lond. 1820. *G. J. Githrie* on Gunshot Wounds, &c. p. 111 &c. ed 2. 8vo. Lond. 1820. *J. H. James* Obs. on the Principles of Inflammation, p. 84, 287, &c. 8vo. Lond. 1821. *Sir J. Cooper*, Surgical Essays, part. ii. p. 186. 8vo. Lond. 1820. *W. H. Porter* in *Dublin Journ. of Med. Science*, vol. iv. 8vo. 1833. *John W. Turner*, of the sudden spontaneous Obstruction of the larger Arteries, &c. in *Edinb. Med. Chir. Trans.* vol. iii. 8vo. 1828. *Baron Dupuytren*, Leçons Orales de Clinique Chir. t. i. yme. Art. xi. 8vo. Paris, 1834. *Robert Carswell's* Illustrations of the Elementary Forms of Disease, Fasciculus vii. fol. Lond. 1835. *Cruveilhier*, Anatomie Pathol. du Corps Humain, livr. xxvii.

MOXA.—The Chinese moxa consists of the omentum of the leaves of the *artemisia latifolia*. That which Baron Percy employs is made of the stalk of the great sunflower, soaked in a solution of nitre, and afterwards well dried; cotton, however, similarly prepared, completely answers the purpose. Mr. Dunglison, who has translated Larrey's memoir on this subject, and added to it some interesting matter, shows that the moxa has been used in the eastern parts of the world many centuries. The cone or cylinder of moxa is composed of a certain quantity of cotton wool, over which a piece of fine linen is rolled, and fastened at the side by a few stitches. This conical cylinder should be about an inch long, and of a proportionate thickness; the size, however, may be varied according to circumstances.

A porte moxa, is intended to fix the cylinder upon the precise spot, where the application is to be made. The metallic ring of this instrument is kept from touching the skin by means of three small supports of ebony, which is a bad conductor of caloric. After the extremity of the cone has been set fire to, the combustion is kept up by means of a blow-pipe; however, it should not be too much hastened, but allowed to proceed slowly. The precise spot, to which the moxa is to be applied, ought to be first marked with a little ink, and all the surrounding surface covered with a wet rag, that has a whole in the middle, so as to leave the part bare, which has been marked. After the top of the moxa has been set on fire, the base of it, held in the porte moxa, must be placed upon the intended part, and the combustion kept up with the blow-pipe, until the whole is consumed. In order to prevent the subsequent inflammation and suppuration from being too considerable, the liquor ammoniac should be immediately applied to the burnt part.

The diseases, in which Baron Larrey has found the moxa efficacious, are amaurosis, and incipient

cataract (cases in which he applies it over the course of the facial nerve, just behind the angle of the jaw); deafness and aphonia arising from cold; tic douloureux, and partial paralysis of the muscles of the face; palsy of the lower extremities; phthisis; diseased spine; disease of the hip-joint, &c.

M. Roux, when he visited the London hospitals, had two opportunities afforded him of applying the moxa, in order to convince the rising generation of surgeons in this country of its superior efficacy. The first was in a case of spontaneous paralysis of the deltoid muscle at St. Bartholomew's. The moxa was applied a little below the acromion, and a few days afterwards the motion of the arm began to be restored. This, however, was a case, which, according to the account of Roux himself, had relapsed, after having been cured by other means. I think one of the surgeons of St. Bartholomew's informed me, that notwithstanding the moxa, the relief proved again only temporary. If, however, the moxa had succeeded, a caustic issue, a blister, or the volatile liniment, would probably have answered equally well. The second instance, in which M. Roux applied the moxa, was a case of white swelling at Guy's Hospital; but the disease had advanced too far to allow any hope of a favourable issue. (See *Voyage fait à Londres en 1814, ou Parallèle de la Chirurgie Angloise avec la Chirurgie Française*, pp. 19, 20.) M. Roux flatters himself that, "*les chirurgiens Anglois répugneront sans doute moins à l'avenir à faire usage du moxa.*" The truth is, English surgeons, as well as English farriers, knew very well before the arrival of M. Roux what might be done with moxa and the actual cautery. But, though the application of fire still prevails in the veterinary art, as a mode of curing diseases, it has long been abandoned as a means of relief in the English practice of surgery; not on the ground of its being always ineffectual; but, because equal good has been found to result from measures, which are milder, always less terrific, and frequently less painful. In order to convince an English surgeon that moxa and the actual cautery ought to be introduced into practice, M. Roux should prove, that there is at least some particular disease, which may in this manner be cured, but which cannot be cured by other means ordinarily employed in our practice. He should also make us forget, that the application of actual fire was once as common in English surgery as in French; but that it had not attractions enough to maintain its ground.

However, that the reader may know the arguments used by the advocates for the practice, I submit to him the following observations, which are contained in a periodical work. All the world knows, that counter-irritation is of great use in the treatment of disease; and almost all the world knows, that different forms of counter-irritation produce different effects on the human body. We do not pretend to specify what is the reason of these different effects, simply because we do not know. But, while such men as Percy and Larrey, and twenty others of character, speak so highly in favour of the actual cautery, we have scarcely authorized to say, that the use of the potential cautery can be made to replace it in all cases. We can easily understand how the actual cautery should fall into

disuse, however good a remedy it might be; for, if we ourselves were patients, we should be slow in believing, that the pain of the application was not so severe as our fears point out; but, the scepticism of the medical man ought to rest on different grounds. We may say, respecting the moxa, that its action may be more easily regulated than that of caustics; so that by the more or less sedulous use of the blow-pipe, we may create a superficial eschar, or a deep suppurating wound. In fact, in all cases, where more than a mere irritation of the skin is required, the moxa affords a certainty in its applications possessed by none of the other caustics. Of course, it would be improper to compare the moxa with blisters, or with any other counter-irritant, which acts by irritating the skin, without destroying it: if we compare it, therefore, with the emetic tartar ointment, issues, setons, and the caustics, properly so called, we shall find, that it possesses greater advantages than they do. The first of these is a long time in destroying the cutis, and it is very uncertain in the quantity of its effect: moreover, whether the effect be produced at all, generally depends on the diligence and knowledge of the patient's attendants, and not on the medical man. Hence, it is not likely, often to be properly applied. Issues and setons produce but little instantaneous effect; their efficacy, therefore, depends on the irritation and discharge daily kept up. Indeed, these also, if they are left to the care of the patient, which they almost always are, soon become inert and useless. The different caustics approach to the moxa in their properties. Their effect is, in some degree, rapidly produced, and a suppurating ulcer is formed; but, still to produce their smallest effect, a longer time is necessary, than the surgeon can conveniently stay with his patient; so that, as the operation of the remedy is dependent on time, and that time varies according to the constitution of the patient, the quantity of effect produced can never be calculated upon. It is very different, however, with the moxa. The effect is almost instantaneous, and the surgeon's hand regulates the quantum of action; so that not only is the moxa the most manageable of counter-irritants that destroy the skin, but, as many medical men believe, that suddenness of operation forms not a small part of the efficacy of counter-irritants, the moxa stands also pre-eminent on this ground. (See *Med. Intelligence*, vol. iii. p. 578: also *Larrey, Recueil de Mémoires de Chirurgie*, Paris, 1821, and particularly, *Dunglison's Translation of the first memoir.*)

MURIATIC ACID. *Hydrochloric Acid.* Gargles containing this acid, are often made use of with advantage in various cases of sore throat, and the disease known by the name of cancrum oris. The following formula is employed at St. Bartholomew's Hospital. *R. Rosæ rubræ exsiccatæ 3j. Aquæ ferventis 1℥j. Infunde per horam dimidium, dein cola, et adde Acidi muriatici 3j. Mellis Rosæ 3j. Sacchari purificati 3vj. Misce.*

Muriatic acid appears to have been tried in syphilis earlier than the nitric, Dr. Zeller, of Vienna, having employed it as a successful remedy for this disease ever since the year 1789. (*Vide Sim. Zeller's Prakt. Bemerk. über den vorzügl. Nutzen d. allerem, bekannt. Badeschwamens, &c. Nebst. einem Anhang v. d. Salzsäure, &c. Wien. 1797.*)

As a medicine capable of improving the appearance of venereal ulcers, and of restraining for a time the progress of the disease, it was known to Mr. Pearson for many years. He says, that he was first induced to give this acid in venereal ulcers of the tongue, and of the throat, in consequence of the great benefit which he had seen result from its use in examples of *cancrum oris*: and without viewing it as an antidote for lues venerea, he has frequently availed himself of its useful qualities, when it was desirable to gain a little time previously to the commencement of a mercurial course. (*Obs. on the Effects of various Articles in the cure of Lues Venerea*, p. 193, ed. 2.) From what he saw, however, he never inferred, that the sulphuric and muriatic acids could radically cure the venereal disease; and he ascribed the benefit derived from them partly to their salutary effects on the stomach and constitution, and partly to their agency on ulcers of the throat and tongue, as local applications. (P. 117.) When Mr. Pearson made these observations, the fact, which has now been so unequivocally demonstrated in the army hospitals, that nearly, if not all, the forms of disease going under the name of syphilis, may be cured without mercury, had not undergone the strict and impartial investigations, which have of late years been devoted to the subject. (See particularly *Obs. on the Treatment of Syphilis, with an account of several cases of that disease, in which a cure was effected without the use of mercury*, by T. Rose, in *Medico-Chir. Trans.* vol. viii. p. 349.) If this point be admitted as fully established, the question about the antisiphilitic virtues of various articles of the *matéria medica* requires to be taken up in a very different light, not clouded with a notion, that the disease will certainly get worse and worse, if no remedy whatever be exhibited, or that it cannot finally get well of itself. While these doctrines prevailed, the amendment of any syphilitic affection during the use of muriatic, or any other acid, was entirely referred to some specific effect, supposed to appertain to such medicine. But now the question involves several considerations; first, the actual virtue of the medicine in expediting the cure of the disease; secondly, the changes which might happen if the complaint were left to itself; and, thirdly, the benefit sometimes ascribable to the improvement produced in the constitution, under particular circumstances, by the discontinuance of mercury. The latter mineral no longer claims the name of a specific for the venereal disease, either in the sense of the only, or a completely certain; antidote; because nature herself would in time bring most cases to a favourable conclusion; because the cure can be completed by a variety of other medicines, noticed in this publication; and, lastly, because mercury, though it may be generally the quickest means of cure, is, in particular cases, which are complicated with debility and constitutional irritability, the surest medicine to aggravate the complaint and prevent any progress towards a favourable termination. Here it is enough to know, (and Mr. Pearson himself acknowledges the fact) that in the circumstances above specified, muriatic acid is a safer medicine than mercury. The dose is from ten to twenty drops, which are to be mixed with a proper quantity of water.

Muriatic acid has sometimes been employed, as the active ingredient in injections for the cure of

gonorrhœa, in the proportion of eight or ten drops to four ounces of distilled water.

In cases of poison from muriatic acid, the experiments, made by Orfila, lead him to consider calcined magnesia and prepared soap the most fit substances for neutralizing such portion of the acid, as may not yet be combined with the texture of the œsophagus, stomach, &c. They should be given as soon as possible after the corrosive poison has been swallowed, care being taken to let the patient drink copiously of warm water, milk, broth, or some mucilaginous diluting liquid. When, from the symptoms, there is reason to believe that inflammation exists in the viscera, or when spasms and convulsions come on, antiphlogistic remedies, and antispasmodics, are indicated. (*Traité des Poisons*, p. 476, vol. i. ed. 2. Paris, 1818.) In order to detect the presence of muriatic acid, when mixed with wine, or other fluids, we are recommended to distil a portion of it from a small retort over a candle into a phial containing a solution of nitrate of silver. The precipitation of muriate of silver, which is soluble in ammonia, but not in nitric acid, will take place, if the poison contain muriatic acid. (*Thomson's Dispensatory*, p. 434, ed. 2.)

By Morveau, who employed himself in investigating the merits of Dr. Carmichael Smith's mode of destroying infection, the muriatic acid, in the form of gas, was alleged to have the very important quality of neutralizing putrid miasmata. The gas is extricated from common salt, by means of sulphuric acid. In this way, it is often employed in hospitals as a mode of preventing and obviating infection.

The use of muriatic acid, as an application to certain cases of sloughing, and phagedæna, has been explained in the articles HOSPITAL GANGRENE and MORTIFICATION.

MYDRIASIS. (From *μυδαν*, to abound in moisture.) A preternatural dilatation of the pupil.

NÆVUS. (*Congenita Næva*; *Envies*; *Mutter-mahl*; *Mother spots*, &c.) A mole, or congenital mark, thickening, or excrescence of the skin. Nævi comprehend all the stains, spots, and deviations of a part of the skin from its normal state, which are congenital. Although they are exceedingly diversified, all of them may be arranged under two principal kinds; one consisting of congenital alterations of the colouring matter of the skin; the other of vascular productions and hypertrophies of the skin, and often of a new growth, or tumour, the texture of which was compared by John Bell and Dupuytren to the erectile tissues, naturally existing in various parts of the body. Hence, the latter structures are now frequently termed *erectile tumours*. (See ANEURISM by ANASTOMOSIS.) Some of them (says Dr. Bateman) are merely superficial, or stain-like spots, and appear to consist of a partial thickening of the rete mucosum, sometimes of a yellow, or yellowish-brown, sometimes of a bluish, livid, or nearly black colour. To these the term *spili* has been more particularly appropriated. Others again exhibit various degrees of thickening, elevation, and altered structure of the skin itself, and consist of clusters of enlarged and contorted veins, freely anastomosing, and forming little sacs of blood. These are sometimes spread more or less extensively, over the surface, occasionally covering even the whole of an extremity, or one half of the trunk of the body; and

sometimes they are elevated into prominences of various forms and magnitude. Occasionally, these marks are nearly of the usual colour of the skin; but most commonly they are of a purplish red colour, of varying degrees of intensity; such as the presence of a considerable collection of blood-vessels, situated near the surface, and covered with a thin cuticle, naturally occasions. (See *Bateman's Practical Synopsis of Cutaneous Diseases*, p. 324. edit. 4.) When a nævus is of a dark red colour, its intensity is generally augmented by every thing which tends to accelerate the circulation of the blood. Fits of anger, hot weather, fevers, and the period of menstruation, in particular, are observed to be attended with an increased turgescence and discoloration of the part affected. Indeed the excrescence sometimes bursts, and pours out a dangerous quantity of blood, and in females it has been known to become the seat of a regular menstrual discharge. (*Boyer, Maladies Chir. t. ii. p. 277*; and *John Bell's Principles, Discourse 9.*) Some nævi, especially those usually called moles, frequently have long, irregular hairs growing upon them; while the surface of others is streaked, and even granulated. Such as appear in the form of a mere red, purplish stain, have been absurdly supposed to arise from a desire for claret, or some other wine of that colour, entertained by the mother of the patient during her pregnancy. The granulated nævi have been compared with raspberries, strawberries, mulberries, &c. for which the mother's longing is ascribed by the vulgar as a cause. The truth is, however, that this doctrine, imputing the origin of nævi to fancies of the mother, is neither consistent with experience nor sound physiology. The causes (as Callisen observes), "*potius autem in evolutione primorum flaminum, a nature solita via aberrante, uti in aliis rebus monstris quærendæ erunt.*" (*Syst. Chir. Hodiernæ*, vol. ii. p. 201.)

From what has been said, then, it appears that certain nævi are merely cutaneous spots, of a red, violet, or purplish colour, of greater or lesser extent, and with scarcely any perceptible elevation. They are an organic malformation of the skin, the natural texture of which does not exist, but a plexus of vessels is substituted for it, not endued with the natural sensibility of the cutis itself. Such nævi generally continue stationary during life, and may be regarded rather as a deformity than a disease. (*Lassus Pathologie Chir. tom. i. p. 477.*)

Others are either of the same nature as the disease, well known by the name of the aneurism by anastomosis, or bear a considerable resemblance to it. They are sometimes of great size; and their shape is subject to much variety. They are soft, and indolent, and of a violet or dark red colour. The skin which covers them is very thin, and when they are opened, their structure is like that of a spleen, whose blood-vessels are varicose. Some are covered with a delicate white skin, and do not increase with age. Others are more disposed to grow large. These tumours frequently occur in the skin of the face, and in other parts of the integuments, on the inside of the labia pudendi, and cheeks, and in the substance of the upper and lower lip, where they sometimes form a kind of elongated mass, attended with great disfigurement. Nævi so situated in new-born infants, may be considered as an obstacle to the action of sucking. *Boyer* has particularly described them

under the appellation of "*tuberculum atro-cruentum labii inferioris.*" (*De Abscessuum Natura*, cap. xxix. p. 803.)

The nævi, which form in the subcutaneous cellular substance, and were named by Petit "*loupes variqueuses*," (*Œuvres Posthumes*, tom. i. p. 276.) are also of the same nature as the aneurism by anastomosis. In time, they attain a very large size. Mr. Latta says, he once saw in a child, two years old, a tumour of this kind, weighing fourteen ounces, which at the time of birth was only equal in size to a large bean. During the first year, it did not enlarge much; but it afterwards grew rapidly to the size already specified. (*System of Surgery*, vol. ii. chap. 22.) Lassus has even seen a tumour of this description as large as a man's head. (*Pathologie Chir. tom. i. p. 479.*)

Although the original causes of nævi are buried in obscurity, experience proves, that whatever produces irritation in the part affected, or an increased determination of blood to it, has generally the effect of accelerating the growth and enlargement of the swelling. Thus, a trifling bruise, or a tight hat, will sometimes excite a more stain-like speck, or a minute livid tubercle, into that diseased action, which occasions its growth. (*Bateman's Pract. Synopsis*, &c. p. 327. edit. 3.)

When these marks, or swellings are superficial, without any disposition to enlarge, or spread, and their trivial elevation does not expose them to accidental rupture, there appears to be no good reason for interfering with them. Indeed, if they were destroyed with caustic, the knife, or a ligature, these means would leave scars, accompanied with nearly the same degree of disfigurement.

But, when nævi evince a tendency to enlarge, or are very prominent excrescences, and either troublesome from their situation, or liable to be ruptured, either their growth must be repressed by sedative applications, or the whole congeries of vessels extirpated, or obliterated. Mr. Abernethy proposed the application of cold washes, and the pressure of a bandage. This practice was found by him in several instances to have the desired effect of checking the growth of the tumours, which afterwards shrunk, and became no longer objects of any consequence. (*Surgical Works*, vol. ii. p. 224.) Boyer also knew of a case, in which a nævus of the upper lip was cured by the mother pressing the part with her finger unremittingly for seven hours at a time, and the use of an alum wash. (*Maladies Chir. t. ii. p. 269.*) However, he is not generally an advocate for this treatment; and Dr. Bateman expressly states, that, in the majority of cases, pressure is the source of great irritation to these maculæ, and cannot be employed. (P. 329.)

Modern experience proves, that superficial nævi may sometimes be successfully treated by plans calculated to produce an effusion of lymph in their structure, and an obliteration of their vessels. Doubtless, it is on this principle that some nævi yield to pressure, or to the effects, produced by the insertion of vaccine matter into several points of the tumour, or the injection of a stimulating lotion into their texture.

I was consulted, about two years ago, for a small superficial nævus situated on the bridge of the nose, where it completely spoiled the countenance of a little girl, about six years old. I touched it twice with the *argentum nitratum*, and

it soon disappeared. Painting a nævus with the tincture of iodine has sometimes answered; and the proposal of Dr. Marshall Hall to pierce tumours of this sort in every part with needles, has cured them, though slowly, without leaving any scar. These methods are, however, only suited to limited forms of the disease. Lallemand has combined the use of needles with the ligature, not to produce such a degree of constriction as to destroy the vitality of the tumour, but to induce coagulation of the blood in the cells, and such inflammation as shall obliterate them. This treatment, which is also followed by Mr. Lloyd, I have explained more particularly in speaking of ANEURISM BY ANASTOMOSES.

Dr. Pendleton, of New York, tried vaccination for a nævus situated on the face of a new-born infant. He introduced the vaccine matter at two opposite points on the margin of the tumour; "the infection was communicated, and had the two pustules met, the deformity would have been entirely removed. The only portion of the disease left is, that between the two cicatrices left by the pustules, and is very inconsiderable." Dr. Reese is of opinion, that vaccination merits a trial in every such case, and believes, that if three or more points of infection can be obtained, so as to envelope the tumour, it will doubtless succeed, and is preferable to excision, or the ligature. But, when the nævi obviously belong to the class of aneurisms by anastomosis, are situated on the head, very prominent, and disposed to increase with rapidity, Dr. Reese joins the generality of surgeons in deeming extirpation advisable. In such cases, Dr. Physick's method was to pass a scalpel round the tumour, cutting down to the pericranium, and then tying the arteries separately. Lint was then interposed to prevent union by the first intention. This plan, he says, has been very successful in the hands of Drs. Mott and Jamieson, as well as those of Dr. Physick, and he greatly prefers it to the cure by ligature. (*Reese, in Amer. Ed. of this Dict.*) The apology for the ligature and caustic, however, we know is founded upon the danger of a sudden gush of blood: o the life of an infant.

With regard to the injection of nævi with stimulating fluids, Messrs. Paget and Fullager, of Leicester, have recorded a case, in which a healthy and remarkably precocious child died in the course of a minute after a nævus, situated over the angle of the jaw, had been injected with diluted liquor ammoniac. It seems probable, that, in this instance, some of the injection passed into the venous system. (*See Lond. Med. Ga. Dec. 30. 1837.*) I have not heard, however, of any similar occurrence; but the fact merits recollection.

For all examples, which partake of the nature of aneurism by anastomosis, and are disposed to grow, the best general mode of cure is extirpation. The exceptions to this plan are certain examples, in which the tumour seems to derive its main supply of blood from some large artery, the trunk of which will admit of being tied. The prudence of extirpating the disease, ere it extend too far, and the necessity of taking away every particle of the disease, has been already explained; this is what was advised by F. Hildanus, (Cent. v. obs. 46.) what was strongly urged by the celebrated Petit, (*Œuvres Posthumes, t. i.*) what was recommended in still more animated terms by Mr. John Bell, (*Principles of Surgery, discourse ix.*) and it is what is

particularly insisted upon in another part of this Dictionary. (See ANEURISM.)

The hemorrhage from the excision of some nævi, however, is so profuse, and the difficulty of cutting away all the disease so great, that my friends, Messrs. White and Lawrence, sometimes prefer extirpating nævi by the introduction of a double ligature through their substance, and then tying each half of the swelling with sufficient tightness to make it slough. (*See Med. Chir. Trans. vol. xiii.*) When the tumour is of considerable size, this plan appears safer than excision.

Mere thickenings, and discolourations of the rete mucosum, have sometimes been removed by a mixture of spirit, and the liquor potassæ. (*Bateman, p. 330.*)

I have touched several superficial nævi on infants with diluted nitric acid, by which means they have been gradually dispersed.

Formerly caustic was much in vogue for the removal of nævi; but, unless its action extend deeply enough to destroy every part of the disease, it may cause a dangerous and useless degree of irritation, copious hemorrhages, and a sudden and fatal enlargement of the tumour. It cannot be denied, however, that the old surgeons had success with their caustics, when nævi did not extend too deeply. Thus, in speaking of caustic remedies, Callisen observes: "inter quæ eximio cum successu adhibetur sapo cum æquali parte calcis vivæ subtilissime commixtus, nævo per emplastrum perforatum admoveendus, et alio emplastro imposito firmandus; hoc remedio eschara inurit, qua soluta, cicatrix alba romanæ solet." (*Syst. Chirurgiæ Hodiernæ, vol. ii. p. 202.*)

Mr. Wardrop, having seen cases in which nævi were cured by accidental attacks of ulceration and sloughing, which destroyed a great part of the tumour, and brought on such inflammation as consolidated the rest, was led to imitate this process by adopting the ancient practice of applying the kali purum. He found the method answer in several instances. I lately attended, with Jephson, a child at Hampton, which had a nævus of some thickness on the fore-arm, and equal to a crown-piece in size. We attacked it with the kali purum, and a cure was soon effected.

In the article ANEURISM, in speaking of aneurism by anastomosis (p. 197). I have noticed Mr. Keate's improvement in the mode of applying ligatures by transfixing the tumour with long pins, and then surrounding its base with a ligature. "Small and trifling creticle tumours (says Mr. Liston), favourably situated, may be removed with the knife; but, it is not a safe practice, and an instantly fatal result from hemorrhage has more than once followed the attempt. In children, it is seldom admissible, for, as is well known, they bear the loss of blood badly. The mode of removing this disease by ligatures was well known to Mr. Bell, and it has been followed by Messrs. A. White, Lawrence, and a variety of others. The ligature cannot be applied with propriety, when the skin is much affected; and when extensively included, the strangulation of the mass can only be effected by slow degrees; the tumour perishes only from inflammation, and from deficient power in the part: deformity besides is produced. This is a very painful and tedious process, but it may be accelerated by the application of fresh ligatures from time to time. The ligature alone is applicable in

some instances, as where the diseased part is small, prominent, and nearly the whole of its covering is involved. The object must be to remove the adventitious tissue thoroughly, so that there shall be no return. Should it be impossible to include it entirely, and should some small portions be by chance left out, it may possibly happen, that its vessels shall be closed by fibrinous deposit, but this is not to be depended upon. Reproduction of the disease has too often followed operations thus imperfectly performed." Mr. Liston then describes his mode of applying the ligatures. "When the skin is of necessity to be tied with the tumour, one or more ligatures are to be passed underneath. A double ligature, carried by a common suture needle (or another instrument represented in his work) will answer perfectly. The loop is cut, and one portion tied on each side, in order to make the ligatures embrace the base thoroughly; a second needle, or harelip-pin, may be thrust across in the opposite direction, and removed after the threads are drawn and fixed under them; or the pin may be clipped short, and left to come away with the threads and tumour. This mode I have followed with good success for a series of years, and in numerous cases. When the skin is slightly, or not at all affected, and the subcutaneous tumour is large, the covering should be turned back, and the ligatures then employed. I operated, for a tumour in this situation, a few weeks ago, on a little girl, who had been subjected to several unsuccessful operations previously. One needle, that across the morbid mass, was in the first instance introduced without a ligature, after the incisions had been made; the tumour was raised by means of it, and the second needle passed underneath the first, carrying a strong thread; the loop of this was laid hold of with a hook, and the needle withdrawn upon the ligature. The first needle was then armed also, and the double ligature brought through with it. These were then secured." (See *Liston's Practical Surgery*, p. 281.)

For additional remarks, see ANEURISM.

Consult *Petit's Œuvres Posthumes*, t. i. *Jassus*, Pathologie Chir. t. i. p. 476, &c. ed. 1800. *Callisen's Systema Chirurgiæ Moderna*, vol. ii. p. 201, Hafnia, 1800. *Abernethy's Surgical Works*, vol. ii. p. 224, &c. *Latta's System of Surgery*, vol. ii. chap. 22. *J. Bell's Principles of Surgery*, vol. i. Discourse 9. *Boyer's Traité des Maladies Chirurgicales*, t. ii. p. 225, &c. Paris, 1814. A Practical Synopsis of Cutaneous Diseases, by T. Bateman, edit. 3. 1814. *Delpsch, Précis Élémentaire des Maladies Chir.* t. iii. p. 214, Paris, 1816. *Scarpa*, Opuscoli de Chirurgia, vol. ii. Obs. 374, Pavia, 1825. *J. Wardrop*, on one Species of Nevus, with the Case of an Infant, where the Carotid Artery was tied, in Med. Chir. Trans. vol. ix. p. 199, &c. *H. Lawrence*, in vol. xiii. of the same work. *P. Rayer*, Maladies de la Peau, t. ii. p. 22. 8vo. Paris, 1827. *Robert Liston on Practical Surgery*, p. 278. 8vo. Lond. 1837.

NECROSIS. (From *νεκρω*, to destroy.) This word, the strict meaning of which is only mortification, is, by the general consent of surgeons, confined to this affection of the bones. It was first used, in this particular sense, by the celebrated M. Louis, who restricted its application, however, to examples, in which the whole thickness of a bone was destroyed. (See *Mém. de l'Acad. de Chir.* t. v. 4to.) By the ancients, the death of parts of bones was not distinguished from caries. However, necrosis and caries are essentially different; for, in the first, the affected part of the bone is deprived of the vital principle; but this is not the case when it is simply carious. Caries is

very analogous to ulceration, while necrosis closely resembles mortification of the soft parts.

Between caries and necrosis, says Weidmann, there is all that difference, which exists between ulcers and gangrene, or sphacelus, of the soft parts. In caries, the nutrition of the bone is only impaired, and an irregular action disunites the elements of the bony structure, which consequently sustains a loss of substance; but every remaining part of it is yet alive. In necrosis, on the contrary, the vitality and nutritive functions cease altogether in a certain portion of the bone, the separation of which then becomes indispensable. (*De Necrosi Ossium*, p. 7.)

I have mentioned, that M. Louis confined the term necrosis to cases, in which the whole thickness of a bone perished; but Weidmann judiciously criticises this limitation of the word, and maintains, that the nature of the disorder is the same whether it affect a single scale, the whole, or a mere point, of the bone. He also objects to the definition of necrosis proposed by Chopart (*Dissert. de Necrosi Ossium*, Paris, 1765), and adopted by David. (*Obs. sur une Maladie connue sous le nom de Nécrase*, Paris, 1782.) These two authors have defined necrosis to be a disorder, in which a portion of bone perishes, and turns dry, in order to be soon separated from the living parts, and replaced by a new bony substance, which is to perform its functions. But, as Weidmann observes, it may happen, that a piece of bone, which dies and separates, may not be replaced by any new formation of bone, though the disease is of the same character, and merely varies in some modifications. He therefore argues, and every rational surgeon will agree with him, that a true necrosis must always be said to exist, whenever a dead portion of bone has either separated, or is about to separate. "*Vera demum necrosis semper est, si aliquod ossis ramentum, in quo vis vitæ extincta est, abscessit, vel proxime abscessurum, est.*" (B. 7.)

The tibia, femur, lower jaw, clavicle, humerus, fibula, radius, and ulna, are the bones most frequently affected with necrosis. Excepting the lower jaw and scapula, the process of regeneration has only been noticed, in the cylindrical bones. From 12 to 18 years of age, is the time of life, most subject to necrosis. Necrosis of the lower jaw, however, seldom occurs before the age of 30.

No climate, age, sex, mode of life, nor condition (says Weidmann), is exempt from this disorder. Childhood and puberty, however, are the periods most liable to it. The same thing may be said of persons, who labour hard, and are much exposed to external injuries. Every bone of the human body is subject to necrosis; but those which are superficial, and enter into the formation of the extremities, are more frequently affected, than others whose situation is deeper. Necrosis less commonly attacks the spongy substance of the bones, because this being endued with a higher degree of vascularity and life, suppuration is most apt to occur. Necrosis, on the contrary, is oftener seen in the compact substance, where the vital principle is less energetic, and more readily extinguished. As a modern writer has remarked, a very slight injury will frequently occasion an extensive exfoliation from the surface of the cylinder of a long bone; but a musket-ball may pass through the cellular structure of an epiphysis, or lodge in its substance, without giving rise to necrosis, suppurative inflam-

mation being much more likely to occur, than the latter affection. (*Bell on Diseases of the Bones, &c.* p. 49.) Lastly, necrosis may affect the long bones, or the broad; the large or small; and even those of the very least size; since it is well known, that the ossicula of the ear may be destroyed by necrosis, and separate. I have seen this happen in two instances, and the fact is recorded by several writers. (See *Astruc de Morbis Veneris*, lib. iv. cap. 1. *Henri, Journal de Médecine*, t. xv. p. 363.)

Though necrosis mostly attacks the cylindrical bones, the flat ones are not exempt from the disease. Pott makes mention of a parietal bone, the whole of which was detached, and of an os frontis, the greatest part of which came away. In a thesis on necrosis, written in 1776, may be found the case of a young man, a very large part of whose scapula perished and separated. Chopart, who relates the case, mentions, that he saw the patient quite recovered, and felt a new triangular moveable bone, firmly supporting the clavicle, but smaller and flatter than natural, and without any spinous process. The same has happened to the lower jaw, as may be seen by referring to the *Ephemerides Nat. Cur.* and *Mém. de l'Acad. de Chirurgie*. In the fifth volume of the latter work, is an account of a woman, who applied to be relieved of some venereal complaints. From the beginning of the treatment, the bone was discovered to be loose just under the gums, and seemed, shortly afterwards, to move backwards and forwards with a tooth. M. Guernery took hold of the tooth with a key-instrument, and found it firmly inserted in the moveable jaw; he made with caution the necessary manœuvres for extracting the portion of bone; but was greatly surprised on finding what an extensive part yielded to his very moderate efforts. It was the whole of the lower jaw, above its right angle, from its division into the coronoid and condyloid processes to the space between the first and second of the front grinders of the left side. On the right, there only remained the condyle in the articular cavity of the temporal bone. This destruction left a considerable empty space, from which great deformity was apprehended, in consequence of the unsupported soft parts falling down. The woman, however, got well in two months, and had the most perfect use of a new jaw. A similar fact is recorded in the *Journal de Médecine*, 1791. Mr. Perry lately removed the whole of the lower jaw, affected with necrosis from one ramus to the other; and such a reproduction of it has taken place, that the woman can now contrive to compress substances placed between the jaws, with some force. The dead bone, taken away, is in the museum at St. Bartholomew's.

When the body of a cylindrical bone, or the middle portion of a flat bone, is destroyed by necrosis, their extremities, which are of a cellular texture, generally continue unaffected, so that, for example, in the cylindrical bones, the articular ends are always formed of portions of the original bone, which are engrafted, as it were, on the new production. There are, however, a few bad cases, in which the necrosis does not altogether spare the heads of the bones, and the disease communicates with the joint. These examples are very uncommon, and are attended with considerable danger to the limb: indeed they generally require ampu-

tation. (See *Boyer, Mal. Carr. t. . p. 442.*) Sir Benjamin Brodie knew an instance, in which, without any obvious cause, a large portion of the head of the tibia died, and exfoliated, and the destruction of the knee-joint was the consequence. (*Pathol. and Surg. Obs. on the Joints*, p. 269.) In Weidmann's celebrated work may be seen engravings, taken from various specimens, in which the heads of bones, and even their articular surfaces were implicated; and in Mr. Liston's collection is a fine example, in which the knee-joint was involved. It is not, therefore, correct to assert absolutely, as Sir C. Bell has done, "that the extremities of bone are not subject to necrosis." (*Surg. Obs.* p. 321.) It would be more accurate to say, that those parts are not frequently attacked. Our museums contain many specimens of necrosis in the compact texture of bones, though but few in the cancellous structure. "This is evidently the result of the lower degree of vascularity, and it may be said, of vital power, in the compact structure; and it is well illustrated by the effects of the excessive use of mercury on the bones of the upper and the lower jaw. The former very rarely perishes; the latter very frequently from this cause; and so too, in necrosis of long bones, the articular extremities are very rarely included in the disease." (See *Lond. Med. Gaz.* vol. xx. p. 497.) Yet, I must confess, that numerous instances have fallen under my observation, where portions of the upper jaw perished from the abuse of mercury. I know of a melancholy case, in which this happened, where syphilis was entirely out of the question, calomel having been carelessly administered for supposed disease of the liver.

Besides the differences arising from the particular bones affected, necrosis also varies, according as the portion of bone attacked happens to be thin, and of little extent, or large and of considerable thickness. The disease is *simple*, when it is confined to one bone, and the patient is in other respects healthy; *compound*, when several different parts of the same bone, or several distinct bones are affected at the same time; when the health is bad; and other parts of the body are also diseased. It should also be known, because the information is of practical importance in the treatment, that necrosis has three different stages, or periods. In the first, the bone affected perishes; in the second, the process of exfoliation, or separation of the dead bone from the living, is going on; and, in the third, the separation is completed. (See *Weidmann*, p. 8.)

Necrosis is divided by some writers into the *traumatic* and *idiopathic*. In the latter, the exfoliations are generally more extensive and deep, than in the former, and frequently comprehend the whole thickness of a bone. The idiopathic is also that which is mostly met with in the flat bones. (See *Bell on Diseases of the Bones*, p. 50.)

The causes of necrosis are not essentially different from those which produce ulcers and gangrene of the soft parts. As, however, the vitality of the bones is weaker, we may infer, that necrosis may be occasioned in them by causes, which are less numerous and intense, and such as would only give rise to suppuration in the soft parts. Every thing, whether in the periosteum, or the substance of the bone itself, that tends to interrupt the nutrition of the bone, must be regarded as conducive to

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the origin of necrosis. It is observed, however, that when the mischief in the periosteum, medulla, or substance of the bone, is of trivial extent, the consequence may be merely an abscess. Some of the causes of necrosis are *external*, while others are *internal*, or constitutional. Sometimes the life of the bone is instantaneously destroyed by them; but in other instances, the bone is first stimulated and its death is preceded by true inflammation.

When a bone perishes from inflammation of its substance, as Mr. Stanley has observed, we are not always able to recognize the presence of inflammatory symptoms; yet that this loss of vitality is sometimes preceded and produced by inflammation seems to have been exemplified in the following case, recorded by that gentleman. A female, aged 17, died a month after the commencement of an attack of deep-seated inflammation of the leg. On examining the limb, the periosteum was found separated from the shaft of the tibia, in its whole extent. The space between it and the bone was filled with purulent fluid; the bone itself was of a deep red colour, which could not be wiped away, and was evidently produced by blood stagnant in the vessels. (See *London Med. Gaz.* vol. xx. p. 497.) And, in another place, he remarks, that the canals, transmitting the vessels in bones, are larger than the vessels themselves, which thus have space afforded for enlargement, so that the bone will contain more blood. It may be presumed too, that vessels, which previously could not admit the red globules of the blood, are now pervaded by them, and hence the bone acquires a deep red colour. Thus, in a bone, from which the periosteum had been stripped, Mr. Stanley observed first a pale rose, and afterwards a bright red colour produced; and, "in an operation to extract a sequestrum, a flow of blood from the cut surface of the surrounding inflamed bone, as free as from a divided muscle." (Vol. cit. p. 422.)

The external causes, which injure the periosteum and medullary structure, and thus produce necrosis, are wounds, contusions, pressure, fractures, comminutions, acrid substances, caustics, and extreme degrees of heat, or cold.

When the periosteum, in consequence of an external cause, inflames and sloughs, or is at once deprived of its vitality, as it may be by the action of caustic, fire, or intense cold, the vessels, which conveyed nourishment to the bone are destroyed, and the death and exfoliation of the denuded portion of the bone are inevitable. But, if the detachment of the periosteum is of little extent, the patient young and healthy, and the treatment calculated to prevent inflammation, and preserve uninjured the vessels distributed to the bone, hopes may be entertained, that no part of the bone will die, but that granulations will very soon arise from its surface, being adherent to it as the periosteum was, and that they will grow to, and cicatrize with the surrounding parts. Weidmann has explained, that this fact of bones not always exfoliating when deprived of the periosteum, which is of great practical importance in the treatment of wounds, was inoculated by Felix Wurtz, Cæsar Magatus, and Belloste, at a time when the contrary opinion prevailed. Weidmann also adverts to his own experience and to the experiments of Tenon, in further proof of the preceding fact. (*Mém. de l'Acad. des Sciences*, 1758, p. 372.)

On the other hand, when the detached piece of the periosteum is extensive; when the bone itself is contused; or when it has been long exposed to the air; when the inflammation is violent and extensive; when the patient is old, decrepit, or of bad constitution; and, more especially, when improper applications are used, necrosis cannot be avoided.

An internal necrosis, affecting the spongy texture of bones, generally arises from constitutional causes, though sometimes an external cause, which seems to affect only the surface of a bone, extends its action to the interior, so as to destroy the medullary membrane, and produce an internal necrosis.

In external injuries of the head, where the pericranium is lacerated, contused, or otherwise hurt, or where the outer table, or the diploe of the skull, is injured, the inflammation frequently extends to the inner table, and the dura mater becomes detached. Hence, a collection of matter forms, which may occasion many bad symptoms, and even death itself; or, if the patient survive, exfoliation of part of both tables of the skull is the consequence. (See *Pott's Chir. Works*, Lond. 1779, vol. i. p. 32.)

The same thing may occur in other bones, as well as those of the cranium. Bromfield had an opportunity of seeing a necrosis of the spongy substance of the upper and internal part of the tibia, brought on by the improper mode, in which an issue was dressed. In order to keep the peas from slipping out of their places, a compress with a shilling in it, and a tight bandage were applied; but, the part was attacked with excruciating pain, and the spongy texture of the tibia in the vicinity became affected with necrosis. (*Chir. Obs. and Cases*, vol. ii. p. 9.)

This circumstance, as Weidmann observes, ought not to surprise us: as numerous vessels quit the periosteum to descend into the substance of the bone, to ramify on the medullary cells themselves, and freely anastomose there, it cannot be difficult to conceive, how inflammation, which is at first confined to the outside of the bone, may (through the medium of the vessels, which serve as conductors to it) penetrate more deeply, and extend its ravages in every direction.

As a general rule (Mr. Stanley observes) when the walls of a cylindrical bone perish in their whole extent, the medullary texture suffers with them; but he met with one remarkable exception, in which, in consequence of the application of nitric acid to a phagedenic ulcer of the leg, the whole of the periosteum of the tibia became inflamed, the walls of the bone perished; yet the medullary texture remained entire and with its vitality unimpaired. (See *London Med. Gaz.* vol. xx. p. 497.)

But necrosis may proceed from another description of causes, which are of a constitutional nature. In fevers of bad type, in the small-pox, and in the measles, experience fully proves that the bones are sometimes attacked with necrosis. Scrofula, lues venerea, and scurvy, also frequently produce such mischief in the bones as terminates in necrosis. As I have already noticed, mercury may itself give rise to the disorder, especially in the lower jaw-bone. (See *Mém. de l'Acad. de Chir.* t. v. p. 356. 4to.)

This happens either in consequence of mercury

having been introduced too quickly into the system, or because the patient exposes himself to cold, or deviates in some other respect from a proper regimen. Certain necroses of the lower jaw, however, appear also to have been caused by blows, and the application of acrid substances to carious teeth. But, says Weidmann, "I feel it incumbent upon me particularly to declare, that the irrational treatment pursued by the ancient practitioners, who neither understood the nature of the bones, nor the differences of their diseases, and which treatment is too confidently adopted in our own days, had frequently the effect of killing these parts, by attacking with spirituous, acrid, or caustic remedies, or even with the knife, diseases which required the mildest applications, and to be left in a great measure to nature. The old surgeons were afraid of laying on the exposed injured surface of a bone unctuous emollient dressings, and yet, for what reason I know not, they subjected the part to the action of spirituous, acrid, drying applications. As for myself, I deem it proved by infallible and frequently repeated trials, not only that an exposed injured bone may be dressed with a mild ointment without any ill consequences, but even with the greatest advantage. Why should that which is beneficial to the soft parts, be so prejudicial to the bones? In ulcers of the soft parts, indeed, the employment of the remedy, which I recommend, is less important, because these parts are naturally humid, and there is no risk of their becoming dry. But, with regard to the bones, whose dry texture is only penetrated by few vessels, which may easily be destroyed if they be suffered to become quite dry, it is absolutely necessary to use an emollient ointment, as a dressing, well calculated to defend these vessels, which are the support of life, and preserve them from the bad effects of exposure to the air. Therefore, observes Weidmann, if a surgeon would avoid producing a necrosis himself, and not neglect any means, that tend to prevent such disorder, *he should make it a rule never to apply any thing acrid to exposed bones, but, on the contrary, to defend them with a dressing of some unirritating ointment.*" (*De Necrosi Ossium*, p. 11.)

It was formerly supposed, that purulent matter, collected near a bone, might in time become acrimonious, corrode it, and produce necrosis. Hence, it was a rule to open such an abscess as soon as its existence was known. But, Weidmann questions, whether there was any real necessity for this practice. No doubt, says he, the preceding erroneous opinion arose from the circumstance of the bones being often found bare, carious, or even affected with necrosis, when abscesses were near them; but things happened thus, because the inflammation, which caused the suppuration, had also extended its effects to the periosteum and bone. He affirms that he has witnessed ulcers, in which the surface of bones, bare and uncovered by the periosteum, lay bathed in pus for a very considerable time; yet, being dressed with a mild ointment, they continued entire, granulations grew from them, and cicatrization followed. He had also in his possession portions of bones, affected with necrosis, which had lain for years in pus: still their surface was smooth, and presented no marks of erosion. If then these pieces of bone underwent no alteration, how much

less likely to do so are bones, which are endued with life!

But, though Weidmann wisely rejects the doctrine of pus being capable of destroying the periosteum and bones by any corrosive qualities, he acknowledges his belief, that the matter of an abscess may by its quantity compress and inflame the adjacent parts, and occasion their removal by the absorbents. While the periosteum intervenes between an abscess and the bone, he does not see how the latter can be hurt by the pus; but, when the abscess is copious and lodged between that membrane and the bone, the vessels passing from the former will be destroyed, and either caries or necrosis ensue.

The inflammation, arising from the causes which excite necrosis, may be *acute* or *chronic*. It is chronic, when it begins and passes through its different stages slowly, and when the mildness of the symptoms may lead us to mistake the nature of the case. This sort of inflammation chiefly happens in debilitated constitutions, in which the necrosis only affects the external part of a bone, and originates from some chronic cause, such as scrofula, lues venerea, and the scurvy. But, when necrosis attacks the interior, and the disease occurs in a strong, irritable, plethoric subject, inflammation is immediately kindled, attended with most acute symptoms, severe pain, considerable fever, restlessness, delirium, &c. Chronic inflammation is more supportable; but its duration is longer: acute inflammation is more afflicting, but sooner comes to a crisis.

The part, in which a necrosis is situated, is affected with swelling. What has been observed, respecting the inflammation, is also applicable to this tumour, which most frequently forms gradually, but sometimes with great rapidity. In the first case, the accompanying pain is dull and inconsiderable; in the second, it is violent. The swelling has not, like that of abscesses, an elevated apex. On the contrary, it so widely diffused, that the limits, which circumscribe it, can hardly be distinguished. This diffusion of the swelling is the greater, in proportion as the diseased bone is more deeply buried in soft parts: it may extend over the whole morbid bone, or even over the whole limb. The swelling comes on at the very beginning of the disorder, and continues to increase, until the matter which it contains finds its way out, when the evacuation is followed by a partial subsidence of the tumour. The swelling is sometimes also combined with oedema, especially in persons, whose constitutions have been impaired by the severity of the disease, the violence of the sufferings, and the long and profuse discharge.

When the inflammation is acute, purulent matter of good quality soon collects in the vicinity of the necrosis. In the contrary case, the pus forms slowly, and is thinner and less healthy.

The abscess which accompanies a necrosis, naturally soon bursts when it arises from intense inflammation, and is situated near the skin, which is itself inflamed. But, when the bone is surrounded by a great thickness of soft parts, and the inflammation is chronic, the quantity of matter daily increases, the cavity, which it occupies, becomes larger and larger, and considerable pressure is made by the abscess on every side. The bones and tendons resist for a long while the progress of the matter; but the cellular tissue

yields, and different sinuses form, which sometimes run to a vast distance from the main collection of matter, especially when the abscess lies under a fascia.

It was supposed a few years ago, that, in necrosis, the matter was invariably sanious, acrid, and fetid. But the celebrated Weidmann exposed the error of this opinion. He had often seen abscesses and ulcers, arising from necrosis, discharge a whitish, inodorous, thick pus, absolutely devoid of any bad quality whatsoever. He had particularly seen this happen in patients, whose necroses proceeded from an external cause, or an internal one of a slight nature, and whose health was generally good. (*De Necrosi Ossium*, p. 16.) If, says the same excellent writer, we sometimes find in practice the suppuration dark and fetid, we must not ascribe it to the affection of the bone, but to the weakness and bad state of the patient's health. Under the same circumstances, common sores of the soft parts would also emit a discharge of bad quality.

After the ulcerated openings have emitted for some time a profuse discharge, the sinuses, if considerable, receive the appellation of fistulæ, on account of their edges putting on a callous appearance, throwing out fungous granulations, and there being impediments to cicatrization. These impediments are caused by the dead portions of bone, which, whether loose or adherent, act as extraneous bodies in hindering the sores from healing. In some instances, also, the ulcers will not heal, though the dead bone has come away, because they run to a great depth, and such a quantity of pus is secreted from every point of their surface, as prevents all contact, and the adhesions, which would result from it.

The fistulæ vary in number; but, they are fewer in proportion as the disease is slighter. In an extensive necrosis, several of these openings are seen, either near together, or separated by considerable spaces; and, when the necrosis affects every side of the bone, the fistulæ in the integuments occur on every side of the limb.

Besides the inflammatory fever, attending the beginning of every severe case of necrosis, and which is sometimes accompanied with exceedingly violent symptoms, and which usually abates when matter is formed, the patient is subject to another fever of a slow hectic type. This takes place in the decline of the disease, is the effect of the long continued profuse suppuration, gradually reduces the patient, and at length brings him to the grave, unless the timely removal of the sequestrum be effected either by nature or art.

Let us next endeavour to trace the signs, by which we may not only ascertain the presence of the disease, but its modifications.

In the first place, we should make ourselves acquainted with every thing, which may have predisposed to the disorder; as for instance, what accidental circumstances have occurred, and what symptoms followed them. We should also inquire into any previous treatment, which may have been adopted; for, as Weidmann truly remarks, injudicious remedies have caused many a necrosis, that would not have occurred at all, if the case had been properly treated, or confided to nature.

The kind of inflammation, with which the disease commences, may afford grounds for suspect-

ing that necrosis will happen: it is generally slow and deeply seated, passing through its stages tardily, and the attendant symptoms are severe. The skin retains its natural colour a long while; but, at length, exhibits a reddish or livid discoloration. The matter does not reach the skin, till a considerable time has elapsed, and when the abscess bursts, the inflammatory symptoms are still slow in subsiding. When the inflammation is acute, the patient suffers intolerable pain a long time.

There are also other symptoms of a necrosis; viz. the swelling which accompanies the inflammation, is situated upon a bone, or rather the bone is included in the tumour; the swelling is at the same time very diffused; and the suppuration lies deeply, and can only be felt in an obscure way.

The ulcers, beneath which a necrosis is situated, discharge a large quantity of matter, and their edges are bent inward. The granulations are either yellowish and pale, or else of an intense red colour; they are also irregular, and generally not very tender, though sometimes extremely painful, and on being slightly touched, they bleed.

Some years ago, the discharge from the sores, which attend necrosis, was described as being always thin, fetid, and sanious; and such qualities of the matter were regarded as a symptom of the disease of the bone. But, as that excellent practical writer Weidmann has explained, it is a symptom, undeserving of confidence. In necrosis, the pus is often thick, white, and inodorous; while other ulcers, unattended with diseased bone, sometimes discharge thin fetid matter. Weidmann, at the same time, does not mean to assert, that in necrosis, the sores never emit unhealthy pus; but, he firmly believes, that such discharge is not always the result of a disease of the bone. So far as he could judge, while the patient's general health is good, the suppuration from ulcers, situated over diseased bones, continues white and laudable; but it deviates from these properties, in proportion as the health becomes impaired.

Neither is the black colour, imparted to the dressings of ulcers, a circumstance, which necessarily indicates the existence of necrosis; for it may occur, when the bone is sound, and may not happen when the bone is affected.

None of the preceding symptoms convey such information, as leaves no doubt of the positive existence of necrosis. The touch is the only thing, which can give us this knowledge, when the bone is not too deeply situated, and the sinuses not tortuous, nor obstructed with fungous growths.

When the openings of the ulcers are considerable, the finger may be introduced. If in this way the bone can be felt to be extensively uncovered by the periosteum, the surgeon may conclude, that all such portion of the bone has perished. He may be still more certain of the fact, when he finds the edges of the denuded bone unequal and rough.

The examinations, made directly with the finger, give the most correct and exact information of the state of the bone; but the orifices of the sores are sometimes so small, that the finger cannot be introduced, without causing great pain.

A probe must then be used for the purpose of ascertaining the extent of the denudation of the bone; whether its edges are rough; whether the dead portion is loose, and likely to separate soon.

Sometimes, the dead fragment of bone, the *sequestrum*, protrudes from the ulcer, or is visible on separating its edges. When it is black, there cannot be a doubt of its being actually dead; but, on the other hand, when its whiteness is increased, the diagnosis is difficult, because bones being naturally white, much experience is necessary to be able to judge whether they are so in excess.

It merits attention, also, that the black colour of the bone is not owing to the necrosis itself, but seems rather to depend upon the fragment having been exposed to the air. In fact, dead pieces of bone with which the air comes into contact, often turn black, while those, which are covered with matter, retain their whiteness. The cylindrical portion of a humerus, which was almost totally affected with necrosis, was universally black at the part, which protruded through the flesh; but the rest, which lay under the integuments, was white. (*Weidmann de Necrosi Ossium*, p. 19. et tab. 9. fig. 1.)

When the early symptoms of the disease are mild, the surgeon may infer, that it is only a superficial portion of the bone, which is about to be separated. But, this judgment will be more certain, if confirmed by examination with the finger, or probe: or if the swelling, which occurred in the beginning, has not spread beyond the affected point, and if the pain affects only the outer part of the bone. In this sort of case, there is also great probability, that the dead bone will be separated within a moderate time.

It is also of importance to ascertain the existence of an internal necrosis, and to learn whether it is situated in the spongy substance, or in the internal parietes of the canal of the bone; whether it affects only a part, or extends to the whole body of the bone. When there is an internal necrosis, says Weidmann, the disease is generally more aggravated, and of longer duration; and in the first stage, the patient is affected with severe symptoms, intolerable pain, loss of rest, a great deal of fever, profuse perspirations, and such disorder of the system as may prove fatal, unless the patient be young and strong. The hard swelling, which was observable at the commencement of the disease, increases but slowly, and extends very gradually over the circumference of the limb, while the skin yet remains free from redness and tension. *If the part be somewhat roughly handled, the pain, which is fixed in the bone, is not rendered more acute, as would happen, were the case an external inflammation.* In this suffering condition, the patient continues a good while, before the formation of matter brings a degree of relief. When the matter is formed, it spreads through the adjacent cellular tissue, amongst the muscles and other parts, and the abscess generally bursts, after a considerable time, by several openings, very distant from the main collection of matter, as also remote from each other, sometimes in diametrically opposite situations. The evacuation of the matter, however, does not produce any material subsidence of the swelling. The pus is of good quality, and issues in large quantities from the ulcerated apertures,

the quantity, however, not being increased when pressure is made. If some of the openings heal, others are formed; but, in general, the edges become callous, and they lose all disposition to cicatrize. When the case presents the foregoing circumstances, and the weakened limb can neither bear the action of the muscles, nor the weight of the body, and by either of these causes its shape becomes altered, the surgeon may conclude that the disease is an internal necrosis. But, in order to avoid mistake, he should introduce into the sinuses a probe, which, passing through the openings in the adjacent bone, will touch the dead piece, which it contains, and which will sometimes be even distinguished to be loose and moveable. *The extent of the sequestrum must be judged of, by the extent of the swelling, and the distances, between the apertures in the bony shell, which includes the sequestrum.*

The surgeon should also endeavour to ascertain with the probe, whether there is only a single sequestrum, or several. When there are several, they may be felt with the probe in different places, down to which this instrument is passed, and the removal of one, or two of the fragments, is not followed by a cure. It ought to be remembered, however, that the same fragment may be touched by the probe in several different places, when it is very extensive. If there are several dead pieces of bone, situated at a distance from each other, each of them is generally accompanied with a distinct swelling, and sinuses. Frequently, these fragments are so concealed, that they cannot be felt with a probe; but, their existence may then be suspected from the ulcers not healing, which can be ascribed to nothing else.

It is also necessary to distinguish with the greatest attention the different stages of the disease. The *first stage* may be considered as existing, when the attack is yet recent, and the inflammation and its concomitant symptoms, the pain, swelling, and symptomatic fever, prevail in a high degree, and no suppuration has taken place, or at least no discharge of matter. The *second period*, in which the dead bone is undergoing the process of separation, is indicated by a diminution of the inflammation, a partial subsidence of the swelling, and the discharge of purulent matter. When a probe is passed into the ulcers, the bone is felt bare and dry, and, towards the limits of the swelling, it is rough, where, as will be afterwards noticed, an excavation is formed. Every part of the bone, however, which is to be detached, still continues adherent to the rest of the living bone. At length, the surgeon knows, that the disease has reached its *last stage*, or that in which the dead portion of bone is entirely separated, when sufficient time for the completion of this separation has transpired, and when the dead bone can be distinguished with the finger, probe, or even the eye, to be loose, and free from all connexions.

Although a necrosis must generally be classed with diseases which are serious and of long duration, yet the character of the disorder is not essentially bad, since it is often cured by nature, or with the assistance of surgery. Confident hopes of a cure may be entertained when the necrosis is confined to the external part of a bone; when it is simple and of moderate extent; when it is not situated near any organ, that may be injured by it; and when it proceeds from an external cause,

and the general health is good. On the contrary the cure is difficult, and the prognosis doubtful, when the disease is extensive, and complicated with other affections, either of the same, or different bones; when it attacks bones, which are of high importance on account of their functions, or situation; when it is situated in the interior of the bone, affects several parts of it, or implicates a large joint; when it arises from an internal cause, for which there is no certain and quick-acting specific; when the patient is weakened by age, or disease; and especially when the sinuses extend into the neighbouring articulations. (*Weidmann de Necrosi Ossium*, p. 22.)

The process of cure generally takes place with more celerity in the lower jaw, than any other bone, and may be completed in three months. Mr. Russell has never known a necrosis of the tibia get well in less than a year; but in general, nearly two years elapse first; and sometimes, the case is protracted to a much greater length of time. Here, however, much will depend upon what can be done by the surgeon for the removal of the dead portion of bone.

Necrosis of the lower jaw and clavicle rarely or never proves fatal; that of the lower extremities which is the worst case, does so but seldom, and only from the violence of the first inflammatory symptoms, which may be rapidly followed by hectic fever, which sometimes proves incurable, unless its local cause be removed by timely recourse to amputation. When the violence of the first stage, however, has abated, the constitutional irritation and hectic symptoms are generally moderate. Nor is this state of tranquillity disturbed till the sequestum, in making its way outward, again produces irritation. At this second period of urgency, extensive inflammation may originate, ulceration spread widely over the limb, assume an unhealthy appearance, violent fever succeed, and the patient either perish or sink into a state, in which he must consent to an operation, as the only means of saving his life. This is the last crisis of imminent danger. (*Russell*.)

When a portion of bone dies, nature uses all her endeavours to bring about its separation from the part of the bone, which still remains alive. Surgeons have denominated this process, *exfoliation*, (see this word,) which resembles the separation of the soft parts affected with sphacelus from the living. The exfoliation of bone, however, happens much more slowly than the separation of a slough. Exfoliations are not completed at any regular and fixed period; for they proceed most quickly during youth, when the constitution is usually more full of energy, the bones more vascular, and less replete with solid inorganic earthy matter. On the other hand, the process is slower, in old, debilitated subjects, whose vitality is less active. A thin small scale of bone separates sooner than a large thick portion; and the most tedious exfoliation is that of a thick bone, from which a portion, including its entire diameter, is coming away. The separation of a necrosis takes place more expeditiously in bones of a light texture than in those of a solid structure; and sooner in the less compact parts of bones, such as the epiphysis and spongy substance, than in those of greater density. The separation happens precisely at the different points where the living and dead parts of the bone come into contact; and it is obvious, that the particles

of the dead bone which are at a distance from the part that retains its vitality, cannot be acted upon by it.

A variety of opinions have been entertained concerning the means employed by nature in effecting this separation. Hippocrates believed, that the dead part was pushed away by a fleshy substance which grew underneath it. (*De Cap. Vuln.* cap. xxiv.) Ludwig, Aitkin, Bonn, and many others, adopted the same idea. (See *Adversaria Med. Pract.* vol. iii. p. 63. *Systematic Elements of Surgery*, p. 287. *Thesaur. Oss. Morb.* p. 1.) Van Swieten conceived that the dead part was forced away by the incessant beating of the arteries. (*Comment. in Aphor. Boerhavi*, § 252.) M. Fabre ascribed the separation to the extension and expansion of the vessels. (*Mém. de l'Acad. de Chir.* t. iv. p. 91.) Others supposed that the exfoliating piece of bone became loosened partly by the suppuration, and partly by the rising of the new granulations. (See *B. Bell on Ulcers*.)

As Weidmann observes, there is unquestionably a reddish fleshy substance formed between the dead and living bone, and which Celsus has noticed under the appellation of *caruncula*. (*De Medicina*, lib. viii. cap. 3.) But it would be erroneous to refer the expulsion of the dead portion of bone to it, since it can never be produced before a change has taken place in the structure of bone, there being in fact no space for it to grow in; and hence it is never seen before the disunion of the parts has considerably advanced. There must consequently be some other power, which destroys the cohesion between the dead and living bone, and produces the groove or interspace, in which the soft granulations arise. Besides, amongst other facts proving the falsity of the idea, that the granulations push off the dead bone, Weidmann particularly adverts to the occasional exfoliation of the whole circumference of a cylindrical bone. Here, if the granulations had the power of causing a disunion on one side, they could not have the same effect on the opposite one; but would tend to make the contact more intimate. The granulations, in extruding the dead bone, may, however, sometimes have influence; and to this view, Mr. Stanley inclines, as will be presently explained.

The separation cannot be made by the pulsation of the small arteries, nor by the weak expansive motion of the vessels of the bone. Weidmann knows not what motives have induced certain writers to impute the effect to suppuration, and observes, that as the doctrine is not founded upon reasoning, it is superfluous to offer any arguments against it. If the least attention be paid to what nature really tries and accomplishes in this operation, nothing will be more manifest, than that it is completed in a very different manner. Swelling first affects the periosteum and bone, which by degrees softens. (*Vid. Troja, passim; Bonn, Thesaur. Oss. Morbos.* p. 122, and *Weidmann de Necrosi Ossium*, tab. 4. figs. 1 and 3.) At the margins of the necrosis, the bony surfaces, which were smooth, become rough and irregular. A fissure is there produced, which extends in every direction under the piece of bone, that is about to be detached. The bony texture is also daily rendered less solid, so that the number of adhesions between the dead and living parts diminish, and in the end are totally destroyed. Weidmann then explains that the true mode by which the separa-

tion is effected, consists in the absorption of the particles, situated betwixt the living and dead parts of the bone, in such a way, however, that the first loses a great deal of its substance; the last scarcely any thing. (P. 25.) After the dead bone has come away, the swelling of the neighbouring periosteum subsides, and the living bone recovers its original hardness and solidity. (*Troja*, p. 67.)

When a piece of bone perishes, it is then with regard to the rest of the body completely an extraneous substance, and, as such, proves a source of irritation to the surface of the living bone which becomes inflamed, and acquires increased vascularity. The next stage of the process is the formation of a groove between the dead and living bone, the earthy matter of which is first taken away and then the animal substance. This Mr. Stanley has often noticed in cases where the exfoliation of the end of a fracture was taking place. When it had just begun, the living bone immediately adjacent to the dead portion was found softened by absorption of its earthy particles, as if it had been immersed in diluted acid. A channel was soon formed in it; and as this became gradually deeper, the dead was separated from the living bone. "As this groove grows deeper, it is filled by granulations, arising from the living bone; and hence, on separating a piece of necrosed bone, there is seen next to it, not the surface of the living bone, but the layer of very vascular granulations, by which it is completely covered, and with whose soft velvet-like appearance every one must be familiar. And in correspondence with the granulations that have sprung up from the living bone, we have the well known rough surface of the dead, with its multitude of prominences and excavations fitted to the granulations, which, as it were, push out, and extrude the dead bone from the cavity in which it is lodged." In every one of its principal stages, therefore, (says Mr. Stanley,) the process of the exfoliation of dead bone is but the repetition of that of the separation of a slough from soft parts. In both may be recognised, 1. Increased vascularity in the contiguous parts; 2. The groove between the dead and living parts; 3. The granulations from the surface, exposed by the removal of the dead bone. (See *Lond. Med. Gaz.* vol. xx. p. 498.)

As this gentleman correctly observes, there can be no doubt about the absorption of dead bone not yet separated from the living; I have seen numerous cases which have perfectly convinced me of the fact. But when dead bone is completely exfoliated, can the absorbents of the surrounding parts act upon it? Mr. Hunter's doctrines maintain the affirmative; but as Mr. Stanley remarks, the question has been repeatedly investigated by experiment; yet, hitherto, he thinks, with negative results. "It has been stated (says he) on the best authority, that Sir W. Blizard tied a piece of bone, which he had carefully weighed, in an ulcer in a man's leg, and that, after a time, having removed it, it was found to have lost part of its weight, and was besides visibly altered on the surface in contact with the ulcer." But Mr. Stanley has repeated the experiment without obtaining similar results: pieces of bone were often placed by him in issues for the purpose of keeping them open, but no action of the absorbents on them could ever be detected. Mr. Gulliver's experi-

ments, communicated to the Royal Med. and Chir. Society of London, also support the inference, that bone, completely disjoined from the living, is not acted upon by the absorbents. (See EXFOLIATION.)

When dead portions of bone are separated and loose, they still lodge in the ulcers, and, like all other extraneous bodies, occasioning irritation of the soft parts, and keeping up the discharge of matter: sometimes, however, nature succeeds in expelling them. This happens when the size and shape of the ulcer are calculated to facilitate the issue of the dead bone, which does not lie too deeply, and is propelled outward by its own weight. In necrosis of trivial size, indeed, the small fragments of bone may be blended with the pus, and come away with it (*David, Boussetin, Hist. de la Société Royale de Médecine*, tom. iv. p. 308.; *Weidmann de Necrosi Ossium*, p. 26.); but such an event can never be expected, when the dead portion of bone is at all extensive.

That dead portions of bone sometimes disappear, and no longer prevent the healing of wounds and ulcers, is a fact often exemplified after injuries of the skull. I have many times had occasion to notice it. The subject is particularly adverted to by M. Velpeau, as well as by MM. David, Boussetin, and Weidmann. "At the hospital, Saint Antoine, twice, and at that of La Pitié, I have seen (says M. Velpeau) the bones of the cranium, after being denuded, and in contact with pus, for ten days or a fortnight, no longer interfere with the healing of the wound, and in another week the patients were cured. The occurrence, moreover, is far from being rare, and I have noticed it in other bones—the tibia, the bones of the nose, the phalanges, &c. There is no reason to be astonished at this; for necroses of a much deeper kind may disappear in the midst of the soft parts, and prove but feeble obstacles to cicatrization. Certain patients have afforded me proof of this after amputation of the leg. In two of them, the end of the fibula; in one, the angle of the tibia; and in a fourth, the surface of both bones remained in a state of necrosis quite visible for more than a week, and then becoming gradually enveloped by the granulations, caused no obstacle to the healing of the stump." From these and other cases which fell under the observation of M. Velpeau, he infers that there is a dissolution or absorption of the dead bone, and not an imperceptible exfoliation; and that certain necroses may disappear without any detachment of the sequestrum. Hence, in particular instances, he recommends leaving a necrosis alone. The facts and practice to which it leads, he admits, were not unknown to Russell. (See *Velpeau de l'Opér. du Trépan*, p. 20. 8vo., Paris, 1834.) In some instances, a thin layer of bone separates, and is imperceptibly destroyed, or else expelled. Lastly, in some young subjects the dead layer of bone, though very thick, ceases to keep up suppuration, and yields to the molecular action of the surrounding textures. (*Id.*)

The last thing, which nature does, is to restore the loss of substance which the bone has suffered. Although this operation is so extraordinary and wonderful, that one might be disposed to doubt its reality, numerous examples, recorded in the annals of surgery, prove not only its possibility, but also its frequency.

In works referred to at the conclusion of this,

article, the following authors speak of the regeneration of a part, or the whole of the lower jaw-bone: viz. Bonetus, Bayer, Guernery, Belmain, Acrel, Van Wy, Trioen, Bonn, Reiplein, Desault, Henkel, and Dussaussoir. A student showed Weidmann a lower jaw-bone, which had been thus regenerated, and taken from the body of a man, whom the latter distinguished writer had been well acquainted with. The bone could not be freely depressed: yet it performed its functions tolerably well. A similar case has lately been under the care of Mr. Perry. Moreau saw a case in which the clavicle was regenerated, and the new bone was presented by Dangerville, after the patient's decease, to the Academy of Surgery at Paris. (*De Necrosi Ossium Theses, Præs. F. Chopart, resp. P. G. Robert, Parisiis, 1776.*) Chopart had an opportunity of witnessing the death and reproduction of a scapula. Weidmann saw an instance, in which nearly the whole cylindrical shaft of the humerus perished, and was afterwards regenerated; a phenomenon, that had been observed at earlier periods by Job of Mekren, Cajetano, Tacconi, E. Blancard, Duhamel, David, Acrel, Boehmer, Cheselden, and Vigaroux, whose respective works are cited at the end of this article. Morand, Cheselden, and Biomsfeld, published engravings respecting a reproduction of the upper part of the humerus, where the old dead bone was included in a sort of bony tube. Regenerations of the ulna have been observed by Ruysch, Duverney, and Fowles. (See *Theaur. X. No. 176. Traité des Mal. des Os, Paris, 1751.*; and *Phil. Trans. No. 312.*) A similar reproduction of the lower ends of the radius and ulna was witnessed by Acrel. (*Chirurgische Vorfälle von Murray, vol. i. p. 194.*) Similar reproductions of the thigh-bone are recorded by Wedel, Battus, Koschius, Hoffmann, Scultetus, Diemberbroeck, Wright, Fabricius Hildanus, Raw, Dobyns, M'Kenzie, Ludwig, David, Bousseclin, Larry, Hutchinson, &c.

The following case of necrosis of the thigh-bone was long ago related by Dr. M'Kenzie. William Baxter, a boy thirteen years old, received a blow on his thigh at school, of which he at first hardly complained; but, in a few months, he began to have pain in the part, which inflamed, swelled, and appeared to have matter in it. The parents being poor, no surgeon was called, and the boy was allowed to linger for a great while. At length, the matter made its way through the skin, by a small opening, on the interior part of the thigh, about three inches above the knee, and a thin sanies continued to be discharged for eighteen or twenty months. The hole in the skin enlarged, and the point of a portion of bone began to protrude, and give a good deal of pain, when the clothes rubbed against it. After suffering in this manner for two years and a half, the boy, as he lay in bed one morning, felt the bone looser, and projecting more than ordinary. He gave it a strong pull, and brought the piece away entirely, which proved to be seven inches and a half of the thigh-bone. A good deal of bleeding followed; but, the wound soon healed, and he had never afterwards the least inconvenience. Dr. M'Kenzie, hearing of this case, sent for him, carefully examined his thigh, and found it as firm as the other. The only difference was, that it was some-

what thicker, and a little more curved. The muscles retained their natural softness, and looseness on the bone. The detached piece of bone was a portion of its whole circumference. (See *Med. Obs. and Inquiries, vol. ii.*)

We may infer, that the occurrence is more frequent in the tibia than any other bone, from the accumulated facts, mentioned by Albucaasis, La Marche, Muralto, De La Motte, Ellinchuys, Ruysch, Tacconi, Laing, Johnson, Hunter, David, Boehmer, Sigwart, Th. Bartholine, Hofmann, Saviard, Le Dran, Duverney, Trioen, Gunther, Ludwig, Michael, Bousseclin, Weidmann, Russell, Whately, Desault, &c., and from the evidence afforded by nearly every Pathological Museum.

Dr. Hunter describes a tibia, which had been amputated. On examination, the case at first sight seemed to be a swelling of the whole bone, with a loose internal exfoliation. However, it proved to be a remarkable instance of the separation of the greatest part of the original bone, whose place was supplied by a callus. The external surface of the enclosed loose piece of bone was smooth. A small part of the surrounding bony substance being removed, the contained piece was taken out, and found to be the whole body of the tibia. It had separated from the epiphysis at each extremity. The middle part of the bone had perished, consequently had lost its connexion with the periosteum, and was gradually thrown off from the living parts of the bone at each end. A callus, extending from end to end, united the two extremities of the original tibia, preserved the length, and gave firmness and inflexibility to the limb. The exfoliation was so encompassed by the new bony case, that, though quite loose, it could not be thrown out. (*Med. Obs. and Inq. vol. ii.*) Various fine specimens of similar reproductions of long cylindrical bones are contained in almost every Pathological Museum.

Weidmann saw a shoemaker who, after much suffering, extracted, with his own hands, the greatest part of the diaphysis of the tibia; yet, the loss was so well repaired, that the man could walk afterwards nearly as ably as ever. (*De Necrosi Ossium, p. 29.*)

"We are not to imagine (says Weidmann), that these regenerations happen by chance: experiments made upon living animals by Troja, Blumenbach, Koehler, Desault, and myself, prove, that they invariably follow certain laws."

In fact, whenever the medullary structure of the long bones of pigeons, or dogs, is destroyed, these bones become affected with necrosis, and are afterwards reproduced to the full extent of their destruction.

The observations and experiments, cited by Weidmann, also prove, that it is the long bones which are usually reproduced; though the flat ones are not entirely destitute of the power of regeneration, since experience fully evinces, that, when a portion of the skull is removed, either by a wound, by disease, or by the trepan, nature always endeavours to cover the deficiency, the edges of the aperture extending themselves by means of a bony substance, furnished by the periosteum, the dura mater, and cranium itself. (*Tenon, Mém. de l'Acad. des Sciences, 1758, p. 412, 413, 415, 416, 418.*) But, still the

reproduction is imperfect, as an unossified place is always left, even when the bone has lost only a small piece, like what is taken out by the trephine; and when the destruction of the cranium is very extensive, sometimes no reproduction at all happens. This fact, which is proved by the observations of Saviard, Pott, Sabatier, &c. is particularly noticed by Sir A. Cooper. In University College Museum, however, there is a fine specimen of the partial regeneration of a considerable portion of the skull, which had been removed by trephining, forty-five years before the death of the individual. The appearances seem to denote also, that the new bony deposit has not been entirely produced in the manner referred to by the following passage:—"In persons, who have lived ten, twenty, or fifty years, after loss of portions of the cranium, the slow restoration of the bone appears to have been progressive for the whole period. In fifty years, a trephine hole is closed by the shelving growth of bone from the margin towards the centre." (See *Mayo's Pathology*, p. 8.)

When, in a case of necrosis, a scale, or table, of either a long, or flat bone, is separated, no regeneration follows, because, according to Weidmann, the granulations, which rise up under the sequestrum, then serve as a periosteum; and as soon as the dead bone is removed, they become united to the adjacent parts. On this point, I believe, nearly all surgeons agree. Thus, Mr. Stanley notices, that if the surface of a bone has perished to a limited extent, producing a superficial necrosis, which implicates only a portion of the thickness of the walls, the dead bone will exfoliate or be absorbed, but no reproduction of bone will ensue. It is true, that, when the external wound has healed, the surface of the bone may present no irregularity perceptible externally; yet, the filling up of the excavation has been effected only by means of a dense fibrous tissue; and, in these cases, if the bone be macerated, the excavation, which the exfoliation had produced, will be clearly shown, and it will be found that no reproduction has taken place. (See *Stanley*, in *Lond. Med. Gaz.* vol. xx. p. 577.) Mr. Mayo's view, however, is different; for, he represents the surface, from which a thin exfoliation has separated, as becoming covered with granulations, the growth and ossification of which replace, in some degree, the substance lost. (*Human Pathology*, p. 34.)

It is likewise ascertained, that the power of reproduction in the bones is particularly active in the early periods of life, and in healthy subjects; and that it is languid and even annihilated in old persons, pregnant women (*Bonn's Thesaur.* p. 174.), and in venereal, cancerous, and ricketty patients. (*Caissen, Syst. Chir. Hodiernæ*, pars i. p. 636.) Two circumstances are specified by Mr. Stanley as having important influence; viz. the situation of the dead bone, and the mode in which the necrosis has occurred. For instance, a portion of the cranium perishes, and exfoliates, but is rarely or never regenerated. This may be, he thinks, because the pericranium perishes, and leaves no cellular tissue as a matrix for the reproductive vessels. "But, there are other instances, where the reproduction fails, and in which such an explanation cannot be admitted. Why, for instance, should a part of the upper

jaw fail to be reproduced, while, in the lower, the process constantly succeeds? The regeneration of a portion of the sternum, or of a rib, does not appear to have been witnessed, nor of any of the short bones of the tarsus, or carpus, nor, except rarely, of those of the metacarpus, or metatarsus. It may probably be affirmed, that the reproduction of bone, lost by necrosis, is limited to the cases in which it suddenly and completely perishes, and in which there is no circumstance to check the occurrence of inflammation in the periosteum and surrounding soft tissues, which must be the first step in the process of reproduction. Where, on the contrary, the bone perishes very slowly, as under the operation of some morbid poison, or where the surrounding soft parts are diseased, the reproduction is not to be expected." (See *Lond. Med. Gaz.* vol. xx. p. 580.)

In order that a new bone may form, Weidmann thought that the periosteum and other membranes, concerned in the nutrition of the original bone, must be spared from destruction. In fact, says he, we observe, that, in cases where the tube of a long bone has suffered necrosis, the bone is never reproduced, if the periosteum has been destroyed by inflammation, or other causes. Surgeons ought also to understand, that it is not always a reproduction which has happened, when a part of the bone perishes; not even when a tubular portion of a long bone dies, and is contained in the medullary canal. For, according to Weidmann, if the innermost layers of a long bone perish, while those which compose, as it were, the cortex are preserved, the latter swell and soften, as if they were actually a new bone. Several round apertures are observable upon their surface, which serve for the transmission of vessels, and are larger than those which perform this office in the natural state. Large openings, or fistulae, are likewise formed, which, as in a new bone, lead to the medullary canal. Here it would be erroneous to conclude, that a new bone has been produced; and a very little attention will discover, that all is limited to some changes in the external part of the bone, which the necrosis has not affected. When, therefore, the interior of the canal of a long bone is destroyed by a necrosis, which does not extend to the external layers, the case is not a reproduction of the bone. If, however, we find the tube of any long bone included in a sort of osseous shell, and the interior surface of this tube smooth, like that of a bone in the natural state, we may be certain, that it has been detached directly from the periosteum, and that the bony shell, which contains it, is a new production. On the contrary, if the surface of the dead tube be rough, we may infer, that the separation has taken place between the innermost layers of the bone, and those which are superficial, the latter composing now the osseous shell, in which the sequestrum is included. (*Weidmann de Necrosi Ossium*, p. 31.)

This last theory, concerning the production of the osseous shell in necroses of long cylindrical bones, is adopted by Richerand as the true one, not only in the instances specified by Weidmann, but, in every other example, where the old bones seem to be included in another, which has the appearance of being a new production, and which was supposed by Troja, David, &c. to be formed

by the vessels of the periosteum. (See *Nosographie Chir.* t. iii. p. 158. 161. edit. 4.)

The short or cuboid bones are incapable of reproduction. Duverney mentions an astragalus, which was destroyed by necrosis; but does not state, that any substitute for it was afterwards formed. (*Maladies des Os*, p. 458.)

Weidmann never witnessed a reproduction of the spongy substance, such as it was before its destruction, round the medulla. He always found the substituted matter dense and compact, at least, for some time after its formation.

It is now admitted, however, that in process of time, the inner surface of the new bone becomes cellular, and is lined with a membrane containing medulla. The regeneration of the medulla was first observed by Koehler, and afterwards by Dr. J. Thomson, in an extensive series of experiments, which he made with Dr. Alexander M'Donald, and which were published in the latter gentleman's inaugural dissertation in 1799. (See *Thomson on Inflammation*, p. 393.) Mr. Russell was not aware of the regeneration of the medulla; for, he states, that, after the absorption, or removal of the sequestrum, the cavity of the new bone becomes filled up with granulations, which are at length converted into bony matter. Thus, he says, the new bone differs from the original one, in being solid, instead of hollow. Authorities, however, are decidedly against Mr. Russell on this point: in the 5th vol. of the *Mém. de l'Acad. de Chir.* is the history of a man, the whole of whose clavicle came away, without his being deprived of any of the motions of the arm. The death of this patient, which happened shortly afterwards, afforded an opportunity of examining how nature had repaired the loss. Another clavicle was found regenerated, which neither differed from the original one in length, nor solidity; but only in shape, being flatter, and not so round. It was connected with the acromion and sternum, just like the primitive bone.

Mr. Mayo believes, however, that, in the ordinary course of a necrosis of the shaft of a cylindrical bone, it appears to be the cortex only which dies: "At all events (he observes) the cortex alone comes away as sequestrum. The cancellous structure, which it contained, whether dead or living, is absorbed before the sequestrum becomes detached. One may suppose, that it does not die, for two reasons: first, the cancellous structure has more vascularity and vitality than the cortex, and might be expected to resist an influence, which would destroy the latter; secondly, if the cancellous structure dies with the cortical part, where is the agent which removes it?" (*Pathology*, p. 30.) It cannot be doubted, however, that, when necrosis affects the whole thickness of a bone, it usually includes at once the walls and the medullary texture; and it seems impossible to conceive how these cancelli can possibly live within the sequestrum itself, when the medullary texture in that part of the original bone is destroyed; and their not being found within the sequestrum composing the shaft of a cylindrical bone, must be received, I think, as an unequivocal proof that they are not spared with it.

The Royal College of Surgeons, in 1837, Mr. Stanley exhibited a drawing of a remarkable exception to the general rule, of the destruction of

the medullary texture, when the walls of a cylindrical bone perish. It was a case, in which, in consequence of the application of nitric acid to a phagedenic ulcer of the leg, the whole of the periosteum, covering the tibia, became inflamed. Here the walls had become necrosed, but the medullary texture had retained its vitality. (See *Lond. Med. Gaz.*, vol. xx. p. 497.)

Many able men have ascribed the whole work of the regeneration of bone to the periosteum. (C. Havers; Duhamel, *Mém. de l'Acad. des Sciences*, 1739. 1741, 1742. 1747. Fougereux; *Mém. sur les Os*; Paris, 1760. Swencke, *Harlemer Abhandlungen*, i. th. p. 39. Bertin, *Ostéologie. Marigues, Abhandlung von der Natur und Erzeugung der Callus*, p. 199.)

Haller, (*Elém. Physiol.* t. viii. p. 352.) Callisen, (*Collect. Hafn.* t. ii. p. 187.) Tenon, (*Mém. de l'Acad. des Sciences*, 1758. p. 415.) Bordenave, (*Mém. sur les Os*, p. 227,) and many others, have seen a part of the new production spring up from the substance of the old bone; a thing, says Weidmann, which one is also led to believe by the fact, that, when the whole tube of a long bone is affected with necrosis, the epiphyses, which remain sound and untouched, unite and grow to the new tube, though no periosteum exists in the situation of the union.

Paletta records a case, in which five inches of the tibia were regenerated; and he concludes, that the new osseous substance was not formed from the periosteum, which had been destroyed, but from the remaining portion of healthy bone. (See *Excercitationes Pathologicae*, 4to. Mediolani.) Dr. R. Knox has also seen an instance of caries of the trochanter major, where nature had attempted to repair the injury by a secretion of new bony matter, round the ulcerated part of the bone, and where the new osseous substance was evidently formed by the vessels of the old bone, the periosteum remaining perfectly sound and unchanged. His remarks are all in favour of the doctrine, which refers the production of new bone to the vessels of the remaining portion of living bone. (See *Edinb. Med. Surg. Journ.* vol. xviii.)

That, however, the periosteum is frequently the organ of the reproduction of the bones, seems proved by the experiments of Troja, Blumenbach, Desault, Koehler, and Stanley, since in these the bones were invariably regenerated, though there was nothing left of the old bone, that could furnish the new reproduction, except the periosteum. Mr. Stanley repeated Troja's experiment, which consisted in destroying the medullary texture, and thus producing the death of the walls of the bone to the extent of the injury done to the medullary texture. The periosteum, quitting its hold of the dead bone, now became the formative organ of the new bone, of which the osseous matter was secreted by the internal surface of that membrane; "and in this way, the same periosteum which had covered the old bone, was become the periosteum of the new." (See *Lond. Med. Gaz.* vol. xx. p. 578.)

If we examine the new bone, at different periods of its development, it appears in the earliest state in the form of a reddish fluid, as has been observed by Duhamel, Fougereux, Bordenave, Haller, Callisen, and others. If we also attend to the progressive changes which this

fluid undergoes, we cannot but believe, that, as in the embryo, an organic and fixed arrangement of parts takes place. Indeed, it would be erroneous to consider such fluid destitute of organization and extravasated at random. Thin and little in quantity on its first appearance, its consistence and quantity afterwards gradually increase (*Troja*, p. 42. 44.), so that what at first appeared like a liquid, soon becomes a gelatinous substance, in which are developed, especially at its inner surface and towards its lower part, bony fibres, which incessantly become more and more numerous. These fibres in a short time form little layers and cells, and extend themselves every where, so that at length all which was fluid disappears, and the new bone is produced. While young, however, it is still spongy and reddish (*Troja*, p. 44.), but soon becomes denser, harder, and more solid, than that was for which it is a substitute, and it acquires the ordinary colour of the rest of the bones.

The external surface of the new bone, which, during the period of its formation, was irregular, and studded with several excrescences of various sizes, and pierced with apertures of different dimensions, becomes in the course of time smooth and regular, especially after the expulsion of the sequestrum.

The sides, or walls of the new bone, which at first were of considerable thickness, in time also grow thinner. (*Troja*, p. 21.) When the entire dead bony cylinder continues in its cavity, the new bone is neither shorter, nor longer, than the original. But, should one of the ends of the dead tube protrude from the cavity, while, by the side of the affected bone, there is not another one capable of resisting the action of the muscles, the new bone will be shortened, and undergo some change in its shape and direction. Indeed, says Weidmann, the new bone in its early state, from want of consistence, must yield to the efforts of the muscles.

Its shape is not exactly like that of the original bone: the sides are flatter; the usual angles, depressions, and eminences are not observable, and sometimes others are formed.

How admirable is the process, by which the muscles, detached from a bone affected with necrosis, have other insertions given to them, and are thus rendered capable of performing their functions! (*Troja*, p. 27.)

The periosteum, which swells as soon as the exfoliation of the old bone commences, shrinks, and is not at all thickened, when the exfoliation is finished. *Troja*, having destroyed the medullary structure of a long bone, found the periosteum swelled at the end of 36 hours; but he observed, that the whole of such swelling disappeared before the 25th day. (P. 43. 67.)

The periosteum, which thus survives, adheres to the new bone, as it did to the old one; its vessels, which are now increased in diameter, and convey a larger quantity of blood, dive into large apertures in the regenerated bone, ramify every where in its substance, and nourish it.

Dr. Macartney's observations nearly agree with those of *Troja* and Weidmann, respecting the formation of the new bone by the periosteum, with this difference, however, that he does not describe the original periosteum as becoming

afterwards attached to the new bone, but as disappearing. Dr. Macartney remarks, "that the first and most important circumstance is the change which takes place in the organization of the periosteum: this membrane acquires the highest degree of vascularity, becomes considerably thickened, soft, spongy, and loosely adherent to the bone. The cellular substance, also, which is immediately connected with the periosteum suffers a similar alteration: it puts on the appearance of being inflamed, its vessels enlarge, lymph is shed into its interstices, and it becomes consolidated with the periosteum. These changes are preparatory to the absorption of the old bone, and the secretion of the new osseous matter, and even previous to the death of the bone, which is to be removed. In one instance, I found the periosteum vascular and pulpy, when the only affection was a small abscess of the medulla, the bone still retaining its connexion with the neighbouring parts as it readily received injection. The newly organized periosteum, &c. separate entirely from the bone, after which it begins to remove the latter by absorption;" and while this is going on, its inner surface becomes covered with little eminences, resembling granulations "In proportion as the old bone is removed, new osseous matter is dispersed in the substance of the granulations, whilst they continue to grow upon the old bone, until the whole, or a part of it, is completely absorbed, according to the circumstances of the case. What remains of the investment, after the absorption of the old bone, and the formation of the osseous tube, which is to replace it, degenerates, loses its vascularity, and appears like a lacerated membrane. I have never had an opportunity of examining a limb, a sufficient time after the termination of the disease, to ascertain, whether the investment be at last totally absorbed, but, in some instances, I have seen very little remaining. During the progress of the disease, the thickened cellular substance, which surrounded the original periosteum, becomes gradually thinner; its vessels diminish, and it adheres strictly to the new-formed bone, to which it ultimately serves as a periosteum." The anatomical preparations, authenticating the above observations, are preserved at St. Bartholomew's Hospital. (See *Cruithner on White Swelling*, p. 163. ed. 2.)

However, Mr. Stanley showed me, in the same museum, a preparation, which tends to confirm the accuracy of *Troja's* account of the old periosteum becoming adherent to the new bone. In this example, the periosteum is perfectly continuous with that covering the epiphyses. If this were not the fact, we should have to explain in what way the periosteum of the new bone is formed. We know that the vessels of the original periosteum enter the new bone, in order to complete its formation; and it seems more consonant with the uniform simplicity of nature's operations, to suppose that this connexion is kept up, than that the old periosteum should be totally removed, after the production of the new bone, and another membrane of the same kind be then generated.

An interesting example of necrosis of the thigh bone, published by my friend Mr. Copland Hutchison, tends also to prove, that the new osseous shell is commonly formed by the periosteum, as, in this case, the medullary bags, or cells, were

found completely ossified (*Practical Obs. in Surgery*, p. 135), and could not therefore be supposed to be capable of the work. Amongst the moderns, Dr. M'Donald deserves to be mentioned as one of the most distinguished advocates for the truth of Troja's explanation of this subject. (See M'Donald's *Thesis de Necrosi ac Callo*; Edinb. 1799.) Another late writer has adduced many arguments to prove that the pulpy mass, which extends from one epiphysis to the other, and is itself at last converted into bone, is formed quite independently both of the original bone and of the periosteum. (See Russell's *Practical Essay on Necrosis*, p. 27. Edinb. 1795.) This account, however, is contrary to the observations of Troja, David, Weidmann, M'Donald, Macartoe, and numerous other observers. Indeed, Mr. Hutchison seems to think the periosteum so essential to ossification, or the production of a new bone, that he attempts to explain the cause of fractures of the patella not becoming united by a bony substance, by adverting to the deficiency of periosteum upon it; a circumstance, which he deems also a strong argument against Mr. Russell's doctrine. (See *Practical Obs. in Surgery*, p. 141, 142.)

These very same cases, however, fractures of the patella, do sometimes unite by bone, and, therefore, while Mr. Hutchison is urging them as facts against Mr. Russell's opinion, Baron Larrey is actually adducing them in its support. (See *Journ. Complém. du Dict. des Sciences Méd.* t. viii.) The experiments of Breschet, Villerme, Dupuytren, and Cruveilhier (see *Fracture*) are decidedly against the periosteum being exclusively the organ of ossification.

Boyer does not refer all the work of reproducing bones exclusively to the periosteum in every instance; but joins Weidmann in believing, that what seems a new bone is sometimes only a separation and thickening of the external layers of the original bone, which have escaped destruction. He notices the modifications, to which the phenomena of necrosis are subject when the disorder affects the whole thickness, and the whole, or the greater part of the circumference of a long cylindrical bone. When the periosteum is destroyed together with the bone, while the medullary membrane, which does the office of an internal periosteum, is preserved, Boyer represents the latter membrane as undergoing similar changes to those which we have mentioned as taking place, under other circumstances, in the external periosteum, and he describes it as becoming the organ by which the new bone is formed. (See *Mal. Chir.* t. iii. p. 432.) The foregoing account is corroborated by Mr. Stanley. "If, in a living animal, (says he) a portion of one side of the walls of a bone be removed, without much injury to the medullary texture; the lost bone will be reproduced by the vessels of the medullary membrane." This he ascertained by an experiment made on the tibia of a dog. He had seen also an illustration of a similar circumstance in the ulna of the human subject. (See *Lond. Med. Gaz.* vol. xx. p. 501.) Mr. Mayo also states, that, if the integuments, and one aspect of the cortex of a cylindrical bone are killed by an injury, the cancellous structure granulates, and reproduces what has been lost. (*Human Anatomy*, p. 35.) But when the whole thickness and circumference of a long bone are destroyed, together with the medullary membrane,

while the periosteum survives, Boyer agrees with Troja, &c. in believing the latter membrane to be the means by which the new bone is generated. On this part of the subject, I find an interesting observation adduced by Mr. Stanley. "If, (says he) from peculiar circumstances the wall of a bone perish, while the medullary texture is left perfect, and the periosteum is preserved entire, then there may be a complete reproduction effected by the vessels of the periosteum. Of this, he exhibited at the College of Surgeons an unique specimen. There had been a deep phagedenic ulcer on the leg, and, to prevent its destructive progress, nitric acid had been applied. Its action penetrated to the periosteum, and was followed by inflammation of that membrane over the entire circumference and length of the bone. The walls to the same extent perished. From the preparation and a drawing of it, it appeared, that the dead walls were separated both from the periosteum and medullary texture, while a new bone case was seen in progress of formation between the dead bone and periosteum. The peculiarity consisted in the death of the entire walls, while the medullary texture retained its vitality.

But, according to Mr. Stanley's investigations, when the necrosis is attended with destruction of the walls of the bone and the medullary texture, the bone may be regenerated from three sources. 1. The articular ends of the original bone, which are very rarely implicated. 2. The periosteum, which invests the dead bone. 3. The soft parts, indifferently, whatever their nature may be, which surround the periosteum, supposing this to have been destroyed. Of these agents in the reproduction of bone, Mr. Stanley joins several of the foregoing pathologists in regarding the periosteum as the most important. Yet he is far from maintaining, that the periosteum is the only tissue capable of forming bone, observing that there are but few textures or organs in the animal body, whose vessels, either in disease, or in the natural progress of age, may not deposit osseous matter. But so important, says he, is the influence, which the periosteum exercises in the reproduction of bone, in consequence of its being perhaps more prone to form osseous matter, than any other fibrous tissue, that, in all cases in which bone has been lost, whether by necrosis, or external violence, the chance of its reproduction, and the perfection of the process, are materially influenced by the condition of this membrane. In reference to this point, Mr. Stanley had repeated the experiment, made by another pathologist. A portion of the radius, in its whole thickness, and with its periosteum, had been removed from the fore leg of one dog; and from the fore leg of another, a similar piece of the radius, but with the periosteum carefully spared, which was merely slit, separated from the bone, and turned aside, so that the required portion could be removed. The result proved the influence of the periosteum in the reproduction of bone; for, on killing both dogs, ten weeks after the operation, it was found, that, in the dog, whose periosteum had been left, the reproduction was so complete, that scarcely any vestige of the injury remained. But, in the other dog, whose periosteum had been removed, a false joint had formed between the divided ends of the bone. (Stanley, *Op.* vol. cit. p. 578.)

The experiments of Villerme, Breschet, and Du-

pytten, in relation to the formation of callus (see *Fracture*) left no doubt about the power of the vessels of other textures, besides those of the periosteum and bone, to take a share in the work of ossification; and, as Mr. Stanley correctly observes, important as the periosteum is, as an organ for this purpose, the conclusion must not be made, that it is essential to the reproduction of bone. Mr. Stanley removed the periosteum from a dog's tibia and destroyed the medullary texture; yet the reproduction ensued, and this evidently by the vessels of the surrounding cellular tissue, which had become exceedingly condensed, and adhered to the surface of the new bone, forming, in fact, its periosteum. The same thing undoubtedly often happens in the human subject. In necrosis of a large cylindrical bone, like the femur, considerable and repeated abscesses form in the soft parts, and extensive ulceration accompanies the progress of the suppuration from the deeper tissues, to the surface. In such cases, there must often be more or less complete destruction of the periosteum, which had invested the old bone, and yet the formation of the new bone may be perfectly, though tardily, accomplished.

Besides the periosteum and surrounding soft parts, the articular ends of the bone, whose shaft has perished, contribute also to the reproduction; for luxuriant granulations will arise from their surfaces, and, becoming ossified, will at length unite to the rest of the new bone produced either by the periosteum, or by other soft parts. This fact is finely displayed in a preparation presented to Mr. Stanley by Sir James M'Grigor.

The internal surface of the new bone is lined by a new membrane, which serves as a periosteum, and is at first hardly distinguishable. (*Troja*, p. 56.) In the early state, it is soft and pulpy (*ibid.* p. 22.); but by degrees, it grows thicker and firmer, and is at length converted into a true membrane, which sends a great number of vessels into the substance of the bone. When this membrane is torn off, the surface, which it covered, is found somewhat smooth, the edges of the bony layers and projections of the fibres being blunt and rounded.

The cavity of the new bone includes, and almost entirely conceals, the dead fragments. Sometimes, however, the new bone forms a sort of bridge over the sequestrum, in such a manner that the cavity is open above and below, in both which situations the sequestrum can be felt. (*Hunter, in Med. Obs. and Inquiries*, vol. ii. p. 418.)

Sometimes, it is only a narrow cross piece, which forms the bridge retaining the sequestrum. (*Weidmann*, *vid.* tab. 5. fig. 1. a.)

The new bone may also have an opening in it, out of which the dead portion protrudes. (*ib.* p. 35.)

Sometimes the cavity of the new bone is single; while, in other instances, there are several successive cavities in the direction of the length of the bone, with transverse interspaces between them; or else the cavities are situated laterally with respect to each other, and divided by partitions. (*Weidmann*, tab. 7. fig. 2.)

These cavities are proportioned in size and shape to the fragments of dead bone, which lodge in them. It occasionally happens, that they open into some neighbouring joint, and bring on suppuration there; a very unfavourable complication. (*ibid.* p. 34, and tab. 6. fig. 3. Also, *Boyer, Mal. Chir.* tom. iii. p. 436.)

Let me take notice of the holes, by which the cavities, including the dead pieces of bone, open externally, which *Troja* denominated the large foramina, and which the preceding excellent writer preferred calling the *cloacæ*, because they serve to convey outward the matter and any separated pieces of bone. In the beginning they are not observable, a certain space of time appearing to be requisite for their formation. They are noticed in long cylindrical bones, whether original, or of new production, whose cavities contain dead fragments.

These openings vary in number; when the sequestrum is small, only one is found; but, when the piece of dead bone is extensive, there may be two, three, or four. *Weidmann* never saw more than five. But *Troja* met with eight. (P. 58.) *Weidmann* possessed a small portion of the diploe of the os innominatum, which was affected with necrosis, and contained in a bony cavity, that had no external opening whatever.

When there are several distinct cavities in the same bone, containing dead fragments, each cavity has at least one external opening.

These *cloacæ*, or apertures, are commonly situated at the lower and lateral parts of the cavities; pass obliquely outwards; and communicate with fistulous ulcers, which open on the surface of the skin. (*David*, p. 186.) Some of the *cloacæ*, however, form at the middle, or (what is exceedingly rare) at the upper part of the cavities, and proceeding outward, without any oblique track, go to the front, back, or lateral parts of the limb. They are of a round or oval shape, or nearly so. Their usual size is such, that it will just admit a quill. They terminate internally by converging edges in the manner of a funnel; while, on the contrary, the margins of their outer extremity expand. The canal, between these two orifices, is sometimes long, sometimes short, and, in certain cases, of scarcely any extent.

Different opinions have been broached, respecting the causes which produce the apertures in the new bone, termed by *Weidmann* the *cloacæ*. *M. David* says that the pus, collecting in an early stage of the disease between the bone and the periosteum, distends and corrodes this membrane, and that the openings which form in it become afterwards a cause of fistulæ in the new bone. (P. 186.) But it is observed by *Weidmann*, that this explanation is inadmissible, since the existence of the collection of pus mentioned by *M. David*, is not proved by observation: in fact, it was never met with by *Troja*, *Blumenbach*, *Desault*, *Koehler*, and many others in repeated experiments on the subject. (*Troja*, p. 56 and 66; *Weidmann*, p. 36.)

Koehler thought he had seen the new bone itself destroyed by the pus, and *cloacæ* thus produced. (P. 68—72.) *Weidmann*, however, deems this opinion quite as improbable as the preceding, for the fact of the surface of these bony apertures being always smooth, always formed in one manner, and constantly lined by the periosteum, decidedly proves, that they cannot arise from the action of pus on the bone.

Troja, in his third experiment upon the regeneration of bones, remarked, that forty-two hours after the destruction of the medulla, there took place, between the bone and the periosteum, an effusion of lymph, which was at first thin and in small quantity, but afterwards became thicker.

He noticed, in the midst of this gelatinous substance, some small spaces, where it was deficient, and which had, instead of it, a subtle, whitish, dry incrustation, which, though tolerably adherent, could be rubbed off. These small spaces, according to Troja, produce the apertures called the cloacæ. (Troja, p. 45.)

In another experiment, he had an opportunity of examining the above little spaces at the end of forty-eight hours: he affirms, that they were replaced by the large apertures, or cloacæ, of the new bone (P. 47.), and that such openings were invariably formed in the place of the small incrustated spaces already described. (P. 58.) As Troja took notice, that no lymph was effused at these particular points, he was inclined to impute the circumstance to a defect in the ossification, and, perhaps, to the death of some parts of the periosteum. Weidmann acknowledges, that the mode in which the formation of the cloacæ happens, is exceedingly obscure; and expresses his belief, that Troja's account of it is the nearest to the truth. But, says he, one thing is certain, namely, that these openings have no other use, but that of conveying outward the pus, which collects in the cavity, and the small bony fragments, since, as soon as every atom of dead bone has passed out, they diminish, and, at length, are totally obliterated. (Weidmann, *De Necrosi Ossium*, p. 36.)

It is a remarkable circumstance, in the history of necrosis, that, in favourable instances of the disease, the inflexibility and firmness of the limb are preserved, during the whole of the process, by which the new bone is formed. Consequently, the new bone must have begun to grow, and have acquired firmness before the old bone separated, or was absorbed. Were this not the case, the limb must become flexible and useless, the moment the dead bone is removed. Another consequence of the new bone being formed, before the removal of the old one, is that the former must surround and include the latter. For, since the lifeless portion of bone completely occupies the space between the two living ends, these cannot be immediately connected by the new bony matter. The connexion can alone be completed by the new bone being deposited on the outside of the old one, from one end to the other, and attaching itself to the portions which still remain alive. The new bone must also be necessarily larger than the old one, because externally situated; and hence the affected limb, after the cure is complete, will always continue larger, clumsier, and less shapely than the other. The length of it, however, remains unaltered, because the old bone retains its attachment, while the rudiments of the new bone are lying on its outside, and connect the living ends of the old one, by an inflexible mass, equal in length to the portion which is destroyed.

Thus we see, that in the process, which nature follows in the formation of the new osseous shell, the old bone serves as a mould for the new one, and the first step of the process is to surround the old bone with an effusion of coagulating lymph. (See Russell on Necrosis, p. 2—7.)

When the sequestrum is thrown off slowly, the inflammation is moderate; but when it separates quickly, while the new bone is in a soft state, the detachment is always preceded by severe inflammatory symptoms, and followed by a temporary loss of the natural firmness of the limb. This pre-

mature separation of the sequestrum often occurs in necrosis of the lower jaw, and the chin consequently falls down on the neck. In certain cases, the sequestrum separates at each end from the living portions of the old bone, before the new osseous shell has acquired firmness, so that the limb is as it were broken in two places. (Russell.) I have known cases of this description require amputation.

Let us next consider the states and circumstances of necrosis, in which surgery may be advantageously exerted in the assistance of nature, and the means which may be employed for the purpose.

In some instances, the shaft of a cylindrical bone may have perished, and become completely separated from the living ends, and yet the process of reproduction may take place to only a limited extent, or it may entirely fail. In some other cases, and these in whatever circumstances the death of the bone has occurred, whether from constitutional or local cause, from external violence, or otherwise, the necrosed portion will still retain its connexion with the living bone, and no exfoliation ensue. In University College Hospital I lately had a patient with necrosis of the thigh bone, which had continued fourteen years, without any sequestrum having become loose. In many examples, the cause of this failure of separation seems inexplicable: "In some, (says Mr. Stanley,) it may arise from simple debility, or a peculiar derangement of the system; or it may be the effect of a diseased condition of the soft parts surrounding the dead bone. This is perhaps capable of illustration by those cases, in which necrosis takes place from the influence of the venereal disease. In these, a portion of the front of the tibia, for example, having perished, and the skin covering it ulcerated, dead bone is exposed, and becomes perfectly black; but it undergoes no further change," till mercury is exhibited. (See *Lond. Med. Gaz.* vol. xx. p. 579.)

Weidmann strongly advocated the plan of confiding the process of separation, or exfoliation, to nature. In what other manner, he asks, could it be more safely accomplished, without hemorrhage, or pain to the patient—without any risk of a recurrence of inflammation, or of a fresh necrosis? He admits, however, that the process frequently requires a considerable time; and that it would be desirable to accelerate it, if possible.

"Will any topical applications have this effect? They are put upon the inert surface of a dead piece of bone, in which no vital power or action can be again excited. When acrid, they prove irritating, inflaming, and destructive of the neighbouring flesh, without any utility—and cause pain to the patient, which is compensated by no good. Would the perforations recommended by Celsus, Belloste, and many others, have the desired effect? If, says Weidmann, they are confined to the dead bone, they cannot have more effect than the scarifications, which were formerly practised in cases of gangrene; and, if they extend to the living bone, this will be injured. Lastly, Weidmann inquires, whether the separation can be accelerated by the actual cautery, which cannot act upon every point of the necrosis, and which, unless applied with the greatest precautions, will burn the subjacent parts, and bring on a new attack of inflammation, without forwarding the exfoliation in the smallest degree. Of what use, says he, can rasping and scraping in-

struments be, which act merely upon the dead part? Or will the gouge, and other cutting instruments do more good? They cannot take away the whole of the dead portion, without injuring the adjacent living bone, and causing a risk of another necrosis. And, if they leave any pieces of the old dead bone behind, nature will be as long in effecting the separation of these, as she would have been in detaching the entire necrosis."

A certain degree of irritation in the soft parts around a necrosis is set down by Mr. Stanley as a necessary condition for exfoliation. I believe that the process is frequently expedited by it; and that it is on this principle that perpetual blisters, issues, setons, mineral acids, the cautery, and some other plans above specified, have occasionally proved serviceable.

"In cases of slight superficial necrosis, surgeons have frequent opportunities of trying every kind of topical application; and when the cure takes place, during the use of any of them, the benefit is ascribed to whatever happens to be in use. But says Weidmann, in numerous more serious examples of necrosis, it is impossible to make these applications reach the whole surface of the dead bone; yet notwithstanding this circumstance, the separation is not impeded. Some exfoliations happen, without our knowing of their occurrence, and without a thought having been entertained of promoting them by any vaunted applications. We even see necroses separate, whose situation rendered them inaccessible to our remedies: such are the necroses, which occur within the long bones, and comprehend the whole of their cylindrical shaft or body. What surgeon can boast of having effected, by topical applications, the separation of the whole lower jaw-bone; a thing, which nature has very frequently accomplished? And when, as often happens, the entire diaphysis of the thigh-bone, tibia, or other long bone, comes away, or splits longitudinally, such bone loses a half of its cylinder, how is it possible for any topical applications to reach every point, at which the separation occurs?" (*Weidmann*.)

Weidmann justly condemns the practice of making incisions, for the purpose of exposing the whole surface of a necrosis, immediately the existence of the disorder is known. As such incisions soon close up again, so as to leave only a small outlet for the matter, they must be repeatedly practised before the dead bone becomes loose. The avowed design of them is to make room for the topical remedies, which are to render the exfoliation quicker; but, as these remedies possess no real efficacy, it follows, that making incisions, before the dead bone is loose, only torments the patient, without producing the least benefit. The orifices of the ulcers, then, which allow the discharge to escape freely, are, as Weidmann states, sufficient, so long as the fragments of bone are not entirely detached, and the surgeon should abstain from the use of the knife.

It appears to Weidmann, that the indications are limited to removing the original cause of the disease; to alleviating the symptoms; to supporting the patient's strength, and improving the state of the constitution, in whatever respect it may be bad; and, lastly, in removing the dead portions of bone, when they become loose.

Above all things, the surgeon must not regard every piece of exposed bone, as necessarily affected with necrosis, and, in consequence of such idea,

have recourse to acrid, drying, caustic applications. Such means are not only useless, but absolutely pernicious; because they may actually cause a necrosis, which did not exist before they were used, and which would not have taken place at all, if only mild simple dressings had been employed.

When the disease presents itself with violent symptoms, the inflammation and fever being intense, the severity of the case is to be assuaged by low diet, antiphlogistic remedies, emollient applications, and venesection in moderation, the disease being one which is of long duration, and apt to wear out the patient's strength. Here, perhaps, topical bleeding ought always to be preferred to venesection. When the necrosis has arisen from syphilis, scrofula, or scurvy, &c. the medicines, calculated to remedy these states of the constitution, should be employed. I cannot say, however, that my experience has taught me to believe, that, in necrosis from syphilis, mercury is generally useful. On the contrary, in necrosis of the bones of the palate and nose from this cause, I have mostly found it hurtful to the constitution, and at least useless in relation to the dead bone itself. At the same time, I must confess, that some examples of necrosis of the tibia from syphilis have fallen under my notice, where the ulcers never assumed a healthy character, and exfoliation made no progress, till mercury had been administered. Similar facts are adverted to by Mr. Stanley. Here, as he conjectures, mercury may quicken the action of the absorbents, independently of their influence on the constitutional affection. Instead of mercury, I usually now employ in University College Hospital preparations of iodine, and especially the hydriodate of potash, combined with decoct. sarsæ, which at once improves the health, and quickens the action of the absorbents, or, as Velpeau terms it, the molecular action, by which exfoliation is accomplished. This is an excellent plan, not only in necrosis from syphilis, but in that from scrofula, and other causes.

Lastly, it is the duty of the practitioner to extract the fragments of dead bone, in order that the deficiencies produced by them may be filled up, and the ulcers of the soft parts heal.

Nature, who succeeds by herself in detaching the dead pieces of bone, can do very little in promoting their passage outward. Frequently, indeed, she has no power at all in this process, and it is only from surgery that assistance can be derived. When a dead piece of bone is still adherent at some points, its extraction should be postponed, until it has become completely loose. If it were forcibly pulled away, there would be danger of leaving a part of it behind, which must have time to separate, ere the cure can be accomplished.

But, when a fragment is entirely detached, and the orifices of the sores are sufficiently large, it is to be taken hold of with a pair of forceps, and extracted. If the ulcer has only a narrow opening, suitable incisions must be practised, in order to facilitate the removal.

Sometimes, the dead fragment protrudes from the ulcer, and projects externally, so that, if loose, it admits of being taken hold of with the fingers, and removed. In this way, Weidmann took away a large dead piece of the humerus, which protruded nearly two inches out of an ulcer in the middle of the arm. The patient was a young lad,

fourteen years of age; and the limb concave within, convex externally, thicker, and one inch shorter than its fellow. He got quite well, three weeks after the removal of the dead bone.

I have already adverted to the example, recorded by Weidmann, in which a shoemaker removed by himself nearly the whole body of the tibia. Doubtless, the projection of the bone, and its looseness, enabled the man to do this easily with his fingers. But there are cases, which present more difficulty: such are those, in which the sequestrum is included in a cavity, either of the original, or new bone.

The old surgeons were in the habit of amputating limbs, which were in this state; although instances were not wanting in their days to prove the possibility of relieving the disease, without amputation. This blameable custom of removing every limb, thus affected, is justly exploded from modern surgery. Albucasis was the first, who attempted to cure such a necrosis, by the judicious employment of the knife and saw. (Lib. ii. cap. 88.) The same kind of practice was successfully adopted in two instances by Scultetus. (See *Armament. Chirurg.* tab. xlvii. and obs. 81.) This commendable method, however, afterwards fell into disuse, until M. David, by twenty examples of success, refuted all the objections which had been urged against it. (P. 197.) Since the period of this distinguished author, the practice has been imitated by all enlightened surgeons, so that the case is no longer regarded as a disease necessarily requiring amputation. M. Boussetin cut out the sequestrum eight times from the tibia, and four times from the thigh-bone, with perfect success. (Vid. *Mém. de la Société Royale de Médecine*, t. iv.)

The method consists in exposing the bone, and making it an opening of sufficient size for the removal of the loose dead fragments. Experience proves, not only that patients, affected with necrosis, bear this operation well, but that, after its performance, the ulcers commonly heal favourably, the health becomes re-established, and the functions of the limb are hardly at all impaired.

Surgeons, however, are not indiscriminately to choose any period for doing the operation. If they are too hasty, they will run the risk of finding the dead portion of bone still adherent to the adjacent parts: and if they delay too long, the patient may be irrecoverably reduced, while the new bone, on account of the hardness which it has now acquired, cannot be so easily perforated.

Patients are met with, who have been afflicted with necrosis several years. In such cases, great circumspection is necessary, and the practitioner should carefully endeavour to ascertain, that the dead pieces of bone have not been absorbed, nor come away piecemeal in the discharge, lest a useless operation should be done, as once happened in the practice of M. Boussetin. (*Mém. de la Société Royale de Médecine*, t. iv. p. 304.) Therefore, when the disease is of long continuance; when the discharge is much less than it was at the commencement; when small pieces of bone have at times been voided; and the sequestrum cannot be felt with a probe; it may be most prudent to abandon all idea of operating, and allow nature to finish what she has so well begun. In short, when the sequestra are undergoing a gradual absorption, without ever making their appearance

externally, or giving any considerable disturbance to the constitution; or, when the dead bone is making its way outward without occasioning urgent inconveniences; the surgeon should interfere but little with the natural progress of the case. When the dead bone does not tend to make its way through the skin, but lies quietly concealed in the new osseous shell, extensive suppurations may be prevented, by occasionally applying leeches, and keeping open a blister with the savine cerate, as recommended by Mr. Abernethy in his Lectures, and Mr. Crowther in his work on the White Swelling. The blister will, at the same time, have great effect in promoting the separation of the sequestrum, and, of course, in accelerating the progress of cure.

If the surgeon operate as soon as the sequestrum becomes loose, he will often find the new bone so soft, that it can be divided with a knife; a circumstance, which materially facilitates and shortens the operation.

Excepting in very young children, Mr. Mayo considers it generally right to remove the sequestrum by an operation, several months perhaps before it would spontaneously come away, because "the confinement of the patient to his bed, or couch, may produce sloughing of the integuments, or contraction of the limbs. The long confinement, or continued discharge, may exhaust the constitution. The protracted continuance of the sequestrum in the new bone may give rise to caries, or even involve the neighbouring joint in the disease." (*On Human Pathology*, p. 30.)

Keeping in mind the foregoing precepts, the surgeon is to begin with exposing the bone, in which the sequestrum is contained. When the bone lies immediately under the skin, Weidmann recommends making such incisions as will lay bare the whole of its surface; and when its situation is deeper beneath the muscles, he even sanctions cutting away as much of the flesh, as may be necessary to allow the instruments to be freely worked upon the bone. I cannot, however, see the propriety of this advice: exposing the whole surface of the bone in the first instance, before it is known whether the saw need be so extensively used as to require such a denudation, certainly appears irrational. And, as for cutting away any portions of muscle, this can be no more necessary here, than it is in the operation of trephining. But, it is unquestionably proper to make with the bistoury sufficient space for the use of whatever instrument is employed for the division of the bone. Yet, it is only necessary to make this exposure in the first instance in one place. The surgeon can afterwards enlarge the incision, or practise others, as circumstances may indicate. The surface of the bone being brought into view, if the cavities, in which the dead fragments lodge, present apertures which are too narrow, these apertures must be rendered larger by means of small trephines, saws constructed on the principles of those described by Mr. Hey, of Leeds, or else with a pair of cutting forceps, with which the removal of the requisite portion of bone can be very expeditiously accomplished. In University College Hospital, I have employed for this purpose a curved pair of bone forceps, and found them convenient. The perpendicularly acting wheel-like saw, turned by machinery, and invented by Mr. Machell, here promises also to be of important assistance. It

has been used by Sir A. Cooper, who has given an engraving of it in his *Surgical Essays*, part i. pl. 8. fig. 7. Another saw, constructed on somewhat similar principles, has been employed by Graefe of Berlin with great advantage for several years. A tract by Schwalb (*De Serra Orbiculari*, 4to Berol. 1819.), giving an account of it, was sent to me by the late Dr. Albers, a little before his death: it is turned by means of a handle, which projects horizontally from the cutting part of the instrument, and it has a frame or fulcrum, on which it works. Professor Thal's rotation-saw may also prove of service. (See *Edinb. Med. Journ.* No. lxxviii.) Messrs. Weiss, of the Strand, lately lent me a most perfect kind of wheel-saw, worked by machinery, and calculated to act through a narrow space, on bone deeply placed.

If the cutting forceps are used, the point of one blade is introduced into a cloaca, and a portion of the new bony case divided. In this way, the bridge of bone between one cloaca and another, may often be cut with great facility, and the aperture then enlarged to the necessary extent.

When the sequestrum is found to be very large, it will be necessary to expose more of the surface of the bone by incisions. In this sort of case, Weidmann recommends applying a trephine to the upper and lower parts of the cavity, and then cutting away the intervening portion of bone with the saw, or gouge. But, there can be no doubt, that a more prudent way would be to go on with the enlargement of the aperture in the bone, at the place where the first perforation took place, if the sequestrum presented itself equally well there; because, by proceeding in this manner, the surgeon might discover, that the dead fragment could be taken out, without so great a destruction of bone, as is caused in the other mode; and, if this were not to be the case, no harm is done, as the necessary removal of bone can be continued.

When the bone, which includes the sequestrum, is a recent production, its soft state may enable the operator to perform the needful excisions with the bistoury alone.

When several sinuses exist in the limb, each may be dilated, in the manner which seems most advantageous.

Sufficient openings having been made into the cavities including the sequestra, the next object is to extract these dead portions of bone. In accomplishing this part of the operation, Weidmann particularly advises two things: first, that no piece of the sequestrum be left behind; secondly, that no injury be done to the membrane, which lines the cavity, in which the dead bone is lodged.

This author observes, that there are examples in which the vicinity of certain parts impedes the surgeon from making an opening in the bone, large enough for the extraction of a voluminous sequestrum in an entire state. In this circumstance, he recommends the sequestrum to be broken in pieces, or, as I should prefer, divided with any convenient means, and the fragments separately removed.

The cutting of the sequestrum in its centre, so as to make two pieces of it, is here right, on the principle of not destroying too much of the new bony case. Sometimes, when neither end of the sequestrum is uncovered, it may be disengaged and extracted, by pushing it downwards or upwards, so as to enable the surgeon to get at one

extremity of it, which may then be raised with an elevator, or the finger. When neither end can thus be reached, the opening may be enlarged upwards or downwards, and the sequestrum divided with a trephine, small saw, or cutting forceps. If necessary, a central piece of it may be thus removed, so as to make room for the extraction of each extreme portion of it separately.

It is not to be dissembled, however, that cases present themselves, in which amputation affords the only chance of saving life. In fact, it sometimes happens, that the cavities, in which the sequestra are contained, communicate with those of the neighbouring joints, which then become filled with matter, and carries attacks parts of the bones, to which the necrosis does not extend. On some occasions, the dead pieces of bone are very numerous, and each has a separate cavity; while, in other instances, the sequestra lie so deeply, that a passage for their extraction cannot be prudently attempted. Sometimes, nature fails to carry the reproduction of bone to the extent necessary for the cure, or the new osseous covering gives way, and immense deformity, and vast irritation, followed by profuse abscesses, are the consequences. Sometimes, also, a necrosis is complicated with another disease in its vicinity. Lastly, such may be the reduced state of the patient's health and the particular condition of the necrosis itself, that the constitution cannot hold out during the whole time, which would be requisite for the detachment of the sequestrum. Under circumstances like these, amputation is necessary, and ought not to be delayed.

Dr. Mott had a case, in which the head of the femur was so involved in a necrosis, that amputation at the hip-joint was necessary. As Mr. Mayo observes, "when the articular end of a cylindrical bone is necrosed, it excites disease of the joint, which precludes restoration. In a knee, which I amputated, half of the outer condyle was necrosed, and in process of separating into the articular cavity." (*Human Pathology*, p. 35.)

Albuginis, lib. ii. cap. 88. *Scutetus*, Armament. Chir. tab. 46. and obs. 81. *Trilloste*, Le Chirurgien d'Hôpital, part i. chap. 12. *J. Louis Petit*, Traité des Maladies des Os, tom. ii. chap. 16. *Monro's Works* by his Son. *Tenon*, in Mém. de l'Acad. des Sciences, 1758. *Aitken*, Systematic Elements of the Theory and Practice of Surgery, Edinb. 1779, p. 288. Some interesting cases and remarks, chiefly about the question of amputation, are contained in *Schmucker's Vermischte Chir. Schriften*, b. i. p. 17. &c. ed. 2. *Collisen*, Systema Chirurgiæ Hodierne, vol. ii. p. 893. Gött. 1800. *C. White*, Cases in Surgery, London, 1770, p. 57. &c. *Wrisberg*, Comment. Soc. Reg. Gött. vol. ix. p. 126, &c. *Louis*, in Mém. de l'Acad. de Chirurgie, tom. v. *Chopart*, Dissert. de Necrosi Ossium, Paris, 1776. *David*, Obs. sur une Maladie connue sous le nom de Nécrose, Paris, 1782. *Pott's* Chirurgical Works, Lond. 1779, vol. i. p. 32. *Brosgie's* Chir. Cases and Obs. vol. ii. p. 9. *C. G. Kortum*, Comment. de Vitio Scrofuloso; Lemgovie, 1789, t. ii. part 3. cap. 11. *Knoll*, Dissert. de Carie Ossium venerea; Lips. 1763. *S. G. Raderer*, Progr. de Ossium Vitii Observationes continens; Goettingæ, 1760. *Jind*, on the Scavvy, *Fabre*, in Mém. de l'Acad. de Chir. t. iv. p. 91. *Bonn's* Thesaurus Ossium Morbos. *Bonnet*, Méd. Septentr. i. li. sect. 4. cap. 25. *Ephemer. Acad. Nat. Cur.* Ann. 7 et 8. obs. 4. *Guernsey*, in Mém. de l'Acad. de Chir. t. v. in 4to. p. 355-368. *Belmain*, ibid. p. 363. *Arcet*, Chirurgische Vorfälle, uebers. von Murray, vol. i. p. 194. *Van Wy*, Vermischte Chirurgische Schriften, Nuremberg, 1746, p. 192. *Tryon*, Observat. Méd. Chir. Fascic. L. B. 1743, p. 46. *Reiplein*, in Richter's Chirurgische Bibliothek, t. vii. p. 509. *Henck*, ibid. t. ii. p. 42. *Dussaussoir*, ibid. t. vii. p. 71. *Macken*, Obs. Méd. Chir. cap. 69. *Tacconi*, De Nonnullis Crani Ossiumque Fracturis, &c. Bononiæ, 1751, p. 17. *Blancard*, Inst. Chir. p. 549. *Duchambré*, Mém. de l'Acad. des Sciences, 1741. *Boehmer*, Diss. de Ossium Callo; Lips. 1748, p. 17 and

91. *Cheselden*, Osteographia, or Anat. of the Human Bones, London, 1733, tab. 49, fig. 4. *Morand*, in *Plattner's* Vermischte Chirurgische Schriften, p. 447. *Ruyssch*, Thesaur. 10. No. 176. *Duverney*, Traité des Maladies des Os, p. 457. Paris, 1751. Phil. Trans. No. 312. *Wedel*, in Ephem. Natur. Cur. dec. 2. ann. 2. p. 396. *C. Battus*, in Chir. Tract. 4. cap. 8. p. 275. *Koehus*, in *Roonhuyzen's* Historische Heilkuren, b. 1. p. 217; Nuremberg, 1674. *Hofmann*, in Eph. Nat. Cur. dec. 3. ann. 9 et 10. p. 210. *Diemerbroeck*, vid. Wolf's Obs. Chir. Med. Lib. II. obs. 18. p. 112. *Wright*, in Phil. Trans. abridged, vol. XI. p. 252. *Fabricius Hildanus*, Obs. Chir. cent. 4. obs. 91. *Raw*, Supellex Anatom. edit. à B. S. Albino; Ludg. Batav. 1725. p. 13. *Dobyns*, in *Cheselden's* Osteographia, tab. 49. fig. 4. *MacKenzie*, in Med. Obs. and Inquiries, vol. II. p. 299. *Ludwig*, Advers. Med. Pract. vol. III. p. 60. *Boussetin*, in Hist. de la Soc. Royale de Médecine, 1780, 1781. Paris, p. 121—297—305. *Stalpart Van der Wiele*, cent. 1. obs. 96. *Muralto*, in Schriften von der Wundarzn. Bale, 1711. obs. 202. p. 655. *De la Motte*, Traité Complet de la Chirurgie, t. IV. p. 284. *Ellinckhuys*, in *Trieven's* Obs. Med. Chir. fasc. Lugd. 1743. p. 115. *Ruyssch*, Opera Omnia Anat. Med. Chir. Amst. 1721. tom. I. p. 94. *Laing*, in Med. Essays and Obs. Edinb. vol. I. art. 23. *Johnson*, fbid. vol. v. art. 23. *Hunter*, in Med. Obs. and Inquiries, vol. II. p. 303. *Sigwart*, Diss. de Carie consumptæ tibiæ notabili pectura, tab. 1756. *T. Bartholinæ*, Act. Med. et Phil. Hafn. vol. III. obs. 114. p. 287. *Huffman*, Mautassa, Obs. Select. Obs. 28. *Saviard*, Nouveau Recueil d'Observ. Chir. Paris, 1702, obs. 125. *Le Dran*, Obs. de Chirurgie, t. II. obs. 104. *Michael*, in *Richter's* Bibliothek. t. v. *Troja*, De Novorum Ossium in integrum aut maxillis, ob Morbos, Depositionibus, Regeneratione, Experimenta, Lutetie Parisiorum, 1775. *Troja's* work, though drawn up in an incorrect style, as *Weldmann* remarks, contains many highly interesting experiments. *Blumenbach*, in A. O. *Richter's* Bibliothek, t. IV. p. 107. *Desault's* Parisian Chirurg. Journal, vol. I. p. 100. and vol. II. p. 199. *Kochler*, Experimenta circa Regenerationem Ossium, Gätt. 1786. This is a valuable work, and contains the original discovery of the reproduction of the medullary structure. *I. P. Wedmann*, De Necrosi Ossium, fol. Francofurti ad Moenum, 1793; et De Necrosi Ossium adnotatio, Frank. del. 4. certainly the best general account of the subject at the period of its publication. *Richerand*, Nosogr. Chir. t. III. p. 153, &c. ed. 4. Paris, 1815. *Dr. Alex. McDonald's* Thesis de Necrosi ac Callo, Edinb. 1799. *A. C. Hutcheson's* Pract. Obs. in Surgery, p. 180, &c. London, 1816. *James Russell's* Practical Essay on a certain Disease of the Bones, termed Necrosis, 1794. *Whately's* Pract. Obs. on Necrosis of the Tibia, 1815. *Macartney*, in *Crowther's* Obs. on White Swelling, &c. edit. 2. Encyclopédie Méthodique, Partie Chir. art. Nécrose. *Leveillé*, Nouvelle Doctrine Chir. t. IV. p. 321, &c. Paris, 1812. *Larrey's* Mém. de Chirurgie Militaire, t. III. p. 367, &c. *Thomson's* Lectures on Inflammation, p. 39, &c. Edinb. 1813. *Boyer*, Traité des Maladies Chir. t. III. p. 418, &c. Paris, 1814. *Delpech*, Précis Élémentaire des Mal. Chir. t. I. chap. 3; Paris, 1816. *R. Knox*, Edinb. Med. Surg. Journ. vol. XVIII. p. 62, &c. and vol. XIX. p. 210. *Meding*, Diss. de Regeneratione Ossium per Experimenta Illustrata; Lips. 1823. *Kortum*, Exp. et Obs. circa Regenerationem Ossium; Berol. 1824. *B. Bell*, on Diseases of Bones, 12mo. Edinb. 1828. *Cæsar Hawkins*, Lond. Med. Gaz. case with hemorrhage, calling for amputation. *Herbert Mayo*, Outlines of Human Pathology, p. 28. 8vo. Lond. 1835. *Edward Stanley*, in Lond. Med. Gaz. vol. XX. The matter delivered in the Lectures at the College of Surgeons. Its value may be judged of from the quotations from it, contained in the foregoing columns. *Robert Liston*, on Practical Surgery, 8vo. Lond. 1837.

NEPHROTOMY. (from νεφρός, a kidney; and τμήνω, to cut.) The operation of cutting a stone out of the kidney; a proceeding which, perhaps, has never been actually put in practice. In the *Abrégé Chronologique de l'Histoire de France*, par *Mézerei*, and in the *Phil. Trans.* for 1696, two cases of what is called nephrotomy are mentioned; but several circumstances in the accounts led *Haller* to conclude, that the operation alluded to in the first work was nothing more than the high operation for the stone. With respect to the example in the latter work, the particulars are not detailed enough to prove that an incision was really made into the kidney. There is no doubt, that stones have often been extracted from abscesses about the region of the kidney, after being touched with a probe. But, with

regard to cutting into the kidney, the deep situation of this viscus, and the want of symptoms, by which the lodgment of a stone in it can be certainly discovered, will always be strong objections to the practice. When a stone, from its size, cannot pass from the kidney, and excites inflammation and suppuration, no doubt the surgeon may make an incision into the tumour, and extract the calculus. In this sense, nephrotomy is certainly a practicable operation. *Warner* contends, that it can only be practised in such circumstances, notwithstanding whatever may have been said by *Marchetti*, or others. In such a case, the operation would not be attended with any greater difficulty, than opening an abscess in any other part of the body. (See *Warner's Cases in Surgery*, p. 241. edit. 4.)

NEURALGIA. (derived from νῆρον, a nerve, and ἄλγος, pain,) a term signifying pain in a nerve, but first employed, I believe, by *Chaussier*, as the name of a class of diseases, the chief character of which is excruciating pain in the trunk or filaments of some particular nerve, or in the nerves of some part of the body, independent of any inflammation, or apparent disease in it. As *Sir Benjamin Brodie* remarks, the natural sensations of a part may be increased, diminished, or otherwise perverted, although no disease exists in it, which our senses are able to detect, either before, or after death. There are, says he, other cases, in which the nerves of motion are affected, instead of those of sensation. Here there is involuntary contraction, or spasm of a particular set of muscles, or certain muscles lose their power of action altogether; and yet, after death, the most minute dissection will demonstrate nothing in them different from what would have been noticed, if no spasm, nor paralysis had ever existed. These facts are not difficult of explanation. "Every part, to which a nervous filament can be traced, may be said to have its corresponding point in the brain, or spinal marrow, and an impression, made either at its origin, or anywhere in the course of the trunk of a nerve, will produce effects, which are rendered manifest where the nerve terminates, or at that extremity which is most remote from the brain." (See *Brodie on Local Nervous Affections*, p. 2.) In every case of neuralgia, therefore, one important indication always presents itself, namely, that of enquiring, whether there is any cause of irritation, affecting the trunk of the nerve, sufficient to account for the symptoms in the part, to which its ultimate filaments are distributed. Thus, in one case, recorded by *Sir Benjamin Brodie*, the pressure of a femoral aneurism against some branches of the anterior, crural nerve, which were kept on the stretch by the tumour, accounted for severe pain experienced at the inner side of the knee. In another case, a neuralgia, in the course of the peroneal nerve during life, was discovered after death to depend on a tumour on the left side of the lumbar vertebra, and extending into the pelvis, which had occasioned pressure on the origin of the sciatic nerve. Sometimes, as *Sir Benjamin Brodie* has likewise explained, similar effects take place, where the actual seat of disease is in the brain, or spinal marrow. "Thus, (says he) caries of the dorsal vertebra, irritating the spinal marrow, produces pains and muscular spasms of the lower

trabs; and the same disease, affecting the superior cervical vertebra, produces corresponding symptoms in the upper limbs." A gentleman complained of severe pains, referred to one side of the abdomen. After having been fixed in one situation, they attacked another. No disease could be detected in the part apparently affected, and the pains were therefore regarded as nervous. It was observed, at the same time, that his powers of articulation were affected, and that he spoke in an indistinct and drawling manner. This seemed to indicate, that there was some disease in the brain, and the suspicion was confirmed soon afterwards by the occurrence of epileptic fits, from which the patient continued to suffer during the few remaining years of his life." (Op. cit. p. 6.)

In some instances, as the same interesting writer notices, the cause of irritation at first affects one portion of the brain, to which a certain function belongs, and then another, whose function is entirely different, and the symptoms vary accordingly. A gentleman laboured under severe pains in the left side of the face, a kind of *tic douloureux*. While under the influence of this pain, he was suddenly seized with a pain in the calf of the left leg, having precisely the character of that in the face. When the pain in the leg attacked him, that in the face abated, so as to cause little or no inconvenience; but, in a few days, when the pain quitted the leg, that of the face returned with its usual severity. Sir B. Brodie also refers to cases, in which certain neuralgic affections alternated with insanity.

Many nervous filaments of the testicle being derived from the renal plexus, will account for the severe pain in the testicle often experienced, when a calculus is descending from the kidney down the ureter.

Sometimes, an impression made on one part of the body, will produce a nervous affection in a distant situation, where no explanation of the fact can be afforded on the principle of the trunk of the nerve supplying such part being compressed, or irritated. Thus, a disease in the liver produces a pain in the right shoulder; a disease in the heart, pains in the back. Acidity of the stomach, or indigestible articles in it, have been known to cause pain in the foot, which subsided directly the cause was obviated. In one case, a similar symptom appeared to depend upon a stricture, and yielded as the latter gave way. (Brodie, *ib.*) One remarkable feature of these neuralgic diseases, adverted to by the same experienced surgeon, is, that they seem to be suspended during sleep. A patient, suffering from the pains of *tic douloureux* in the face, may, for a time, be prevented from falling asleep; but, if once asleep, his sleep is likely to be sound for many hours. Even when the patient is awake, the pains usually have intermissions, and occur in paroxysms. The intervals of cessation, or abatement, vary in different cases from a few minutes to several hours, or even to several days. The pains in neuralgic affections are sometimes dull and wearying, but more frequently sharp, darting, or stabbing. Occasionally, they are periodical, and then, as Sir B. Brodie notices, quinine and arsenic, which would cure the intermitting fever, will also cure the intermitting pain. Neuralgia of the face, from being often attended with twitches of the small muscles of the part, has received the name

of *tic douloureux*; which consists in severe attacks of pain, affecting the nerves of the face; most frequently, the filaments of that branch of the fifth pair, which comes out of the infra-orbital foramen; but sometimes the other branches of the fifth pair, and occasionally the numerous filaments of the portio-dura, which are distributed upon the face. Some doubt its ever being felt in the portio-dura. "An hospital patient of ours complained of it not only in the cheek, but, in the course of the portio-dura from the stylo-mastoid foramen. We do not see, why the disease should be confined to nerves of sensation. Two, or even all the three branches (of the fifth pair) are sometimes affected, and the pain may extend even to the other side of the face. We have known it extend down the neck to the shoulder, and all along the inside of the arm to the ends of all the fingers and the thumb. Various nerves of the legs, arms, fingers, or toes, are occasionally the seat of the disease; and an intercostal, a lumbar, and even the spermatic nerve has been attacked. The pain may be confined to one nerve, or to it and its branches, may extend to other nerves in the neighbourhood, or at a distance, or it may affect nerves at a distance from each other, simultaneously, or successively, and change its seat backwards or forwards. The pain does not always shoot in the course of the nerve, but frequently in the opposite direction." (J. Elliotson, in *Cyclop. of Pract. Med.* art. *Neuralgia*.)

Neuralgic affections are more frequently met with in some parts than others. They are less common "in the viscera, which are supplied by the great sympathetic nerve, than other parts. Nervous pains are more severe, and perhaps, on the whole, more common in those parts, which receive their nerves from the fifth pair, as the face, the eye, the tongue, than in any other individual part. Muscular spasms are common in the muscles of the neck, especially the sterno-cleidomastoideus. I am inclined to believe that they occur also more frequently in the upper limbs, than in the lower." (See Brodie on *Local Nervous Affections*, p. 20.) *Tic douloureux* is not continual, but occurs in violent paroxysms, which vary in duration in different instances. It is the *trismus dolorificus* of Sauvages; the *faciei morbus nervorum crucians* of Dr. S. Fothergill; and of that order of diseases which Professor Chaussier has so aptly denominated *neuralgies*.

The first excellent description of *tic douloureux* was published in the year 1776, by the late Dr. Fothergill. (See *Med. Obs. and Inq.*, vol. v.) It is not true, however, as is generally stated, that he was the first author who noticed the complaint. This, indeed, is so far from being correct, that we even find an account of an operation done long ago by Louis, for the relief of the disease (see No. xxxvi. *de la Gazette Salulaire*, 1766); and this identical case actually became a subject of hot dispute between the physicians and surgeons of the French metropolis. (See a Thesis, entitled "*Utrum in pertinacibus capitis et faciei doloribus aliquid prodesset possit, sectio ramorum nervi quinti paris?*" *Proponebat Viellart*, 1768, *conclusio negativa*.)

Neuralgia was in fact first described at a still earlier period, namely, in 1756, by Andrè, in his work on diseases of the urethra. He met with

it more frequently in women than men, but never in persons much under forty.

Tic douloureux conveniently admits of being divided into four species, called by the French *frontal, sub-orbital, and maxillary neuralgia, and the neuralgia of the facial nerve.*

In the frontal neuralgia, the pain usually begins in the situation of the supra-orbital foramen, extending at first along the branches and ramifications of the frontal nerve, distributed to the soft parts upon the cranium, and afterwards shooting in the direction of the trunk of the nerve towards the bottom of the orbit. In a more advanced stage, the conjunctiva and all the surface of the eye participate in the effects of the disorder, and become affected with chronic inflammation, which is described as a particular species of ophthalmia. At length, the pain passes beyond the distribution of the branches of the frontal nerve, and affects all the corresponding side of the face and head. It seems as if it extended itself to the facial, sub-orbital, maxillary, and even to the temporal and occipital nerves, through the communications naturally existing between the filaments of all these organs. Each paroxysm produces a spasmodic contraction of the eyelids, and a copious effusion of tears.

The sub-orbital neuralgia is first felt about the sub-orbital foramen. The seat is probably in the nerve of this name, and the pain extends to the lower eyelid, the inner canthus of the eye, the muscles about the zygoma, the buccinator, cheek in general, ala of the nose, and the upper lip. At a later period, the pain appears to extend backward to the trunk of the nerve, and those branches, which are given off in its passage through the sub-orbital canal. Hence, pains are then experienced in the upper teeth, the zygomatic fossa, the palate, tongue, and within the cavity of the nose. As the disorder advances, it may extend, like other neuralgiae of the face, to all the same side of the head. During the paroxysms, when the disease is fully formed, an abundant salivation usually takes place. In general, the attendant toothach deceives the practitioner, who, in the belief that the pain arises from another cause, uselessly extracts several of the teeth.

Tic douloureux of the lower jaw, or maxillary neuralgia, is usually first felt about the situation of the anterior orifice of the canalis mentalis, and it extends to the lower lip, chin, neck, teeth and temple. This form of the complaint is more uncommon than the preceding; but, after it has prevailed some time, is equally remarkable for its intensity.

With respect to the neuralgia of the facial nerve, or portio-dura of the auditory nerve, it is a case, which very soon cannot easily be distinguished from the other species of tic douloureux. The pains at an early period are no longer confined to the passage of the principal branches of this nerve between the parotid gland and ramus of the jaw. The numerous communications of the portio dura with the rest of the nerves of the face seem to facilitate the extension of the disease, so that the pain is soon felt over the whole side of the head. The original source of the disorder can only be detected by attentively considering the progress of the complaint in all its stages. (See *Delpsch, Traité des Maladies réputées Chirurgicales*, t. iii. p. 214, &c.)

Tic douloureux may be known from rheumatism by the paroxysm being excited by the slightest touch, by the shortness of its duration, and the extreme violence of the pain. In acuterheumatism, also, there is fever, with redness, heat, and generally some degree of swelling; and, in chronic rheumatism, the pain is obtuse, long continued, and often increased at night; none of which symptoms characterize tic douloureux.

It may easily be distinguished from hemicrania by the pain exactly following the course of the branches of the affected nerve.

It is known from the toothach by the comparative shortness of the paroxysms; the quickness of their succession; the intervals of entire ease; the darting of the pain in the track of the particular nerve affected; the more superficial and lancinating kind of pain; and the convulsive twitches, which sometimes accompany the complaint.

The causes of tic douloureux may be said to be in general unknown; though a few instances are recorded, which appear to have been the consequence of external violence, wounds, contusions, &c. It is mentioned in one of the journals, that distant irritations, especially of the splanchnic nerves, often produce this disease, and that Sir H. Hallford has met with cases, where the discharge of portions of diseased bone, even from a distant part, has cured the complaint. (*Med. Chir. Review*, No. ix. vol. iii.) Sir B. Brodie has seen one or two cases, which confirm this observation; but he entertains no doubt, that the disorder may arise from other causes; and adverts to instances of its seeming dependence on disease of the brain, or disorder of the digestive organs. (*On Local Nervous Affections*, p. 19.)

A modern writer has related an instance of a resembling disease in the arm, where the affection proceeded from the lodgment of a small bit of bullet in the radio-spiral nerve. (*Denmark, in Med. Chir. Trans.* vol. iv. p. 48.) Dr. Parry attributed the pain to increased vascularity, or determination of blood (perhaps amounting to inflammation) to the neurilema, or vascular membranous envelope of the nerves affected. (*Elements of Pathology and Therapeutics*.)

Sir A. Cooper states, however, in his lectures, that the nerves in this disease are certainly not in an inflamed state; for they are found of their natural colour, and rather diminished, than enlarged. The latter fact was ascertained in a dissection made by Mr. Thomas. An occasional thickening of the nerve is mentioned by Larrey, Delpsch, &c.; but whether from conjecture, or actual observation, I am uncertain.

Stimulating embrocations, blisters, caustic issues, fomentations, leeches, friction with mercurial ointment (*Edinb. Med. and Surg. Journ.* vol. iii.), electricity, opium in large doses, the arsenical solution, and a variety of antispasmodic medicines, are the principal means, which have been tried; but, for the most part, they only afford partial and temporary relief. Lassere reported two cases, which were cured by bark, joined with opium and sulphuric ether; and two other examples, which yielded to pills, composed of the extract of hyoscyamus, valerian, and peroxide of zinc. (*Journ. Univ. des Sciences Méd.* No. lxiv. art. 14.) Belladonna has often been tried, and often failed. Two cases in which it answered in doses of two grains, and two grains and a half, were published by Mr.

Thompson of Whitehaven. (See *Lond. Med. Repository for July, 1822.*) Various neuralgic affections, in the practice of Mr. Cusack, have yielded to the exhibition of three grains of blue pill, combined with from three to seven of the pil. galbani comp., and given every second or third night, the bowels being regulated occasionally with a draught of infusion of quassia and sulphate of magnesia. (See *Dubl. Journ. of Med. Science*, vol. v. p. 220.) M. Piedagnel cured a neuralgia of the infra-orbital nerve, with the sulphate of quinine, ten grains of which were blended with equal portions of orange-flower water and syrup, and taken in four doses, the medicine being continued afterwards in weaker doses for a short time. M. Dupré has also published various observations, representing the sulphate of quinine as a powerful remedy for neuralgia in its various forms. The testimony of Dr. Rabey is likewise in favour of its exhibition, and his opinion is backed by two cases in which he tried the medicine with success. (See *Magendie, Journ. de Physiol. Avril, 1822, &c.*) Sir B. Brodie adverts to cases, in which neuralgic affections assume an intermittent and periodical character. "According to my experience (says he), there is no part of the body, in which such pains may not occur, and when they occur daily, or on alternate days, they are always relieved by the exhibition of the sulphate of quinine, or of the cinchona combined with arsenic. But, large doses of these medicines are sometimes required. A respectable medical practitioner consulted me, believing that he laboured under a disease of the spine. He complained of pain, which he referred to the inferior dorsal vertebrae, and which was so severe, that he could scarcely endure it. On inquiring, I learned that the pain always attacked him at a particular period of the night; that it lasted for a certain number of hours; and that he was free from pain, or nearly so, in the intervals. I recommended that he should take the sulphate of quinine procured at Apothecaries' Hall. He took as much as fifteen or sixteen grains daily, without any decided amendment. I advised him to increase the dose still further. At last, he took half a drachm of the sulphate of quinine daily, and this effected his cure." (Sir B. Brodie, on *Local Nervous Affections*, p. 28.) An example of violent frontal neuralgia yielded to pills, containing in each one-sixth of a grain of arsenious acid, made up with soap. This case was the consequence of an injury of the os frontis. (*Journ. Complém. du Dict. des Sciences Méd.* No. xlviii.) From some facts, published by Dr. Marcet, the extract of stramonium, in doses of from one-eighth to half a grain thrice a day, seems to be sometimes capable of alleviating the distressing agony of the present disorder. (See *Med. Chir. Trans.* vol. vii. p. 75, &c.; also *Kirby's Cases*, 8vo. Lond. 1819.) The best anodynes for this disease appear also to Dr. Elliotson, to be the salts of morphia, stramonium, and belladonna, which, if carried to due extent, will sometimes alone cure. Colchicum is undoubtedly another valuable medicine. The veratria ointment, I have sometimes found give relief, but, in general, this has only proved temporary.

In 1820, the late Mr. B. Hutchinson published some cases tending to prove, that the subcarbonate of iron, in doses of ʒij. or ʒj. two or three times a day, is often an excellent remedy for tic douloureux. In fact, if the sulphate of quinine be

excepted, this medicine at present possesses more reputation than any other, for its virtues in this complaint. It is highly commended by Sir A. Cooper in his lectures.

A convincing fact, in proof of the real efficacy of the subcarbonate of iron, is mentioned by Dr. Crawford: a severe case was benefited soon after its exhibition; but, by mistake, the carbonate of potass was then given for a few days, during which time the spasms returned with their usual violence and frequency: but when the iron was given again, the good effects formerly experienced from it returned. (See *Med. and Phys. Journ. for Feb. 1823.*) Dr. Elliotson observes, that the old dose of a drachm, or half a drachm, will sometimes succeed; but, while exhibiting this remedy in various diseases, he found, that it might be given without any inconvenience, in far larger quantities. (See *Med. Chir. Trans.* vol. xiii.) Even children only eight years old, will often take half an ounce or six drachms every four hours. If given in twice its weight of treacle, it rarely constipates. But, strict attention should be paid to keep the bowels open during its employment, because being an insoluble substance and bulky, if it is not regularly discharged, its accumulation may be considerable, and prove an inconvenience. If doses of a drachm, every six hours, do not succeed, it should not be relinquished till larger ones fail. In all cases of neuralgia, whether exquisite or not, unaccompanied by inflammation, or evident exciting cause, iron seems to Dr. Elliotson the best remedy yet known, though he admits its frequent failure, or only temporary success. (See *Cyclop. of Pract. Med.* art. *Neuralgia*.)

The same experienced physician also expresses his opinion, that, when inflammation is obvious, or presumable, whether rheumatic or not, local bleeding, mercury, colchicum, and the whole antiphlogistic plan, general and local, are appropriate. Should these not succeed soon, anodynes may be added. When the complaint is rheumatic, yet not inflammatory, he sanctions stimulants external and internal, tonics, mercury, and counter-irritation. In addition to generous diet, he particularly commends the ammoniated tincture of guaiacum, of which a dose of half a drachm, or of six drachms, may be requisite every six, or every two hours, according to the effects. When there is debility, he prefers iron to quinine. The hot bath, of water or vapour, douches, electricity, blisters, moxa, sinapisms, tartarised antimony, croton oil, and acupuncture, he adds, frequently cure, if combined with all other appropriate means.

The tincture of iodine has occasionally proved beneficial.

The operation of dividing the trunk of the affected nerve, and even of dissecting out a portion of it, so as to prevent all chance of a relapse from the reunion of the ends of the nerve, is a plan, which has sometimes been practised with permanent benefit. Thus, any one of the three branches of the fifth pair of nerves may be divided at the point, where it comes out upon the face. But, before having recourse to this means, the surgeon should be sure that the particular nerve, which he is about to expose and divide, is really the principal seat of the disease; for, when all the nerves of the face generally are affected, or when the branches of the portio-dura are especially concerned, there is little hope of success. In fact, it must be con-

fessed, that the operation has had many failures and relapses, either from the cases not having been duly discriminated, or from the neglect to remove a portion of the exposed nerve. Richerand, Delpêch, and most of the leading surgeons in France, express their preference to the application of the moxa, or cautery, which, they say, proves more frequently successful than the knife. This should be done directly over the apertures, from which the nerves emerge on the forehead, cheek, or chin; and Richerand asserts, that, by such treatment, the pains may always be cured, or at all events rendered supportable. (*Nosogr. Chir.* t. ii. p. 218. edit. 4.) Delpêch also affirms, that the section of the nerve very often fails, and that issues, and the repeated use of the cautery, have been attended with the greatest success. (See *Precis. des Mal. Chir.* t. iii. p. 213.) The disfigurement of the countenance by burning applications must, however, be very objectionable; and, as I think there is no positive evidence of the superiority of this method over the use of the knife, I consider what Richerand and Delpêch have stated only as an instance of the extreme partiality of the French surgeons to the moxa and cauterization. Delpêch confesses, however, that when the pains seem to be the consequence of a ganglion, or thickening of a part of a nerve, the excision of such part is indispensable. There can be little doubt, that this would have been more proper, than amputation, in Mr. Denmark's case, to which I have already referred. The theories of Dr. Parry, senior, who was generally inclined to refer the effects of disease to increased determination of blood to the parts affected, led him to believe, that the operation of cutting the nerve, as performed by Dr. Haighton and others, did good rather by the division of the arterial branch supplying the affected ramification of the trigemini nerve, than by the division of that ramification itself. (*Parry, Elements of Pathology, &c.*)

There have been many examples of tic douloureux, which, after resisting all attempts to cure them, have been left to themselves, and, after a long time, spontaneously subsided. (*Delpêch, Maladies Chir.* t. iii. pp. 212. 215.) This author has seen the operation of dividing the chief branches of the portio-dura, in front of the parotid gland, undertaken, and even a portion of the soft parts cut away; but without any favourable consequences. (P. 218.)

When the infra-orbitary nerve is to be divided, Sir A. Cooper recommends it to be done a quarter of an inch below the orbit. The supra-orbitary nerve should be cut through just where it passes out of the supra-orbitary foramen. An instance, in which this measure produced an immediate alteration in the seat of the pain, may be read in the 6th No. of the Quarterly Journal of Foreign Med.; but the cure was not complete, till the integuments had been divided from the root of the nose to the temple. The method of dividing the inferior maxillary nerve, advised by the same surgeon, is to cut down to the foramen mentale on the inside of the lip, directly under the bicuspid tooth. By the division of this nerve, M. Bouillard effectually cured one very severe case. (See *Lond. Med. Repository*, No. lxxix.)

I have already stated, that the nerves of the extremities are subject to affections very analogous to tic douloureux. The following instance,

related by Mr. Abernethy, will be found interesting:—

A lady became gradually affected with a painful state of the integuments under, and adjoining to, the inner edge of the nail of the ring-finger of the left hand. No injury to the part was remembered, which could have brought on this disease. The pain occurred at irregular intervals, and was extremely severe during the time of its continuance, which was for a day or two, when it usually abated. Accidental slight injuries always produced great pain, and frequently brought on the paroxysms, which, however, occasionally occurred spontaneously, or without any evident exciting cause. In all these particulars, the disease correctly resembled tic douloureux. As the pain increased, the disorder seemed to extend up the nerves of the arm. After the patient had endured this painful affliction for seven years, she submitted to have the skin, which was the original seat of the disorder, burnt with caustic. This application gave her intense pain, and, on the healing of the wound, she found her sufferings rather augmented, than diminished, by the experiment. After four more years of suffering, she consulted Mr. Abernethy, when the circumstances of the case were such as to render an operation indispensably necessary. The pain of the part was intolerable, and it extended all up the nerves of the arm; and this general pain was so constant during the night, as to deprive the patient of rest. The muscles of the back of the neck were occasionally affected with spasms. The integuments of the affected arm were much hotter than those of the opposite arm, and sometimes the temperature was so increased as to cause a burning sensation in them. Under these circumstances, Mr. Abernethy did not hesitate to divide the nerve of the finger, from which all this disorder seemed to originate. He laid it bare by a longitudinal incision of about three quarters of an inch in length, from the second joint of the finger, and divided it opposite to that joint, by a curved sharp-pointed bistoury, which was conveyed under it. He then took hold of the nerve with a pair of forceps, and reflecting it downwards, removed a portion of it, half an inch in length, so that the possibility of a quick reunion might be prevented. The wound was brought together with sticking plaster, and it united by adhesion; but the upper part of the wound, opposite to the upper end of the nerves, became slightly inflamed, and was very painful. However, in the course of three weeks, the appearance of inflammation gradually went off. After the operation, Mr. Abernethy pinched the originally affected integuments sharply with his nails, without causing any sensation; but if, in so doing, he moved the finger, then pain was felt.

The result was, that, nine months after the operation, the general pains in the nerves had become very trivial; but the sensation in the integuments at the end of the finger had gradually increased, and the skin had now its natural sensibility, so as accurately to distinguish the tangible properties of any body applied to it. If also the originally affected part was slightly compressed, painful sensations, resembling those which formerly occurred, took place. (*Abernethy's Surgical Works*, vol. ii. p. 203.) In a case resembling the former, but the consequence of a wound of the finger, Mr. Lawrence also cut down to the nerve and removed

a portion of it, with permanent success. In a case of severe pain in the thumb, extending up the arm to the neck, and causing a distortion of the neck, fits, &c., Sir A. Cooper cut down upon the radial nerve, by the side of the flexor carpi radialis, and cut out about five-eighths of an inch of it. The result was a complete cure.

Dr. Mott has adopted the practice of dividing the nerve in almost every case of neuralgia, where it is practicable. He has repeated this operation on the infra-orbital, mental, and other nerves so frequently, and with so great success, that he confidently recommends it. He sometimes insulates a portion of the nerve by repeated incisions through it at small distances from each other, preferring this to a removal of a portion of the nerve. If these plans fail, Dr. Reese believes, that the application of potassa fusa, or lapis infernalis, will almost always prove a remedy. (See *Amer. Ed. of this Dictionary*.)

Notwithstanding the occasional success of the knife and caustics, I concur with Dr. Hosack, Sir B. Brodie, and others, in the opinion, that many forms of neuralgia depend upon constitutional, or other causes, completely out of the reach of such expedients. "If the original disease operates immediately on the nerves of the affected part (says Sir Benjamin Brodie), producing in it pain, or muscular spasm, or paralysis, you will have first to consider how far it is within the reach of topical remedies. If a tumour presses on a nerve, or if some foreign body, as a musket-ball, or a piece of dead bone, irritates its surface, or is entangled in its substance, perhaps the tumour, or the foreign body may be removed by a surgical operation, or the tumour may be reduced by other means. If this cannot be accomplished, or if the nerve itself be altered in structure, either from disease, or injury, it will become a matter for consideration, whether the limb should be amputated, or whether the nerve should be divided. It is only under these circumstances, that any advantage can be expected to arise from the division of the nerve. In ordinary cases of neuralgia, where the disease, on which it depends, is in the brain, or in some other distant part of the body, or where it is connected with some derangement of the general health, it is evident, that such an operation cannot be recommended on any sound principle; and it need be a matter of no surprise, that, where it is performed, it should so generally fail." (*On Local Nervous Affections*, p. 27.)

Fothergill's Paper in vol. v. of the Medical Obs. and Inq. Dr. *Haighton's* Obs. in the Med. Records and Researches. *Darwin's* Zoonomia. *Abernethy's* Surg. Works, vol. ii. p. 203, &c. *Despech, Précis des Maladies Chir.* t. iii. p. 206, &c. Dr. *S. Fothergill's* Systematic Account of the Douloureux, 1804. *Good's* Study of Medicine, vol. i. Med. Chir. Trans. vol. iv. p. 48; vol. vii. p. 575, &c. *Kirby's* Cases, 8vo. Lond. 1819. *Be Hutcheon's* Cases of the Douloureux, 8vo. 1820. Also 2d edit. 1822. *Richmond*, in Lond. Med. Phys. Journ. Sept. 1821: a case in favour of subcarbonate of iron. *Wadell*, in Edinb. Med. Journ. No. 32: case to the same purport. *Lisars*, in same work. No. 69. *Carter's* Case in Med. Repository, No. 89. *L. D. Yeate's* Review of a severe Case of Neuralgia, &c. 1822. Dr. *Stewart Crawford*, in Med. and Phys. Journ. Feb. 1823. *A. T. Thomson*, in the same No.; and additional cases by various other practitioners in the Nos. for April, June, and Sept. 1823. *A. Wilson*, in Ed. Med. Journ. No. 75: a case cured by purgatives, followed by bark, after the subcarbonate of iron and liq. arsenicalis had failed. *H. Jeffries*, Neuralgia of the Median Nerve, after a burn on the Thumb, cured by subcarbonate of iron. See Med. and Phys. Journ. May, 1823. *T. Taylor*, in Edin. Med. Journ. No. 76: carbonate of soda, hemlock and the prussic acid, pre-

scribed with success. *John Elliotson*, in Cyclop. of Pract. Medicine, art. Neuralgia. *S. Cusack*, in Dublin Journ. of Med. Science, vol. v. p. 220. *Sir Benjamin Brodie* on Local Nervous Affections, 8vo. Lond. 1837.

NEUROMA, (from *νεῦρον*, a nerve), a term originally employed by Odier to signify a tumour formed in or upon a nervous trunk. This subject has been ably investigated by Mr. Wood, the results of whose researches are published in the *Edinb. Med. Chir. Trans.*, vol. iii. part 2. Tumours, connected with nerves, are subject to much variety. Sometimes, though rarely, the swelling consists almost entirely of a cyst, filled with a fluid, as exemplified in the case operated upon, and reported by Cheselden. In other instances, it is in part solid, and in part fluid: more frequently it is solid throughout. In one of the cases, detailed by Mr. Wood, the tumour consisted almost entirely of a firm membranous cyst, containing a thick fluid; in three others, it consisted partly of fluid, and partly of a solid substance; and, in twenty, it was entirely of a solid texture. The consistence, colour, and appearance of the solid part differ in different cases; and sometimes in different parts of the same tumour. In some instances, the whole mass is very firm and hard, of a whitish, or yellowish colour, and of a fibro-cartilaginous appearance, harder than a nerve, and rather more shining. The fibres run generally in a longitudinal direction, but are not always parallel, and the interstices of them were observed by Mr. Wood to be filled up by the substance of the tumour. In other cases, one part of the mass is solid, of a reddish colour, and steatomatous appearance; and, in another part, there are cells of a larger or smaller size, some empty, others containing either fluid, or a softish medullary substance. Occasionally small lobes are met with, all distinct, but closely pressed together. In almost all cases, Mr. Wood observed a firm sac, more or less dense, and of a shining appearance, not unlike tendon, and seemingly formed in part, or entirely, of diseased neurilema. In some cases, the sac is loosely attached to the contained parts by a thin cellular substance; in others, it is firmly incorporated with them; and sometimes it is attached to, or partially covered with muscular fibres. The nerve itself is sometimes sound where it enters and comes out of the tumour; but more frequently it is thickened, and now and then reddened. The nerve may often be traced to the surface of the diseased part, and some of its fasciculi even into the substance, or sac of the tumour. When, however, the swelling is very large, none of the nervous fibres can be traced from the trunk above to that below the tumour. The circumstance of the disease affecting only a certain number of the fibres of the nerve, seems to Mr. Wood to account for the complete power of sensation and motion, often retained in the limb beyond the tumour. That part of the nerve does continue adequate to its functions, when another part of it is much diseased, is proved by the effect of dividing the nervous trunk in the operation for the removal of the tumour, when the sensation and power of motion, which had previously been little impaired, became instantly destroyed, or much diminished. (See *Wood*, in *Edinb. Med. Chir. Trans.* vol. iii.)

The pressure of a neuroma may give rise to local pain and numbness, and, in some instances,

"It has been known to occasion convulsions and epilepsy. In a case recorded by Portal, a woman was freed from epileptic attacks by the removal of a tumour, which had formed on one of the nerves of the thumb.

The generality of neuromatous swellings do not seem to be of a cancerous nature; "first, because however large the diseased mass is, or however long it may have existed, the contiguous textures, and more particularly the skin, do not become affected with disease of a malignant kind; and, secondly, because there seems to be no tendency to a return of the complaint after it has once been removed by operation." (*Wood, ib.*)

We know from the history of medullary cancer, however, and especially from the history of this disease, as it presents itself in the eye, that the nerves may be the seat of it. Now and then a neuroma is met with exhibiting a brainlike and bloody substance. Mr. Liston removed from a middle-aged and healthy-looking man a tumour, which had occupied the popliteal space for a considerable period. It was growing rapidly, had attained the size of a cricket-ball, and was seriously impeding the motions of the limb. On the dissection, the tibial nerve was found intimately connected with it, the fibrillæ stretched over its sheath entering into, and being mixed with the substance of the growth. The nerve was cut above and below, and the whole mass extirpated, broken, and entire. During the stay of the man in the hospital, a tumour was detected on the front of the thigh of the same limb; here an inflammatory swelling took place, and suppurated. It was opened, but the original lump did not disperse. Within six months after the healing of the wound in the ham, the patient returned with an enormously swollen limb, and a large elastic morbid mass in the back part of it. A bleeding fungus protruded; and the disease was soon fatal. The original tumour, now in Mr. Liston's collection, is soft and bloody; but that on the fore-part of the thigh, was fibrinous, ovoid, larger than a hen's egg, and involved the anterior crural nerve. The diseased structure, which had been reproduced in the popliteal space, had all the characters of fungus hæmatodes. It seems extraordinary, that, in this case, the removal of the tumour from the ham, with at least three inches of the tibial nerve, should not have been followed for an instant by any loss of power of motion or sensation in the limb or foot. (*See Liston on Pract. Surgery, p. 294.*)

The following advice in relation to the treatment, as offered by Mr. Mayo, appears good. The tumour should be exposed, and if separable from the surface of the nerve should be removed, whether solid, or a cyst. If completely implicated with the whole structure of the nerve, and that nerve a small one, it should be removed with the portion of nerve involved with it. "If so implicated, and the nerve the sciatic, and the tumour a cyst, the cyst might be punctured, and the fluid evacuated, every precaution being taken to unite the wound by adhesion. In the last case, supposing the tumour to prove solid, another question might still arise; whether, the nerve being first divided above the tumour, the latter would not admit of being dissected out of so palsied a limb, with more probability of safety to the patient, than if the nerve to be operated upon were left in

communication with the brain." (*See Mayo's Human Pathology, p. 146.*)

An interesting account of the removal of a tumour of the radio-spiral nerve of the right arm has been published by Dr. Gibbs. The case terminated successfully, with a recovery of some slight use of the extensor muscles of the fingers; and "the patient was dismissed with returning sensation in the back of the hand, and a tolerably free use of the arm." (*See Edinb. Med. and Surg. Journ. vol. xxxiii. p. 250.*)

As is well known, when nerves have been divided in amputation, their extremities swell into firm bulbs of an oval shape, and frequently of the size of a nut. In certain instances, these enlargements of the ends of nerves cause most severe neuralgic sufferings, and this probably, as Mr. Lawrence conceives, either from the bulbous swellings of the nerves being involved in the cicatrix, or pressed by the contraction of it against the sawn end of the bone. (*See Langstaff, in Med. Chir. Trans. vol. xvi. p. 155.*) For additional remarks on this last subject, see *STUMP*. For engravings of the appearances of the ends of nerves in stumps, consult P. G. Van Hoorn de iis *quæ in partibus Membri præsertim ossis amputatione vulneratis, notanda sunt.* Lugd. Batav. 1803. 4to.*

NIPPLES. In addition to what is stated upon the subject of sore nipples in the article *MAMMÆ*, I may observe, that the nitrate of silver is an excellent application for the cure of this painful and sometimes obstinate complaint. Dr. Hannay, of Glasgow, strongly recommends its use in the following manner. Having gently, but carefully dried the nipple, the part is to be freely touched with a sharp pencil of nitrate of silver, which is to be insinuated also into the chaps and chinks. The nipple is then to be washed with a little warm milk and water. The pain soon subsides, and the sore may then be healed with a little zinc ointment. Dr. Hannay occasionally washes the nipple with a saturated solution of borax, before and after suckling the infant. (*See Lond. Med. Gaz. vol. xiv. p. 674.*) Sir Astley Cooper's formula of borax for these cases is specified in the article *MAMMÆ*. Dr. Jewel adds his testimony in favour of nitrate of silver. (*Op. et vol. cit. p. 753.*) Pyroligneous acid, blended with white of egg, is another remedy sometimes preferred. (*Gaz. Medicale.*)

NITRIC and NITROUS ACIDS, in a diluted state, have been extensively tried, as substitutes for mercury, in the cure of lues venerea. Numerous cases were published by Rollo, Cruickshank, Beddoes. P. G. Prioleau, of Charleston, and others, exemplifying the success, with which this disease may be treated by the nitrous, or nitric, acid.

The practice of exhibiting nitric acid, in lieu of quicksilver, began with Mr. Wm. Scott, in 1793, a surgeon at Bombay, who, being himself afflicted with chronic hepatitis, resolved to take a quantity of oxygen, united to some substance, for which it has no great attraction; and after some reflection, nothing appeared to him better than nitric acid. September 11th, he took at different times about a drachm of the strong nitric acid diluted with water. Soon after drinking it, he felt a sense of warmth in his stomach and chest; but no disagreeable sensation, nor any other material effect.

The two following days the medicine was continued, the gums beginning to be somewhat red, and enlarged. He slept ill; but could lie for a length of time on his left side, which the disease of the liver had prevented him from doing during many months previous to this period. He also felt a pain in the back of his head, resembling what he had commonly experienced when taking mercury. On the fourth day his gums were a little tender; the headach and pain about his jaws still troubled him; but the symptoms of his liver-complaint had already left him. The acid was continued on the 4th, 5th, and 6th days; the soreness of the mouth increasing, and a salivation taking place. On the 7th day he felt his mouth so troublesome, that he took no more acid. His mouth got gradually well, and he found his health considerably improved.

Mr. Scott likewise administered nitric acid in several cases of tedious intermittents, in two cases of diabetes, and in many syphilitic cases, with the happiest effect. His account of the nitrous acid was first published in the *Bombay Courier* of April 30th, 1796, and soon afterwards republished in this country. (See "*An Account of the Effects of the Nitrous Acid on the Human Body*," by IV. Scott, in *Duncan's Annals of Medicine* for 1796, vol. i. p. 375—383.) The hypothesis suggested by Girtanner, in 1790, that the efficacy of mercury in the treatment of the venereal disease depended upon the oxygen combined with this mineral, required but little extension to lead to the discovery of the anti-syphilitic virtues of the acids. Yet, Girtanner had all his attention so fixed on mercury, that it never struck him, that the principle on which he explained the efficacy of this medicine might apply to other substances, which abound with oxygen, and are readily separable from it. This was the idea which led Mr. Wm. Scott to suspect, that the nitric acid might be as efficacious as mercury in venereal cases; and, as he had already observed a great analogy between the effects of this acid and mercury in the experiments, which he made with the first of these medicines in his own case of chronic hepatitis, and other diseases, he ventured to recommend the trial of it in syphilis. The result was, that the acid was found not only to equal the preparations of mercury, but sometimes to surpass them; for it had the best effect, in some cases, where mercury had been tried in vain, and it was observed to remove the disease in less time, than the common remedy. Nor were any of the inconveniences, usually known under the names of *mercurial symptoms*, *mercurial fever*, found to be the consequence of its employment, however long continued. With it alone many syphilitic cases are stated to have been cured, the disease not having returned at the end of two years. (See *Duncan's Annals of Medicine*, &c. vol. i. 1796, p. 383, &c.)

The letter from Mr. Scott to Sir Joseph Banks, describing these effects of the nitric acid in India, soon excited the attention of medical practitioners both in Europe and America, the inquiry being taken up with all the zeal, which the preceding accounts were calculated to inspire. In 1797, Mr. G. Kellie, a surgeon of the navy, gave the nitric acid to five sailors, affected with gonorrhoea, venereal sores, and buboes. Three of them were perfectly cured. A fourth, who had sores on the

glans, and who had been much debilitated by the long use of mercury, recovered nearly his original strength, while taking the acid; but, the sores were not healed, before mercury had been repeatedly exhibited. In the fifth patient, who was also scrofulous, the nitric acid contributed very essentially to heal the sores. On the whole, Mr. Kellie seems to regard this medicine, as possessing very efficient power of stopping and eradicating the venereal disease. (See *Letters from G. Kellie, respecting the Effects of Nitrous Acid in the Cure of Syphilis*, *Duncan's Annals of Medicine* for 1797, p. 254, 277.)

In the same year appeared a letter, in a German periodical work, (*Hufeland's Journ. der Prakt. Heilk.* iv. bd. p. 356—359.) written by Albers, giving the history of a venereal ulcer on the breast, successfully treated by the nitric acid.

The reports of Dr. Prioleau, who tried the nitric acid in the autumn of 1797, are particularly favourable to the practice. "We have seen (says he) every stage and form of syphilis cured by this medicine, and even in habits broken down by the antecedent use of mercury, under which the disorder had gained ground. The patients recovered their health and strength in a short time, without the use of diet-drinks, bark, or any other tonic medicine whatever." (See *Caldwell's Medical Theses*, p. 103. 8vo. Philadelphia, 1805.)

The praise of the nitric acid from numerous quarters induced Dr. Rollo to try it in the military hospital at Woolwich, and in conjunction with Mr. Cruickshank to examine further into the anti-syphilitic virtues of oxygenated substances. The results of Mr. Cruickshank's investigations constitute the second part of Rollo's work on diabetes, published in 1797. The medicines, which were selected for the experiments, were the nitric, citric, and muriatic acids, and oxygenated muriate of potash. Of these, the nitric acid, and the oxygenated muriate of potash, were found to possess the greatest efficacy: the first acting in many cases with remarkable mildness; the second, with greater expedition and certainty. The new plan was tried upon young persons, affected with primary venereal complaints, who had never used mercury; and no other internal medicine was given, except opium when required for diarrhoea, or colic. The liquor plumbi acetatis dilutus was used as a wash for chancres. In debilitated subjects, sure and speedy good effects were observed uniformly to follow; and hence, previously to giving the acid to strong, plethoric patients, the method of preparing them for this treatment by purging and bleeding was adopted, as is alleged, with great success. In some cases, after the nitric acid had been continued a good while without producing a salivation, the exhibition of mercury for a short time completed the cure. Mr. Cruickshank's opinion in favour of the new remedies was on the whole extremely sanguine, as he ventures to express his conviction, that they would render the employment of mercury in the cure of the venereal disease unnecessary. (See *An Account of two Cases of Diabetes Mellitus, with Remarks*, &c. by John Rollo, M.D. vol. ii. 8vo. London, 1797.)

In the same year, Dr. Beddoes published a valuable work, comprising all the information, which had then transpired respecting the anti-syphilitic virtues of the nitric acid, with additional

communications from his medical friends. (See *Reports principally concerning the Effects of Nitrous Acid in the Venereal Disease*, by Thomas Beddoe, Bristol, 1797.) And two years afterwards, the same author finished a still more comprehensive volume on the subject. (*A Collection of Testimonies respecting the Treatment of the Venereal Disease by Nitrous Acid*. Lond. 1799.) In the Plymouth Hospital, Mr. Hammick gave the nitric acid to between sixty and seventy venereal patients, and found that the cures were generally more speedily accomplished, than with mercury, no ill effects being produced on the system, similar to those usually remaining after the use of the latter mineral. He assures us, that, after the removal of the symptoms, the disease never returned; and that for debilitated, scorbutic, or scrofulous patients, affected with venereal complaints, the acid was found a most valuable means of relief.

Dr. Ferriar tried this medicine in various ways, either alone, or after, or in conjunction with, the exhibition of mercury. His inferences are, that, in the treatment of the venereal disease, the nitrous acid is useful only in protracted cases. He corroborates, however, the generally received opinion, that, where the patient has been considerably reduced by the long, or injudicious employment of mercury, the nitrous acid is a most beneficial medicine. (See *Medical Hist. and Reflections*, vol. iii. p. 290—310. 8vo. 1798.)

Mr. Blair wrote some observations on the venereal disease, and the new method of treating it. (*Essays on the Venereal Disease, and its concomitant Affections*. Lond. 1797.) Though he does not regard the acids as medicines to be depended upon, he bears testimony to their virtues in venereal cases, either singly, or alternately with mercury, where the patient's strength has been much reduced; and he confesses, that venereal buboes, indurated glands, nocturnal pains in the bones, &c., yielded to these remedies.

Seven years after the appearance of Mr. Blair's work, Mr. Pearson delivered his sentiments in a book of considerable merit. (*Obs. on the Effects of various Articles of the Materia Medica in the Cure of Lues Venerea*. 2d ed. Lond. 1807. p. 198. &c.) He relates a very few examples, in which the nitrous acid appeared effectual in curing chancre, and one of its virtues in gonorrhœa; the only one, which this gentleman had ever seen. The rest of his observations are unfavourable to the character of the medicine, as an antisyphilitic meriting confidence. The first trials, which Mr. Pearson made, were of the nitric acid; but, as he did not remark any of its effects to be different from those produced by the nitrous acid, he commonly employed the latter in the following form:—Nitrous acid, two drachm.; pure water, a pint and a half; syrup, four ounces. This mixture was usually taken in the space of twenty-four hours. As local applications, he employed a saturnine lotion to the sores, and emollient poultices to tumours and inflamed parts. All mercurial applications were absolutely prohibited. (P. 200.) In making his inferences, in a subsequent page, he says, "The nitric and nitrous acids have removed both primary and secondary symptoms of syphilis; and, in some instances, it seems that the former have not returned, nor have secondary symptoms appeared at the period they commonly show themselves, when the cure has been imperfect. But,

so far as my own experience extends, and that of many respectable friends, who are connected with large hospitals, a permanent cure has never been accomplished by these acids, where secondary symptoms have been present. The same acid, when exhibited with the utmost care and attention to many patients, labouring under the primary symptoms of the venereal disease, and where they have agreed perfectly well with the stomach, have been nevertheless found inadequate to the cure of those symptoms. Indeed, the failures, which have occurred, both in my own practice, and that of many of my surgical friends, have been so numerous, that I do not think it eligible to rely on the nitrous acid in the treatment of any one form of the lues venerea." However, Mr. Pearson joins several other writers in bearing witness to the good effects of this medicine, where impairment of the constitution renders the employment of mercury inconvenient, or improper. Here, he says, it will restrain the progress of the disease, and improve the health and strength. On some occasions, he thinks, that it may be given, in conjunction with a course of mercurial inunction; and he agrees with other practitioners about its supporting the tone of the stomach, acting as a diuretic, and counteracting the effects of mercury on the mouth and fauces. (P. 236—238.)

While these inquiries were going on in England, numerous experiments on the same subject were undertaken in France. In a work, published in 1797, Alyon positively declares, that mercury ought to be entirely relinquished in the cure of the venereal disease. (*Essai sur les Propriétés Médicinales de l'Oxigène, et sur l'Application de ce Principe dans les Maladies vénériennes, psoriques, at dartreuses*. Paris, an 5. 8vo.) Here we find a relation of many cases, successfully treated in the hospitals of Val-de-Grace and St. Denis, by the oxygenated muriate of potash, the nitric, oxymuriatic, and citric acids, an ointment of the author's own invention, called the unguentum oxygenatum, being applied to the sores. (See *UNGUENTUM*.)

In 1798, Dr. Swediaur brought out the third edition of his treatise on the venereal disease (*Traité Complet sur les Symptômes, les Effets, la Nature, et le Traitement des Maladies Syphilitiques*), in which he highly commended the virtues of the nitrous acid, and oxygenated acid, as expediting the cure, with very few exceptions. But, in the fourth edition, he retracts, and details the results of the new practice, as tried upon twenty-six venereal patients in the *Hospice d'Humanité*: of these only seven cases remained permanently cured; the issue of seven others was doubtful; and, in twelve, no amendment was observed.

Nor were the statements of Lagneau much more favourable to the reputation of the nitrous acid as an antisyphilitic; for from the trials which he had seen made of it, he concluded, that it was not unfrequently ineffectual, while it was apt to excite an obstinate cough and hæmoptysis. (*Exposé des Symptômes de la Maladie Vénérienne, des diverses Méthodes de Traitement, &c.* 3me ed. Paris, 1812.)

According to Holst, (*De Acidi Nitrici Usu Med.* 8vo. Christ. 1816.) the following are the chief circumstances, under which the employment of nitrous or nitric acid is generally sanctioned.

1. Where the disease is complicated with scurvy.

2. Where it is attended with scrofulous enlargement of the glands, and other strumous symptoms. I may remark, however, that these complaints are often as undefinable, as some of the forms of syphilis, and therefore the rule is frequently difficult of application.

3. Where the disease is accompanied with considerable debility, either brought on by mercury, or febrile indisposition.

4. Where, from idiosyncrasy, mercury cannot be safely exhibited. Experience fully proves, that there are some patients, more especially females, in whom a few grains of mercury taken inwardly, or mercurial frictions on the most limited scale, bring on vomiting, rheumatic pains, nervous febrile symptoms, colic spasms, severe headach, and a rapid immoderate salivation.

The nitrous acid has also been extensively tried as a means of curing syphilitic complaints, in the form of what is termed the *nitro-muriatic bath*, of which a description will be given in speaking of the Venereal Disease.

Mr. Pearson's mode of exhibiting the nitrous acid has been already mentioned. Some practitioners give it as follows: R. Gum. arab. 3 iv. aquæ menth. 5 viij. acid. nitrosi, vel nitrici 3 ij. 5 iij. F. M. Of this mixture, a table-spoonful is to be taken every hour, mixed with some sweetened water. Should the acid occasion colic or diarrhoea, its quantity must be lessened, and opium added to the mixture.

As the nitrous and nitric acids decompose and destroy the teeth, the utmost care must be taken to prevent so serious an effect. Their being properly diluted, and blended with sugar, syrup, or mucilage, will materially tend to hinder the evil. But the safest way is always to drink the mixture through a glass tube, and wash the mouth well immediately afterwards.

Strong nitrous acid, extricated in the form of vapour, is often employed as a means of purifying the air of large crowded hospitals and sick-rooms; a subject, on which the observations of Dr. J. C. Smyth and G. de Morveau are particularly interesting.

The nitrous acid is sometimes taken by accident, or design, as a poison. Here, according to the observations of Tartra, Orfila, &c., the best antidote is calcined magnesia, or soap. If the first of these articles be at hand, a drachm of it, suspended in a glass of water, is to be instantly given, followed by copious draughts of some mucilaginous drink, the design of which is to fill the stomach, and excite it to reject the diluted poison. While the vomiting is going on, the doses of magnesia are to be repeated, and followed, as in the first instance, by draughts of linseed-tea, solution of gum arabic, milk, or broth.

When reiterated courses of mercury induce dropsy, as not unfrequently happens in very impaired constitutions, Mr. Carmichael prescribes the nitrous acid, in as large doses as the stomach will bear, conjoined with digitalis. (*Essays on Venereal Diseases*, &c.) Taken in doses of eight, ten, or fifteen drops, two or three times a day, it is alleged to be efficacious in the cure of some eruptive complaints, especially of the lower extremities, connected with disorder of the liver. (*Wilson's Pharm. Chir.* p. 6.) Another well-informed writer also bears testimony to its good effects when used together with mercury, for old obstinate ulcerations of the legs, though no venereal taint can be

suspected; and, he says, it may be applied with benefit as a local stimulant to fetid ulcers, attended with a thin ichorous discharge, and in some examples of caries. In such cases, 3 ij. of the diluted acid is to be mixed with 3 j. of water. (See *A. T. Thomson's Dispensatory*, p. 441. ed. 2.) With respect to caries, in the sense of *necrosis*, however, the reader will understand, from what is stated in the article on the subject, that it can rarely be advisable to apply this, or any other acid, either to the exfoliating portion of bone, or to that which is yet alive. The nitrous acid has sometimes been used for destroying warts, condylomata, and other excrescences; and the nitric acid, applied to the skin, has been proposed as a means of producing an immediate vesication of the part. By Sir E. Home, it is praised as a local application for certain ulcers, when properly diluted. (See *ULCERS*.) It is likewise commended as a most useful application to hospital gangrene: and an interesting paper was published by Mr. R. Welbank, detailing the excellent effects of the undiluted nitric acid, as an application to diseases, which he has described under the name of sloughing phagedena; and which he considers as identical with hospital gangrene. (See *Med. Chir. Trans.* vol. xi. p. 369. and *HOSPITAL GANGRENE*.) The cases, reported by this gentleman, are highly favourable to the practice, which, as may be seen by reference to the article *HOSPITAL GANGRENE*, is not entirely new, with respect to this disease; and in speaking of Mortification, I have mentioned, that it was Kirkland's practice sometimes even to dress certain gangrenous and phagedenic diseases with a solution of mercury in nitrous acid. But, notwithstanding these facts, and the well-known custom of Sir A. Cooper to apply to sloughing phagedenic ulcers the nitric acid lotion, composed of 50 drops of the acid, and a pint of distilled water, I feel that Mr. Welbank has rendered a service to the profession by drawing their attention still more particularly to the use of undiluted nitric acid in the forms of phagedena, which he has so well described.

NITRO-MURIATIC BATH. (See *VENEREAL DISEASE*.)

NODE. A swelling of a bone, or a thickening of the periosteum, from a venereal cause. (See *EXOSTOSES*, and *VENEREAL DISEASE*.)

NOLI ME TANGERE, or LUPUS. Under the last term, Dr. Willan intended to comprise, together with *noli me tangere* affecting the nose, other slow tubercular affections, especially about the face, commonly ending in ragged ulcerations of the cheeks, forehead, eyelids, and lips, and sometimes occurring in other parts of the body, where they gradually destroy the skin and muscular parts to a considerable depth. (*Bateman's Synopsis of Cutaneous Diseases*, p. 296. ed. 3.)

Sir E. Home says, that the ulcers, for which he has been led to employ arsenic, are named, from the virulence of their disposition, *noli me tangere*, and are very nearly allied to cancer: differing from it in not contaminating the neighbouring parts by absorption, but only spreading by immediate contact. Ulcers of this kind differ exceedingly from one another in their degree of virulence; but, they are all so far of the same nature, that arsenic generally agrees with them, and puts a stop to their progress, while they are aggravated by milder dressings. (*Home on Ulcers*, ed. 2. p. 267.) There is much truth in this statement, as the following

observations prove; yet the differences of such ulcers from cancer, are greater, than one might suppose from Sir Everard's distinctions, as here laid down. He knew very well indeed, the light thrown by pathological anatomy, on these subjects. (See CANCER.)

The disease generally commences with one or more small tubercles, which change after a time into spreading ulcerations on the alæ of the nose, more or less concealed beneath furfuraceous scabs. Sir A. Cooper believes, that the disease consists in ulceration of the sebaceous glands, or follicles of the nose. The cartilages and even the whole nose are frequently destroyed by the progressive ravages of this peculiar disorder, which sometimes cannot be stopped or retarded by any treatment, external or internal.

M. Bielt and Dr. Houghton notice three varieties of Lupus: 1. The *deep*, or *erosive* lupus, in which the ulcerative process advances chiefly in depth. It almost always commences on the nose. On one of the alæ, or the point of this organ, a small tubercle, seated in the skin, makes its appearance, and as it makes progress, assumes a livid colour. The surrounding skin becomes somewhat swollen and painful, and puts on the same colour. After some time, a thickish scab forms, and under this the ulceration extends. The crust falls off and is renewed; and after each detachment of it, the ulceration is found to have penetrated the skin more deeply. These changes go on very slowly for a long time, the loss of substance taking place nearly insensibly. In many instances, the ulceration is accompanied by a thin fetid discharge from the nostril. The disease is alleged, indeed, very often to begin in the mucous membrane of the nose. But, whether it commence in this texture, or the skin, after a time, the subjacent cellular tissue, and the muscles are destroyed by the ulceration; then the cartilages; and occasionally the bones themselves. The destruction is generally complete in one of the alæ, or the tip of the nose, before the disease spreads further on the surface; but, sooner or later, it extends to both sides of the nose, and wherever it establishes itself, it is by the same kind of tubercular deposit, with which it began. Sometimes, after having destroyed the tip of the nose, or one of the alæ, it forms a puckered cicatrix, and seems to be nearly healed up; but, more generally, after a while, new tubercles become developed in the midst of the cicatrix itself, which ulcerate, and the original destructive process is renewed. Nor are the internal parts of the nose generally exempted. The inner surface of the alæ, corresponding to the external disease, is a common situation for it within the nose; but the septum narium is a still more frequent seat of it. In such cases, the discharge, which is continual, proves a vast annoyance to the patient; and the crusts which accumulate on the septum and on the turbinated bones may nearly block up the nostrils. Sometimes, indeed, these openings are shut up by adhesions. At length, the soft parts, and the septum having been destroyed, the entire nose is lost, and a square aperture remains, with a partial perpendicular partition within it. Examples are met with, in which the ravages are not restricted to this degree, but even involve the superior maxillary bone. I remember one case in St. Bartholomew's Hospital, where the disease extended itself to the bones of the palate, and formed a com-

munication between the nostrils and mouth. Usually, however, when the ossa nasi fall, and the septum has been destroyed, the disease pursues its course no further in the bones.

A few cases occur, in which the disease heels up, after having destroyed the point, or one of the alæ of the nose, or without having occasioned even this degree of mischief. Sometimes it terminates after having thinned the integuments of the end of the nose, which is thus rendered more pointed. (See Houghton, cit.)

Dr. Houghton has described a form of lupus, entirely restricted to the interior of the nose, hardly ever met with except in children under twelve years of age, and causing a destruction of part, or the whole of the septum narium. Whether these perforations of the septum from ulceration, confined to the interior of the nose, should be regarded as instances of lupus, may perhaps be questionable. I have lately had two or three such cases in the Bloomsbury Dispensary; and they were cured by the free application of nitrate of silver.

2. *Lupus with hypertrophy*, differs from the foregoing more common variety in not beginning particularly on the alæ and tip of the nose; but frequently near the bridge, or on the forehead, or even on the cheek, or other part of the face. The tubercles are not round and firm, as in the first species; but are softish, ill-defined rugosities of a purplish colour, which spreads from them to the surrounding skin, until a circumscribed patch of it presents this hue. No open ulceration takes place in the tubercle, which gradually disappears, leaving a slight furrow behind. While this process is going on in one tubercle, others are forming near it, and they, in their turn, undergo the same imperceptible destruction and cicatrization. At length, the skin swells considerably so as to conceal the remaining tubercles; and then the disease appears in the form of a circumscribed, hypertrophied patch of skin, of a purplish colour, and in this area are spots of a deeper hue, denoting the surface of the tubercles, and white marks, the cicatrices of tubercles which have disappeared.

This form of lupus may continue for years, without producing any further serious consequences; and though not disposed to heal of itself, is much more under the controul of internal medicine, than the first variety. Its cure has been known to be brought about by an accidental attack of erysipelas, which, encroaching on the morbid structure, produced a new and healthy action in the part.

3. *Superficial Lupus*, another variety described by M. Bielt, is that characterised by the superficial form of the ulceration. It begins with the formation of large soft tubercles in the skin, which at first differ but little in colour from the surrounding parts. They remain indolent for a long period; but, as they increase in size, and rise above the level of the skin, they assume a dusky livid colour, which extends far over the adjacent skin. At length, ulceration commences on their surface; and as their bases have become by this time nearly conjoined, the part often presents, for a large extent, but one continued ulcerated surface. A thin ichor is secreted, which sometimes concretes on the edges into closely adherent scabs; but these are not like the solid scabs covering the tubercles of the first variety. Frequently while ulceration breaks out in new-formed

tubercles, the parts first divided heal up; and, in this way, it may travel over a great space, leaving behind disfiguring puckered scars. (See *Bielt, in Abrégé Pratique des Mal. de la Peau, par MM. Casenave et H. E. Schedel, &c.*) Dr. Houghton doubts the propriety of arranging this disease as a specimen of lupus; and states, that, in the instances, which he had observed, it appeared to be connected with syphilis, or derangement of the constitution, resulting from a course of mercury, and still more frequently with scrofula. "The success of iodine (says he) in this superficial ulceration, while it seems an evidence of its scrofulous nature, may be regarded as one criterion of the difference of its nature from the two former species; for, against these iodine is found to possess little or none of the virtues, which have given it such a high place in scrofulous affections." (*Cyclop. of Pract. Med.* art. *Noli me Tangere.*)

Lupus does not excite any febrile disturbance; nor are the mucous surfaces of the lungs and intestinal canal usually either primarily, or secondarily affected, as they are in the generality of other cutaneous diseases. It is not common to meet with any variety of lupus in a person under forty, and women are deemed more subject to the disease than men. Dr. Houghton describes it as particularly prone to occur in weakly females, in whom the period of puberty arrives late, and the menstrual function is feebly performed. He also joins in the belief, that it is more common in the country, than town, and in places where vegetables and fruit form the chief articles of food.

Lupus, though difficult of cure, is not altogether incurable; and cases are even met with, where the parts spontaneously heal. When the disease is left to take its own course, such a termination is rare; and its ravages seldom stop till the nose is nearly level with the face, and then indeed it does sometimes show a disposition to cease. In many cases, however, it still continues its progress on the cheek.

The treatment consists of general and local means.

Internal remedies. When lupus is associated with a debilitated, reduced state of the constitution, brought on by unwholesome and insufficient diet, and the effects of cold and uncleanness, as sometimes exemplified in the poor; the patient should be allowed a light animal nutritious diet, and every comfort which can be obtained for him. If any disorder of the chylopoietic organs can be detected, sometimes gentle alteratives with aperients, and light tonics, will bring the health into a better condition. When the liver performs its functions torpidly, the pilula hydrargyri, the pilula hydrargyri chloridi comp. the advantages of which were known to Desault, (see *Parisian Chir. Journ.* vol. i.) or the pilula rhei comp., may be prescribed.

If the individual be evidently scrofulous, he should be kept steadily under the influence of appropriate internal remedies. This, says Dr. Houghton, should be done, whatever be the form of the lupus; but the superficial variety of it is most commonly met with in scrofulous persons, and consequently it is for it that antiscrofulous treatment is particularly indicated. Dr. Houghton has seen striking amelioration produced by Lugot's solutions of iodine. The proto-ioduret of mercury, he assures us, is one of the preparations, which has proved of the greatest service, the ulceration hav-

ing been observed to heal under its use, with a rapidity which is quite foreign to its indolent character. One fourth part of a grain may be exhibited twice a day. (See *SCROFULA.*)

The muriate of barytes, which was recommended by Bateman for tubercular affections of the skin, does not retain the confidence of practical surgeons, and, being violent in its action on the stomach, is now generally relinquished for the muriate of lime, one drachm of which may be mixed with a pint of water, and a table-spoonful of the medicine given, at first ounce, or twice a day, and the doses gradually increased, till ten or twelve spoonfuls are taken daily.

Preparations of iron are in some repute for the cure of lupus: the muriated tincture and the carbonate being generally preferred.

Arsenic is another internal remedy of more decided power over lupus, than the generality of other medicines. The liquor arsenicalis is the formula usually employed. Three drops of it may be given at first thrice a day, and the doses afterwards very cautiously increased. The bichloride of mercury, or corrosive sublimate, administered so as gently to affect the gums, has sometimes answered.

External Applications. All experienced practitioners agree, that these are the most important means of cure, and that no success would attend an exclusive reliance upon internal remedies. Stimulating applications may be tried, where the disease presents itself in the stage of tubercle. Sometimes Dr. Mac Farlane has found, as Rayer has done, and, as I have seen in St. Bartholomew's Hospital thirty years ago, that the progress of a lupoid tubercle may be arrested, and the ulceration prevented by the application of leeches round its base, especially when the tumour is painful, and covered by inflamed integuments. This plan, followed by evaporating lotions, and alternative doses of calomel, will not unfrequently subdue the inflammation, upon which the progress of the disease depends, and reduce it to that indolent and chronic state, in which friction with an ointment, containing the ioduret of zinc, or mercury, may be beneficially employed to promote its absorption." Besides these applications, Bielt is in the habit of using the ioduret of sulphur, blended with simple ointment in the proportion fifteen grains to an ounce of the ointment. In the hypertrophic lupus, Dr. Houghton regards these resolute ointments as particularly indicated.

When the tubercles are ulcerated, merely stimulating applications generally fail, and it is necessary to resort to escharotics. Even in this stage, however, I have frequently known the following lotion succeed,—℞. potassæ arseniatæ gr. iv. Aq. Menth. Sativæ ℥iv. Spir. Vin. tenuioris ℥j. Misce. Lint is to be dipped in the lotion, and laid upon the part. The liquor arsenicalis is in still more common use, the diseased surface being bathed with it two or three times a day. I have also known the unguentum hydrarg. nitratis, a strong lotion of nitrate of silver, or sulphate of copper, have excellent effects.

As escharotics for the cure of lupus, arsenical applications, and the chloride of zinc, enjoy the highest repute. (See *ARSENIC* and *ZINC.*) Sir Astley Cooper employs an ointment, consisting of white arsenic and sulphur (a drachm of each) mixed with an ounce of spermaceti ointment. He

directs some of this to be spread on lint, and to be applied to the ulcer for twenty-four hours, at the end of which a black slough will be formed, and when this falls off, the surface is to be dressed with simple ointment. When the indolent tubercles are covered by a thick cuticle, which impedes the action of arsenic, some practitioners first apply a small blister, or else blend a proportion of the emplastrum cantharidum with the arsenical ointment. Thus Mr. Adams has employed the following composition,—R. Ung. Cetacei ʒss Oxydi Arsenici ʒj. Emplastri Canthar ʒij ft. ung. Whichever plan be adopted, the application should not be made at one time to a larger surface, than what a shilling would cover; and after the eschar has been produced to this extent, a new portion of the surface may be attacked. If a greater part of the disease have the arsenic applied to it at once, the patient may be poisoned, or suffer dangerously from the absorption of the mineral.

One of the safest and best arsenical applications to lupus, is that employed by Dupuytren, consisting of a small proportion of arsenic mixed with calomel, and sometimes used in the form of a powder, and sometimes in that of a paste. Useful information respecting it will be found in another place. (See ARSENIC.) My experience enables me to attest its efficacy in the cure of *noli me tangere*, and other lupoid diseases. In University College Hospital, and elsewhere, I have tried it with decided success. If the surface is ulcerated, moist, and clean, the powder may be applied by shaking it out of a little dossil of lint, or cotton, till the part is covered with a thick layer of it, care being taken not to let it be applied to more than a square inch of an ulcerated surface at a time. If the surface have a scab upon it, this must be loosened and separated by means of a poultice, and then the powder applied. But, if the lupus be covered with an imperfect cicatrix, this must be destroyed, and in twenty-four hours the raw surface is to be powdered with the application. If there be any reason to think that the powder will not adhere well, it may be blended with gum water, or simple ointment. In the latter case, the proportion of arsenic should be somewhat increased. (See ARSENIC.) In all cases, the powder, paste, or ointment, must be allowed to fall off of itself, which commonly happens in eight or ten days; and the applications are to be repeated till the cure is complete. This is generally effected in eight or ten weeks, or after five or six applications. (See *Ravien, Formulaire Pratique des Hôpitaux de Paris*, ed. ii. 1825; and *Rayer, Mal. de la Peau*, t. i. p. 632.)

M.M. Richerand and Cloquet employ, for the cure of lupus, the acid nitrate of mercury, made by dissolving a drachm of the proto-nitrate of mercury in an ounce of nitric acid. The ulcerated surface is to be touched with it by means of a dossil of lint, and some scrapings of lint, moistened with the same solution, are then to be laid upon the part. This is also an excellent application for the destruction of the soft flabby edges of unhealthy, half-formed cicatrices. (See *Houghton in Cyclop. of Pract. Med. art. Noli me tangere*.)

I have seen three or four cases, in which lupus was cured by removal with the knife. Escharotics are generally to be preferred; but, as the latter author states, if they were inapplicable, as, for instance, where a solitary tubercle is situated near

the eye, the knife might be the right means of cure.

The mode of applying the chloride of zinc will be hereafter described. (See ZINC.)

In numerous examples, where the nose has been destroyed by lupus, a new one has been formed by the Tagliacotian operation; and experience has now fully proved, that the skin taken from the forehead, unites very well, after portions of the cicatrix have been duly pared away, so as to form a surface, calculated for adhesion to the new-formed flap. (See NOSE.)

See *Bateman's Synopsis of Cutaneous Diseases*, ed. 3. *Rayer, Mal. de la Peau*, t. i. 8vo. Paris, 1826. *M.M. Casenave et Schedel, Abrégé Pratique des Maladies de la Peau*, &c. 8vo. Paris, 1828. *Houghton, in Cyclop. of Practical Medicine*. *Jacob, in Dublin Hospital Reports*, vol. iv. *A. T. Thomson, Atlas of Cutaneous Diseases*, 4to. *Dupuytren, in Leçons Orales de Clinique Chir.* t. iv. p. 471.

NOSE, HYPERTROPHY, or LIPOMA OF THE. The growth, or enlargement, seems to be restricted to the skin and subjacent cellular tissue. These textures become thickened; and "the sebaceous crypts are enlarged and distended with their secretion, some of them to a considerable degree, and forming encysted tumours of the size of a garden pea; the cellular tissue is loaded with serosity, and, in some places, there is fibrinous deposit. The arterial capillaries are not much enlarged; but, when the part is dependent, or the circulation much excited, or the return of blood prevented by violent exertion of the lungs, the veins are much enlarged, giving the tumour a more blue and distended appearance. Different parts become affected in succession, and the mass is made up of many growths from the point and sides, of various sizes, separated by fissures, in which the sebaceous secretion, often rancid and offensive, lodges. These swellings, though attached by pretty broad bases, are loose and pendulous." (See *Liston on Pract. Surgery*, p. 237.)

In some instances, the tumour has been known to extend over the mouth and nostrils so much, that the patient could not breathe well, especially during sleep, unless a tin tube was placed in one of the nostrils. If the tumour were not supported with the hand, it also became immersed in any liquid that was brought towards the mouth to be drunk. (See *Hey's Surgery*, ed. 2. p. 565.)

In one of the cases, under this last practitioner, the case appeared to be nothing more than an enlargement of the common integuments of the nose. The bones and cartilages seemed to be in their natural state. For, though the latter were buried in the mass; yet, when the tumour was supported, Mr. Hey could distinctly trace, with his finger, the border of the cartilages. The tumour was divided in the middle; and, at the origin of this cleft, he could discern a small portion of the tip of the nose. The sebaceous crypts were so much enlarged, that some of them would admit the end of a crow's quill. Mr. Hey operated as follows:—having felt, with his finger, the border of the cartilaginous part, which gives the nose its proper figure, he marked out this border upon the inferior surface of the tumour, with a pencil moistened with Indian ink. Then, allowing for the thickness of the cartilage, and a proper covering of adipose membrane, he made his first incision parallel to the line marked out. He next pursued the dissection upwards, aiming at preserving the natural figure of the nose. When

the principal mass had been removed, he reduced the remaining part of the adipous substance to an even surface by means of the tonsil scissors. The hemorrhage, which was considerable, was stopped during the operation by the pressure of the fingers of the assistants. The patient, though a stout man, nearly fainted from the loss of blood; but, after the completion of the operation, the bleeding did not return. The case succeeded perfectly.

I have seen the operation performed in one or two instances by Mr. Liston. The following is the method preferred by him. "An incision should be made through the diseased integument and cellular tissue in the mesial line upon the cartilage of the apex and columna, not however so as quite to reach them. An assistant places his forefinger in one nostril, and the surgeon, seizing the mass with his fingers, or with a small volsellum, proceeds to dissect it off with a scalpel. The incisions must be carried pretty close to the cartilages of the ala, until the one side is cleared, the edge of the opening being well observed, and neither that, nor the cavity encroached upon. The assistant will give warning, if the knife, at any stage of the proceeding, approaches his finger. The surface is trimmed a little, if occasion requires, with a pair of thin slightly curved, or knife-edged scissors. A similar proceeding is observed on the opposite side, and they (the two sides) are to be made as symmetrical as possible. A few vessels may bleed; but the bleeding is easily restrained during the dissection, by placing the small spring forceps (Graefe's) upon their mouths, or they are compressed by the point of the finger. Ligatures are afterwards placed upon them if they still persist in bleeding. Should the ligatures not hold, the cut ends (of the vessel) not being readily drawn out from the condensed tissue, a fine cambric needle may be passed across the bleeding point, and a ligature tied under it, the ends of both the needle and thread being cut off. Any troublesome general oozing may be stopped by plugging the anterior nares, applying a compress of lint, and a double-headed roller. Difficulty and pain are experienced in removing this dressing, and, it is much better, if possible, to apply frequently and assiduously for a few hours, pledgets of lint, moistened with cold water, and after coloured discharge has ceased, to substitute the tepid dressing, and thus encourage suppuration as speedily as possible." The exposed surface having granulated, the zinc lotion may be used. Mr. Liston has removed many of these growths without any untoward accident. In only a single case, a repetition of the operation became necessary after an interval of nine or ten years. A tumour of large size had been removed from the apex of the nose, leaving the integuments of the ala slightly thickened. These afterwards increased so as to form a bulky swelling on each side of the apex (See *Liston's Practical Surgery*, p. 240.)

See also Civadier, in *Mém. de l'Acad. de Chir.* t. iii. p. 511. Imbert Delonnes, *New Progress of Surgery in France*; translated by T. Chavernac. 4to. Lond. 1801.

NOSE, HEMORRHAGE FROM. EPISTAXIS. In consequence of the bleeding being sometimes profuse, and incapable of being stopped by other means, it becomes necessary to plug up the nostril and corresponding posterior opening of the nasal fossa. A loop of wire, or a bougie, may be intro-

duced along the floor of the nostril from before, backwards; and when it reaches the pharynx, it may be taken hold of with a pair of forceps, and brought forwards in the mouth, so as to allow a strong ligature to be attached to it, which is next drawn into the nasal fossa, and out of the nostril, by means of the wire, or bougie. This now becomes useless, and may be cut off. To the middle of the ligature, a dossil of lint is fastened, and the ligature being then drawn more out of the nostril, fixes the lint in the posterior aperture of the nares. The nostril itself is then to be closed with a plug of lint. The dossil of lint may easily be removed from the posterior opening, when no longer required, by displacing it with a probe introduced through the nostril, and the aid of the portion of the ligature in the mouth. This part of the ligature should be kept against the roof of the mouth, by fastening it to the upper lip with a piece of adhesive plaster. A still more simple mode is to use a loop of cutgut, which will pass to the back of the fauces as readily as wire, or a bougie, and one portion of it being then drawn forwards out of the mouth, will serve for the conveyance of the plug of lint to the posterior opening of the nasal fossa.

Nose, Operation for the Restoration of. The Tagliacotian method, which consisted in employing a portion of the integuments of the forearm for the purpose, is now superseded by the oriental plan, in which the cicatrized remains of the former nose are converted into fresh-cut surfaces, and a flap of skin, duly shaped, is twisted, and brought down from the forehead, so as to admit of being united to them. This is the *rhinoplastic* art, as it is termed, from *ῥίς*, the nose, and *πλάττειν*, to form, which has been practised in India time immemorial, and for many centuries in Italy, where cutting off the nose was a common punishment for certain offences, even as long ago as the period of the ancient Romans. The following is the mode adopted by Mr. Liston:—"A piece of soft leather, cut to the shape and size of the integument, required to replace the apex and ala, is placed flat upon the forehead. To secure accuracy in the line of incision, its boundaries are marked on the skin with ink, in case the patient prove unsteady. The flap being thus defined, is dissected down, and kept of uniform thickness, till near the lower angle, when the incisions should be carried deeply, so as to insure an abundant vascular supply. Care should be taken, however, to avoid the periosteum, for otherwise exfoliation may follow, which would increase the scar, and render the cure tedious. This narrow part of the flap, or attachment at the root of the nose, must be of some length, to allow of its being twisted, so as to bring the integument to the exterior, when the part is adapted to its new situation; and to facilitate this, a knife should be carried a little lower down on that side on which it is intended to make the turn. After the bleeding has ceased, the flap is retained in apposition with the raw edges of the truncated organ, by points of suture. A little oiled lint is placed in the nostrils to support the flap, but no other dressing should be applied. The surgeon should be in no hurry to fix the flap; for union is most likely to occur when bleeding has ceased, and the edges of the wounds have begun to assume the glazed appearance, which precedes

secretion. The lower part of the wound in the forehead is brought together by suture. To the rest, lint moistened with warm water, and covered with oiled silk, is applied, the lint being rewetted from time to time. As for the nose itself, the lint may be removed in three or four days, and then too perhaps some of the stitches may be dispensed with. The flap will be found adherent, yet moveable with the breath. During the cure, contraction of the nostrils is prevented with tubes. When the nose is firmly consolidated, and a collateral circulation has been established, so as to become independent of the supply of blood through the twisted attachment, this is to be divided with a bistoury, so as to remove a wedge-like portion, and let the front of it be laid down smoothly over the root of the nose. With respect to the columna, the practice in India was to obtain this by taking a slip from the forehead, along with the rest of the flap; but Mr. Liston has found it much better first to form the main portion of the nose, as already described; and, after this has become consolidated, to raise a columna from the upper lip. The inner surface of the apex is first pared. A sharp-pointed bistoury is then passed through the upper lip, previously stretched and raised by an assistant, close to the remains of the former columna. The incision is continued down to the free margin of the lip; and a similar one, parallel to the former, is made on the opposite side of the central line, so as to make a flap about a quarter of an inch in breadth. The frænulum is then divided, and the prolabium of the flap removed. The new columna is then fixed in its proper place with a sewing needle, which after its head has been covered with sealing-wax, to facilitate its introduction, is passed from without through the apex of the nose, and obliquely through the extremity of the elevated flap. Then a few turns of thread suffice to keep the fresh-cut surfaces in contact. Twisting the flap is here unnecessary. Lastly, the edges of the wound in the lip are to be brought together with the twisted suture. (See HARELIP and Liston's *Practical Surgery*, p. 213.)

This article might be extended, but want of room compels me to conclude, with referring to the following works,—

Crisus de Re Medica, lib. vii. cap. ix. *Manzano*, *Annales* Mundii, 1442. *J. G. Tagliacotii*, de cunctorum *Chirurgia per Incisionem*, Venetiis, fol. 157r. Nova Ed. curâ M. Proschel, 8vo. fig. Berlin, 1831. *J. Th. Rendley* and *J. Crusio*, the Cruseman's Mag. 1794. *J. C. Carpus*, an account of two successful operations for restoring a lost Nose, 8vo. Lond. 1816. *C. F. Graefe*, de Rhinoplastice, 4to. Berlin, 1818. *Delpech*, in *Chir. Clin. de Montpellier*, t. ii. 1826. *Dieffenbach*, *Chir. Erfahrungen*, &c. 8vo. Berlin, 1829-30. *A. A. Falgout*, *Méd. Opératoire*, t. ii. 8vo. Paris, 1830. *J. Littré*, sur la Rhinoplastie, in *Mém. de l'Acad. de Med.* t. ii. 1832. *R. Liston* on *Practical Surgery*, 8vo. Lond. 1837.

Nose, *Polypi* of. (See *POLYPI*.)

NYCTALOPIA. (from νύξ, night; and ὤψ, the eye; or ἴσσω, to see.) *Visus nocturnus*, or day-blindness, vulgarly called owl-sight, is an affection, in which the patient either cannot see at all, or sees but very feebly, objects which are in the open day-light, or situations where there is a strong light; but discerns them very well, when they are in a darkish place, or at sunset, or in the night-time, if not immoderately dark. (See *Lamarc*, *Pathologie Chir.* t. ii. p. 539. 504.)

According to Dr. Hillary, there are persons in Siam, in the East Indies, and also in Africa, who

are all of this cat-eyed species, or subject to the disease of being blind in the day-time, and seeing well by night. (*Med. Univ. Hist.* vol. vii.) The same author notices the general rarity of the disorder, and mentions his having met with but two examples of it.

Dr. Pye mentions an intermittent or periodical nyctalopia, which begins regularly in the morning, and goes off in the evening, the patient continuing blind, whether he keep himself in a dark or a light place. The cause of these instances, which, he observes, are very uncommon, is generally seated in the primæ viæ, and requires emetics, resolvents, purgatives, and bark. (See *Lassus*, *Pathologie Chir.* t. ii. p. 540—542. And *Richter Anfangsgr. der Wundarzn.* b. ii. p. 481.) Ramazzini frequently observed amongst the country people in Italy, and especially boys about ten years of age, in March, a great weakness of sight. Through the whole day, they saw little or nothing, but when night came on, they saw distinctly. The disorder ceased of itself by the middle of April. The pupils were noticed to be much enlarged. (*De Morb. Artificum*, cap. xxxviii. Lond. 1718.)

As Dr. Mackenzie has remarked, scrofulous intolerance of light, the photophobia of the albino, or that of a person long shut up in the dark, and suddenly brought out into the glare of the day, must not be confounded with this species of periodical amaurosis. Day-blindness is mentioned as a symptom both of mydriasis and myosis. In the former disease, the pupil admits too much light to enable the patient to see till after sunset. In the latter, the contraction of the pupil is supposed to relax in the obscurity of the night, and thus vision to be improved. On the same principle, the patient, who has an incipient cataract, sees little during the brightness of the day, but finds his sight in part restored by the dilatation of the pupil in the evening. (See *Mackenzie on Dis. of the Eye*, p. 886. ed. 2.) An instance, supposed to be syphilitic, and cured by mercury, is related by Mr. Isbell. (See *Edinb. Med. and Surg. Journ.* vol. ix. p. 260. 8vo. 1813.)

In an example, following scrofulous ophthalmia, and where blisters, tonics, opiates, belladonna, &c. had failed in diminishing the sensibility of the retina, M. Vassal constructed two cones of pasteboard, two inches and a half in length, and painted black internally. He fitted to one extremity of each cone a blue glass, and applied the other extremity on each eyelid, so that the borders of the cone penetrated into the entrance of the orbit. A curtain of black taffeta applied to this extremity, prevented the rays of light from reaching the eye otherwise than through the cone. From the third day of the use of this apparatus, the child could distinguish objects at the distance of three or four feet. Every week, the length of the cones was lessened, and, in three months, the child, with the protection of blue spectacles, could bear the light; and these she continued the use of for a year. (See *Archives de Med.* Fevr. 1832.)

In 1787, Baron Larrey met with a case of day-blindness in an old man, one of the galley-slaves at Brest, who had been shut up incessantly for thirty-three years in a subterranean dungeon. His long residence in darkness had had such an effect on the organs of vision, that he could only see in the dark, and was completely blind in the

day-time. (See *Mém. de Chir. Militaire*, t. i. p. 6.)

Nyctopia may sometimes depend on a peculiarity in the organisation of the eye; by reason of which, the quantity of light, which only suffices for vision in an eye of natural formation, proves too abundant for a nyctalops, and absolutely prevents him from seeing at all. We know, that, in the eye, there is a black substance, named the *pigmentum nigrum*; one supposed use of which is to absorb the redundant rays of light, which enter the pupil. A deficiency of it may explain some forms of nyctopia.

CEDEMA. (from *αἰδω*, to swell.) A swelling, arising from the effusion of a serous fluid in the cellular tissue; the affection, when more extensive, and accompanied with a general dropsical tendency, receiving the name of *anasarca*. An oedematous part is usually cold, and of a pale colour; and, as it is little, or not at all elastic, it *pits*, as surgeons express themselves, or, in other words, it retains, for some time, the impression of the finger, after being handled or pressed. Oedematous and anasarcaous swellings are often connected with constitutional causes, or visceral diseases, and especially with circumstances causing obstruction to the free passage of blood through the heart. The fluid is disposed to gravitate to the lowest situations, and it is enabled to do so by reason of the free communications in the cells of the cellular tissue. In many cases, however, they seem to be entirely local affections, arising from such causes as only act upon the parts, in which the disease is situated. Thus we observe, that after violent sprains of the wrist, or ankle-joint, the hands and feet often become oedematous: and limbs are frequently affected with oedema, in consequence of the return of blood through the veins being obstructed by the pressure of tumours on them, or that of splints, bandages, &c. Pregnant women are known to be particularly subject to oedema of the legs, owing to the pressure of the gravid uterus on the iliac veins. Persons who have been confined in bed, with fractured thighs, or legs, generally have more or less oedema in their feet and ankles, on first getting up again; and the affection in these cases is probably dependent on loss of tone in the vessels of the limb.

In the treatment of oedema, great attention must always be paid to the nature of the cause, in order to determine whether the disease originate from a mere local, or a general constitutional affection. When it depends on the pressure of a tumour on the veins, as we often see happen in cases of aneurisms, the effect cannot be got rid of till the cause is removed; and the aneurismal swelling must be lessened, before the oedematous one can admit of the same beneficial change. When oedema is the effect of vascular weakness in a limb, in consequence of sprains, contusions, &c., the best means of relief is, to support the parts affected, with a laced stocking, or a flannel roller, while they are also to be rubbed with liniments, and bathed with cold spring water, till they have perfectly recovered their tone.

With regard to the oedema, attendant on the advanced stage of pregnancy, a complete cure cannot be expected till after delivery. The affection is generally more considerable in the afternoon than the morning, owing to the different

effects of an erect and a recumbent position. Some relief may be obtained by the patient keeping as much as possible in a horizontal posture; and, when great inconvenience and pain are felt, the parts may be fomented with any aromatic or spirituous application.

Frequently, oedema is one of the symptoms of deeply seated suppuration.

There is a species of oedema, accompanied with a degree of heat, pain, &c. in the part, and which seems combined with phlegmon. In this case, fomentations, leeches, and saline purgatives, are proper.

ŒSOPHAGOTOMY. (from *œsophagus* and *τέμνω*, to cut.) The operation of cutting into the œsophagus, in order to take out of it any foreign body which lodges in it, and can neither be extracted through the mouth, nor pushed down into the stomach, though its removal is absolutely necessary for the preservation of the patient's life. A substance, above a certain size, lodged in the upper part of the œsophagus, not only obstructs deglutition, but by its pressure against the trachea, produces the most urgent symptoms of suffocation. In this circumstance, if relief cannot be expeditiously afforded in any other manner, and the situation of the foreign body is denoted by a prominence distinguishable in the neck, or it can be felt with the finger, or an instrument, œsophagotomy should be practised without delay. However, when the symptoms are pressing, yet unattended with any possibility of feeling the foreign body, either externally, or with the finger or an instrument, desperate as the situation of the patient may be, modern surgeons do not sanction the practice. And this difference from the opinion of the first proposers of œsophagotomy, does not arise so much from any reflections upon the greater difficulty of the operation in this circumstance, as from the consideration of its being unlikely to answer the only purpose, which makes its performance at any time proper, viz. that of enabling the practitioner to extract with reasonable certainty the substance, whose continuance and pressure in the œsophagus are the immediate cause of the patient's danger. Hence, when the symptoms of suffocation are extremely urgent, but the foreign body produces no external prominence in the neck, the surgeon should in the first instance perform tracheotomy, so as to obviate the imminent peril arising from the impeded state of respiration, and afterwards try such measures for the removal of the substance lodged in the œsophagus, as experience points out as most likely to prove successful. Though œsophagotomy was cursorily mentioned by Verduc in his "*Pathologie Chirurgicale*," Guattani, formerly a distinguished surgeon at Rome, published the first valuable observations on the subject. (*Mém. de l'Acad. de Chir.* t. iii. 4to.) He proved by experiments, that the operation might be safely performed upon dogs, which recovered after it very well, and he demonstrated on the dead body, that it was equally practicable on the human subject. Nay, what is still more to the point, he brought forward two instances, in which the practice had been successfully adopted on living patients. "In May, 1738, Goursauld, a surgeon at Coussat-Bonneval, in Limousin, was called to a man, in whose œsophagus a bone was lodged, an inch long and half an inch broad. Various ineffectual endeavours

had been made to force it down into the stomach, and, as it was perceptible on the left side of the neck, Goursauld made an incision for its extraction. The bone was thus easily taken out, no bad symptoms followed, and the wound soon healed. For six days the patient was not allowed to swallow any kind of food, but nourished entirely with clysters. According to Morand, a similar operation was performed, with equal success, by Roland." (*Mém. de l'Acad. de Chir.* t. iii.)

Although the deep situation of the œsophagus amongst the most important parts in the neck, makes œsophagotomy an operation of considerable delicacy in the hands even of a skilful surgeon, and one of great danger in those of a man, deficient in anatomical knowledge, and ignorant of the right way of proceeding, yet the necessity of performing it, under the circumstances, which have been specified, is universally admitted. When, however, I refer to the delicacy and difficulty of the operation, I am meaning a case, in which a deliberate dissection is made down to the œsophagus, without any guidance from the projection of the foreign body within it. With respect to opening the œsophagus, for the purpose of tracing a substance in it, not externally perceptible, and either of taking hold of the same substance with forceps, or pushing it down into the stomach with other instruments, introduced through the incision, as suggested by Guattani, Boyer deems the chances of success too small to justify the practice. Under these circumstances, however, the surgeon must not be deterred by any consideration either of the increased difficulty of cutting into the œsophagus, or of the local consequences of such an incision, after it has been accomplished; because, if the projection of the œsophagus be deemed essential for the performance of the incision with safety, the means are possessed of producing this artificially. (See *Arnott's Case*, in *Med. Chir. Trans.* vol. xviii. p. 94.) The practicable nature of the operation, and the tendency of wounds of the œsophagus to heal favourably, when not complicated with other mischief of too serious a description, are facts proved beyond all dispute. In attempts at suicide and murder, and in cases of gunshot injury, the œsophagus is sometimes wounded, together with other parts in the neck, and yet the patients frequently recover; and, when they die, their fate seems to depend rather upon other unfavourable circumstances in their cases, than upon the accidental injury of the gullet. Cures of wounds, involving the latter tube, as well as the trachea, are reported by numerous writers, B. Bell, Desault, Bohnius, &c. and several have fallen under my own observation. If it were necessary to substantiate this point further, I might cite the instance, recorded on the authority of Dr. James Johnson, where a man recovered after the larynx had been completely severed between the thyroid and cricoid cartilages, and one half of the calibre of the œsophagus divided. (See *Hennen's Military Surgery*, p. 364. ed. 2.) But, supposing a wound of the œsophagus, abstractedly considered, were more dangerous, than it really is, the question of the propriety of œsophagotomy would not be materially affected by it, because the operation is never recommended, except as a matter of necessity, and without which the patient would have no chance of preservation.

On the 22d of Dec. 1832, Mr. Arnott was sent for to see a boy two years and a quarter old, who, six days previously, had attempted to swallow a piece of mutton bone, and had since been unable to get any thing down into the stomach but liquids. In other respects, the child seemed then to suffer but little. "On introducing the finger to the utmost extent, deep below the entrance of the glottis, and on the right side, a piece of bone could just be touched projecting upwards. I endeavoured (says Mr. Arnott) to unfix it; but, it was too low. Gullet forceps and Weiss's urethra forceps were tried; but could not be applied so as to seize it. A hook attached to a piece of whalebone, and another of strong wire, were ineffectually endeavoured to be passed beyond it." An emetic was given, and attempts made to press the foreign body down, but all in vain. For a fortnight, no additional suffering was experienced; but emaciation took place, and the bone could be felt in its former situation. At length, œsophagotomy was performed on the 21st of January, 1833, nearly four weeks after the accident. For a few days preceding that date, the breathing had become occasionally oppressed, and more especially at night. The bone formed no prominence, and could not be discovered externally. On examining internally with the finger, however, Mr. Arnott could feel it; and, as it seemed to be fixed at the termination of the pharynx, or commencement of the œsophagus, he determined to cut into the tube, immediately behind the lower part of the cricoid cartilage. The child having been laid on its back upon a pillow, and the head turned a little to the left, an incision was made on the right side of the neck, in the depression between the sterno-mastoid muscle on the outer, and the larynx and trachea on the inner, side. It was commenced opposite to the upper part of the thyroid cartilage, and carried downwards about an inch and three quarters in length. Two vessels, which bled, were now tied. The omohyoideus was drawn to the inner side of the wound; and, with the edge of the knife directed away from the carotid, the outer part of the sterno-thyroid muscle was exposed. The further separation of the parts was accomplished with the handle of the scalpel, and the fingers. Two vessels, which could not be drawn aside, and which passed to the thyroid gland, now had ligatures put on them by way of precaution. By means of a blunt hook, the gland was drawn inwards, and the larynx turned a little round on its axis; but the finger applied behind this could not yet perceive the bone. A male silver catheter was now introduced by the mouth, and its point made to project through the wound, carrying the dilatable gullet upon it. Into this a small incision was made, and a pair of polypus forceps being inserted, the blades were expanded, and the wound easily dilated in a perpendicular direction, so as to admit the finger. With this the bone was felt about half an inch lower down than the aperture, and taken out with the forceps. It proved to be the spinous process of one of the lower dorsal vertebræ of a sheep. For some hours after the operation, the breathing was somewhat interrupted by mucus collecting in the throat; but, after this, a good night was passed. The child had been fed by means of an elastic gum catheter, passed through the mouth; but, on the following morning, some

difficulty was experienced in passing it, and it was therefore introduced through the wound, which method was continued. In the course of the second night, the breathing became laborious; and the child died 56 hours after the operation, as the dissection showed, with manifest effects of inflammation about the lungs. (Arnott, in *Med. Chir. Trans.* vol. xviii. p. 86.)

As the œsophagus does not descend exactly in a straight line, between the trachea and vertebræ, but inclines rather to the left side of the spine, Guattani directs the left side of the neck to be preferred for the performance of œsophagotomy. But, as the operation will rarely be attempted, unless there be a projection of the foreign body, or it can be felt by the finger, the right place for the incision will usually be determined by the known place of the extraneous substance, the left side being chosen only when the foreign body is either most distinguishable there, or not less than on the opposite side of the neck. (See Boyer, *Mal. Chir.* t. vii. p. 192.)

On the outer side of the trachea, its muscles, and the thyroid gland, there is on each side of the neck a triangular space, the apex of which is downwards, and which is bounded externally by the sterno-mastoid muscle. In the area of this triangle, we find the skin, and superficial fascia, the platysma myoides, some cellular tissue, the layers of the cervical fascia, between which the omohyoideus plays, and lastly, the sheath enclosing the carotid artery and the jugular vein. If this sheath be drawn away from the trachea, we approach the organs situated in front of the bodies of the cervical vertebræ, and in tracing the parts from without inwards, we meet with the œsophagus, which is the first and only muscular texture that will present itself. No vessels, nor nerves of importance need be injured. But, the wound must not descend nearer to the sternum than one or two finger-breadths, lest the inferior thyroid artery be cut; nor be carried up above the hyoid bone, not only because the laryngeal nerve, and the lingual and superior thyroid arteries might be wounded, but because we should thus get to the pharynx, in which the foreign body is not lodged. (See Malgaigne, *Manuel de Méd. Opér.* p. 497. ed. 2.)

Guattani, who preferred the left side of the neck, recommended the following mode of operating. The patient is to sit on a chair, with his head inclined backward, and steadily supported by an assistant. The skin having been pinched up into a transverse fold, an incision is to be made in the integuments from the upper part of the sternum. The cellular tissue, between the sterno-hyoid and sterno-thyroid muscles and trachea, is next to be divided. With two blunt hooks, the lips of the wound are to be kept open; and, on separating the cellular tissue at the side of the trachea with the aid of the finger and a few strokes of the knife, the œsophagus will be seen. The lower part of this tube is then to be opened, and the wound in it enlarged with a pair of curved blunt-pointed scissors, a director being employed, if any difficulty arise. With a small pair of curved forceps, similar to those used for the extraction of polypi, the foreign body may then be removed. According to Guattani, the wound will serve for the extraction of the foreign body, whether this be situated above, or below it, and he asserts, that

the opening will even be useful, when the extraneous substance has passed so far down, that it cannot be taken out, because it may now be easily pushed into the stomach. Guattani lays great stress on the usefulness of endeavouring to unite the wound, and adverts to his experiments, proving that, in animals, wounds of the œsophagus heal very favourably. If, says he, the vein, which brings back the blood from the inferior parts of the thyroid gland, and runs into the subclavian, happen to be cut, the hemorrhage may be stopped with a dossil of lint held upon the aperture in the vein during the operation, and afterwards if the bleeding continue, compression, or a ligature, is to be employed. The recurrent nerve, if likely to be touched with the knife, is to be cautiously drawn aside with a blunt tenaculum. (See *Mém. de l'Acad. Chir.* t. iii. 4to.)

However good Guattani's directions for finding the œsophagus may be, he falls into the error of representing the place for the incision as being always the same, whereas it ought to be partly regulated by the situation of the foreign body itself. However, his advice to make the incisions close to the trachea appears to me more judicious, than that more recently delivered by Boyer, who directs them to be made through the cellular substance between the sterno-hyoid and sterno-thyroid muscles, and the omohyoideus (see *Mal. Chir.* t. vii. p. 193. 8vo. Paris, 1821), in which method he quits the trachea, which is the best guide to the œsophagus, and approaches unnecessarily the large blood-vessels of the neck. Mr. Arnott's case proves, that œsophagotomy is very practicable, even when the situation of the foreign body is not indicated by any prominence in the neck; yet the certainty of its lodgment ought to exist, and be confirmed by manual or instrumental examination, before the operation is thought of. Boyer cautions the operator to let the incisions always be made in such a manner, as to leave unhurt the trachea and recurrent nerve at the inner edge of the wound; the carotid and internal jugular vein at its outer edge; the superior thyroid vessels above; and the inferior ones below. With this view, the cellular tissue is to be slowly divided layer by layer, and the blood absorbed with a sponge; but, if any vessel bleed freely, it is to be immediately tied.

M. Malgaigne recommends the incision through the integuments to be made parallel to the trachea, in the depression between it and the sterno-mastoid muscle, and within the limits already specified. The platysma, cellular tissue, and cervical fascia, having been divided, and the space between the carotid and trachea, reached, the omohyoideus is to be drawn outwards. In this stage of the operation, the assistant, with his fingers, or a blunt hook, is to draw inwards the trachea and parts connected with it, while the surgeon, with the middle and ring-finger of his left hand, deeply passed into the wound, covers and protects the great vessels and nerves. (See *Man. de Méd. Opér.* p. 498. ed. 2.)

After the operation, a gum-catheter should be passed from one of the nostrils down the pharynx and œsophagus, by which means, the requisite food and medicines may be injected into the stomach, without any risk of their passing through the incision, and retarding the cure.

In Graefe and Walter's *Journ.* (b. v. p. 712.),

Vacca-Berlinghieri has described an instrument, with which he conceives that this operation may be more easily and safely done, than in any other manner. It is passed into the œsophagus as far as the lower angle of the external incision, and then by means of an olive-shaped knob, which is moved by a spring, the parietes of the œsophagus are made to protrude at the wound.

Mr. Arnott is of opinion, that the difficulties of œsophagotomy have been much exaggerated. At all events, they are obviated by the method just now adverted to, or that first suggested, by M. Giraud (see *Malgaigne, Op. cit.* p. 497.), which consists in introducing a silver catheter into the œsophagus, and making a part of the canal project on the beak of the instrument. The same plan was pursued by Mr. Arnott. It seems to this gentleman, that the œsophagus will generally require to be opened at its commencement; and, in his case, the incision into it was one half below the cricoid cartilage, and one half above it. The superior thyroid artery was too high to be injured; and the inferior thyroid artery and recurrent nerve were below, and on the inner side of the wound.

ŒSOPHAGUS, Foreign Bodies in the. There are few situations, in which foreign bodies lodge more frequently, than in the œsophagus; a fact, explicable by the consideration of the function of this tube, the nearness of part of which to the windpipe at the same time accounts for the frequent danger of suffocation, when a substance, above a certain size, is lodged in it. The lodgment often takes place at the lower part of the pharynx, or beginning of the œsophagus, and sometimes just above the diaphragm; but very rarely in the intervening portion of that canal.

Dr. Bond, of Philadelphia, differs from Sir Charles Bell and Dr. Dorsey, in believing, that, in these cases, the interruption of breathing is not caused by any spasmodic contraction of the glottis, induced by the irritation of the foreign body. The doctrine, he admits, may be true, so far as foreign bodies in the trachea are concerned; but, in relation to the pharynx and œsophagus, it is not confirmed by his observation, or the cases on record. In all, or nearly all these instances, where immediate suffocation took place, the foreign body was of sufficient magnitude to produce a mechanical stoppage of respiration; being impacted between the horns of the hyoid bone and those of the thyroid cartilage.

Foreign bodies, liable to lodge in the œsophagus, are not only articles of food, such as pieces of crust, or meat imperfectly chewed, the yolk of an egg, boiled very hard, and not masticated, a chestnut, or small apple, &c.; but also various substances, which are accidentally swallowed either alone, or together with the food, such as pieces of bone, stones, pins, needles, buttons, pieces of money, knives, forks, scissors, spoons, keys, &c. These latter articles, by lodging in the pharynx, or œsophagus, may occasion very bad and fatal symptoms, and, if forced down into the stomach, may produce effects of a not less serious description. Hence, an immediate attempt should always be made to extract them. For this purpose, the fingers may be employed, and, if they will not reach far enough, a pair of long moderately curved forceps should be used. But, no instrument seems better calculated for cases, in

which the body lodged in the œsophagus is not too broad, than the urethra-forceps, invented by Mr. Weiss, of the Strand, and used by Sir A. Cooper for the removal of calculi, under a certain size, from the bladder. (See *Med. Chir. Trans.* vol. xi.) As Dr. Bond, of Philadelphia, observes however, it may not be superior to Desault's modification of Hunter's forceps; and it should be less curved than for the urethra, because otherwise, as Dr. Bond explains, the point would press so hard against the anterior part of the œsophagus, that there would be little chance of its seizing the foreign body, and every probability of its laying hold of a fold of the canal. Instead of this and other contrivances, Dr. Bond generally prefers a pair of long-handled forceps of his own invention, and which appear to me to be excellently constructed for the purpose. They have such a curve, that, when the head is held back, they may be passed down to the œsophagus to any depth, or even into the stomach. The blades admit of being opened, or closed, without pinching or otherwise injuring the contiguous soft parts, the edges being ground away, and the joint covered by a sheath of elastic gum. Another advantage is, that by means of the narrow line of rough surface, by which the blades come in contact, they are well calculated to hold securely a pin, needle, fish-bone, &c. Nooses of wire, and bunches of thread with a multitude of nooses, fastened upon the end of a probang, and a piece of sponge, fixed on the extremity of the same instrument, or on that of the strong wire stilet of a long elastic gum catheter, and various other contrivances, have been made for the purpose of extracting different articles from the œsophagus. The bunch of thread seems well calculated for catching hold of small substances, like fish-bones, needles, &c.; and the sponge, when expanded with moisture and withdrawn, will sometimes bring up articles, which, on its introduction, it had passed in its dry and diminished state. When the stomach is full, the excitement of vomiting has sometimes answered; but, if the foreign body be sharp and pointed, the method is not free from danger, and, instead of relieving the patient, may put him to great pain, and bring on violent inflammation of the passage, and the most distressing symptoms.

According to Dr. Bond, pins can seldom be removed by means of emetics. He has repeatedly tried them, and never with success; but he once removed part of the clavicle of a chicken, by exhibiting sulphate of zinc. "The above remarks (says Dr. Bond) will apply to a needle, except for the circumstance, that the two ends of it, especially if it be small, may fix in opposite sides of the canal. In such a case, an emetic will cause the body to be more firmly fixed; but, if the needle be long and large, we need not dread this accident, for it will remain nearly parallel with the course of the canal. An irregular rough fragment of bone would perhaps never be removed by the mere inverted action of the œsophagus; but, it might sometimes be forced up by vomiting, if this should be induced soon after swallowing a considerable quantity of solid food. The success, attending the use of vomits for the removal of coins from the œsophagus, is not such, so far as I can learn, as to encourage a resort to them. A case occurred within a few days in this city

(Philadelphia) where vomits were repeatedly tried without success in the case of a child, who had swallowed a half-cent. After a coin has been in the œsophagus some time, the part where it lodges, has, from continued distention, lost its contractility. The parts above and below contract, perhaps, the more on account of the neighbouring irritation; a sort of pouch, or sinus, is formed for the foreign body; and, as the natural position of the coin would be vertical, there would be space enough for the contents of the stomach to pass up, without dislodging the coin.

"Two cases are quoted in the *Dict. des Sciences Med.* t. vii. p. 21, 22., in which persons, at the very point of suffocation from the lodgment of large pieces of tough meat in the pharynx, were relieved by injecting a solution of tartarized antimony into a vein in the arm. In Dorsey's Surgery, two cases are noticed, in which Dr. Physick removed peach-stones from the pharynx by directing the patients to take a solution of tartarized antimony in the mouth, and to attempt to swallow it. These, and other similar cases, show, that it would be very unwise to discard emetics from among the means of treating such accidents.

"Another means of relief deserves to be noticed, as it has succeeded in cases where other means failed. As Professor Richard W. Hall, of Baltimore, is the only writer by whom I find it mentioned, I will present it in his own words. It is contained in a note to his translation of *Larrey's Memoirs of Military Surgery*, vol. i. p. 143. When a small bone is lodged in the fauces, or œsophagus, it may be decomposed, or rendered so flexible, that it will pass into the stomach, by the patient frequently taking diluted mineral acids. They should be taken through a tube, to prevent their action on the teeth. The strength of the acid should be accommodated to the sensibility of the parts, over which it must pass. By this means (observes Dr. Hall) I have succeeded in removing a small chicken-bone from the œsophagus, across which it had remained firmly fixed for several hours, although an emetic had been administered, and the curved forceps and probang had been repeatedly used without success." Even the acetic, or acetous acid, will convert fish-bones into a pliant and gelatinous substance. Dr. Bond's paper, read to the Philadelphia College of Physicians in 1828, seems to me a most valuable document, and I feel obliged to him for his kindness in presenting it to me.

When the substances are not of a very hurtful kind, and cannot be extracted, they must be pushed down into the stomach with a whalebone probang, fifteen or sixteen inches long, and to the end of which a piece of fine sponge is securely fastened. But such practice is not advisable, when the foreign bodies have a sharp, pointed form, so as to be likely to prove a source of at least equal danger and suffering, if placed in contact with the inner surface of the stomach. Experience proves, however, that hard, angular substances, and pointed bodies, like nails, pins, needles, &c. which surgeons have not ventured, or not been able, to force down into the stomach, have often made their way, after a time, to the surface of the body, where an abscess has formed, out of which they have been discharged.

When hard, irritating bodies have either passed of themselves, or been pushed with a probang

into the stomach, their ill effects should be counteracted, and their passage through the bowels promoted, with mucilaginous draughts, containing the oleum amygdalarum, or oleum ricini. When the substances, lodged in the œsophagus, can neither be extracted, nor pushed down into the stomach, if respiration be not dangerously obstructed, and liquids can yet be swallowed, the wisest plan is to avoid irritating the passage with the further use of instruments, and leave the case to nature, that is to say, so far as manual interference is concerned; for bleeding, and mucilaginous oily draughts, may be useful. But, when the lodgment of a foreign body in the œsophagus dangerously obstructs respiration, and the substance itself cannot be felt externally, the patient would perish, if some means of facilitating the breathing were not immediately adopted; and, under these circumstances, perhaps, the most prudent plan would be to make an opening in the trachea. (See BRONCHOTOMY.) The subsequent treatment, with reference to the foreign body itself, might be determined by circumstances.

In this part of surgery, one fact deserves to be particularly remembered, which is, that after a sharp, hard substance has been either ejected, or propelled into the stomach by nature, or art, the same painful sensations in the throat frequently continue a certain time afterwards, which were experienced while the foreign body was actually lodged in the passage. These sensations, however, are entirely owing to the manner in which the œsophagus has been irritated, and, consequently, would be seriously aggravated by the further unnecessary introduction of probangs, and other instruments.

There may be cases, in which the patient would lose his life by suffocation, if a foreign body of considerable size were not taken out of the œsophagus, so as to remove the compression of the trachea. Here, if it could neither be extracted, nor pushed into the stomach by common means, an operation would be necessary for its removal. (See ESOPHAGOTOMY.)

A foreign body, not large enough to cause danger of suffocation by pressure on the trachea, may yet bring on fatal symptoms, as is exemplified in a case, which fell under the notice of Guattani. As a man was throwing up a boiled chestnut in the air, and catching it in his mouth, it passed down his throat, and he was immediately seized with a difficulty of swallowing, and sent to the hospital. However, as he breathed and spoke with facility, and had vomited since the accident, which happened when he was tipsy, the story of his having swallowed the chestnut was disbelieved. His symptoms grew worse, and he died on the 19th day. Guattani made an incision in the left side of the neck, below the larynx and thyroid gland, which was considerably swelled, and soon came to a large abscess, formed around the portion of the œsophagus, enclosing the chestnut.

When the extraneous body is sharp and pointed, so as to stick in the mucous membrane of the passage, and it cannot be removed, nature will sometimes expel it herself, without any dangerous symptoms being the consequence. The foreign body is gradually loosened by ulceration, and is then either ejected by vomiting, or descends into the stomach, whence it is voided either through the bowels with the feces, or, as is more common,

by making its way through some part of the alimentary canal, and approaching the surface of the body, where an abscess forms, out of which it is discharged. In other instances, foreign bodies, like pins and needles, which cannot be removed, pierce the cesophagus itself, gradually pass completely out of this canal, and afterwards travel to remote parts of the body, without exciting much inconvenience, until, perhaps, at the end of some years, they come near the surface of the body, in a very remote situation from the throat; and an abscess is produced, in which they are unexpectedly found. However, this transport of sharp-pointed substances from one part of the body to another, which is effected by a process, in which the absorbents have a principal share in the work, is not conducted in every instance with so little disturbance, and, when foreign bodies of this description come into contact with particular organs, symptoms of a dangerous and fatal kind may be excited.

The great art of passing any instrument down the cesophagus, for surgical purposes, consists in extending the head back, so as to make the axis of the whole passage, from the mouth to the stomach, approximate as nearly to a straight line as is practicable; and in then putting the extremity of the instrument at once directly against the posterior part of the pharynx, and keeping it closely against the vertebrae so as to avoid touching the epiglottis. The knowledge of this circumstance will be found extremely useful in passing probangs and bougies. When gum-catheters are intended to be left in the passage, they are introduced down the pharynx from one of the nostrils, and, being secured, they serve for the conveyance of liquid food and medicines into the stomach with great advantage, either where the patient cannot swallow at all, or where the disturbance of swallowing would be attended with considerable harm. When, however, the plan is not to leave the instruments introduced, they may be passed through the mouth.

CESOPHAGUS, Strictures, and other Diseases of the. Properly speaking, a difficulty, or impossibility, of swallowing, should not be regarded as a disease itself; but only as a symptom of different affections, to which the organs of deglutition are liable, or of other diseases in the vicinity of the pharynx and cesophagus. The object of the present article is not the consideration of all the diseases, which may produce dysphagia, as a symptom, but chiefly to notice this effect, as depending upon spasm, paralysis, or some morbid change of structure affecting the pharynx or cesophagus.

Spasmodic dysphagia, as Barro Boyer has remarked, principally occurs in nervous individuals, hysterical females, and hypochondriacal men. It is sometimes an attendant on fevers; it is declared to be constant in hydrophobia, and epilepsy, and occasionally present in particular forms of mania. (*Traité des Mal. Chir.* t. vii. p. 151.) However, with respect to hydrophobia, the foregoing assertion should be received with some qualification, for reasons detailed in another part of this work. (See *HYDROPHOBIA*.) Spasmodic dysphagia is sometimes a consequence of taking cold drink, after a violent fit of anger; strong impressions upon the imagination; worms in the stomach, &c.

When the spasm is situated in the pharynx and upper part of the cesophagus, and is considerable,

neither solids nor liquids can be swallowed, and the patient has great pain and a sense of constriction in his throat. When he tries to swallow any thing soft, or even fluid, he is seized with acute pain, insufferable nausea, and violent agitation of the whole frame. In this case, the spasm is never restricted to the pharynx and upper portion of the cesophagus, but extends to other organs, the inability of swallowing coming on in the midst of numerous other spasmodic symptoms, exceedingly complicated, and sometimes of an alarming nature. When it is the middle, or lower part of the cesophagus, which is concerned, as is frequently the case in hysterical women, the food passes through the pharynx and unaffected portion of the cesophagus with tolerable facility; but, as soon as it reaches the seat of the spasm, it is either stopped, or descends further with great difficulty and effort. Liquids, especially when warm, and swallowed slowly in small quantities at a time, usually pass down with more ease, than solid substances. When the matter to be conveyed into the stomach reaches the point of obstruction, the generality of patients are attacked with pain extending along the spine between the shoulders, and sometimes shooting to the stomach, which is considerably disturbed, and often discharges its contents. In some cases, however, no such pain is experienced, and whatever the patients try to convey into their stomachs, regurgitates quietly into their mouths. Although spasmodic dysphagia is mostly complicated with other marks of disorder of the nervous system, it is sometimes unattended with any particular impairment of the health. (*Boyer*, t. vii. p. 152.)

As the treatment of spasmodic affections of the pharynx and cesophagus belongs rather to the physician than the surgeon, I shall be very brief on the subject. The removal of the cause of the infirmity, that is to say, of the particular state of the mind, or constitution, giving rise to the spasm, is the principal thing, at which the practitioner should first aim. Thus, Boyer cured an hysterical woman of a difficulty and dread of swallowing solid food by attending her, at her meals, twice every day for a month, and gradually convincing her of the absurdity of her apprehension of being suffocated by attempting to swallow solid aliment. (*Vol. cit.* p. 154.) Sauvages mentions an hysterical female, whose difficulty of swallowing was cured by a regimen consisting of regular exercise, cold bathing, and milk-diet. The most successful remedies, however, are camphor in large doses, opium in draughts, or pills, or in clysters; the carbonate of iron, blisters and cupping-glasses applied to the nape of the neck, or to the epigastrium: Anodyne embrocations, and frictions with veratrin ointment, have also been useful. At the present day, the common idea, that many anomalous affections depend upon disorder of the liver and digestive organs, leads to the frequent employment of the compound calomel pill, and decoct. sarsaparillæ, with draughts of senna, rhubarb, and gentian *pro re nata*.

Dysphagia may originate from a weakened, or paralytic state of the muscular fibres, which enter into the structure of the pharynx and cesophagus. The affection may be either symptomatic, or idiopathic. The first case frequently occurs in febrile diseases, and is generally set down by writers, as a very unfavourable omen. The idiopathic form

of the complaint may be complete, or incomplete, and is chiefly seen in persons of advanced age, though occasionally the patients are in the prime of life. The causes may be said to be little, or not at all understood, and the only remark, which can be safely made respecting them, is, that they are usually connected with constitutional derangement.

With regard to the symptoms of paralysis of the œsophagus, when the disorder is complete, deglutition is absolutely prevented, and, if the patient tries to swallow, the food lodges in the pharynx, and sometimes produces violent fits of coughing. Some patients eat solid substances with moderate facility; but find more or less difficulty in taking liquids. Others can swallow hastily a large quantity of fluid at a time, yet cannot drink slowly and a little at once. Morgagni relates an instance of still greater singularity, which was an ability to swallow all kinds of food very well, except the last mouthful, which always remained in the œsophagus until the next repast. (*De Sed. et Caus. Morb.* epist. xxviii. art. 14.) In dysphagia from paralysis, the patient suffers no pain, nor sense of choking; if the neck be examined, no hardness, nor swelling can be felt; and a probang descends down the gullet without the slightest impediment. (*Boyer*, t. vii. p. 158.)

In its duration and termination, dysphagia from paralysis presents considerable variety; the complete paralysis sometimes proves rapidly fatal, not, however, as I conceive, on account of the affection of the œsophagus alone, but other complications, and the exhaustion arising from inadequate nutrition. Thus, Tulpinus relates an instance, in which a woman died on the seventh day from the commencement of the inability to swallow, notwithstanding every endeavour was made to support her with nourishment thrown up the rectum, which was the only thing that could be done, as she would not allow a tube to be passed down the œsophagus. In other cases, the patients live a considerable time, and afterwards perfectly recover, and this sometimes, under the disadvantage of having been entirely supported for several weeks with broth-clysters, as we find exemplified in a case recorded by Ramazzini. Certain examples are also reported, in which the food was forced into the stomach by means of probangs, for years, and the patients either ultimately recovered their power of swallowing, or in this manner prolonged their days, without any cure taking place. (*Stalpart van der Wiel*, vol. ii. obs. 28.; *Willis*, *Pharm. Rat.* sect. ii. cap. i. p. 45.)

Paralysis of the œsophagus is to be treated on the same principles, as other paralytic affections; a subject, which I shall not be expected to discuss; but, it is of importance that practitioners recollect, in these cases, the very essential service, derived from the use of elastic gum catheters, with which the requisite food and medicines may be injected into the stomach. I may likewise remind them of the benefit occasionally produced by blistering the side of the neck, and applying from a quarter of a grain to a grain or more of strychnia to the excoriated surface.

Dysphagia from organic disease, or morbid change of structure, is the most frequent case, and generally the most difficult of cure. In dissections, the parietes of the œsophagus are often found considerably thickened, indurated, and

scirrhus, or sometimes almost cartilaginous, and even ossified. The parts, where the pharynx terminates in the œsophagus and where the latter tube joins the stomach, are occasionally converted into thick scirrhus rings, with or without ulceration, exactly in the same manner as the pylorus. In one fatal case of dysphagia from disease of the cardiac orifice of the stomach, the œsophagus was found distended into a sac, reaching from two inches below the pharynx down to the diseased part, and capable of holding two quarts. (*T. Purton*, in *Med. Phys. Journ.* Dec. 1821.) But, such diseases are not restricted to the above-mentioned parts of the œsophagus, but sometimes occupy other points of the passage. Neither is the organic disease producing a difficulty, or impossibility, of deglutition, always situated in the coats of the œsophagus itself: for, the surrounding parts are subject to various diseases, which may have the same effect. Thus, dysphagia may depend upon enlargement of the thyroid gland; tumours formed between the trachea and œsophagus, or at some other point near the latter tube; swelling and induration of the thymus gland; aneurism of the aorta; enormous enlargement of the liver; and diseased lymphatic glands in the vicinity of that portion of the œsophagus, which is covered by the peritoneum, and the largest of which glands are situated near the fifth dorsal vertebræ, just at the point where the œsophagus inclines a little to the right side to make way for the aorta. (*Boyer*, t. vii. p. 162.) About five years ago, I attended a patient with Mr. Broxholm, of Sunbury, for a tumour, situated on the occiput, and attended with some difficulty of deglutition. I removed the tumour, which was of the size of an orange and of a fibro-cartilaginous structure; the wound healed; but the difficulty of swallowing gradually increased, and the patient died of inanition in about two months. On examining the œsophagus a large pouch was detected on each side of it, containing orange-pips.

Baron Boyer sets down every case of dysphagia, depending upon organic disease of the œsophagus, as incurable; and with respect to the cure of other examples, in which this tube is compressed by swellings in its vicinity, as these are almost always beyond the power of medicine and surgery, the prognosis is nearly as unfavourable, as where there is a change of structure in the œsophagus itself. There are no unequivocal symptoms, by which a case of dysphagia from enlargement of glands in the vicinity of the œsophagus can be known from several other forms of the complaint. Hence, it is difficult to estimate the correctness of certain cases, recorded by Ruysch (*Advers. Anat. Med. Chir.*, dec. i. art. 10. p. 24.), and Haller (*Opuscul. Pathol.* obs. lxxi.), where dysphagia, stated to have been produced by enlarged lymphatic glands, was cured by mercurial frictions, or pills composed of calomel, aloes, and camphor. As Boyer justly remarks, these accounts of the nature of the diseases, thus cured, are the more doubtful, inasmuch as the resolution of chronic swellings of lymphatic glands, even when externally situated, is very difficult, and frequently impracticable, notwithstanding the use of topical applications may here be combined with the exhibition of internal medicines. (*T.* vii. p. 169.) However, dismissing the question, whether the cases really arose from the pressure of

enlarged lymphatic glands, or not, the facts of the cures having taken place, under the use of mercurial medicines, are of themselves interesting. Several writers consider, that there is a great analogy between certain forms of constriction of the œsophagus, and strictures of the urethra, and Mauchart recommended the two diseases to be treated, on the same principles, with bougies, and elastic gum-catheters. Baron Boyer, however, represents this doctrine as completely erroneous, declaring that the affection of the œsophagus is of the nature of scirrhus, and absolutely incurable. He relates one case, in which a woman's life was prolonged by the use of an elastic gum-catheter, though it proved of no service as a means of permanently dilating the diseased part; and, notwithstanding nourishing liquids were plentifully injected into the stomach, the patient suffered a good deal from hunger, and died exhausted about three years after the beginning of the disorder. This case, however, cannot be received as a proof of the inefficacy of bougies for what is commonly implied by a stricture of the œsophagus, because the nature of the disease was not ascertained by an inspection of the œsophagus after death, and the case might have depended upon some organic disease either of this tube, or the parts in its vicinity, not classed by the generality of modern writers with strictures of the passage.

The following are some of Sir Everard Home's opinions, respecting these last cases.—As the œsophagus is required to be wider at one time, and narrower at another, in order to be fitted for conveying the different kinds of food into the stomach, it is nearly under the same circumstances, with respect to the formation of stricture, as the urethra. For obvious reasons, strictures of the œsophagus are much less frequent than those of the urethra. However, they are by no means uncommon, and produce symptoms even much more distressing and dangerous, than those which ordinarily arise from analogous obstructions in the passage for the urine.

Of course, the most remarkable symptom of a stricture in the œsophagus is the difficulty of swallowing, which must be greater or less, according as the obstruction is more or less complete. Sometimes no solid food whatever can pass down into the stomach, and fluids can only descend with great difficulty, and in very small quantities. In some instances, this is attended with considerable pain, which extends along the fœces to the basis of the skull, and through the Eustachian tube to the ear. The pain sometimes returns at intervals, and lasts a considerable time, even when no effort is made to swallow. If a bougie of proper size be introduced down the pharynx, it will often be stopped by the stricture just behind the thyroid, or cricoid cartilage; for, from Sir Everard Home's remarks, it appears that the obstruction is generally as high up as this situation. However, there are other cases, in which the obstruction is only of a spasmodic nature, and in these a bougie may be passed quite down. It is curious, that strictures high up in the œsophagus, often occasion ulceration in this tube very low down towards the stomach, just as strictures in the urethra occasion ulceration in that passage towards the bladder. This is most apt to occur, when strictures of the œsophagus have been of long continuance, and may arise from the efforts in retching, which frequently come on, and

must strain the parts already deprived of their natural actions, and of the benefit of the secretions, with which they are lubricated in a healthy state. When such ulceration takes place, the characters of the original disease are lost; and when the ulceration extends upwards, the stricture itself may be destroyed. A bougie, introduced under such circumstances, will, in general, have its point entangled in the ulcer; and when so skilfully directed as to go down into the œsophagus, it will meet with a difficulty while it is passing the commencement of the ulcerated part of the œsophagus, and another impediment where it leaves the ulcer, and enters the sound portion of the œsophagus below. These two resistances may lead to the supposition, that there are two strictures, while in fact there is not one, but only ulceration as above described.

Strictures in the œsophagus are sometimes so complete, that swallowing even fluids is utterly prevented; the patient is obliged to have all nourishment injected *intra anum*, and in general soon perishes in a most emaciated condition.

Though any part of the œsophagus is liable to the kind of contractions forming strictures, the part immediately behind the cricoid cartilage, where the pharynx ends, and the œsophagus begins, is the most frequent seat of the obstruction. Those, which are situated further down, do not so easily admit of being examined, and relieved by any surgical operation. Strictures of the œsophagus occupy but a small extent of the passage, consist of a transverse fold of the internal membrane, and are attended with little thickening of the adjacent parts. These latter circumstances are such as render the disease capable of receiving relief either from simple or armed bougies.

There are two other diseases of the œsophagus which have symptoms similar to those of strictures. One is a thickening of the coats of the œsophagus, which extends to the surrounding parts, and generally ends in a cancer, or an incurable disease. The other affection is an ulcer of the lining of the passage, commonly situated a little below the seat of the stricture, on the back part of the tube. In the early state, these diseases can only be distinguished from a stricture, by an examination with a bougie; afterwards their nature becomes clear enough from other symptoms which arise. Strictures also take place more commonly in young subjects; the other two diseases in the more advanced periods of life.

Sir E. Home has found, that a bougie can be more easily introduced into the œsophagus, when the tongue is brought forwards out of the mouth. The head should also be carried back, as advised in the last article. (See ŒSOPHAGOTOMY.) This gentleman remarks, that when a bougie is passed, with a view of learning the nature of the case, if it passes down to the distance of eight inches, measuring from the cutting edge of the front teeth in the upper jaw, its extremity has gone beyond the usual seat of stricture. If it be withdrawn without any resistance, the aperture in the œsophagus must then be larger than the bougie employed. But if the bougie stops at the distance of six inches and a half, or even lower, it must be retained there with a uniform pressure for half a minute, so as to receive on its point an impression of the surface by which it was opposed. If the end of the bougie retains its natural form, or

nearly so, and there is an indentation on one side of it, or all around it, the surgeon may conclude there is a stricture. On the other hand, should the bougie descend without impediment, as far as seven inches and a half, and, when withdrawn, the surface of its point appear irregular, and jagged, the disease is an ulcer on the posterior part of the œsophagus.

The mode of treatment adopted by Sir E. Home, consisted either in passing a common bougie occasionally through the stricture, and employing one of a larger size, in proportion as the dilatation of the obstruction was effected; or else in introducing an armed bougie at convenient intervals. The latter means, I believe, is entirely relinquished in the treatment of strictures of the œsophagus. The views, which I take of the disease, lead me to prefer a full and fair trial of gum-catheters. Instead of bougies, tubes, and caustic, Dr. Jameson, of Baltimore, uses probangs of a particular construction, and ball-probes, which serve for the examination of the stricture, and also as guides for the probangs. (See *Amer. Med. Recorder* for 1825.) The probang consists of whalebone, which terminates in a smooth ivory ball, and is secured by a screw that is adapted to a female screw in the ivory. After the parts have been firmly screwed together, they are further secured with a rivet. Sometimes a probang, invented for the purpose, is made to slide down the œsophagus on the wire of the ball-probe previously introduced through the stricture. The outer end of the ball-probe is passed through the hole in the probang, and the latter having been introduced as far as the root of the tongue, the wire of the ball-probe, and the staff of the probang are brought together, and the whole passed through the stricture. As the account is rather obscure without explanatory plates, I must refer to the above work for additional particulars. Many years ago, Sir Charles Bell devised ball-probes for the cure of strictures in the urethra.

Consult *Practical Obs. on Strictures in the Urethra and Œsophagus*, 3 vols. ed. 3. 1805. vol. II. 1803. and vol. III. 1821. by Sir E. Home. Ph. H. Bruttel, le Struma (Œsophagi; hujusque Coarctu difficil ac abolitæ Deglutitionis Causis; (in Haller's Disp. Chir. 2. 395.) Tubing. 1742. Mauchart, de Struma Œsophagi, Tubing, 1742. J. Warner, Cases in Surgery, p. 130. ed. 4. P. A. J. Zinckernagel, de Clysterum Nutritium Antiquitate, et Usu (Trilleri Opusc. 1. 399.) A. Vater et F. A. Zinckernagel, de Deglutitionis difficult et impedite Causis additis (Halleri Disp. ad Morb. I. 577.) E. F. Bultsius de Fame lethali ex callosa Oris Ventricle Angustia. J. M. Ricardus, De his qui diu vivunt sine Alimento, 4to. Kilie, Holsat. 1711. Boyer, Traité de Mal. Chir. t. vii. 8vo. Paris, 1821. Sir C. Bell, Surgical Obs. vol. i. Dr. Jameson, in *Amer. Med. Recorder* for 1825.

OLEUM CAMPHORATUM. R. Olei olivæ, ℥j. Camphoræ ʒiv. Misce ut solvatur camphora. Sometimes employed for promoting the suppuration of indolent, particularly scrofulous swellings, which are to be rubbed with it once, twice, or thrice a day, according to circumstances.

OLEUM LINI. In surgery, linseed oil is sometimes used as an application to burns, either alone, or mixed with an equal quantity of the liquor calcis. It has also been applied to cancerous ulcers.

OLEUM ORIGANI. The oil of marjoram was formerly used for dispersing ganglions, which were rubbed with it two or three times a day.

OLEUM PALMÆ CAMPHORATUM. R. Camphoræ ʒij. Olei palmæ ℥j. The camphor is to be reduced to powder, and the palm oil, being

melted, and suffered to become almost cold, is to be mixed with it. A mild topical stimulant.

OLEUM RICINI. In surgical cases, requiring the bowels to be opened with the slightest degree of irritation possible, and yet with certainty, oleum ricini is one of the best and safest medicines. The usual dose is one or two table-spoonfuls, which may be repeated, every two or three hours, till the desired effect is produced. It may be taken, floating on a little peppermint-water, or milk, or in the following draught. R. Olei Ricini ʒss. Mucilaginis q. s. tere optime, et paulatim adde aquæ distillatæ ʒj. Spir. Lavand. comp. ℥xx. Syr. Tolutani ʒss. Misce.

OLEUM TEREBINTHINÆ. In the article LINIMENT may be seen some formulæ, in which turpentine is an active ingredient. It is strongly recommended by Dr. Kentish, when mixed with the ung. resinæ flavæ, as an application to burns. It is sometimes given internally for the relief of gleet, and various affections of the bladder and its mucous membrane.

OLEUM TEREBINTHINATUM. R. Olei amygdalæ ʒss. Olei terebinthinæ gutt. xii. Misce. In deafness, occasioned by defective, or diseased action of the glandulæ ceruminæ, Mr. Maule directs a little of this oil to be dropped into the patient's ear, or applied at the end of a small dossil of cotton. When a thin secretion takes place, the cure is to be promoted by a small blister, placed as near the ear as convenient, and kept open with the sævine cerate. The meatus auditorius externus must also be cleansed every day with a bit of soft cotton affixed to a probe. (See *Pharmacop. Chirurgica*.)

OLEUM TIGLI. Croton Oil. This medicine is well known for its active purgative qualities in minute doses, varying from mss to ʒij. It may be given on a bit of sugar. Sometimes it is blended with extract. Colocynt. c. and administered in the form of pills. It is prescribed in cases attended with great torpor of the bowels, as in those of tetanus, injuries of the spine, &c. It should not be employed when any inflammation is present in the abdomen.

OMPHALOCELE. (From ὀμφαλός, the navel, and ῥήξη, a rupture.) A rupture, or hernia at the navel. (See HERNIA.)

ONYCHIA. (ὄνυξ, the nail.) An abscess near the nail of the finger. (See WHITLOW.)

ONYX. (From ὄνυξ, the nail.) A small collection of matter in the anterior chamber of the aqueous humour, and so named from its being shaped like a nail. Maître-Jean, Mauchart, and others, imply by the term *onyx*, a small abscess between the layers of the cornea.

OPHTHALMY. (From ὀφθαλμός, the eye.) *Ophthalmia.* *Ophthalmitis.* Inflammation of the eye. This is not only a consequence of several affections of the eye, and adjacent parts, on the existence of which its continuance entirely depends; it is frequently the primary complaint, and too often the forerunner of such irreparable mischief as for ever bereaves the patient of vision.

In general, the modifications of inflammation from differences of texture in the parts affected are displayed in the eye with much distinctness. The muco-cutaneous conjunctiva, secreting a flood of purulent matter, as in contagious ophthalmia; the fibro-sclerotic conjunctiva affected for months with rheumatic inflammation; the

cornea losing entirely its transparency, becoming infiltrated with pus, or destroyed layer after layer by a penetrating ulcer; the iris pouring out coagulable lymph, and this lymph forming the medium of morbid adhesions, so that the pupil is deprived of its natural power of expanding and contracting; these are facts, as Dr. Mackenzie justly observes, in which are displayed some of the modifications of inflammatory action more strikingly than in any other part of the body. (*On Dis. of the Eye*, p. 381. ed. 2.)

Since every disease of the eye presents some differences, depending upon the nature of the disorder itself, and others, arising from the peculiar organization of the texture, which happens to be principally affected, the characteristic appearances of ophthalmia must be subject to a vast number of modifications, according to the particular structure which is inflamed; and hence, sometimes one symptom of inflammation, sometimes another, chiefly predominates, while others are less conspicuous, and often scarcely distinguishable. Yet, says Beer, none of the characteristic marks of inflammation are ever entirely absent. This author represents the degree of pain as being proportioned in a great measure to the tough unyielding nature of the parts, immediately around the inflamed texture of the eye, to the firm nature of the inflamed texture itself, and to the quantity of nerves, with which such texture, and the parts in its immediate vicinity, are supplied. In proof of the truth of this doctrine, he instances whitlows and internal ophthalmia, where the pain is very severe; while inflammations of the conjunctiva, not extending to the deeper textures of the eye, are described as eases, in which the pain is slight, because the structure affected is loose and yielding. But, without scrutinizing every reason, assigned by Beer, for the varieties observable in the symptoms according to the texture which happens to be most affected, I shall briefly state a few other examples quoted by the same author. That the degree of redness, as well as of pain, varies considerably in different states of ophthalmia, is a fact universally known. In the beginning of the complaint, such redness is generally less perceptible, than when the inflammation has attained its highest pitch; but it is not equally great in every individual, nor in every species of ophthalmia, being sometimes more intense and diffused, sometimes less both in degree and extent. This diversity is referred by Beer to the texture, affected in the eye, being furnished with many considerable blood-vessels, obvious to the sight, or only containing vessels, more concealed and rather filled with a colourless fluid, than with red blood. The looseness or unyielding nature of the texture is also represented as making a difference in the degree of redness. In inflammation, principally affecting the conjunctiva and sclerótica, says Beer, the redness is so intense, as to give the eye a frightful appearance, as is seen in chemosis; while in inflammation of the innermost textures of the organ, the redness is scarcely perceptible. (*Lehre von den Augenkrankheiten*, b. i. p. 34—36.)

Nay, in some conditions of the cornea, the iris, and the crystalline capsule, which are regarded as inflammations, there is no visible swelling, no redness, nor does it seem to Mr. Lawrence that we can detect the existence of heat, or pain.

In the case of parts, removed by their

situation from direct observation, as the retina and hyaloid membrane, we cannot determine whether pain, heat, redness and swelling, the four circumstances regarded as criteria of inflammation, are present or not. (*On Dis. of the Eye*, p. 63.)

Dr. Vetch remarks, that the conjunctiva is capable of being stretched to a great extent, owing to the loose structure of the cellular tissue, on which it lies, and consequently little resistance is made to the enlargement of its vessels. From slight irritation, they soon become distended with red blood, "but their tone, or power of reaction, is speedily exhausted, and, if the exciting cause is not kept up in an increasing ratio, they quickly fall into a chronic, or varicose enlargement, or again contract to the diameter of the serous vessels." On the other hand, inflammation of the sclerotic coat is slow in its commencement, and often insidious in its progress, even when its ultimate violence is great. In the early stage of conjunctival ophthalmia, the inflammation is most observable at a distance from the cornea, around which the membrane often preserves for a length of time its natural appearance. Precisely the reverse takes place in the case of sclerotic inflammation, which invariably appears at the circumference of the cornea, forming a zone, more or less complete about it, and most conspicuous above it, the form and colour of the vessels being at the same time wholly different from those, which appear in the course of conjunctival inflammation. Intolerance of light invariably accompanies sclerotic inflammation, and is entirely unconnected with that of the conjunctiva. (See Vetch on the Dis. of the Eye, p. 10.)

When the sclerótica partakes of the inflammation of the conjunctiva, the vessels, which pursue a straight course to the margin of the cornea, are strongly distinguished, and have a somewhat darker hue, than the areolar vessels upon the loose portion of the conjunctiva. (See Travers, in *Synopsis of Dis. of the Eye*, p. 128.)

Diversified as the pain, redness, swelling, and heat, the four characteristic symptoms of inflammation, may be in ophthalmia, the incidental appearances in the eye are not less subject to numerous modifications. Thus, sometimes an extraordinary involuntary action of the muscles of the eyeball and eyelids, or of the secreting and excreting lachrymal organs, and of the Meibomian glands, may be noticed; and sometimes the action of all these parts is either diminished, or completely stopped. These differences Beer refers to the latter parts being either themselves inflamed, or sympathizing with the inflamed texture of the eye. In the first case, the action of the muscles, and the functions of the lachrymal organs, and Meibomian glands, are more and more interrupted in proportion as the inflammation increases, and must thus remain, while the inflammation lasts in its genuine form; but in the second case, they go on, and this even with greater activity, while the inflammation continues, and until it has ceased to become more violent. (B. i. p. 39.)

Acute ophthalmia, when severe, and particularly when the inner textures of the eye are affected, produces a febrile disturbance of the whole constitution. This change from a local to a general indisposition takes place with greater certainty and quickness, in proportion as the inflammation is extensive, the constitution irritable, the dis-

order of the eye neglected, and the mischief produced in the organ considerable. (*Beer*, vol. cit. p. 42.)

It is on the accession of the second stage of ophthalmia, that one may remark the sudden increase of redness in the inflamed texture, with a brown and afterwards a blue tinge; actual extravasations of blood in the chambers of the aqueous humour; ecchymosis of the conjunctiva; a considerable increase of swelling; the decline and irregularity of the pain; the decrease of the inflammatory heat and throbbing; a sensation of cold and heaviness in the organ; and more or less cedematous swelling of the surrounding parts. It is also in the second stage, that suppuration is liable to happen. (*Beer*, *Lehre*, &c. b. i. p. 46.) And, in another page, the same author observes, that the characteristic signs of the second stage of ophthalmia consist in the following appearances: while the redness and swelling undergo a sudden and striking increase, the hardness manifestly diminishes, and the pain becomes very unequal, and not continual; the secretions and excretions, also, which, during the first stage, were completely stopped, commence again, but more copiously, and are of a very different quality from what they were in the state of health. The disorder is now quite in its second stage, and this is the time when purulent matter may begin to be formed. (B. i. p. 50.) According to Beer, the duration of idiopathic ophthalmia depends upon the circumstances of each individual case; first, the nature of the causes giving rise to the affection; secondly, the irritability of the patient, in relation to constitution, sex, and age; thirdly, what may be termed the constitution of the affected eye itself, and the texture in it immediately inflamed. Thus ophthalmia is likely to be attended with great severity, when it attacks plethoric individuals, in whom there has been for some time previously a great determination of blood to the head and eyes, or whose sight has been strained by looking at shining objects, or whose constitutions have been hurt by good living and hard drinking. Every severe ophthalmia runs through its first stage much more rapidly in weak, irritable subjects and children, than in robust individuals. It is also another remark, made by Beer, that every inflammation of the eye, at all considerable, is generally of shorter continuance in gray or blue-eyed, than in dark, or black-eyed persons.

With respect to the causes of ophthalmia in general, as the disorder frequently affects the innermost parts of the eye, and, when severe, is attended with some risk of the loss of the organ, the annihilation of its functions, or the spoiling of some of its textures; and, also, as inflammation is the most frequent complaint to which the eye is subject, it is important to learn, as far as possible, the causes, which, either directly or indirectly, give rise to it.

The atmospheric air and light have a direct and powerful operation upon the eyes; and, in order that the former may have no hurtful effect upon these organs, it should be pure, that is to say, its regular component parts should not be altered, nor blended with extraneous substances. The temperature of the air is likewise described by Beer, as making a good deal of difference in the susceptibility of the eyes for inflammation, either a very warm, or cold air, being, in this respect, hurtful. The observation, however, is

qualified with the admission, that the terms *warm* and *cold* have only a relative signification to individual circumstances. The effect of a blast of cold air on the eye, in exciting inflammation, is universally known, and needs no comment. It is an opinion of Beer, that the eye is much affected by the quantity of electricity in the atmosphere, and, he says, that, on this account, no experienced practitioner would undertake the extraction of a cataract during, or on the approach of, a storm. (B. i. p. 65.)

Passing over many interesting observations made by Beer, on the contamination of the atmospheric air by the admixture of other gases, and the injurious effect of this change upon the eyes, I come to his remarks on the operation of light upon these organs. Though light, he observes, is indispensable to the functions of the eye, it becomes pernicious, when suddenly increased beyond what the organ can bear, so as to be a source of irritation. As a proof of this fact, he cites an instance, in which a young, plethoric, strong man, whose eyes had been for some time unavoidably strained by immoderate exercise of them, was suddenly attacked with a violent ophthalmia, while looking at an optical representation of the rising sun, and carried home in great agony. But, with respect to the influence of light, every statement is to be received only in a relative sense; for, the degree of light, which would answer very well for the eye of an African, would destroy many European eyes; and the same light, which is borne without inconvenience by the eye of an adult, would excite in the eye of a new-born infant the *ophthalmia neonatorum*, by which so many children are deprived of the most valuable of the senses in the first days of their existence. Beer further explains, that the same degree of light produces a stronger, or weaker effect, according to the greater or lesser irritability of the eye of the same person at different times, as we see exemplified in every individual in the tenderness of his eye to light when he first awakes in the morning. Light is also not hurtful to the eyes, merely according to its quantity; for, the direction of the rays makes a great deal of difference, the eye being less capable of bearing them with impunity the more they recede from a perpendicular line, and strike the organ slopingly, or horizontally. Much likewise depends upon the kind of light; that which is reflected from a scarlet surface, being even more prejudicial, than the sunshine, which is reflected from a country covered with snow; another convincing proof, that the bad effects are not always in proportion to the quantity of rays. The light of burning glasses, concave mirrors, white screens, the full moon, &c. and the shining of diamonds, are well known to render the eyes weak, and prone to inflammation. Amongst other occasional causes of ophthalmia, Beer enumerates the custom of washing the eyes immoderately with cold water, a remark in which I do not place much confidence; the application of various stimulating medicated substances to them; compresses and bandages; the badness of instruments employed in operations upon the eyes; the employment of spectacles unnecessarily, or of such as are not adapted to the eyes of the individual; and every immoderate exertion of the eyesight.

But, amongst the most important and frequent

exciting causes of ophthalmia, are extraneous bodies, which insinuate themselves between the eyeball and eyelids, and every kind of wound or injury of the eye.

Foreign bodies, liable to enter under the eyelids, are of three kinds: first, such as are in themselves completely innocuous to the eye; or such as are likely to hurt the eye only when strongly pressed upon by the spasmodic closure of the eyelids, or by the patient's imprudently rubbing the eye; or they may be of a quality, which injures the eye the moment they come into contact with it. Foreign bodies of the first description lie loose under one of the eyelids, and, for the most part, either immediately behind its edge in the groove destined for the conveyance of the tears, or else in the fold, seen when the eyelid is everted, exactly at the line where the palpebra and sclerotic conjunctiva join together. They never actually lodge in the coats of the eye; but they irritate it mechanically, or chemically, or in both ways together, according to their size, shape, and chemical properties.

In the list of such extraneous substances are inverted eyelashes; particles of dust; snuff; pepper; minute insects; and other small things generally carried under the eyelids by the wind.

As these foreign bodies are all of them more or less irritating to the eye, they must be considered as a principal exciting cause of ophthalmia, which frequently follows their entrance under the eyelids with extraordinary rapidity. However, the redness and effusion of tears, sometimes instantly following the insinuation of extraneous substances under the palpebræ, and as suddenly ceasing on their removal, Beer considers rather as preliminaries to inflammation, than as this disorder itself. (B. i. p. 92.)

Wounds and other injuries of the eye, regarded as causes of ophthalmia, Beer divides into three kinds; namely, *mechanical, chemical, and mixed*. A prick of the eye with a fine needle is an example of a simple mechanical injury; the action of quicklime upon the organ is an instance of one purely chemical; and the violent propulsion of a red-hot bit of iron against the eye is a lesion, which may be said to be both mechanical and chemical. The same author makes a variety of original reflections upon the differences, connected with the extent and intensity of such injuries. Their intensity, he views only as something relative; thus, either the force, with which the eye is injured, is of itself too great ever to be resisted, as is seen in a gunshot wound; or the organic powers of the patient are, from age, sex, or constitution, much too feeble for the eye to bear favourably any considerable injury, as is the case with children and weak unhealthy females; or the organization of the eye itself may be weak, and the effects of the violence therefore greater, as exemplified in the fact of a brown or black eye generally bearing a wound better than a gray, or blue one; or, lastly, the organic powers of the texture of the eye, immediately injured, may be too feeble to bear even a slight lesion, as is the case with the retina. (B. i. p. 95.)

Mechanical injuries of the eye may be made either with sharp, or obtuse bodies. Sharp-pointed and cutting instruments are capable of readily penetrating the eye, without occasioning, at the moment of their entrance, any violent compression, or laceration of the neighbouring textures;

and consequently the injury inflicted is a simple puncture, or an incision. Sabre-cuts of the eye, however, are to be excepted; for, though the weapon may be sharp, the blow is always attended with more or less concussion, and injury of the textures, adjoining the wound, which are very delicate and readily spoiled. Blunt weapons, or bodies, can only enter the texture of the eye by dint of great force, and, in this case, always cause a serious degree of compression, stretching, and laceration; but, sometimes, when they do not penetrate the organ, the contusion is such as is productive of not less mischief.

In the case of a simple puncture, or incision of the eye, Beer seems to think, that the subsequent ophthalmia is generally more owing to the incapacity of the wounded organ to bear the effects of the light, air, &c. than to the injury itself abstractedly considered. He observes, that a proof of the truth of this opinion is seen in the extraction of the cataract; for, if the operator is careless in the operation itself, opening the flap of the cornea very wide, so as to let the atmospheric air have free access to the inner textures of the eye; or if after the operation is finished, he do not apply the dressings with caution, and properly darken the patient's chamber, he is letting the eye be subjected to some of the most active causes of inflammation. But though Beer is unquestionably correct, in regard to the injurious effects of light on the wounded eye, it may be doubted, whether his theories do not make him attribute too much to the irritation of the air, and too little to that of the mechanical division of the parts.

Passing over many of Beer's observations on injuries of the eye produced by blunt bodies, and substances acting chemically upon it, I leave the topic of the direct exciting causes of ophthalmia, and come to the consideration of those which he regards as *indirect*. And the first to which he adverts, is every thing that has a tendency to keep up a determination of a large quantity of blood into the vessels of the head and eyes. Immoderate bodily exercise; violent emotions of the mind; injudicious clothing; and high living; are afterwards enumerated as having an indirect effect in the production of ophthalmia. With respect to *infection* and *contagion*, Beer sets down infectious diseases as very seldom the cause of ophthalmia, unless some of their matter be applied immediately to the eye itself; but, he admits, that they often dispose this organ to inflame from slight causes, by the impairment, which they produce, of the general health. On the other hand, he considers *contagion* as much more frequently, than *infection*, the indirect cause of the disorder. (B. i. p. 121.)

In Beer's general observations on the treatment of inflammations of the eyes, the first indication specified, is *to remove immediately every thing, which is obviously producing an irritating effect upon the eye, and to take care that no fresh source of irritation to the organ incidentally takes place*. And, as it frequently happens, even in healthy, strong individuals, that ophthalmia is occasioned by foreign bodies, either lodged under the eyeballs, or inserted in some part of the eyeball, and not suspected to be there, the earliest attention should always be paid to their gentle and skilful removal. Easy as this object is of accomplishment, when not delayed, when the eye has not been seriously irritated by friction and pressure,

and the patient is not of a weak, irritable constitution, it is often attended with great difficulty under one, or the other of these circumstances, especially the last. In this case, strong convulsive rotations of the eyeball, followed by a violent and obstinate spasmodic closure of the eyelids, render it impossible to separate them; and the spasm is the stronger and more lasting, the more the extraneous substances are calculated, by their shape and chemical quality, to irritate the eye; and the greater the irritability of the patient is. In this state of things, every attempt forcibly to open the eye, or to examine it in the light, is not only useless, but increases and keeps up the spasm, which nothing will lessen and shorten, except darkness and perfect repose. But, as timid, irritable persons are exceedingly apprehensive of the consequences of the lodgment of extraneous substances in the eye, the surgeon should endeavour to lessen their inquietude, by assuring them that every thing will be right again, which is strictly true, when the foreign bodies are of the first class. Then the spasmodic closure of the eyelids will cease, and the extraneous substance admit of being properly taken away.

Success, however, does not always attend this simple method; for, in very weak subjects, the spasm of the orbicularis palpebrarum is so violent and obstinate, especially when a foreign body lodges in the eye, and at the same time mechanically and chemically irritates it (as is the case with particles of snuff), that it becomes indispensable to have recourse to medicinal applications. For this purpose, Beer's experience has convinced him, that the best thing is a bread poultice, made either with milk or water, and containing some of the vinous tincture of opium. Care is to be taken, however, never to let it become quite cold, during its application; for then the spasm would only be aggravated by it; and, if such spasm has been of long continuance, when the surgeon is first sent for, the poultice, according to Beer, may be rendered more efficacious by the addition of hyosciamus to it. In irritable, hysterical, and hypochondriacal persons, such local treatment alone is frequently insufficient, and recourse must be had to the internal exhibition of antispasmodic anodyne medicines. At length, when the spasm of the orbicular muscle is so far diminished, that the eyelids can be effectually opened without any force for the extraction of the foreign body, great caution and gentleness will yet be necessary, and, in particular, the eye should be kept in a very moderate light, as the spasm would be immediately excited again, either by sudden exposure of the eye to too much light, or rough handling of the eyelids.

Sometimes a person rubs his eye at first awaking in the morning, and if the eyelashes are very numerous and rigid, one of them will lodge between the eyeball and lower eyelid: it may readily be taken away with the end of a fine moist sponge, or camel-hair pencil, the eyelid being depressed as much as possible, and the eye itself turned upward, so that the hair may not be concealed in the fold of the conjunctiva. When the hair is situated under the upper eyelid (which Beer says rarely happens), it always lodges in the fold of the preceding membrane, whence it may be extracted in the manner above directed, with the difference that the eyelid must be raised or everted,

and the eye rotated downwards. (*Lehre von den Krankh. b. i. p. 128—130.*)

Small globular smooth extraneous bodies, lodged under the eyelids, are very easily extracted, when the eyelid is gently taken hold of both by its edge and the eyelashes, and lifted up from the eye, while the patient inclines his head forwards, and the eye is turned completely downwards: the effusion of tears, excited by these manœuvres, will now generally wash these extraneous substances out of the eye, as they are not at all fixed. When the fissure between the eyelids is wide and open, but the eyeball at the same time very prominent, the object may also be easily accomplished, when the upper eyelid is gently and repeatedly stroked with the finger from the outer towards the inner canthus; in which case, the round smooth foreign body soon makes its appearance above the caruncula lachrymalis, whence it falls out of itself, or may be taken with the corner of a pocket-handkerchief.

The worst cases are those, in which the eyes are very prominent, and the fissure of the eyelids small, as all the above methods are then useless, and only productive of irritation. In this circumstance, the eyelid is to be simply everted by taking hold of the cilia, and drawing them forward and upward, while a probe is used for pressing back the upper portion of the tarsus. The foreign body may then be plainly seen, and easily removed.

Particles of common dust, and of sand and powders thrown over letters, which frequently get into the eyes of persons, who open their letters carelessly, or, from short-sightedness, are obliged to bring them close to the nose, are generally more difficult of extraction. In the attempt, however, the eye must never be subjected to too much irritation. According to Beer, these extraneous particles of dust, or sand, may sometimes be removed by washing the eye well, or by dropping into it milk, or some other viscid fluid, while the patient lies upon his back, and the eyelid is lifted up from the eye. But, the most expeditious and certain plan is to employ a syringe, the pipe of which is to be introduced under the upper eyelid near the outer canthus, and the fluid thrown briskly in the direction towards the nose. If all the extraneous matter cannot be thus removed, the rest may sometimes be taken out, if the eyelid be everted in the manner above directed, which seems to me the right method to be adopted in several cases, for which Beer recommends other proceedings.

When particles of sugar, or other soluble, not very irritating substances, happen to insinuate themselves into the eye, professional aid is seldom requisite, as they generally dissolve in the tears, and are voided before a surgeon can arrive. Snuff, pepper, and other minute irritating bodies, as well as small winged insects, are to be removed in the same manner, as particles of dust and letter-and; but, particular care is to be taken afterwards to wash the eye well with some lukewarm mucilaginous collyrium, until the irritation, caused by the chemical effect of such foreign bodies, has been completely obviated.

The removal of foreign bodies of the second class is usually attended with more difficulty, because they, as well as those of the third class, more frequently produce a violent and obstinate

spasmodic closure of the eyelids, and are seldom loose, being generally fixed in the cornea. However, when they happen to be detached, they may be extracted in the same way, as small round smooth extraneous bodies, except that the stroking of the eyelid with the finger should be omitted, not only as useless, but likely to press any of these substances, which are of a pointed shape, into the loose conjunctiva, so as to injure the eye itself, which would otherwise not be hurt. The nibs of pens, the parings of the nails, and small hard-winged insects, when lodged in a depression of the cornea, or white of the eye, Beer says, may be easily dislodged by means of a small silver spatula, or a probe. Other foreign bodies of the second class are not only fixed in a depression, but even penetrate more deeply than the conjunctiva; and, in old subjects in particular, they often insinuate themselves into the loose cellular tissue under the conjunctiva, partly in consequence of the convulsive motions of the eyeball and eyelids, and partly by reason of the attempts made to loosen them. Hence, they frequently become situated a great way from the place of their entrance, and are completely covered by the conjunctiva. But, even when they lie immediately in the wound, they are so intimately connected with the subjacent loose cellular tissue, that every attempt to remove them with forceps is not only unavailing, but hurtful to the eye, inasmuch as the injury is thereby rendered deeper. They may be taken away with facility, however, when lifted up with a pair of small forceps, and cut away with a pair of scissors, together with the piece of cellular membrane, with which they are directly connected. If such extraneous substance should be actually underneath the sclerotic conjunctiva, Beer recommends the eyelids to be well opened, and the eye to be brought into a position, in which the part of the conjunctiva, covering the foreign body, is rendered tense, when an incision is to be made with a lancet down to the extraneous substance, which is to be taken hold of, and removed with a pair of scissors, the assistant being careful to keep hold of the eyelids during the operation. On the other hand, when the foreign body is actually lodged between the layers of the cornea, Beer considers that its extraction may be best accomplished with a lancet-pointed couching-needle. But, whatever instrument be used, its point must be passed with great caution slowly and obliquely under the foreign body; and care must be taken not to introduce it too deeply, lest the anterior chamber be opened, which may readily happen in young subjects; and when it does, the aqueous humour flows out, and the cornea becomes so flaccid, that the removal of the extraneous substance is quite impracticable, before the puncture has healed, and the anterior chamber is again distended.

The removal of foreign bodies of the third class mostly demands very great caution, first, because, as Beer observes, no particles of them should be allowed to remain in the eye, which without the utmost vigilance is apt to be the case; and secondly, because the wound of the eye, already considerable, should not be made larger than can be avoided. The extraction of small bits of glass is particularly difficult, as they cannot be seen, but may be found out entirely by the feelings of the patient, or the *tactus eruditus* of the surgeon,

assisted with a probe. When in this way, a particle of glass is detected, Beer directs us to take hold of it with a pair of forceps, and cut it away with scissors. The place, from which it has been removed, must then be carefully probed, in order that no other fragment may be left in it.

According to the same author, pieces of iron and steel, which strike the eye so forcibly as to enter it, as well as all other fragments of metals, which are readily oxydated, should be as carefully removed, as bits of glass; for, the more easily they combine with oxygen, and the longer they remain, the more brittle they become, and the more apt are minute particles to be left in the eye, especially in the cornea. A speck on the part of this membrane, where the splinter has lodged, is the least serious consequence of such an event. When fragments of steel, which have quite a black appearance, remain fixed in the cornea several hours, it is found, after their removal, that the whole circumference of the depression, from which they have been extracted, is of a reddish-brown colour, produced by the rust left behind, and firmly adhering to the cornea. Every particle of rust must be carefully removed with a couching-needle, or else a permanent speck will ensue; but caution must be used not to puncture the anterior chamber. The extraction of particles of lead and gunpowder is generally difficult, as they have mostly been projected with great force against the eyelids, so as to produce not only a great deal of spasm, but instantaneous swelling of those parts. Hence, Beer says, that they should commonly be taken hold of with forceps, and cut away. Particles of cantharides are easily removed with a small silver spatula, or the end of an eye-probe; but, their violent chemical effect must be obviated by frequently applying to the part a little fresh butter, touching it with a camel-hair pencil, dipped in diluted liquor ammoniac, or dropping into the eye lukewarm mucilaginous collyria.

The attempt to wash particles of quicklime, mortar, &c. from the eye, Beer says, only has the effect of rendering their violent chemical operation more diffused, and he recommends them to be taken out by means of a fine hair-pencil, dipped in fresh butter, or oil. This is the only way of immediately counteracting their chemical effect, and, after their extraction, the application of unctuous substances to the part should still be continued.

The stings of small insects, when lodged in the sclerotic conjunctiva, are often very difficult of detection; but they are more readily seen on the skin of the eyelids. Beer directs us to remove them with a pair of forceps, or a couching-needle, and then to have recourse to means calculated to diminish ophthalmia, which, in these cases, always begins on the first occurrence of the accident. Small shots, lodged in the loose cellular texture of the conjunctiva, must be cut out. In general, says Beer, it is necessary to divide the conjunctiva, as they are mostly situated some distance from the place of their entrance, and of course are quite covered by that membrane.

As soon as a foreign body has been extracted from the eye, all precursors of ophthalmia diminish, as, for instance, the redness, intolerance of light, and the increased secretion and effusion of tears. Even the inflammation itself, when already

developed, subsides; but this affection is slight, if the eye has not itself been injured by the extraneous body. On the other hand, when the eye has suffered more or less irritation from the nature of the substance itself, and the treatment requisite for its complete extraction, the inflammation may become more severe, unless the surgeon pay immediate attention to the degree of injury remaining. (Beer.)

According to the principles laid down in the foregoing columns, the first indication in the treatment of wounds of the eye in general is to remove every kind of extraneous substance, which may impede the cure. Hence, the necessity of observing whether the instrument with which the wound has been afflicted, or any part of it, is lodged in the eye. When this is the case, the foreign body should be quickly extracted, or else no recovery can take place. Beer relates a case, to which he was called, where a piece of tobacco-pipe had been driven so forcibly and deeply at the external canthus between the eyeball and orbit of a young student, aged 19, and of delicate make, that the eye was immediately pushed out of its socket, and on Beer's arrival, it lay with the cornea, quite against the nose. Its very position led Beer to suspect, that some extraneous body was lodged in the orbit, and, notwithstanding the assurances of all the bystanders to the contrary, and the patient's being affected with violent spasms, the part was examined with a fine flexible whale-bone probe, by which means, a piece of the pipe, nearly an inch in length, was felt and immediately extracted with a pair of forceps. Scarcely had this substance been removed, when the eyeball was spontaneously drawn back into the orbit, though with the cornea still turned towards the nose, and the twitchings of the muscles also instantly ceased; but the eye was blind, and had but a very faint perception of light. By careful treatment, the eyesight was restored in five weeks; but the eye could not turn towards the temple, owing to the considerable injury, which the external straight muscle had sustained. With the aid of electricity, the power of rotating the eye about half its natural extent outwards was in the end regained, and the remaining infirmity resisted every method, deemed worthy of trial. (Beer, b. i. p. 146. See EXOPHTHALMIA.)

Fragments of broken instruments are not the only kind of extraneous substances, which may lodge in the wounded eye; for, as Beer observes, when the injury is extensive, contused and lacerated, there may be splinters of bone, or pieces of membrane, cellular substance, muscle, &c. so detached as to be quite incapable of reunion, on which account, this author sets them down as foreign bodies requiring to be taken away. However, I conceive that with respect to the soft parts, the advice here delivered should be received with much limitation.

Wounds of the eye, like those of most other parts of the body, may be healed either by direct union, or a slower process, in which suppuration, the filling up of the chasm by granulations, and the gradual but not complete, approximation of its edges to each other, are the most conspicuous effects. Clean incised wounds may be cured in the first way (see CATARACT); and lacerated, contused wounds, or such as are attended with loss of substance, in the second. But, whichever

plan be attempted, the eye must be kept quiet, and excluded from the air and light.

In healthy individuals, small punctures of the eye, made with instruments like needles, and perforating only the conjunctiva, or cornea, but not reaching the deeper textures of the organ, are generally followed by no serious consequences, even when all the aqueous humour is voided. It is only necessary to keep the eye quiet, and the air and light excluded from it by means of a light compress, suspended over it from the forehead. Under this treatment, such punctures are so firmly closed in twenty-four hours, without any opacity, that the chambers are nearly filled again with aqueous humour, and the intolerance of light, which was only the effect of the loss of that fluid, is entirely removed.

In large clean cut wounds of the eye, whether accidental or made in the extraction of the cataract, the prognosis must be very cautious, and the treatment conducted with the utmost care; for, says Beer, it too readily happens, that, though the wound is not important in itself, its effects become from the least mismanagement highly dangerous to the eye. Hence, when the patient is known to be either an individual not likely to take proper care of himself, or one too much alarmed about the fate of his eye, the prognosis should be very guarded, even where the constitution is of the best description, because a violent and dangerous attack of ophthalmia is apt to ensue and destroy the eye, sooner than effectual succour can be administered. On the other hand, when the patient is steady and intelligent, and the case is properly treated, the prognosis is favourable.

In considerable cuts of the eye, it is only possible to promote their union with a suitable bandage, and by effectually preventing all motion of the eye and eyelids, which is best accomplished, when the sound, as well as the injured eye, is covered, and the patient kept quiet in bed until the sides of the wound have grown together.—(Beer, b. i. p. 164.)

As cases of deeply penetrating wounds of the eyeball itself, Beer enumerates the punctures made in the depression and reclinacion of the cataract, and in every mode of forming artificial pupils; lacerations of the conjunctiva with ears of corn, pointed pieces of iron, splinters of wood, &c. In these cases the prognosis, he says, is always favourable, when the patient can put himself under all the conditions which the treatment requires, and his constitution is good. The first thing here to be carefully fulfilled, is the removal of any fragments of the instrument or body, with which the injury has been inflicted, and, it should be recollected, that, in these cases, minute splinters, which are scarcely discernible, frequently lodge in the conjunctiva, and, if not immediately traced and removed, produce the worst consequences.

With respect to lacerated wounds of the cornea, they either penetrate the anterior chamber, or not. They are all of them attended with more or less concussion, laceration, stretching and partial contusion, of the delicate anterior textures of the eyeball; a consideration, as Beer observes, materially affecting the prognosis. When, in such injuries of the cornea, inflammation and suppuration cannot be prevented, or the discharge is protracted, an obvious scar is always the consequence, which,

when situated in the centre of the cornea, is a serious impediment to vision. Every endeavour should therefore be made to unite the wound by the first intention; and the best chance will be afforded by treating the eye precisely in the same manner as after the extraction of the cataract. (See CATARACT.) And when the plan fortunately succeeds, the flow of the aqueous humour out of the eye ceases in about 36 or 48 hours, and the anterior chamber becomes distended again; but the site of the injury continues visible for some time afterwards. The speck, however, ultimately disappears, though much sooner in young, healthy subjects, than in the aged and feeble. When the opacity does not go off of itself, Beer finds a collyrium, containing some of the lapis divinus (see LACHRYMAL ORGANS), and the vinous tincture of opium, the most effectual means of dispersing it. Through large wounds penetrating the cornea near its edge, a fold of the iris is apt to protrude, and, when it does, it should be replaced, which can only be effected without mischief to the eye by gently rubbing the upper eyelid, and then letting a strong light suddenly strike the organ. In this case, the employment of instruments is considered by Beer highly objectionable. When the iris is not immediately reduced, it, as well as the cornea, is attacked with inflammation, and soon becomes firmly adherent to the edges of the wound. (See IRIS, *Prolapsus of the.*)

Large wounds penetrating the eyeball, and reaching the iris, are always of a very serious nature, even though the latter part may have received only a prick, or cut, because as the injury has been produced by accident, and not by art, the wound of the iris cannot be free from all laceration and contusion. It is incredible, says Beer, what extensive injuries the iris will bear in healthy individuals at its pupillary and ciliary edges, especially when produced by very sharp instruments; nay, rents may happen at both its edges, without any ill consequences, if the constitution be favourable; a proof of which fact is seen in the two common methods of forming an artificial pupil, viz. the excision of a piece of the iris, and the detachment of the iris from the ciliary ligament as practised both by Schmidt and Scarpa. But, according to Beer, all violent pressure, or actual contusion, particularly when it affects the portion of this organ between its two circles, cannot be borne even in the best constitutions, and the least grievous consequence is inflammation, soon followed by a partial, or complete closure of the pupil, or supuration in the eyeball. When the instrument causing such injury passes to the iris through the cornea, as is mostly the case, and the wound in the latter tunic is extensive, the torn iris is frequently pulled between the edges of the wound, at the moment when the weapon is withdrawn, and protrudes in a lacerated state. In this case, Beer recommends the torn projecting piece of the iris to be cut away with scissors close to the wound in the cornea, when the rest, he says, is generally retracted within the eye. Thus an adhesion of the iris to the cornea, termed *synechia anterior*, may often be prevented; which, when the lacerated iris is suffered to hang out of the cornea, is inevitable, surrounded by a large opaque cicatrix.

Some violent blows on the eye, though they cause no wound, are attended with such a con-

cussion of the anterior hemisphere of the organ, that more or less of the iris is instantaneously separated from the part of the ciliary ligament, where the force is most vehement. The consequence of this accident is either a double pupil, or the natural pupil closes, and the artificial one remains open. Such injuries may be produced by the lash of a whip, or a horse's tail (a common accident in the narrow streets of Vienna), or the thrust of any bluntish weapon against the outer part of the cornea; and they are inflicted in the method of forming an artificial pupil, recommended both by Schmidt and Scarpa.

Wounds, which enter the eye through the sclerotic near the cornea, usually produce a considerable effusion of blood in the chambers of the aqueous humour; but, Beer thinks, that there is never any necessity for making an opening for its discharge at the lower part of the cornea, except when it is so considerable as completely to hide the iris, and at the same time that the eyeball is affected with very painful tension and hardness.

Wounds of the eyeball, affecting the corpus ciliare, are set down by Beer as extremely dangerous, independently of the inflammation, which quickly follows. However, such injuries are most serious when they consist in a real contusion, or laceration of the corpus ciliare, which can hardly take place without a severe concussion, or actual disorganization of the retina, and laceration of the principal ciliary nerves and vessels. Hence, besides an effusion of blood in the chambers of the aqueous humour, a partial, or complete amaurotic blindness is instantly produced, and the iris, in the vicinity of the place where the instrument entered, is so retracted towards the margin of the cornea, that neither of its circles can be seen. In cases of this description, it also frequently happens, says Beer, that the patient, or the person who inflicted the wound, suddenly and roughly pulls the weapon out of the eye again, and together with it a part of the corpus ciliare, which is then to be regarded as an extraneous substance, and immediately cut off. With respect to the prognosis and treatment, the observations already made on these topics, in reference to wounds of the iris, are here quite applicable; excepting that as the effused blood is less copious, than in the latter cases, there can never be any necessity for letting it out by a depending opening in the cornea.

Wounds of the eye, affecting the crystalline lens, are not unfrequently followed by the formation of a cataract, and so are blows on the eye, which may be supposed to produce this effect by destroying some of the minute nutrient vessels naturally connecting the capsule with the lens. (Beer, b. i. p. 218.) The treatment of these accidents resembles that of injuries of the iris, except that the surgeon has rarely any extravasation of blood to deal with. However, when the lens has slipped into the anterior chamber, Beer recommends its immediate extraction through an incision in the cornea, in order to prevent the eye from being destroyed by a violent attack of traumatic inflammation and suppuration. Nor, when inflammation has come on, should this measure be postponed, as Beer has constantly found the disorder lessen, after the lens has been taken out.

Considerable wounds of the eye, attended with loss of the vitreous humour, are described by Beer as of a very serious nature; but, they rarely

take place accidentally, being almost always the consequence of a surgical operation. Accidental injuries of this kind are generally combined with so large, or complete a discharge of the vitreous humour, and with such mischief to the organization of the eye, that the consequence is a loss of the eyeball, or such a dwindling of it, that the fissure of the eyelids becomes nearly closed. According to Beer's experience, injuries of the foregoing kind, arising from accident, are mostly produced by the horns of cows. On the contrary, the effusion of the vitreous humour in operations upon the eye, he observes, is seldom followed by the loss of vision. See CATARACT.

Considerable injuries of the eyeball, complicated with a concussion, bruise, or actual wound of the retina, produce, either gradually or immediately, an amaurosis, which is almost always incurable. When the concussion of the retina is less violent, and does not affect every part of this texture, it may occasion only an amaurotic weakness of sight. In worse cases, the surgeon may think himself very successful, if he can prevent the figure of the eye from being destroyed by the subsequent inflammation, all idea of the recovery of the eyesight being out of the question. The treatment is the same as that commonly adopted after operations for the removal of an opaque lens (see CATARACT); but, there is one particular circumstance, sometimes attending injuries of the retina and ciliary nerves, claiming notice, viz. violent vomiting; a symptom which Beer says may even attend contusions of the sclerotica and of the ciliary nerves and retina, without any wound. Injuries of the ciliary nerves, he observes, are denoted by a very peculiar appearance; for, near the injured part, the iris is drawn up so close to the edge of the cornea, that its colour can scarcely be seen. When the surgeon is consulted in a case of this kind, though some inflammation may have commenced, the prognosis is yet favourable, in regard to the preservation of the eye; for a gentle opiate will relieve the vomiting, when merely a nervous effect, not depending upon the loaded state of the gastric organs; but, if the case be of this last description, the *primæ viæ* should first be emptied. However, when a traumatic inflammation is completely established, before the treatment is begun, the eye is generally destroyed, as the repeated and violent vomitings cause a great determination of blood to the head and eyes, and increase of the inflammation; an effect, which the opiates, given for the relief of the vomiting, also tend to produce.

Beer has seen two cases, in which the eye was pricked with a needle near the insertion of the external straight muscle into the sclerotica: in both instances, the punctures were so small, that they would scarcely have been found, had not the patients known their situations exactly by the pain, and they were then only perceptible with a magnifying glass. The punctures were soon followed by a convulsive rolling of the eyeball, and afterwards by trismus, which continued severe in one patient a day and a half, and in another two days, but yielded to large doses of musk and opium given at short intervals, the warm bath, and the application of warm poultices containing hyosciamus.*

As chemical injuries of the eye produce an actual loss of substance, they are even more se-

rious than common mechanical lesions. However, chemical injuries of little extent are generally repaired with tolerable facility and expedition. Quietude of the organ, and moderating the outward noxious effects by lukewarm mucilaginous applications, either in the form of fomentations, or eye-waters, are the only requisite measures. If the cornea itself be hurt, as frequently happens, when boiling hot fluids strike the eye, a kind of vesicle appears on the injured part, which becomes more and more white. The vesicle either bursts of itself, or subsides without breaking. In both cases, the production of the conjunctiva, of which the cyst of the vesicle is composed, shrivels up, and peels off, a new membrane of a similar nature being regenerated underneath. An opaque speck is frequently apprehended; but, says Beer, if the surgeon will merely avoid being too much in a hurry to open the vesicle, and not disturb the work of nature by applying various remedies to the eye, there will be no danger of such an occurrence.

More extensive chemical injuries of the eye, which at first are not in themselves very severe, frequently become dangerous, in consequence of care not being taken to prevent the influence of external stimuli. To this class of cases belongs the accidental sprinkling of the eye with boiling fluids, or strongish mineral acids. And, even in these examples, says Beer, the prognosis is not unfavourable, and a complete recovery may be effected, when the treatment is conducted according to the directions, already given with respect to such accidents in general. While this author approves of cutting away any substance, which is dead and partially detached, he strongly cautions surgeons not to remove the thin layer of the conjunctiva, nor to puncture any vesicle which may form.

When the burning, or corrosion, is not limited to the conjunctiva of the eyeball, but extends to the lining of one or both eyelids, Beer recommends covering the injured parts with mucilaginous applications, and mildly astringent ointments, containing tutty, or the white oxide of lead. In these cases, keeping the eye perfectly motionless must be hurtful, as it tends to promote the formation of adhesions, either between the eye and eyelids (*Symblepharon*), or between the eyelids themselves (*Anchyloblepharon*.)

Extensive, deeply penetrating, chemical injuries of the eyeball, are almost always followed by impairment of the functions of the organ, or of some of its particular textures, because such accidents never happen without a loss of substance. Thus a part, or the whole, of the cornea may be entirely destroyed, as in injuries caused by quicklime; and, frequently adhesions between the eye and eyelids, or between the two latter parts, cannot be prevented by any kind of skill. (*Beer*.) These serious degrees of mischief, as the same author observes, are mostly occasioned by slaked or unslaked lime, concentrated mineral acids, fire, &c. Unslaked lime, especially when extensively diffused over the eye by the immediate application of water, not unfrequently produces a sudden destruction of the whole of the cornea, which is changed into a greyish pappy substance, capable of being removed from the subjacent iris with a camel-hair pencil. Such an annihilation of texture, however, is generally restricted to particular

points, or the surface of the cornea. Wherever this membrane has been so much decomposed that a manifest depression is directly perceptible in it, when inspected sideways, a snow-white shining speck must be expected to be the consequence. Slaked lime never operates upon the cornea with so much violence, usually causing (as Beer states only a superficial corrosion, or a coagulation of the lymph between the layers of the cornea. Nor are mineral acids, even when concentrated, generally so destructive to the cornea as quicklime: first, because, as fluids, they do not long remain in contact with the eye; and secondly, because the immediate mixture of the tears with them weakens their operation, whereas it only increases that of unslaked lime. The local treatment here consists in carefully removing every particle of the hurtful substance, afterwards dropping frequently into the eye lukewarm mucilaginous decoctions or collyria, or covering the injured place with a mild oerate, and excluding the air and light from the eye. Every endeavour must also be made to prevent the formation of adhesions between the injured surfaces.

In severe burns of the eyeball, of course all idea of restoring its functions is out of the question. The violence of the injury is the greater, the more numerous the vesicles are upon the conjunctiva, and the more the eyeball and the iris are incapable of motion. Here the only indication is to moderate the inflammation, and avert such additional mischief, as might otherwise be produced by it. With this view, the eye should be kept at rest, and excluded from the light and air. According to Beer, the most common injuries of the eye, partaking both of a mechanical and chemical nature, are those caused by mortar, or the accidental touching of the eye with hot irons: When the mortar contains no particles of quicklime, it often occasions, at particular points of the cornea, very white specks, which Beer describes as being composed of coagulated lymph, and admitting of dispersion. He even declares, that when the whole of the cornea is in this state, its transparency may be restored by proper treatment, as has been frequently exemplified to the gentlemen attending his clinical lectures. (B. i. p. 234.) The pricking of the eyeball with a red-hot needle, and the stinging of it by bees, wasps, and other insects, are also both chemical and mechanical injuries. Whether the sting be left in the skin of the eyelid, or in the conjunctiva, or not, a considerable inflammatory swelling immediately takes place; and, if the sting be lodged, and not now taken away, the inflammation spreads, and the eye itself is endangered. In two cases, where the stings of bees were left in the skin of the upper eyelid, Beer knew gangrene arise, and the patients were saved with great difficulty. The treatment of such cases consists in immediately extracting the sting, if lodged, and applying folds of linen over the eye, wet with cold water.

After noticing the destructive effects of burning substances, the explosion of gunpowder, and fulminating silver, on the eye (cases in which, when the functions of the organ are annihilated, the only indication is to diminish the subsequent inflammation and its consequences), Beer inquires, what is the reason why the slightest mechanical, or chemical injuries of the eye, in an apparently healthy subject, are sometimes followed by an im-

moderate degree of inflammation, and even the loss of the organ from suppuration? It is, says he, an observation made by Schmidt, that there are some eyes, which the greatest bunglers may abuse for hours at a time without being spoiled, their powerful organization defying all such unskilful disturbance; while other eyes are met with, which the most skilful operators can hardly touch, without inducing a destructive degree of inflammation and suppuration. It was to this peculiar idiosyncrasy that Schmidt applied the term *vulnerability*. (*Verwundbarkeit*.) Patients of this habit are said to possess an exceedingly fine soft skin, with a reddish polish upon it; and their cheeks are not only red, but exhibit a network of very minute vessels, which seem as if injected. Such individuals appear as if they were in the bloom of health: and, says Beer, in some respects they are really so. When their spirits are raised by the slightest causes, their complexion is universally reddened; but the least fear turns them as pale as a corpse. Their skin is uncommonly irritable, sensible of every impression, and attacked with an erysipelatous redness, whenever any fatty substance touches it. In such habits the utmost caution is necessary whenever the eyes have been injured, and the prognosis should be reserved.

In severe ophthalmies, particularly those which affect the eyeball itself, all mental emotions, anger, joy, &c. should be avoided. Hence, no talkative nor quarrelsome persons should be suffered to remain with the patient; and noisy children ought to be kept away from him. The apartment should be ventilated at least once a day, without the patient being exposed to any current of wind. All touching of the eye, or rubbing it with the bed-clothes during sleep, must be strictly prohibited. Stimulating, spicy food, spirituous drinks, and great bodily exercise, are likewise to be forbidden. In the list of things which have a hurtful effect, Beer also includes all exertions of the lungs, every kind of disturbance, an atmosphere impregnated with tobacco-smoke, &c.

Having fulfilled the first general indication by removing, if possible, every kind of irritation acting upon the eye, the *second general indication*, specified by Beer as proper in the first stage of ophthalmia, is to moderate, according to the degree of inflammation, the agency of several things which the organ is naturally subjected to the effects of. Thus the inflamed eye should not be exercised, even though the eyeball itself may not be immediately inflamed; and the operation of the light and air should be diminished partly by green silk eye-shades, and partly by window-blinds. Attention to this rule is still more necessary, when the eyeball itself is affected.

The *third general indication*, mentioned by Beer, when the disorder threatens to extend to the whole organ, and to bring on febrile disturbance, is to counteract these effects by covering the eye with folded linen wet with simple cold water, or vinegar and water; and having recourse to leeches. (B. i. p. 242.) Here, however, it merits particular notice, that Beer, in expressing a general preference to cold lotions in the first stage of ophthalmia, differs from Richter, Scarpa, Travers, (*Synopsis of the Dis. of the Eye*, p. 250.) and several others, all of whom, in the painfully acute stage, recommend tepid emollient applications.

With regard to leeches, the late Mr. Ware ob-

jected to their being put on, or very near the eyelids, as they sometimes cause a considerable swelling of these parts, and increase, instead of lessening the irritation. In ordinary cases, his method was to apply three on the temple, about an inch and a half from the outer part of the orbit. Scarpa recommends applying the leeches to the vicinity of the eyelids, especially about the inner canthus, on the vena angularis, where it joins the frontal, deep orbital, and transverse vein of the face. Beer prefers nearly the same situation as that specified by Scarpa, viz. the inner canthus, immediately below the under eyelid; and he forbids the application of leeches above either canthus, as likely to produce a disagreeable ecchymosis of the upper eyelid. The number of leeches, and the time which they should be allowed to suck, he thinks, ought to depend upon the severity of the inflammation. According to Beer, when this mode of bleeding is to be of any service, the patient will experience a considerable abatement of the throbbing pain, tension, &c. in the affected eye. Hence, when any of the leeches fall off prematurely, the bleeding from the bites is to be kept up with a sponge dipped in warm water, until such relief is felt. In the acute stage, Beer considers the abstraction of blood by means of scarifications rarely admissible. (B. i. p. 243.) By Mr. Lawrence it is decidedly condemned; and it is a method to which I never have recourse. Mr. Travers also sets down scarifications of the conjunctiva as mostly objectionable in the acute stage, though highly beneficial in the chronic, where the lining of the eyelids is thickened and over-vascular; and a considerable discharge of blood may be thus obtained, if the operation be briskly done with a sharp lancet, and the lower lid kept everted, and fomented. The same gentleman states, that cupping has a decided superiority over leeches, but that both are well adapted to relieve local congestion. Yet, he deems these methods too indirect to answer as substitutes for the lancet, where it is desirable to make the system "sustain and feel a reduction of power," in which case, blood must be taken from a vein, or the temporal artery. (*Synopsis*, &c. p. 249.) The taking away of blood, by cupping the temples, is considered by many surgeons a very efficacious plan; quite as much so as that of opening the femoral artery, the hemorrhage from which is sometimes difficult to suppress. Some time ago, however, I had a woman under my care in University College Hospital, who had a temporal aneurism from cupping. (See ANEURISM.) While inflammation of the conjunctiva is described by Dr. Vetch, as not much affected by bleeding, unless the quantity of blood taken away be such as to occasion syncope, he states, that the abstraction of blood, in quantities proportioned to the violence of the symptoms, more especially by means of cupping and leeches, has for the most part sufficient control over the various states and individual symptoms of sclerotic inflammation. In some obscure cases of what this author terms amaurotic inflammation, he has seen great benefit derived from the application of leeches to the septum nasi: and he represents their being put directly on the conjunctival lining of the eyelids, as being sometimes more advantageous than on the adjacent integuments, the orifices bleeding with great freedom. (*On Dis. of the Eye*, p. 15.)

The fourth general indication, enumerated by

Beer, is that, which has for its objects a diet and regimen suited to the state of the case, after it has attained a degree, in which its effects begin to be felt throughout the system. The patient's ordinary diet is to be reduced, and he is to be allowed only vegetable food, cooling drinks, water, weak lemonade, &c. And not merely the eye itself is to be kept at rest, but the whole body.

Should the disorder be further advanced, and attended with a great deal of inflammatory fever, the observance of the foregoing indications will not suffice for checking the inflammation and preventing suppuration, unless the *fifth indication*, laid down by Beer, be fulfilled, which is to employ such remedies as operate upon the whole constitution, purging, general bleeding, &c. The blood, as Beer remarks, should be allowed to flow, until the hard, small pulse rises and becomes plainly softer; for, otherwise the operation will be completely useless. When general bleeding is no longer indicated, the employment of leeches may yet be advantageous. In severe cases, we commonly combine the exhibition of mercury with other active antiphlogistic means.

In the second stage, every thing which has a tendency to produce further weakness of the eye must be avoided: the first indication therefore specified by Beer, is to let the eye be cautiously exposed, according to its tendency will allow, to its wonted stimuli again. 1. By letting fresh, dry, and, if possible, a warmish air, have free access to the organ. 2. By exposing the eye to as much light (not of a reflected description) as can be borne, not only without difficulty, but with pleasure. 3. By moderately exercising the organ, especially, in the inspection of agreeable diversified objects; a plan which is of infinite service, when the eyeball itself has been affected.

The second indication is to apply tonic astrigent remedies. In this country, "when the extreme vascular congestion and excessive sensibility are reduced, and the inflammation tends to become chronic, the use of cold lotions, of a slightly tonic quality, is substituted with great advantage for ablations of warm water. The sulphates of alum and zinc are the best." (Travers, *Synopsis*, &c. p. 252.) This employment of astrigents also agrees with the advice delivered by Richter and Scarpa.

As an appendix to these general observations, I annex the sentiments of some other writers.

According to Scarpa, when bleeding and other evacuations have been practised, the next most useful measure is the application of a blister to the nape of the neck. He observes, that the skin here and behind the ears has a stronger sympathy with the eyes, than any other part of the integuments. On the other hand, the late Mr. Ware preferred blistering the temples, and says: "When the leeches have fallen off, and the consequent hemorrhage has ceased, I would advise a blister of the size of half a crown, to be applied on the temples, directly over the orifices made by the leeches; and I have found, that the sooner the blister has followed the bleeding, the more efficacious both have proved." He adds, that when ophthalmia is violent, and resists common methods, the most beneficial effects are sometimes produced by the application of a blister large enough to cover the whole head. (P. 43, 44.)

With respect to blisters, another modern writer particularly objects to their being applied near the

eye, or on the temples, "where they never fail to prove injurious." There is, says he, "but one exception to this, as a general rule; for, it would seem, that blisters, applied to the external surface of the palpebræ, in cases of purulent ophthalmia, tend considerably to diminish the purulency and chemosis." (*Vetch on Dis. of the Eye*, p. 17.)

In the second stage of acute ophthalmia, the *vinum opii* (*tinctura thebaica*) has been very extensively used, as a topical application. In common cases, two or three drops may be insinuated between the eyelids and globe of the eye, twice a day; but, in other instances, attended with more sensibility, once at first will be sufficient. The late Mr. Ware, who brought this application into repute, found, that introducing two or three drops of this medicine at the inner canthus, and letting them glide gradually over the eye, by gently drawing down the lower eyelid, proved equally beneficial, and less painful than letting them fall directly upon the eyeball. Immediately the application is made, it usually creates a copious flow of tears, a smarting, and a sense of heat in the eyes; which inconveniences, however, soon cease, and the eyes become clearer, and feel decidedly improved. But, notwithstanding these statements, unbiassed surgeons are now fully convinced, that the *vinum opii* is a proper application only when the inflammatory action has been previously diminished by bloodletting, aperient medicines, and blisters, and when the action of the vessels has been weakened by the continuance of the disease. Scarpa has seen the necessity of limiting its use, and has expressly pointed out, that it is beneficial only when the violence of the pain, and the aversion to light, have abated. Mr. Travers remarks, that "there are inflammations, which assume a chronic character in their commencement, evidently depending on a state of atony, of very partial extent, void of pain, and scarcely possessing any sign of inflammation, except the congestion of the vessels, or, if any, so feebly marked, as to encourage us to disregard them in the treatment. In such cases, a single stimulus will often restore the healthy action at once. The vinous tincture of opium has acquired a nostrum-like importance from its restorative operation in such cases; a virtue, I believe, not proper to it. A drop or two of the zinc, or the lunar caustic solution, or water impregnated with calomel, or a minute portion of the citrine ointment, or any other stimulant, would do as much." (*Synopsis*, &c. p. 252.)

Whenever the patient can easily bear a moderate degree of light, Scarpa directs all coverings to be removed from the eyes, except a shade of green, or black silk. A brighter light should be gradually admitted into the chamber every day, so that the eyes may become habituated, as soon as possible, to the open daylight; for, as Scarpa truly states, nothing has a greater tendency to prolong and increase the morbid irritability of the eyes, than keeping them unnecessarily long in a dark situation, or covered with compresses and bandages.

Dr. Vetch has such a dislike to the plan of covering the eye, that he never suffers a shade to be worn, conceiving, that, in conjunctival inflammation, it always does a great deal of harm by preventing a free exposure of the eye to a temperate atmosphere. (*On Dis. of the Eye*, p. 17.)

Besides the common remedies for inflammation, there are some very powerful means, which may

be employed for the relief of particular states of ophthalmia with great effect. Thus, as the latter author has observed, by means of *hyosciamus*, *belladonna*, and *stramonium* (see *Belladonna*), the important structure of the iris may be secured from injury, at the same time that other measures are adopted for checking the inflammation. Such medicines may even be applied, as a mechanical force, for detaching any recent adhesion. (*Op. cit.* p. 18.)

The uses of the *argentum nitratum* are also very extensive: "the slightest application of it in substance (says Dr. Vetch) can often remove the highest degree of morbid sensibility to light, and instantaneously restore quietude to the organ; it can prevent incipient changes, and obviate advanced ones; and may also be used in solution, as a valuable sedative."

The mention of so stimulating and active a substance as the nitrate of silver having a sedative effect may excite surprise; but the fact is unquestionable, and well illustrated in the treatment of several diseases. (See *CORNEA* and *IRIS*.) As another modern writer correctly states, it is remarkable, that even the weaker forms of medicated lotions irritate, and none more than such as contain opium. The relief afforded by anodyne fomentations in general, is very various. "I have known them (says Mr. Travers) objected to as painful, and patients inquire if they might not substitute warm water for the aqueous solution of opium, and infusions of poppy and hemlock. The same observation applies especially to painful herpetic cutaneous affections, and acutely irritable ulcers. Upon these a solution of opium often acts as a stimulant, and augments pain, while the lunar caustic solution as often assuages it." At the same time, Mr. Travers admits, that exceptions occur, and that he has met with cases, "in which no other application, than the aqueous solution of opium, could be borne." He has also known the vapour of *ludanum* afford the most marked relief to the irritability to light accompanying strumous ophthalmia. (*Synopsis of the Dis. of the Eye*, p. 251.)

According to Dr. Vetch, it is impossible, in cases of conjunctival ophthalmia, to possess an application of greater efficacy, than the undiluted *liquor plumbi subacetatis*, for altering the morbid and purulent state of that membrane: he also describes *nicotiana*, externally employed, as a narcotic and astringent, of singular service in lessening the pain and tumefaction. (P. 19.) However, the discordance amongst the best writers, about the effects of favourite local applications, would lead me to enjoin rather attention to the leading principles of the treatment, than confidence in the superior efficacy of any particular drug, or composition. As also the local applications should vary in the different stages of purulent ophthalmia, no single one will always be right. If Beer had delivered no observations of greater importance, than his condemnation of Bates's camphorated lotion, and his praise of other styptic stimulating applications, his remarks would be of little value; but, as he has pointed out the different stages of purulent ophthalmia in a very correct manner, and adapted his remedies to these various states of the disease, his information comprehends scientific principles, and becomes peculiarly interesting. The same praise belongs also to Dr. Vetch's

observations on purulent ophthalmia, who, in some points, both of the description of the complaint and its treatment, has surpassed Beer.

The term *ophthalmia*, according to its etymological import, would embrace all inflammations of the eye; yet, many of them have but few points of resemblance; and, as Mr. Lawrence inquires, what similarity of character could we expect between inflammation of the conjunctiva, sclerótica, cornea, iris, and retina? Inflammations of the external and internal coats differ widely from one another. The whole globe may be inflamed at once; but this is not a common occurrence. In general, inflammation affects only the external or internal tunics, and often only one at a time. It commonly begins in one structure, is confined at first to that, and if judiciously treated, does not extend beyond it. But if it is neglected, it readily extends beyond its original seat, and perhaps finally implicates the whole of the organ. (See *Lawrence on Dis. of the Eye*, p. 72.) The best arrangement of inflammations of the eye is that founded on the structure first and chiefly affected. *Acute suppurative inflammation of the conjunctiva* is divisible into the mild and severe forms. (See *Travers, Synopsis*, &c. p. 96.) Dr. Vetch, who prefers the general term *conjunctival inflammation*, observes, that from many external and internal causes, the conjunctiva is liable to become the seat of inflammation, more especially that portion of it which gives a lining to the inner surface of the eyelids. The disease, in its general nature, seems to him to differ but little from that which is met with in other parts having a similar surface, as the nose, the fauces, the bronchial cells, and the urethra; but the continuation of the membrane forward upon the anterior portion of the eye, and the consequent liability of the inflammation to affect this important organ, attach much interest to all the circumstances capable of producing it. (On *Dis. of the Eye*, p. 148.) One variety of it corresponding to more moderate forms of the disorder, and here well known under the name of *mild purulent, or catarrhal ophthalmia*, is rather incorrectly termed by Beer *glandular inflammation of the eyelids*, the Meibomian glands, if affected at all, not being so primarily, but secondarily.

As one of the best writers on this branch of surgery has observed, there are three kinds of ophthalmia excited, especially in adults, by atmospheric influences; namely, the *catarrhal*, the *rheumatic* and the *catarrho rheumatic*. The first of these is a puro-mucous or blenorrhœal inflammation of the conjunctiva; the second, an affection of the fibrous sclerótica; while, in the third, both the conjunctiva and sclerótica are attacked, the symptoms of catarrhal being united to those of rheumatic ophthalmia. (See *MacKenzie on Dis. of the Eye*, p. 399. ed. 2.)

In adults, *catarrhal ophthalmia*, as the first is called, more especially when other catarrhal symptoms, pain in the frontal sinuses, chills, heat, &c. attend, it is by far the most common disease of the eye. The symptoms are reticular redness, sandy pain, and adhesion of the eyelids in the morning (*Id.*); stiffness and smarting, some uneasiness on exposure to light, watering, and external redness usher in the attack. As Beer states, there is also an annoying itching. When fully developed, it is characterised by redness and increased mucous, not lachrymal discharge: the pain is inconsiderable, and there is

no intolerance of light. The redness is superficial, and of a bright scarlet colour, forming a striking contrast to the rose or pink tint, which belongs to inflammation seated in the sclerotic coat. In mild cases, the redness is chiefly in the conjunctiva lining the eyelids. On the white of the eye, the vessels are arranged in a net-work, and can be removed in every direction by pressing the eyelid against the eyeball with the finger. The redness is mostly in patches, some fasciculi of vessels being more filled than others. In the highest degree of the inflammation, however, the whole surface becomes of a bright red. The redness begins at the circumference of the globe, and gradually advances towards the corner; but in the commencement it is confined to the palpebral conjunctiva, or to the angle of reflection. (*Lawrence*, p. 152.) Not unfrequently, spots of extravasated blood are observed beneath the conjunctiva, or even a general but slight ecchymosis. In catarrhal ophthalmia, the patient is generally free from headach; whereas in rheumatic inflammation of the eye, one of the most remarkable symptoms is supraorbital, or circumorbital pain, severely aggravated during the night. In catarrhal ophthalmia, he also constantly complains of a pricking, or feel of roughness in the eye, as if sand, hot ashes, or broken glass were under the upper eyelid; a sensation which never attends the pure rheumatic ophthalmia. When headach does attend catarrhal ophthalmia, it is seated in the forehead, and is chiefly experienced in the morning. (See *MacKenzie, Op. cit.* p. 400.) Catarrhal ophthalmia rarely produces any swelling of the conjunctiva approximating to the state termed *chemosis*, and so common in the more severe forms of purulent inflammation. The only approach to such an appearance is a loose serous effusion, raising the mucous membrane from the sclerótica. The pain in the commencement of catarrhal ophthalmia is not considerable, except in severe cases. The intolerance of light is slight at first, and after a time the patient hardly complains of uneasiness, and opens the eye freely to the light, even when there is considerable redness. The feeling as if a foreign body were in the eye, seems to Mr. Lawrence to be produced by the partial vascular distention, and consequent inequality of surface, and mechanical irritation on motion. When the fulness of the vessels is lessened by bleeding, the sensation subsides. "When the lachrymal discharge observed in the very commencement, stops, its place is supplied by increased secretion of mucus from the inflamed membrane itself. This is at first thin, and, as the inflammation goes through certain stages, it becomes thicker, assuming a whitish or yellowish appearance, and sometimes putting on an appearance approximating to that of pus. This increased mucous discharge distinguishes the catarrhal form of inflammation. Its quantity will depend on the degree and extent of inflammation. It may be just sufficient to collect in small quantity in the corners of the eye; a whitish streak may be seen on the inside of the lower lid at the angle of reflection. There may be enough to form more or less copious incrustations about the cilia, and agglutinate the edges of the lids at night; or, it may constitute a copious muco-purulent discharge, hardly distinguishable from that of mild purulent ophthalmia. The eyelids participate, more or less, whenever there is a marked attack of catarrhal inflammation in the

eye. In the daytime the redness is generally less than at night; and so are the pain and intolerance of light. (See *Lawrence, Op. cit.* p. 153.)

As this form of ophthalmia is originally restricted to the conjunctiva, it is not usually dangerous, unless it be violent, and either totally neglected, or wrongly treated; then it may extend to the scleritica and cornea, and cause ulceration, or opacity of the latter. (*Id.*)

Beer ascribes glandular inflammation of the eyelids, or, as we call it, catarrhal and mild purulent ophthalmia, to the operation of various stimuli, acting chemically upon the edge of the eyelid, and upon the exposed follicles of the glands of the eyelid towards the inner canthus. Hence, says he, when many men are living together in a polluted, noxious air, impregnated with extraneous substances, this form of inflammation is found to occur even in the strongest constitutions with such frequency, that it seems as if it were epidemic. And, according to Beer, the principal cause of the disease will be found to be in the atmosphere, and the next most frequent occasion of it, he observes, is uncleanness, as washing the eyes with foul water, &c. At the same time, he seems aware that this explanation would not of itself be always quite satisfactory; for, he adds, that, although under the above circumstances, no constitution, no sex, nor age, is spared, there must be some particular condition which is conducive to the disorder, or, at all events, to its more rapid and severe course, and the quick extension of the inflammation in certain individuals, which condition, he supposes, must depend either upon weakness of constitution, or upon excessive irritability, or, as he terms it, *vulnerability* of the whole surface of the body. Beer makes no mention of the effect of damp nocturnal air in warm countries as giving origin to purulent ophthalmia, so much insisted upon by A-salini and Dr. Vetch, but which doctrine, in reference to the origin of purulent ophthalmies in England, I think completely fails; and what is still more worthy of notice, Beer never attempts to explain the propagation of the disease by its infectious nature. It is observed by Dr. Vetch, that the history of all diseases, originating from some particular impression received from the atmosphere, but capable, when formed, of propagating themselves by contagion, is rendered particularly difficult; because the same circumstances, which favour the communication by contagion, produce also a predisposition to be acted upon by the more general causes existing in the atmosphere. The principal cause, which gives force and opportunity to the action of contagion, is the crowding individuals together into too limited spaces. The same circumstance, Dr. Vetch has seen, give a predisposition to diseases of an epidemic, but not a contagious nature; and hence he infers, that it may produce the same predisposition to diseases, which are both contagious and atmospheric. — "The appearance of ophthalmia among the crews of ships and in barracks was often met with long before the late destructive and virulent disease (presently to be described). In the army, such an ophthalmia has extended to whole regiments, without any appearance of the disease among the inhabitants of the neighbourhood; and while the free intercourse, which subsists among the men, as to washing in the same water, using the same towels, and sleeping more than one in a bed, readily accounts for the rapid

extension of the disease in the same corps, yet the excessive crowding together of men will often of itself engender inflammation of the conjunctiva." (*On Dis. of the Eyes*, p. 171.) I believe, with respect to the causes of all purulent ophthalmies, our present knowledge will permit us to venture no further than the tenor of the preceding observations, which is, that they originate epidemically, but probably multiply both in this manner, and by the infectious matter of the disease being inadvertently applied in various ways to the eyelids of other persons.

As the state of the atmosphere, uncleanness, crowded and close places, &c. are considered by Beer to be the principal causes of glandular inflammation of the eyelids, or simple purulent ophthalmia, one of the most important indications, in the first stage of the disorder, seems to him to be the removal of these hurtful circumstances. And, he declares, that, if immediate attention be not paid to such indication, it will be quite impossible to prevent a dangerous increase of the disorder. A cool fresh air, and bathing the eye with cold water, or a weak lotion of vinegar and water, Beer represents to be means usually adequate to stifle this inflammation in its birth. But, in the beginning of this stage, while the secretion is a pure mucous and sebaceous matter, he deems it absolutely necessary to employ such external means, as are calculated to promote the action of the veins and absorbents. For this purpose, he recommends the following collyrium: R. Aq. rosæ ꝑiv. Hydrarg. Bichloridi gr. j. vel. gr. dimidium. Mucil. sem. cydon. ꝑj. Tinct. opii. vinos. 3j. Misce. This eyewater is to be used lukewarm from four to six times a day, and the eye afterwards carefully and completely dried. No eye, in this state, he says, will bear more than the proportion of one gr. of the bichloride of quicksilver, and only seldom more than half a grain.

But, as soon as the suppurative period commences, attended with excoriations, gentle astringents, like the liquor plumbi subacetatis, in a solution of the lapis divinus (see LACHRYMAL ORGANS) should be added to the above lotion, for which they may at length be entirely substituted. And when the suppurative period has terminated, but a morbid secretion of mucus yet obstinately continues, and threatens to become habitual, recourse should be had, without the least delay, to one of the following eye-salves, a bit of which, about the size of a small pea, Beer directs to be smeared once a day over the edges of the eyelids. R. Butyr. recentis insulsi 3 ss. Hydrargyri nitrico-oxydi gr. x. Tutia ppt. gr. vj. Misce. This ointment, he says, will sometimes answer, but, that it is mostly necessary to use Janin's salve, composed as follows: R. Butyri recentis insulsi 3 ss. Hydrargyri præcipitati albi, gr. xv. Bol. albi ꝑj. Misce.

The mild acute suppurative inflammation of the conjunctiva is not attended with that excessive swelling of the eyelids, that intense pain, nor that profuse secretion, with which the vehement acute form of the disease is characterized. In the treatment, Mr. Travers directs a solution of alum to be early substituted for emollient fomentations, which he recommends to be freely used during the acute period. Simple purging and abstinence, he says, are generally sufficient to allay the febrile irrita-

tion, which is moderate. Topical bleedings, and blisters, kept open, on the back of the neck, are also of great efficacy. "When the pain and irritability to light subside, and the discharge becomes glecty, the conjunctiva pale and flaccid, tonics, especially the extract of bark and the acids, do great good." (*Synopsis*, &c. p. 264.)

Mr. Lawrence recommends mild antiphlogistic treatment. Venesection does not seem to him to be generally necessary; but, in a young subject of full habit, with catarrhal inflammation in both eyes, and that severe, a full blood-letting appears to him proper. In ordinary cases, he would be content with cupping and leeching. "The bowels should be freely evacuated by an active aperient, or, if the tongue be foul, an emetic may advantageously follow the loss of blood. Saline sudorific medicines may then be given, such as liquor ammoniac acetatis, with nitre, or tartrate of antimony, and occasional purgatives. The patient should be kept warm, taking plentifully of warm diluent drinks, and no animal food, nor fermented liquor. If blood should have been taken by venesection, or cupping in the morning, and the alimentary canal should have been subsequently cleared by an emetic and a purgative, the warm bath, or warm pediluvium, may be used at night, and a full dose of Dover's powder given at bedtime. The patient will be nearly recovered the next day, or it may be necessary to repeat cupping, or leeches, to persevere in low diet, diaphoretics, and purgatives, for a few days, and perhaps to apply a blister to the nape. When the inflammatory affection is not considerable, and seems entirely referable to a disordered state of the alimentary canal, it may not be necessary to take blood from the part. An emetic and an active aperient, containing calomel, or the latter alone, may be administered, and followed by mild purgatives, the diet being light." (See *Lawrence*, *Op. cit.* p. 155.)

This gentleman deems warm water, or poppy head fomentations, better than cold applications. In order to keep the eyelids from becoming adherent in the night, their margins are to be smeared with a little lard, or spermaceti ointment, at bedtime.

Catarrhal and other mild purulent ophthalmies, we see were successfully treated by Beer by means of rather stimulating applications, resorted to in the second stage of the disorder. Solutions of the nitrate of silver have often been preferred; a plan, which is stated to have been first practised by Dr. Ridgway, who recommends a solution of ten grains of the caustic to an ounce of water. (See *Bacot*, *on Syphilis*, p. 136.) Catarrhal ophthalmia is found by Dr. Mackenzie to yield readily to treatment chiefly of a local stimulating kind. He employs a solution of four grains of nitrate of silver in one ounce of distilled water, applying a large drop of it to the eye once, twice, or thrice a day, by means of a camel-hair pencil. If the patient is of a torpid constitution, and the discharge copious, Dr. Mackenzie uses a stronger or even a saturated solution, or a nitrate of silver ointment, in the proportion of ten or twenty grains to the ounce, as proposed by Mr. Guthrie, or the red precipitate salve, sixty grains to the ounce. As a collyrium, he is in the habit of using a solution of one grain of the bichloride of mercury, and six grains of urate of ammonia, in eight ounces of water, to

which are added 5 ij of vinum opii. The eyelids are bathed with it in a tepid state by means of rag, or soft sponge. In mild cases, a few drops are then allowed to flow in upon the eye; but in severe ones, attended with copious puriform discharge, the lotion is injected over the whole surface of the conjunctiva. At night, a little red precipitate ointment is smeared along the edges of the eyelids. Dr. Mackenzie rarely takes away blood, unless there be much constitutional irritation, and pronounces scarifications only necessary when there is some degree of chemosis. He prescribes at first a brisk dose of calomel and jalap, with neutral salts occasionally in the course of the disorder. He approves of mild diaphoretics, and, in severe cases, of blistering the nape of the neck, or behind the ears. If there is any tendency to a rough and sarcomatous state of the conjunctiva, he alternately scarifies it, and touches it with nitrate of silver, or sulphate of copper. (See *Mackenzie*, *Op. cit.* ed. ii. p. 404.)

A shade for the eye need not be employed unless as a protection from strong light. Free exposure to a mild atmosphere is deemed beneficial.

Mr. Middlemore considers bleeding generally advantageous. His collyria consist of a weak solution of alum, or zinc, applied either warm, or cold, as the patient's feelings may dictate. In severe cases, he sanctions the use of fomentations. The strong nitrate of silver ointment he does not recommend for catarrhal ophthalmia. (*On Dis. of the Eye*, vol. i. p. 98.)

Severe Purulent Ophthalmia, including the *ophthalmia neonatorum*; the *Egyptian ophthalmia*; the *gonorrhoeal ophthalmia*, &c., is sudden in its attack; a feature, in which it particularly differs from the milder cases, usually met with in schools. (See *Lloyd on Scrofula*, p. 321.) It is accompanied with most severe darting pains; and the upper eyelid is sometimes in a few hours prolonged upon the cheek, owing to the infiltration and enormous swelling of the tissue, connecting the conjunctiva to the tarsus. (*Travers*, *Synopsis*, &c. p. 265.)

This modification of purulent ophthalmia consists entirely in the rapid extension of the inflammation and suppuration, the disorder affecting, ere it is suspected, not only the whole of the conjunctiva of the eyelid, but also that of the eyeball, and the sclerotic and cornea. In the first stage of purulent ophthalmia in the adult, there is redness of the palpebral conjunctiva, with profuse lachrymation, a sensation as if sand were under the eyelids, and some stiffness of these parts; a small quantity of whitish mucus being observed on the conjunctiva. The swelling of the palpebral conjunctiva is described by Beer as being unusually great; at first, soft, somewhat elastic, smooth, and readily bleeding; but, afterwards, in the second stage, hard and granulated, or, as another writer says, it "becomes preternaturally vascular, thickened, and scabrous, or forms fleshy eminences." (*Travers*, *Synopsis*, &c. p. 96.) The first stage is rapidly over. At the first period of the second stage, the secretion both of mucus and pus is surprisingly copious. First, the mucus is whitish and thin; but as soon as the suppurative process begins, it becomes yellowish and thick, and when an attempt is made to open the eyelids, it gushes out with such force, and

in so large a quantity, as frequently to cover, in an instant, the whole cheek. Sometimes this mixture of mucus and matter contains light-coloured streaks of blood; but, in worse cases, these streaks are dark and brownish, or else a thin ichor is discharged, in which case, the progress of the disease is so rapid, that the eye can seldom be saved. The swelling of the conjunctiva of the eyelids, especially of that of the upper one, always increases during the first period of suppuration, and, when the discharge is more ichorous, the membrane is more granulated, so that, if the eyelid be opened carelessly, the whole tumefied conjunctiva of the upper eyelid is immediately thrown outward, in the form of ectropium, and it is sometimes difficult, and even impracticable, to turn the part inward again, especially when the conjunctiva is already changed into a hard sarcomatous substance. While the swelling at the inner surface of the eyelids continues to increase, their outer surface, particularly that of the upper one, becomes reddened; but the redness is dark-coloured, inclining to brown. The patient then at first complains of stiffness in the eyelids and globe; and then of a sensation as if sand or gravel were lodged in the eye. There is at first profuse lachrymation, then abundant purulent discharge, not only covering the edges of the lids, and the cilia, but pouring out over the face, and dropping on the clothes. Dr. Vetch never knew pus in these cases form in the anterior chamber. The purulent discharge sometimes amounts to several ounces in the twenty-four hours. (*Account of the Ophthalmia, &c.* p. 54.)

This form of ophthalmia soon extends to the globe in what may be called its second stage; and "now we see it marked by high vascular action, and bright redness, great tumefaction of the membrane, and profuse discharge. The redness is uniform and bright, and there are often red patches, apparently of ecchymosis. The swelling of the membrane on the globe raises it into an elevation called chemosis, which is often so considerable, as to overlap and completely hide the eye." At this period of the complaint, the whole palpebra swells, from serous effusion into its cellular texture. In this way, the lids often form two large convex, colourless, or slightly red protuberances, which meet and entirely close the eye." (See *Lawrence on Dis. of the Eye*, p. 179.)

When during the first, very short and transient stage, the inflammation extends also to the sclerotic conjunctiva, this membrane forms a pale red, soft, irregular swelling, all round the cornea, which at length seems so buried, that at the period of the mucous secretion, its centre can hardly be discerned; and, when suppuration begins, both mucus and pus are discharged from the conjunctiva of the eyeball in profuse quantity, particularly accumulating over the cornea, and not unfrequently drying into a thick pellicle, when long detained in the eye. Hence, the case looks as if the whole eyeball, or, at least, all the cornea, were in a state of complete suppuration. At length, the tumefied conjunctiva of the eyeball becomes sarcomatous, though never in such a degree as that of the eyelids. When the suppurative period ceases, and with it the most urgent danger to the eye, the secretion of mucus alone continues, as at the first period of the second stage, the swelling of the conjunctiva of the eyelids, and of

the sclerotic conjunctiva when this also has been affected, diminishes, and the disorder ends in an increased effusion of tears, or true epiphora. When the effects of the suppuration upon the conjunctiva of the eyeball are more severe, the corneal production of this membrane in the most favourable cases is raised from the subjacent cornea, and so opaque, that the eyesight is lost, or at all events seriously impaired, until the transparency returns, which is sometimes late, especially when efficient treatment is not put in practice. Should the suppuration be very deep, the cornea, which always turns whiter and whiter, presents near the edge of the swelling of the conjunctiva an arrangement, similar to that of the leaves of an old book, and at length seems converted into a mass of purulent matter, which projects more and more out of the depression in the swelled conjunctiva, and then bursts in its centre either quickly and with very violent pain, or slowly without any suffering, an oval hole being left, behind which the yet transparent crystalline lens appears, included in its undamaged capsule. At this period, adults can often see very plainly, and fancy their recovery near at hand, or, at least, all danger over. Already, however, every part of the cornea has been more or less perforated by ulceration: the iris protrudes through all these apertures, so as to form what has sometimes been named the *staphyloma racemosum*. In a very short time, not exceeding a few hours, the capsule of the lens is affected, and bursts like the cornea, when it is discharged either with, or without, a portion of the vitreous humour. At length, the suppuration subsides, and with it the protrusions of the iris, the opening in the cornea becoming closed with a brown, or blueish, opaque flat cicatrix. But, if in this destructive form of suppuration, nothing is done for the relief of the disease, the whole eyeball suppurates, the eyelids become concave, instead of convex, and the fissure between them closes for ever. In adults of feeble constitution, when the case is not properly treated, but particularly in weak children, this excessively violent form of conjunctival inflammation and suppuration spreads with such rapidity, that a considerable general disturbance of the system is occasioned. Indeed, according to Mr. Travers, in the common course of this vehement form of conjunctival suppurative ophthalmia, the system sympathizes; chilliness is succeeded by a hot and dry skin; and the pulse is frequent and hard. Yet, it is particularly pointed out by the army surgeons, that one peculiarity of the Egyptian purulent ophthalmia is its being generally attended with little constitutional disturbance.

Chemosis, or a copious effusion of lymph in the loose cellular tissue between the conjunctiva and the eyeball, is one of the usual effects of severe purulent ophthalmia. "It is after this morbid condition, which is characteristic of the suppurative ophthalmia (says Mr. Travers), that the conjunctiva forms fungous excrescences, pendulous flaps, or hard callous rolls protruding between the palpebrae and globe, and everting the former, or, if not protruding, causing the turning of the lid over against the globe. The tarsal portion takes on from the same cause the hard granulated surface, which keeps up incessant irritation of the sclerotic conjunctiva, and at length renders the cornea opaque." (*Synopsis, &c.* p. 98.)

Catarrhal ophthalmia is the only affection liable to be confounded with the foregoing complaint. The peculiar change of structure in the palpebral conjunctiva, the long continuance of the disorder, and the relapses, the great swelling, chemotic and palpebral, the violent vascular congestion, and general bright red of the membrane, with the profuse purulent discharge, are sufficient distinctions. Suppuration, ulceration, opacity, and staphyloma of the cornea, frequent consequences of severe purulent ophthalmies, are very uncommon in catarrhal. But, as Mr. Lawrence observes, the two diseases, if we look merely to an attack of the contagious disorder, without embracing the whole history, differ more in degree, than in kind. The distinction between a mild catarrhal and an acute case is obvious; but, we might not be able to distinguish between a mild purulent and a severe catarrhal ophthalmia. There would be no difference in treatment. (*On Dis. of the Eye*, p. 189.)

Egyptian, or Contagious Purulent Ophthalmia. One of the best accounts of this disease, as it appeared in the army, is that delivered by Dr. Vetch. Although there can be no doubt, that the disorder, in all its general characters, closely corresponds to other severe forms of acute suppurative inflammation of the conjunctiva, yet, it has some peculiarities. Thus, one thing noticed was, that the first appearance of inflammation was observable in the lining of the lower eyelid: (*Peach, in Edinb. Med. and Surgical Journ. for January, 1807; Vetch, on Diseases of the Eye*, p. 196.) According to the latter writer, the feeling of dirt, or sand rolling in the eye is a symptom requiring particular attention, as its accession is a certain index of the disease being on the increase. It is subject to exacerbations and remissions, the attacks always taking place in the evening, or very early in the morning. The first stage of the disease is said by Dr. Vetch to be characterised by its great and uniform redness, without that pain, tension, or intolerance of light, which accompanies most other forms of ocular inflammation; and, in particular, that in which the sclerotic coat is affected. From the very beginning of the complaint, there is a disposition to puffiness in the cellular texture between the conjunctiva and the globe of the eye, often suddenly swelling out into a state of complete chemosis, and, at other times, making a more gradual approach to the cornea. While effusion is thus taking place upon the eye, oedema is likewise going on beneath the integuments of the eyelids. This enormous tumefaction of the eyelids is said to be generally consentaneous with the complete formation of chemosis; entropium is produced, and the integuments of the two eyelids meet, leaving a deep sulcus between them. When the external swelling begins, the discharge, which was previously moderate, and consisted of pus, floating in a watery fluid, changes into a continued stream of yellow matter, which diluted with the lachrymal secretion, greatly exceeds in quantity that derived from any gonorrhoea. Although, says Dr. Vetch, the tumefaction may be, at first, farther advanced, in one eye than the other, it generally reaches its greatest height in both about the same. The patient now begins to suffer attacks of excruciating pain in the eye; a certain indication of the extension of the mischief. "An occasional sensation, as if needles were thrust into the eye, accompanied with fulness and throbbing of the temples, often precedes the deeper

seated pain." This last is often of an intermitting nature, and a period of excruciating torture is succeeded by an interval of perfect ease. Sometimes the pain shifts instantaneously from one eye to the other, and is seldom or never equally severe in both at the same time; and sometimes, instead of being in the eye, it occurs in a circumscribed spot of the head, which the patient describes by saying, he can cover the part with his finger. Sooner or later, one of these attacks of pain is terminated by a sensation of rupture of the cornea, with a gush of scalding water, succeeded by immediate relief to the eye, in which this event has happened, but generally soon followed by an increased violence of the symptoms in the other. At length the attacks of pain become shorter, and less severe, though they do not cease altogether till after the lapse of many weeks and even months. During this stage of the disease, according to Dr. Vetch, there is seldom the slightest alteration of the pulse, unless the lancet have been freely employed. The patient's general health is little impaired, his appetite continues natural, but sleep almost totally forsakes him.

As the pain abates, the external tumefaction also subsides, and a gaping appearance of the eyelids succeeds; their edges, instead of being inverted, now becoming everted. This is what Dr. Vetch designates as the third stage of the disease.

After the swelling of the second stage has subsided, the eyelids are prevented from returning to their natural state by the granulated change of the conjunctiva, which lines them; and an eversion of them now occurs in a greater or lesser degree. (*Vetch, on Dis. of the Eye*, p. 196, 202.) Amongst other interesting remarks, made by the same author, he states, that there is no reason to warrant the idea, that the ulceration ever proceeds from within outwards. He observes, that, when any large portion of the cornea sloughs, an adventitious and vascular membrane is often produced, which finally forms a staphyloma. "In some few cases (says he), I have seen the lens and its capsule exposed, without any external covering whatever, and, for a short time, the patient saw every thing with wonderful accuracy; but, as soon as the capsule gives way, the lens and more or less of the vitreous humour escape, the eye shrinks, and the cornea contracts into a small horn-coloured speck." This total destruction of the globe of the eye is said generally to ensure the other, and renders it less liable to be affected by future attacks of inflammation.

A few years ago, an ophthalmia, supposed to be of the same nature as the Egyptian, though milder, like that which has generally been observed in schools, occurred to a great extent in the Royal Military Asylum at Chelsea, and Sir Patrick M'Gregor, the surgeon, favoured the public with an excellent description of the disease. The symptoms generally made their appearance in the following order: "A considerable degree of itching was first felt in the evening; this was succeeded by a sticking together of the eyelids, principally complained of by the patient on waking in the morning. The eyelids appeared fuller externally, than they naturally are; and on examining their internal surface, this was found inflamed. The sebaceous glands of the tarsi were considerably enlarged, and of a redder colour than usual.

The caruncula lachrymalis had a similar appearance.

"In 24 or 30 hours after the appearance of the above-mentioned symptoms, a viscid mucous discharge took place from the internal surface of each eyelid, and lodged at the inner canthus, till the quantity was sufficient to be pressed over the cheek by the motions of the eye. The vessels of the tunica conjunctiva, covering the eyeball, were distended with red blood, and the tunica conjunctiva was generally so thickened, and raised, as to form an elevated border round the transparent cornea. This state was often accompanied with redness of the skin round the eye; which sometimes extended to a considerable distance, and resembled, in colour and form, very much what takes place in the cow-pox pustule, between the ninth and twelfth days after inoculation.

"When the purulent discharge was considerable, there was a swelling of the external eyelids, which often prevented the patient from opening them for several days. The discharge also frequently excoriated the cheeks as it trickled down. Exposure to light caused pain. When light was excluded, and the eye kept from motion, pain was seldom much complained of.

"These symptoms in many subsided, without much aid from medicine, in 10, 12, or 14 days; leaving the eye for a considerable time in an irritable state. In several, however, the disease continued for a much longer time, and ulceration took place on the internal surface of the eyelids, and in different parts on the eyeball. If one of those small ulcers happened to be situated on the transparent cornea, it generally, on healing, left a white speck, which, however, in the young subjects, under our care, was commonly soon removed. In some few instances, an abscess took place in the substance of the eyeball, which, bursting externally, produced irrecoverable blindness." (See *Trans. for the Improvement of Med. and Chir. Knowledge*, vol. iii. p. 31—40.) When the local symptoms had prevailed two or three days, some febrile disturbance occurred; but, except in severe cases, it was scarcely observable.

Sir P. M'Gregor considered this ophthalmia to be of the same nature as that which raged with such violence in the army at different periods, after the return of our troops from Egypt in 1800, 1801, and 1802. However, he found that its consequences were not so injurious to children as to adults; for, out of the great number of children afflicted with the disease at the Military Asylum, only six lost the sight of both eyes, and twelve the sight of one eye. (*Op. cit.* p. 49) On the other hand, Dr. Vetch informs us, that, in the second battalion of the 52d regiment, which consisted of somewhat more than 700 men, 636 cases of ophthalmia were admitted into the hospital between August, 1805, and August, 1806; and that "of this number, fifty were dismissed with the loss of both eyes, and forty with that of one." And, as Sir P. M'Gregor observes, it is a melancholy fact, as appears from the returns of Chelsea and Kilmainham Hospitals, that 2317 soldiers were, on the 1st of December, 1810, a burden upon the public, from blindness in consequence of ophthalmia. The cases in which only one eye was lost, are not here included.

The attacks of the disease appear to be much

more frequent, severe, and obstinate, in hot sultry weather, than in cold, or temperate seasons. (*Op. cit.* p. 37, 54, &c.)

Sir P. M'Gregor also observed, that the ophthalmia was more severe and protracted in persons of red hair, or a scrofulous habit, than in others. The right eye was more frequently and violently affected than the left. In females the symptoms were greatly aggravated for some days previous to the catamenia; but, on this evacuation taking place, they were quickly lessened. He further remarked, that the measles, cow-pox, and mumps, went through their course as regularly in persons affected with this species of ophthalmia, as when no other disease was present; a circumstance, which, with some others, proved to him that the disorder was entirely local. (*P.* 54, 55.)

With respect to the causes of *Egyptian Purulent Ophthalmia*, much difference of opinion prevails, and, indeed, there was a time, when the disease was regarded by the majority of army-surgeons, who alone had opportunities of judging of it, as not being in reality contagious, but dependent upon local epidemic causes; the irritation of sand; peculiarity of climate, &c. The late Mr. Ware even doubted the propriety of calling this ophthalmia *Egyptian*, and he contended that a disease, precisely similar in its symptoms and progress, had been noticed long ago in this and other countries; and that, in Egypt, several varieties of ophthalmia prevail. He preferred calling the disease the *Epidemic Purulent Ophthalmia*. On the other hand, Sir W. Adams conceives, that it ought rather to be called *Asiatic Ophthalmia*, as recent investigations prove, that it prevails in the greater part of Asia, and was long ago described by Avicenna. (*Graefe, Journ. der Chir.* b. i. p. 170.)

That there has been long known in this country an infectious species of purulent ophthalmia, cannot be doubted. The case, described by many surgeons, as proceeding from the sudden stoppage of gonorrhoea, or the inadvertent application of gonorrhoeal matter to the eyes, is certainly an infectious purulent ophthalmia. There have been epidemic ophthalmies, of other kinds, which have been known to affect the greater part of the population of certain districts and towns in England. The celebrated ophthalmia, which happened at Newbury, in Berks, some years ago, is an instance that must be known to every body. This was a catarrhal ophthalmia. "I regard it (says Dr. Mackenzie) as scarcely admitting of doubt, that the discharge in catarrhal ophthalmia, especially when distinctly puriform, if conveyed from the eyes of the patient to those of others, by the fingers or by the use of towels, &c., will excite a conjunctivitis still more severe, more distinctly puriform, and more dangerous in its effects on the cornea, than was the original ophthalmia. This is the conclusion at which I have arrived from the observation of many instances, &c." (See *Mackenzie, on Dis. of the Eye*, p. 403, ed. 2.)

The reflections and observations of Sir P. M'Gregor, as well as those of Dr. Vetch, and Dr. Edmonstone, I think, leave no doubt of two facts: first, that the ophthalmia now under consideration, was at all events brought from Egypt; and, secondly, that it is infectious, but only capable of being communicated from one person to another by actual contact of the discharge. "If (says Dr. Vetch) any belief were entertained by the office-

of the British army, during the first expedition to Egypt, that the disease was contagious, it was of a nature very vague and indefinite. Combined as its operations necessarily must be in that country with other exciting causes, there would be more difficulty in the first recognition of the fact. But, the continuance of the complaint with the troops after their departure from the country, could scarcely fail to lead to the obvious conclusion of its possessing a power of propagation. Before the disease reached this country, the opinion of its being contagious was adopted by many. Dr. Edmonstone, in the account which he published of the disease, as it appeared in the regiment, to which he was surgeon, after his return to England, first made the public acquainted with the fact of the disease being communicable. In an account of the Egyptian ophthalmia, as it appeared in this country, printed in the early part of 1807, I first established, that the communication of the disease was exclusively produced by the application of the discharge from the eyes of the diseased to those of the healthy." (*On Dis. of the Eye*, p. 178.)

The opinion, that the disease is ever communicated from one person to another, through the medium of the atmosphere, is at present nearly abandoned. During the whole time that Dr. Vetch had the management of the ophthalmic hospitals, there never was an instance of any medical officer contracting the disease, although exposed to what might be supposed to be the greatest concentration of any contagion that could arise in the worst stage of the complaint. Two orderlies only contracted the disease, and both in consequence of the accidental application of the virus. However, Sir W. Adams maintains that he has seen many cases which prove that the disorder, like small-pox, may spread contagiously, without any kind of inoculation. (See *Graefe's Journ.* b. i. p. 174.) That the disease may also be partly propagated by epidemic causes in particular situations, I think is certain and clear, as that there must be a cause for the first commencement of the disorder in situations where infection by contact is out of the question. And, as Dr. Vetch has observed, "from whatever cause inflammation of the conjunctiva may originate, when the action is of such nature, or degree of violence, as to produce a puriform, or purulent discharge, the discharge, so produced, operates as an animal virus, when applied to the conjunctiva of a healthy eye. Considering the various modes, by which such a contact must inevitably occur in the usual relations of life, it must be obvious, that wherever ophthalmia prevails, whether it be the effect of local conditions of the soil, or of the atmosphere, naturally or artificially produced, this contagious effect must sooner or later mix, or unite its operation with that of the more general and original one; and hence, without regard to this property of the disease, its occurrence must often remain inexplicable, and at variance with the more general cause existing in external circumstances. And, further, as the disease, produced by infection, is of a nature more violent and malignant than that produced by the impression of atmospheric causes, it will in every instance of extensively prevailing ophthalmia, occasion two different forms of disease, which, as long as they are considered as one and the same, will produce, according as the one or the other predominates,

very discordant results." (*On Dis. of the Eye*, p. 175.)

Sir P. M'Gregor relates three cases, which prove, that the matter, after its application, produces its effects in a very short time. I shall only cite the following example:—On the 21st of October, 1809, about four o'clock, p. m. Nurse Flannelly, while syringing the eyes of a boy, let some of the lotion, which had already washed the diseased eyes, pass out of the syringe into her own right eye. She felt little or no smarting at the time; but, towards nine o'clock the same evening, her right eye became red, and somewhat painful, and when she awoke the next morning, her eyelids were swelled, there was a purulent discharge, pain, &c. (*Op. cit.* p. 51.)

That in Egypt the origin of the disease cannot rightly be imputed to the effect of the sand and hot winds of the country, is clearly proved; 1st. Because, if this were the case, the disease would not be most prevalent in the autumnal season, during the inundation of the Nile. 2dly. The inhabitants of the Delta would not be more subject to it, than the Bedouin Arabs, who live on the sands of the desert. Not only the Bedouin Arabs, says Dr. Vetch, remain free from the disease, but Europeans, who are not particularly exposed to the night air, are also safe from its attacks. "The nature of military duty prevented our soldiers from using this precaution, and in a particular manner they became victims to the complaint. The men suffered more in proportion to the officers of the English army; as the latter enjoyed a better, though often an incomplete defence from the coldness and dampness of the night; and officers, employed in strictly military duty, suffered more than those attached to the civil departments." (*Vetch on Diseases of the Eyes*, p. 157.) And Assalini remarks, that if the dust or sand were the sole cause of ophthalmia, we ought to be exempted from the disease where the cause does not exist. The contrary, however, was the case in the Delta, and principally on the cultivated borders of the Nile, during its inundations. When we were exposed to the air during the night, we were immediately attacked with ophthalmia, though the dust and sand were then under water. Larrey also imputes the origin of the disease to the cold damp nocturnal air, after the great heats of the day. (*Graefe's Journ.* b. i. p. 179.)

The first breaking out of Egyptian purulent ophthalmia would seem to depend upon epidemic causes; but the multiplication of the disease may often be owing not merely to these causes, but to its contagious nature. This is the view which I am inclined to adopt. Dr. Mackenzie deems it probable "that the ophthalmia, which attacked the British and French armies in Egypt was an atmospheric puriform conjunctivitis, but that it afterwards degenerated into a contagious, perhaps infectious, disease; that is to say, that it was propagated by actual contact of the discharge; and perhaps by miasmata from the eyes floating through the air." (*On Dis. of the Eye*, p. 403. ed. 2.)

Probably, the common mode of propagation is the inadvertent use of the same towels, or even merely touching the same articles, which have been in the hands of infected persons, who must be supposed occasionally to apply their fingers more or less to the eyelids. In this last way, the commencement of the disease may be accounted for in regiments

upon their entering into barracks, which have been quitted by other infected soldiers. "Flies, in warm weather (says Sir P. M'Gregor), are seen in great numbers surrounding patients labouring under ophthalmia; and I much suspect are very frequently the medium, by which the disease is communicated." (P. 54.) The matter is observed to be most infectious, when the disease is in the acute state.

Dr. Vetch adverts to two important questions, connected with the history of the Egyptian ophthalmia. The first relates to the length of time which the disease has, at different periods, lain dormant, and especially between the return of the troops from Egypt, and the breaking out of the disease in the 52d regiment. An explanation of this fact is attempted by supposing, that the complaint exists, and is liable to a renewal of its infectious quality, long after the eye seems to have recovered its natural and healthy appearance. Perhaps, it would be as well to be content with the fact, that, in crowded barracks, under particular circumstances, soldiers, who have once had the disease, are very liable to relapses. The other question is, why has the disease produced such ravages in the army in England, and not in that of France? It is well known, that the French soldiers in Egypt suffered as much as our own troops from the affection, and great numbers of them returned to France with the disease in a chronic form. "In many (says M. Roux) the influence of their native climate has sufficed for the removal of all vestige of the disorder. On the contrary, in others, it has continued in a chronic state, either attended with the loss of one or of both eyes; and many of our invalids remain with the affliction. But, it has not been found, that those soldiers who returned from Egypt, have ever communicated a contagious ophthalmia, either in regiments, in which many of them have been incorporated; or in invalid houses, where others have obtained their retirement; or in the individuals belonging to the different classes of society. Such is the objection that has been made, and may always be again urged, against the opinions and remarks of the English, respecting the Egyptian ophthalmia." (*Voyage faite à Londres en 1814, ou Parallèle de la Chir. Angloise, &c.* p. 49.)

Larrey, who admits that the disease may be communicated by application of the matter, argues, that it is not contagious in any other way, because, in Egypt, for want of sufficient hospital room, patients with this and other diseases were mixed together, without the ophthalmia being propagated to any of the patients, who were careful to avoid the above mode of infection. (*Græfe's Journ. b. i. p. 179.*) Larrey, however, need not have used this reasoning with us, because it is a mistake in him to suppose, that the disease is here commonly regarded as communicable through the medium of the atmosphere. While, however, English surgeons chiefly explain the extension of the disease by the infectious nature of the discharge when applied to the eyelids, and Larrey admits that the matter is thus infectious, the latter, as well as M. Roux, assures us, that some of the healthy soldiers, who came home with the blind invalids from Egypt, were attacked with this species of ophthalmia. A great number of those invalids were received into the hospital of the guards at Paris, and treated there without any of the other

patients being infected. (*Græfe's Journ. loc. cit.*) On my return from the Mediterranean through France in 1802, I saw many of the French troops at Aix and Avignon, with bad eyes, contracted in Egypt, associating with other soldiers, whose eyes were perfectly healthy, and living in the same barracks; a proof, that the French soldiers, with the exception of climate, or some other protecting cause, were placed apparently in circumstances, in which the disease here made such extensive ravages. This is a point, which I humbly conceive, is not at all solved by Dr. Vetch's belief, that the difference is explicable by the French troops being sent into the field; for, in fact, the soldiers with diseased eyes were in barracks, or hospitals, as well as our own troops.

But, notwithstanding it seems proved, that the discharge from the eyes in the Egyptian ophthalmia is so actively infectious in England, it appears from an experiment, made by Mr. Mackey, that its application may sometimes be made to a healthy eye, without the disease following as a matter of certainty, for he applied to his own eyes linen, impregnated with matter discharged from the eyes of patients in the fully formed stage of the disease, and even allowed some of the matter to pass under the eyelids; yet the complaint was not communicated. (*See Edinb. Med. and Surg. Journ. vol. xii. p. 411.*)

One of the most material circumstances, in which the practice of English surgeons differs from that of foreign practitioners in severe purulent, and especially Egyptian, ophthalmia, is the freedom and boldness with which the former attack the disease in its first stage. Mr. Peach recommends taking away at once as much as sixty ounces of blood (*Edinb. Med. and Surg. Journ. for January, 1807*); and Dr. Vetch lays great stress on the striking benefit of bleeding the patient till syncope is produced. "When inflammation has its seat in the sclerotic coat (says he), general blood-letting may for the most part be dispensed with, and even when employed to the greatest extent, the same benefit does not ensue. In the purulent inflammation of the conjunctiva, however, although some good may be derived from depletion, yet a perfect command over the disease depends less on lowering the system, than on the temporary cessation of arterial action by syncope, which it becomes the object of the operation to produce. This practice, besides its efficacy, will accomplish the cure with a much less expenditure of blood, than is occasioned by the repeated bleedings generally had recourse to, where this method of rendering one equal to the cure of the complaint has been neglected. Some time before the approach of faintness, the redness of the conjunctiva for the most part disappears; but this is no security against the return of the disease, if the flow of blood be stopped, without deliquium animi succeeding." (*On Dis. of the Eye, p. 206.*) The attacks of a painful sensation, as if gravel were in the eye, he considers as a proof of the disease increasing, and, in the early stage of the disease, as a better indication of the necessity for bleeding, than the appearance of the eye itself. The blood from the arm should be taken from a large orifice, and venesection followed by the application of from ten to twenty leeches round the eye, within two hours after the bleeding. It must not be supposed, however, that bleeding, purgatives, and other antiphlogistic means, will

effect a complete cure, without the aid of local applications. Dr. Mackenzie sanctions the repetition of bleeding from the arm or temple, if, in the course of twenty-four or thirty-six hours, the symptoms have not abated, or have increased; and afterwards again, if any signs of a renewal of inflammatory action appear. "It is (says he) chiefly in cases where there is pulsative pain in the eye, and circumorbital pain coming on in nocturnal paroxysms, that repeated general blood-letting is necessary." (*On Dis. of the Eye*, p. 427. ed. 2.) Next to copious venesection, he says, no remedy will be found more useful in severe cases, attended with nocturnal circumorbital pain, than calomel with opium. Two grains of the former, with from $\frac{1}{4}$ of a grain to a grain of the latter, may be given in the form of a pill, every second hour, or thrice a day, or only at bedtime, according to circumstances, till the mouth is sore. Respecting the employment of mercury, however, differences of opinion exist: "The free use of mercury (says Mr. Lawrence) is recommended by Rust, when the inflammation is advancing in spite of antiphlogistic treatment. My experience corresponds with that of Vetch and Walker, who have seen salivation produced in many instances, without the smallest advantage." (*On Dis. of the Eye*, p. 208.) I have seen a few cases, in which I thought the employment of calomel and opium decidedly advantageous.

As soon as active inflammation has been subdued, great benefit will be derived from diaphoretic means, especially the pediluvium at bed-time, followed by ten or twenty grains of the compound powder of ipecacuanha. Bark, the sulphate of quinine, and steel medicines, are never of service, except in the chronic stage of the disorder.

Counter-irritation is decidedly efficacious; and, Dr. Mackenzie observes, there is generally a marked change in the quantity and appearance of the discharge from the eye, as soon as another discharge has been established by means of blisters on the temples, nape of the neck, or behind the ears. (*Op. cit.* p. 429.)

Another correct remark, made by the same writer, is, that if no local remedies are employed, or only improper ones, the eyes may be lost notwithstanding the best directed general treatment; and, as Mr. Lawrence has explained, antiphlogistic measures, although capable of removing the inflammatory symptoms, which are present in some instances, cannot remedy the affection of the palpebral conjunctiva, which is the source of them.

So far as I have had opportunities of attending to severe purulent ophthalmia, I concur with Dr. Mackenzie in regarding the plan of completely and frequently clearing away the puriform discharge from the eye, as the first and most essential point in the local treatment. "This is to be done with a small syringe, the fluid employed being sent over the whole surface of the conjunctiva with considerable force, but especially into the fold between the eyeball and the upper eyelid." The lotion, recommended by Dr. Mackenzie, is a tepid solution of one grain of corrosive sublimate (bichloride of mercury) with six grains of muriate of ammonia, in eight ounces of water, to which are added 3ij. vinum opii. (*Op. cit.* p. 428.) He deems the nitrate of silver the best means for allaying the painful feeling of sand in the eye, and lessening the discharge. He has tried a solution of it in various

degrees of strength, up to ten grains to the ounce of distilled water, as recommended by Dr. Ridgway; but four grains he finds generally sufficient. The solution may be applied every five or six hours. Should the purulent discharge, however, continue unabated, the strong nitrate of silver solve may be tried, or touching the inside of the lids rapidly with the lunar caustic pencil. (*Mackenzie*, p. 429.)

Rust, Mueller, Walthar, and Lawrence, are advocates for the employment of cold spring, or even iced, water as a lotion, with which the eye may be frequently cleansed, and rags dipped in it kept over the forehead, as well as the eyes. (See *Lawrence*, on *Dis. of the Eye*, p. 207.)

Some practitioners have advocated the early use of powerful astringent stimulating lotions, in the early stage of the disease, and unpreceded by depletion. Thus, strong nitrate of silver lotions and ointments have been used; and even a small quantity of oleum terebinthinæ was found by Mr. Briggs one of the most effectual means of checking the profuse discharge. He recommends it to be applied to the inside of the eyelids, by means of a camel hair pencil, every morning, and the eye then freely washed with cold water. Dr. Herzberg, of Berlin, tried a lotion composed of from ʒj. to ʒij. of chloride of lime, and six ounces of water; and gives the most encouraging accounts of its good effects.

With respect to applications, Dr. Vetch speaks very highly of the beneficial effects produced in the beginning of the case by dropping into the eye the undiluted liquor plumbi subacetatis, which, he says, diminishes the discharge, lessens the inflammation, and is incapable of doing harm in any stage of the disease. He places great confidence in the salutary results of a free exposure of the eye to the atmosphere; and speaks in high terms of the good derived from applying at night to the eye an infusion of tobacco, two drams of the leaves to eight ounces of water. "It possesses (says Dr. Vetch) the valuable properties of acting as a powerful astringent, restraining the purulent discharge, and diminishing the oedema, or external swelling of the palpebra; at the same time, that its narcotic qualities often relieve the pain and the perpetual watchfulness, which the largest doses of opium cannot subdue." (P. 211.) Bleeding, however, is the "sheet anchor," and the only means of preventing the destruction of the cornea, whenever attacks of pain in the eye, or orbit, denote the unsubdued state of the disease. (P. 212.) When the disease shifts its violence from one eye to the other, and is of long duration, Dr. Vetch recommends cupping, and the eye to be more carefully cleaned by the injection of tepid water, or any gentle astringent lotion, and afterwards wiped dry. When the discharge continues acrid and scalding, he directs blisters to be applied to the nape of the neck, and behind the ears. He wishes it to be distinctly kept in mind, that the time for the employment of bleeding, with the view of saving the eye, is during the first stage, or early part of the second; and when ulceration of the cornea has commenced, the case is to be treated on the principles applicable to sclerotic inflammation.

With regard to the plan of diminishing inflammatory action by medicines which excite nausea and sickness, instead of having recourse to the lancet, Dr. Vetch states, that, in soldiers, it does not answer so well, and in the end proves more debilitating.

A soon as the external œdema of the eyelids subsides, and they begin to be everted, Dr. Vetch represses the granulations and general villosity, by a very light and careful application of the argenti nitratum. The everted portion is then to be returned, and secured in its place with a compress and bandage. This method is to be repeated every time the eye is cleaned, and, in the course of a fortnight, the tendency to ectropium will be removed. (P. 229.)

Assalini found venesection, all emollient applications, and eyewaters hurtful. He first purged his patients, and then introduced into their eyes a few drops of a solution of the lapis divinus (see LACRYMAL ORGANS), to which was sometimes added a small quantity of the acetate of lead. He speaks favourably of leeches, and sometimes he put a small blister on the temple, or behind the ears. (See *Manuale di Chirurgia*; Milano, 1812.)

Perhaps, the best mode of putting an immediate stop to the Egyptian ophthalmia, when it prevails extensively in a regiment in garrison, or barracks, is to put the men, actually affected, into a detached hospital at a considerable distance from the rest of the corps, which should be dispersed as much as possible in separate billets and villages. Purulent ophthalmia is a disease, which makes great progress only when large numbers of persons are either exposed together to the epidemic causes, which first give birth to it, or to the causes which occasion the disease to be communicated from one individual to another, as when soldiers are crowded together in the same building, using the same towels and water, &c. Notwithstanding the reports of Roux and Larrey prove, that the disease did not spread in the French army, after the return of uncured soldiers from Egypt to France, though these were freely mixed with their comrades in hospitals and barracks, the same security did not extend to the British troops of the army of occupation in that country in 1816, who were threatened with a very extensive renewal of the Egyptian ophthalmia amongst them, but which was wisely checked by attention to the principles above specified.

In the cases under Sir P. McGregor, local applications were found most advantageous. During the inflammatory stage, however, this gentleman also had recourse to antiphlogistic means, spare diet, bleeding, neutral salts, &c. The topical treatment was as follows: leeches were freely and repeatedly applied near the eye. But while there was much surrounding redness, instead of leeches, which created too much irritation, fomentations, and a weak decoction of poppy-heads, and a little brandy, were used. A weak solution of acetate of lead, and sulphate of zinc, had mostly a good effect, when applied to the eye. The vinous tincture of opium did not answer the expectations entertained of it. But, of all the remedies, the ung. hydrarg. nitrat. was found most frequently successful. It was applied by means of a camel hair pencil, and at first weakened with twice its quantity of lard. The red precipitate, well levigated, and mixed with simple ointment, sometimes answered when the ung. hydrarg. nitrat. failed. Well-levigated verdigris, and a quack medicine, called the golden ointment, proved sometimes efficacious. (P. 41—43.) According to Sir P. McGregor, blisters behind the ears, and upon the neck, are useful; but hurtful when put nearer to the eye.

When the violence of the inflammation has sub-

sided, Sir P. McGregor recommends the use of Bates's camphorated water, diluted with four, five, or six times its quantity of water. But the astrigent collyrium, from which he saw most good derived, was a solution of the nitrate of silver, in the proportion of half a grain to every ounce of distilled water. In some cases, it was used stronger. Tepid sea-water sometimes proved serviceable in removing the relics of the complaint. (P. 56, &c.)

The granulated, or fungous state of the palpebral conjunctiva, produced by purulent ophthalmia, sometimes demands particular treatment, after the original disease is subdued. If such state of the eyelid be not rectified, it often keeps up a "gleety discharge, irritability to light, drooping of the upper lid, a pricking sensation as of sand in the eye, and a preternaturally irritable and vascular state of the sclerotic conjunctiva; with these are frequently combined opacities of the cornea." (Travers, *Op. cit.* p. 271.) The affection, as conjoined with opaque cornea, is particularly noticed by Dr. Vetch, who describes the disease of the palpebræ as consisting, at first, in a highly villous state of their membranous lining, which, if not treated by appropriate remedies, gives birth to granulations, which in process of time become more deeply sulcated, hard, or warty. Along with the villous and fleshy appearance of the lining of the eyelids, there is a general oozing of purulent matter, which may at any time be squeezed out by pressing the finger on the part. The diseased structure is highly vascular, and bleeds most profusely when cut. It possesses, as all granulated surfaces do, a very great power of growth, or reproduction. Dr. Vetch saw many cases, in which it had been removed with more zeal than discretion, twenty or thirty times successively, without this disposition to reproduction having suffered any diminution. Indeed, he assures us, that the operation was unfavourable in the ultimate recovery of the part; a new surface is produced of a bright velvety appearance, much less susceptible of cure than the original disease, and which, even if at length healed, does not assume the natural appearance of the part, but that of a cicatrized surface, not attended with a return of the transparency of the cornea. It is satisfactorily proved by the observations of Dr. Vetch, that this diseased state of the inner surface of the eyelid was not only known to Rhases, and other old practitioners, under the names of sycois, trachoma, scabies palpebrarum, &c. but that its treatment by the actual cautery, excision, and friction was also recommended by them. The honour of having introduced the preferable mode of cure with escharotics, Dr. Vetch assigns to St. Ives. No substance appears to Dr. Vetch more effectual for this purpose, than the sulphate of copper and nitrate of silver. He says that they should be pointed in the form of a pencil, and fixed in a port-crayon. "They are to be applied, not as some have conceived, with the view of producing a slough over the whole surface, but with great delicacy, and in so many points only, as will produce a gradual change in the condition and disposition of the part." So long as any purulency remains, Dr. Vetch states that the above applications will be much aided by the daily use of the liquor plumbi subacetatis. When the disease resists these remedies, and the surface is hard and warty, he applies very minute quantities of finely levigated powder of verdigris, or

burnt alum, to the everted surface with a fine camel's hair pencil, but carefully washes them off with a syringe before the eyelid is returned. The caustic potassa lightly applied to the more prominent parts of the diseased surface, will also answer. (See *Vetch on Diseases of the Eye*, p. 73, &c.) Mr. Lloyd gives his testimony in favour of the superiority of the nitrate of silver, which he has employed in the form of a saturated solution for restoring the healthy state of the inner surface of the eyelid. (*On Scrofula*, p. 328.) The practice of excision was followed by the ancients, and revived of late years in England by Mr. Saunders, who did with scissors what Sir W. Adams and others have subsequently performed with a knife or lancet. Mr. Travers, I may observe, is also one of the advocates for the excision of the granulations and hardened excrescences of the conjunctiva. If there be a nebula of the cornea, with a plexus of vessels extending to it, these are then divided, near the edge of the cornea, in the manner recommended by Scarpa. Mr. Travers afterwards applies a solution of the sulphate of copper, the liquor plumbi subacetatis, or the vinous tincture of opium. One remark which he makes tends very much to confirm the general advantage of the practice inculcated by Dr. Vetch; for it is observed, "the application of the blue-stone, or lunar caustic, is often useful in preventing the regeneration of granulations after their excision." (*Synopsis*, &c. p. 272.)

Purulent Ophthalmia of Infants.—Dr. Vetch describes the external appearances of this case as not materially different from those of the purulent ophthalmia of adults; but, he states, that its nature is considerably modified by the more delicate texture and greater vascularity of the parts affected, and the more intimate connexion, subsisting between the vessels of the conjunctiva and those of the sclerotic coat. Hence, he says, the inflammation is sooner communicated to this coat, and sloughing and ulceration of the cornea occur earlier in infants, than adults. When the œdema ceases, the inner surface of the palpebræ becomes sarcomatous, and this diseased surface, when the eyelids are opened, forms an exterior fleshy circle, beyond which the relaxed conjunctiva of the eye comes forward as a second; and often the caruncula lachrymalis adds still farther to the valvular appearance, which the part presents. (*On Dis. of the Eye*, p. 256–258.)

The inflammation usually commences about three days after birth; but it may take place at a later period, varying from the 4th day even to several weeks or months, though in the latter cases, the nature of the disorder may be somewhat different, more particularly in relation to its cause. (See *Benedict*; also *Middlemore on Dis. of the Eye*, vol. i. p. 153.)

In the first stage it is confined to the mucous linings of the eyelids, the margins of which are observed to be somewhat adherent together when the child awakes, and to be reddened, especially at the corners. The child experiences pain from the access of light; and keeps the eye shut. If the eyelids are everted, their lining is seen to be vascular red and villous, and a little white mucus may be noticed on the inside of the lower. Such is the first stage of the disorder. In the second the inflammation extends from the conjunctiva of the eyelids to that covering the globe. The vascu-

lar redness and congestion are much augmented, the eyelids swell and become red even externally, there is a copious secretion of purulent fluid from the inflamed membrane, which agglutinates the edges of the eyelids, and then accumulates between the lids, or pours over the face, staining the cap and linen. Exposure to light becomes very painful, and hence, even if the swelling of the eyelids should not close them, the child keeps the eye constantly shut. In this second stage, the redness and swelling of the conjunctiva are carried to the highest pitch; the whole of the conjunctiva lining the eyelids and globe, is swollen, and of a uniform bright scarlet colour. The close adhesion of it to the tarsi, prevents the conjunctiva of the eyelids from swelling much; but the loose folds between the lid and the globe become greatly enlarged, forming red tumid rolls, finely granulated. These folds, pressed on by the orbicularis, evert the tarsi, causing ectropion of one or both eyelids (see *Ectropium*), which takes place, when the child cries, or an attempt is made to examine the eye. It is generally temporary, subsiding when the cause ceases; but it may be permanent. The eyelids become œdematous and reddened externally; and, in severe cases, the upper hangs completely over the lower one, presenting a smooth convexity of a bright red colour. During the night, the eyelids become so firmly adherent, that in the morning, they cannot be opened, unless first soaked and moistened with warm water. When separated, the eye is completely concealed by the discharge; which, if wiped away with a soft rag, is still in sufficient quantity to cover the eye-ball and conceal the cornea; and ultimately a coagulated layer frequently remains, which must be removed by syringing. If the inflammation should not now be checked, it will extend to the cornea and interior of the eye, and is likely to cause one or more of the following changes. 1. Sloughing of the cornea. 2. Ulceration of it, and prolapsus of the iris. 3. Opacity of the cornea. 4. Adhesion of the iris to the inflamed, or ulcerated cornea.

In the third stage, there is a gradual abatement and cessation of all the symptoms. The redness, swelling, and discharge are diminished; the child bears the light better; and, when the increased discharge is removed, it opens the eyes spontaneously in the evening, or in a dull light; and no ectropion takes place when the child cries, or the eyes are examined. When the complaint is severe, the infant becomes restless; the tongue white; and the bowels irregular. Paleness and debility commonly follow any serious degree of sloughing of the cornea. Both eyes are usually affected; but the complaint does not commence in both at the same time. (See *Lawrence on Dis. of the Eye*, p. 163–168.)

It is believed, that this disease is in general an inoculation of the conjunctiva by leucorrhœal fluid during parturition, and sometimes by the matter of gonorrhœa, and that in almost all cases it may be prevented by carefully washing the infant's eyes with tepid water directly after birth. The exposure of the child's eyes to strong light, the heat of the fire, and cold currents of air, are sometimes believed to have a hurtful influence; but it is the prevailing opinion, that the mother has had leucorrhœa both before and after parturition, and that the eyes have not been cleaned for some time after birth. Mr. Middlemore thinks, that it may be produced from various vaginal secretions; but

that it is more frequently occasioned by gonorrhœal or leucorrhœal discharge. (*Op. cit. vol. i. p. 162.*)

The possibility of some cases being catarrhal is admitted; and, if it be true, that purulent ophthalmia is often seen in children, whose mothers are free from any kind of discharge, there must be cases, the origin of which is independent of contagion. (See *Mackenzie, Op. cit. p. 432; Lawrence, Op. cit. p. 168.*)

The easiest mode of obtaining a view of the eye, is to open the eyelids while the child is asleep. "If the attempt be made lightly and gently, we generally succeed in obtaining a clear view of the cornea, without awakening the patient. If it be awake we should take the opportunity when it is quiet, and separate the lids quickly before the muscles can resist. If the child be crying when the attempt is made, it is scarcely possible to obtain a view of the cornea on account of the violent contraction of the orbicularis. In opening the lids, if the upper be raised by the skin merely, the action of the orbicularis will produce an eversion of the tarsus, and hinder us from seeing the cornea; but if the tarsus itself be pushed upwards and backwards, the accident will be prevented." (See *Lawrence Op. cit. p. 167.*)

If the cornea is free from opacity, ulceration, and purulent infiltration, how violent soever the inflammation may be and profuse the discharge, the prognosis is favourable, and, under proper treatment, the sight is safe. "If the cornea be of a dull white, or has begun to lose its transparency, injury or loss of vision is very probable; it is most likely that ulceration, prolapsus of the iris, or permanent opacity, will follow. General superficial opacity from thickening of the corneal conjunctiva will disappear." (*Op. cit. p. 171.*) If the progress of the disease remains unchecked for eight days, or longer, it often proves exceedingly tedious; and the cure is always more difficult when the child is exposed to cold damp air, or improperly nourished, or the nurse takes spirits, or porter. If nothing be done to stop the disorder, the cornea will generally be destroyed in three weeks, and on opening the lids, the iris and humours be found protruding. (See *Mackenzie, Op. cit. p. 434.*)

If the disease was in its first stage, Mr. Ware applied leeches to the temples, or neighbourhood of the eyelids, and a blister to the nape of the neck or temples. The child was kept in a cool room, not covered with much clothes, and if no diarrhœa prevailed, a little rhubarb or magnesia in syrup of violets was prescribed. A surgeon, however, is seldom called in before the first short inflammatory stage has ceased, and an immense discharge of matter from the eyes has commenced. Astringents and corroborants seemed to Mr. Ware to be then immediately indicated, in order to restore to the vessels of the conjunctiva and eyelids their original tone, to rectify the villous and fungous appearance of the lining of the palpebræ, and thus finally to check the morbid secretion of matter. For this purpose he strongly recommended the *aqua camphorata* of Bate's Dispensatory: *R. Cupri sulphatis, bol. armen. aa ʒiv. Camphoræ ʒj. M. & f. pulvis, de quo projice ʒj. in aquæ bullientis ʒiv. amove ab igne, et subasidant facies.* In his published *Remarks on Purulent Ophthalmia*, in 1803, he observes, that he usually directs the *aqua camphorata*, as follows: *R. Cupri sulphatis, bol. armen. aa gr. viij. Camphoræ gr. ij. Misce,*

et affunde aquæ bullientis ʒviij. Cùm lotio sit frigida, effundatur limpidus liquor, et sæpius injiciatur paululum inter oculum et palpebras. This remedy possesses a very styptic quality; but, as directed in Bate's Dispensatory, it is much too strong for use before it is diluted; and the degree of its dilution must always be determined by the peculiar circumstances of each case. Mr. Ware ventures to recommend about one dram of it to be mixed with an ounce of cold clear water, as a medium or standard, to be strengthened or weakened as occasion may require. (*P. 143.*) The remedy must be applied by means of a small ivory or pewter syringe, the end of which is a blunt-pointed cone. The extremity of this instrument is to be placed between the edges of the eyelids, in such a manner, that the medicated liquor may be carried over the whole surface of the eye. Thus the matter will be entirely washed away, and enough of the styptic medicine left behind to interrupt and diminish the excessive discharge. According to the quantity of matter, and the rapidity with which it is secreted, the strength of the application, and the frequency of repeating it, must be regulated. In mild recent cases, the lotion may be used once or twice a day, and rather weaker than the above proportions; but in inveterate cases it is necessary to apply it once or twice every hour, and to increase its styptic power in proportion; and when the complaint is somewhat relieved, the strength of the lotion may be lessened, and its application be less frequent.

"The reasons for a frequent repetition of the means just mentioned, in bad cases, are, indeed, of the most urgent nature. Until the conjunctiva is somewhat thinned, and the quantity of the discharge diminished, it is impossible to know in what state the eye is; whether it is more or less injured, totally lost, or capable of any relief. The continuance or extinction of the sight frequently depends on the space of a few hours; nor can we be relieved from the greatest uncertainty, in these respects, until the cornea becomes visible." (*Ware, p. 145.*)

This author condemns the use of emollient poultices, which must have a tendency to increase the swelling and relaxation of the conjunctiva. If poultices are used, he prefers such as possess a tonic or mild astringent property; as one made of the curds of milk, turned with alum, and an equal part of unguentum sambuci, or axungia porcini. This is to be put on cold, and frequently renewed, without omitting the use of the injection. (*Ware, p. 147.*)

When the secreted matter is glutinous, and makes the eyelids so adherent together, that they cannot be opened, after being shut for any length of time, the adhesive matter must be softened with a little fresh butter mixed with warm milk, or by means of any other soft oleaginous liquor, after the poultice is taken off and before using the lotion. (*P. 147.*)

If the eversion of the eyelids only occurs when the child cries, and then goes off, nothing need be done in addition to the above means. When, however, the eversion is constant, the injection must be repeated more frequently than in other cases; the eyelids put in their natural position, after its use; and an attendant directed to hold on them, with his finger, for some length of time, a compress dipped in the diluted *aqua camphorata*. (*P. 148.*)

In some cases, when the inside of the eyelids has been very much inflamed, the tinctura thebaica, insinuated between the eye and eyelids has been useful. If after the morbid secretion is checked, any part of the cornea should be opaque, the unguentum hydrargyri nitrati, melted in a spoon, and applied accurately on the speck, with a fine hair pencil; or Janin's ophthalmic ointment, weakened and used in the same manner; may produce a cure, if the opacity be not of too deep a kind. When the local disease seems to be kept up by a bad habit, alteratives should be exhibited, particularly the sulphuret of mercury, or small doses of calomel.

The treatment, recommended by Dr. Vetch, is as follows: if the inflammation have not extended to the conjunctiva of the eye, its further progress may be checked by removing the infant to a healthy atmosphere, and washing the eye with a mild collyrium. Leeches are commended throughout the whole course of the complaint. On the first accession of the tumefaction, the best effect will often be produced by the application of a small portion of ointment, composed of lard, or butter, 3vj., and x. gr. of the red nitrate of mercury, without any wax. As the purulency advances, the liquor plumbi subacetatis, he says, will be found not less serviceable, than in other instances of purulent ophthalmia. For promoting the separation of any slough, he recommends a solution of the nitrate of silver; and for curing the relaxed state of the conjunctiva, a solution of alum, or of the sulphate of copper. (*On Dis. of the Eye*, p. 260.)

This recourse to leeches throughout the whole course of the disease is certainly not requisite. In the acute form of the disease a leech or two may be placed on the red swelling, formed by the upper eyelid. In this stage, the use of the saturnine lotion, made with rose water, is preferred by Mr. Lawrence. The bowels should be kept open with castor oil, or magnesia; and when the inflammation is active, with a white state of the tongue, a grain or two of calomel may be given previous to the administration of the purgative. Mr. Lawrence refrains from applying blisters to infants, except in cases where they are absolutely necessary. As soon as the violence of the inflammation has been diminished, Mr. Lawrence injects a solution of from two to four or ten grains of alum to the ounce of water, between the eyelids, so as to cleanse out all the purulent secretion, three or four times in the twenty-four hours; and then for a short time covers the eye with a soft rag dipped in the same fluid. When another lotion is required, that containing the nitrate of silver (one or two grains to the ounce, and gradually increased to four or six) may be employed. (*Op. cit.* p. 173.) The lotion, used by Schmidt, consisted of gr. ij. of sulph. of zinc, grs. iij. of the liquor plumbi acetatis, and grs. xii. of camphorated spirit of wine in each ounce of distilled water. (*See Ophthalmio-Bibliothek.*, vol. ii. p. 141.)

Dr. Mackenzie washes the eyes with a tepid solution of one grain of corrosive sublimate (bichloride of mercury) and six of sal ammoniac in eight ounces of water. "The lids are opened gently, and with a bit of sponge, the purulent discharge, which gushes out, is removed. The lower lid, and then the upper, are next everted, and wiped clean with the sponge." This is done

three or four times a day. The action of this collyrium is to be promoted by the use of a stronger one, containing the nitrate of silver or sulphate of copper. Once or twice a day, Dr. Mackenzie applies, by means of a large camel hair pencil, a solution of four grains of nitrate of silver, or six of sulphate of copper, in an ounce of distilled water, to the whole surface of the inflamed conjunctiva, immediately after having cleaned it with the sponge and other lotion. Dr. Mackenzie joins many other practitioners in bearing testimony to the efficacy of blisters behind the ears, or to the back of the head. "Cantharides plaster, (says he,) spread on a bit of candlewick, and laid between the head and the external ear, is a convenient mode of breaking the skin; and by continuing this application either constantly, or several hours daily, a continued discharge will be procured." (*Op. cit.* p. 437.)

When the cornea sloughs, and a white flocculent ulcer remains, indisposed to heal, and the infant becomes pale, weak, and restless, the practice, now most generally approved of, is to give half a grain of the sulphate of quinine, blended with sugar, twice or thrice a day, and to apply to the eye itself a solution of nitrate of silver. For the removal of the relaxed state of the conjunctiva, after the purulent discharge has entirely ceased, the vinum opii is one of the most efficient applications.

One very experienced practitioner disapproves of harsh applications in the early stage, especially the liquor plumbi acetatis, and the ointment of nitrate of silver. The latter, he admits, however, to be an excellent remedy after the acute symptoms have been diminished by means of bleeding, laxatives, and the application of astringent and cooling lotions. (*See Middlemore on Dis. of the Eye*, vol. i. p. 174.)

Gonorrhæal Ophthalmia; *Gonorrhæal Conjunctivitis*; or, *Gonorrhæa Oculi*; is a violent inflammation of the conjunctiva of the eyeball and lids, attended with a profuse discharge of fluid, closely resembling in all its sensible characters that which issues from the inflamed urethra in gonorrhœa, and occurring in some kind of connexion with that complaint. It is the most violent and rapidly destructive inflammation to which the eye is subject; but fortunately one of the most rare. It sometimes destroys the eye within a very short time, and the organ is frequently irreparably injured before the patient seeks for surgical relief. It is at first confined to the mucous membrane of the eye; but it soon extends to the cornea, which it either disorganizes, or so changes the structure of, that sight is either destroyed, or seriously injured. The whole texture of the inflamed conjunctiva swells; its blood-vessels are distended to the highest degree; and the membrane becomes of an intense bright red. Its mucous surface is loosened and softened; it becomes pulpy and granular, and, in this state, it pours forth the puriform discharge. The changes, which the disease has a tendency to produce in the cornea, are sloughing, ulceration, and opacity. Mr. Lawrence, from whose excellent work on the Venereal Diseases of the Eye I have borrowed the foregoing particulars, describes three varieties of Ophthalmia, as occurring in conjunction with, or dependence upon, gonorrhœa. 1. Acute inflammation of the conjunctiva. 2. Mild inflammation of it. 3. In-

Inflammation of the sclerotic coat, sometimes extending to the iris.

In acute gonorrhœal ophthalmia, there is excessive vascular congestion; the most intense and general external redness; great tumefaction of the conjunctiva; much chemosis, with corresponding swelling of the eyelids, and profuse yellow discharge. In the first stage, which is short, the inflammation is confined to the conjunctiva, and is attended with soreness and stiffness, with the sensation of sand in the eye, and with uneasiness from light or using the organ. The second stage is marked by the occurrence of puriform discharge. The third, by the extension of the inflammation to the cornea, with agonizing pain in the globe, orbit, and head, augmented to intolerable suffering on exposure to light, and with febrile disturbance. The violent inflammation, which causes the yellow puriform discharge from the mucous surface of the conjunctiva, produces effusion in the subjacent cellular tissue, termed chemosis. (See *Lawrence on Ven. Dis. of the Eye*, p. 10—16.)

Gonorrhœal Ophthalmia seldom attacks females. Mr. Middlemore has not known it occur in them, but in three or four instances. (*On Diseases of the Eye*, vol. i. p. 177.) And Mr. Lawrence has never met with it in an adult female. In the Hôtel-Dieu, however, this alleged rarity of the disorder in women does not agree with the observations of Dupuytren. According to Mr. Lawrence, it generally attacks only one eye; while common purulent ophthalmia attacks both. Dr. Vetch, speaking of the latter, says, "there is not one case in a thousand, in which only one eye becomes affected." Yet, as Mr. Lawrence states, and as I have lately had an opportunity of witnessing, ordinary purulent ophthalmia may be confined to one eye, while the gonorrhœal form of the disease often attacks the second eye after a short interval. (*Op. cit.* p. 24.) On this point, Mr. Middlemore agrees in the statement, that it seldom affects both eyes at the same time. "Occasionally (he adds) the second eye becomes inflamed in the course of four or five days after the first; less frequently, it becomes affected as its fellow is more nearly approaching recovery. (*On Dis. of the Eye*, vol. i. p. 177.)

The reality of an ophthalmia from the application of gonorrhœal matter to the eyes, seems supported by such a mass of evidence, that I believe the fact must be admitted. From some statements, published by Dr. Vetch, he was led to conclude, that the frequency of this mode of infection must be much lessened by the circumstance of the matter, taken from the urethra, not appearing in his experiments with it to be capable of communicating the disease to the eyes of the individual, by whom such matter is secreted, though probably capable of doing so to the eyes of another person.

In the same way, the urethra cannot be affected by the application of matter taken from the purulent eyes of the individual, on whom the experiment is made. At least, of these circumstances, there is a negative proof in some facts recorded by Dr. Vetch. "In the case of a soldier, received in a very advanced stage of the Egyptian ophthalmia, in whom destruction of the cornea had to a certain extent taken place, I took occasion to represent the possibility of diverting the disease from the eyes to the urethra, by applying the discharge to the latter surface. Ac-

cordingly, some of the matter, taken from the eyes, was freely applied to the orifice of the urethra. No effect followed this trial, which was repeated on some other patients, all labouring under the most virulent state of the Egyptian disease, and in all the application was perfectly innocuous. But, in another case, where the matter was taken from the eye of one man, labouring under purulent ophthalmia, and applied to the urethra of another, the purulent inflammation of the urethra commenced in 36 hours afterwards, and became a very severe attack of gonorrhœa. From the result of these cases, (says Dr. Vetch) I could no longer admit the possibility of infection being conveyed to the eyes from the gonorrhœal discharge of the same person. Some time after this, the improbability, or rather impossibility, of this effect was rendered decisive by an hospital assistant, who conveyed the matter of gonorrhœa to his eyes, without any affection of the conjunctiva being the consequence." (See *Vetch on Dis. of the Eye*, p. 242.) Hence, this gentleman is led to refer the connexion, between gonorrhœa and ophthalmia, in the same person, to peculiarity of constitution; but the theories, on which this opinion rests, my limits will not allow me to examine.

When we consider how gonorrhœal matter is diffused over the linen of patients both male and female; how often the fingers must be smeared with it; and how inattentive to cleanliness the lower classes are, we cannot help concluding, that gonorrhœal discharge must be often applied to the eyes of the same individual; yet gonorrhœal ophthalmia is comparatively rare. On the other hand, as Mr. Lawrence has noticed, washing sore eyes with one's own urine is a popular remedy, and persons with gonorrhœa are sometimes so thoughtless as to resort to this practice. "Experience teaches us, that this direct application of infectious matter is capable of producing not such a slight inflammation as Beer and Scarpa speak of, but acute gonorrhœal ophthalmia in its most destructive form. This is fully proved by Case iv., where both eyes were lost, and Case xiv., in which the vision of one was destroyed. In Case viii., in which partial sloughing of one cornea occurred, the patient had used to his eyes a towel soiled with gonorrhœal discharge from his own urethra. Mr. Wardrop communicated to me two cases, which occurred under his own observation. In one of them, that of a young gentleman, labouring under gonorrhœa, who had inadvertently touched his eyes when his fingers were contaminated with the discharge, violent puriform ophthalmia occurred, and ended in the suppuration and collapse of both eyeballs. A soldier, who had gonorrhœa, was advised to bathe his eyes with his own urine, as a remedy for a slight affection of the lids: purulent ophthalmia seized one eye, which suppurred, and burst." Other cases, produced in the same way, are detailed by Astruc and Foot. (See *Lawrence, Op. cit.* p. 30.)

That gonorrhœal ophthalmia may be produced by the application of gonorrhœal matter from another individual, is a fact, of which no doubt remains; but, as Mr. Lawrence observes, it cannot be a frequent occurrence for obvious reasons; and he has seen no instance of it himself. Mr. Wardrop furnished him with two examples. "An old lady went into the dressing-room of her son, who

had gonorrhoea, and washed her face with a towel which he had been recently making use of. Purulent ophthalmia quickly supervened, and destroyed the eye in a few days. A washerwoman, who had been employed in cleansing foul linen, was seized, in a few hours, with puriform ophthalmia, which terminated in the suppuration and collapse of both eyeballs." (*Lawrence, Op. cit. p. 34.*) Other instances of this are recorded by Delpsch (*Chir. Clin. t. i. p. 318.*), and Bacoit (*On Syphilis, p. 132.*)

If it be actually true, that, in adults, a species of purulent ophthalmia does originate from the sudden suppression of gonorrhoea, are we to consider the complaint so produced as a metastasis of the disease from the urethra to the eyes? This ophthalmia does not regularly follow the suppression of gonorrhoea, nay, it is even a rare occurrence; also, when it is decidedly known, that purulent ophthalmia has arisen from the infection of gonorrhoea, namely, in those instances in which the matter has been incautiously communicated to the eyes, it appears, that such an affection of these organs, so produced, is different from the one alluded to, inasmuch as it is slower in its progress, and less threatening in its aspect. When the eyes are affected, the disease of the urethra is not always suspended. (*Vetch, Op. cit. p. 239.*) Hence, there is good reason for supposing, that no metastasis takes place in this species of purulent ophthalmia, supposed to be connected with a suppressed gonorrhoea.

The injection of warm oil, the introduction of a bougie into the urethra, and the application of cataplasms to the perineum, with the view of renewing the discharge from the urethra, form the outline of the practice of those, who place implicit reliance in the suppression of gonorrhoea being the cause of the complaint. The rarity of the occurrence; the frequency of the sudden cessation of the urethral discharge; the possibility of an ophthalmia arising, as well at this particular moment, as at any other, totally independent of the other complaint; cannot fail to raise in a discerning mind a degree of doubt concerning the veracity of the assigned cause. Besides, admitting that there is a sympathy between the urethra and eyes, how are we to ascertain, whether the suppression of gonorrhoea be the cause or the effect of the ophthalmia, supposing that the one ceases, and the other commences, about the same time? Actuated by such reflections, I am induced to dissuade surgeons from adopting any means calculated to renew the discharge of matter from the urethra. When purulent ophthalmia, in adult subjects, is decidedly occasioned by the actual contact, and infection of gonorrhoeal matter, applied accidentally to the eyes, no one has recommended this unnecessary and improper practice.

The first indication, in the treatment, is to oppose the violence of the inflammation, and thus resist the destruction of the eye and opacity of the cornea. A copious quantity of blood should be taken away; both topically and generally; and, to use Mr. Bacoit's words, "if ever there was a disease, in which blood may be taken away without limitation, it is this." (*On Syphilis, p. 134.*) Mild laxatives should be exhibited, and a blister applied to the nape of the neck, or temples. The eyes

ought to be often fomented with a decoction of white poppy-heads, and warm milk repeatedly injected beneath the eyelids. In the early stage, Mr. Lawrence prefers cold applications, but would let the feelings of the patient be his guide. "A saturnine lotion made with rose water, or poppy fomentation, will answer the purpose. The eyelids and cheek must be frequently cleansed, particular care being taken to prevent accumulation of the discharge and incrustation on the edges of the former." (*Op. cit. p. 39.*) To prevent the palpebrae from becoming agglutinated together during sleep, the spermaceti cerate should be smeared on the margins of the tarsi every night.

When the heat and pain in the eyes, and febrile symptoms, have subsided; when an abundant discharge of pus has commenced, all topical emollients are to be relinquished, and a collyrium of Aq. rosæ ʒx. containing Hydrarg. biclor. gr. j. used in their place. Scarpa states, that in the ophthalmia, originating from the inadvertent communication of the matter of gonorrhoea to the eyes, applications, in the form of ointment, such as the ung. hydrarg. and Janin's salve, to which might be added the ung. hyd. nitrat., avail more than fluid remedies. The best astringent applications seem to Mr. Lawrence to be solutions of alum, from two to ten grains to the ounce of water, the solution of the nitrate of silver, and the undiluted liquor plumbi subacetatis. (*Op. cit. p. 42.*) After what has been stated respecting the treatment of Egyptian ophthalmia, it is not necessary to expatiate on the treatment of the present affection, as both cases require similar plans. For the same reason I refrain from entering into the consideration of the method of treating gonorrhoeal ophthalmia from the first with strong astringent and stimulating applications, the subject having been already noticed in speaking of Egyptian ophthalmia.

Inflammation of the Eyeball. Ophthalmitis.—From cases, in which the eyelids are at first chiefly affected, I pass to the consideration of inflammation, as commencing in the eyeball itself. As Beer remarks, fortunately it is only seldom that the whole of the organ is at once attacked with genuine idiopathic inflammation, without any part of its texture being spared. Some very serious cause is required to produce it; and it occurs chiefly in robust individuals of full habit. It is most frequent in the right eye. (See *Lawrence on Dis. of the Eye, p. 74.*) For the most part, healthy inflammation of the eyeball has a limited point of origin, from which it spreads, sometimes quickly, sometimes slowly, over the whole organ. During an exceedingly violent, tense, throbbing pain, affecting not only the eye itself, but extending to all the surrounding parts, the bottom of the orbit, and within the head, the white of the eye becomes suffused with an uniform redness, which, on attentive examination, is found to be seated not only in the conjunctiva of the eyeball, but also in the sclerotics, and to exhibit at first a fine vascular network, which, as the redness grows more intense, assumes the appearance of scarlet cloth, forming all round the cornea an uniform circular prominent fold, which has a very firm feel, and is so tender, that, when touched in the gentlest manner, the patient cries out with agony. The circumference of the cornea continues to be more and more covered by this

increasing swelling of the conjunctiva, until at length only a portion of its centre remains visible. At the same time, the pupil is very much contracted; the iris motionless; and though vision is nearly or entirely lost, the patient is seriously disturbed by fiery appearances before the eye. When the iris is naturally grey, or blue, it turns greenish, and, when brown, or black, it becomes reddish. Every movement of the eyeball and upper eyelid is suspended, and the orbit feels to the patient as if it were too small, which, Beer says, is in reality the case, because the whole of the eyeball, and not merely the conjunctiva, is enlarged, so as to project like a lump of raw flesh further and further between the edges of the palpebre, and completely fill every part of the orbit. While the eyeball enlarges, the cornea always loses its transparency, and the inflammation spreads to the eyelids, the lower one at last becoming everted by the excessive and firm tumefaction of the parts behind it, and the upper one presenting the most unequivocal marks of phlegmonous inflammation. The secretion of tears and mucus is now entirely suppressed, and, of course, the eye preternaturally dry. At the very commencement of this violent form of ophthalmia, the constitution is disturbed by a severe attack of inflammatory fever, and irritable patients are not unfrequently seized with delirium. Here, says Beer, terminates the first stage of this very dangerous disorder.

When the disease is left to itself, suppuration comes on, attended with fever and constant shiverings; the swelling of the sclerotic conjunctiva undergoes a remarkable increase, and assumes a dark-red colour, at the same time that it becomes softer. The pain becomes irregular, throbbing, and, when the eye or eyelids are touched, of a lancinating description. As a morbid secretion now begins to take place from the Meibomian glands, the swelled conjunctiva has a more moist appearance. The upper eyelid has a purple hue, and, on account of the continually increasing size of the eyeball, is pushed further and further outward. The portion of the cornea, still discernible in the middle of the protuberant conjunctiva, acquires a snowy whiteness, which afterwards changes to yellow. The patient feels an oppressive sense of heaviness in the orbit, and a disagreeable kind of coldness all round the eye. At length, the throbbing and tension are so agonising, that the patient often expresses a wish to have the eyeball extirpated. If no effectual treatment be adopted, the eye now bursts, and a mixture of matter and blood, together with the scarcely perceptible remains of the lens and vitreous humour, is discharged with considerable force to some distance in front of the patient; an occurrence sometimes termed *rhexis*, or *rhegma oculi*. From this moment the pain all at once subsides into a very moderate feel of burning in the eye; and suppuration goes on, until all the textures of the organ are annihilated, the orbit has an empty appearance, and the closed eyelids sink into a concavity. Thus ends, as Beer observes, the second stage, after such tedious and general indisposition. But, he remarks, that the course of the case is quite different, when it has been wrongly treated in its first stage with stimulants, or exposed to the ill effects of tobacco smoke, the drinking of spirit, improper diet, immoderate exercise, &c.; for, under the operation of these unfavourable circumstances, the second stage may commence with

dreadful gangrenous mischief, every vestige of the organisation of the eye disappearing, and the parts at length sphacelating, while large abscesses form around, and unless sufficient medical aid be promptly given, the patient loses his life.

With respect to the causes of such an attack of the whole eyeball at once by common inflammation in a healthy subject, they must be of an exceedingly violent description, such as injuries produced by gunpowder, burns and lesions, either of a mechanical kind, or acting both chemically and mechanically together; a subject already fully treated of in the foregoing columns.

The following are the observations which Beer delivers on the prognosis: While, in the first stage of this dangerous form of ophthalmia, the eyesight yet remains, and the eyeball itself is not enlarged, if the patient can be properly taken care of, some hope may be entertained of dispersing the inflammation so favourably, that, with the exception of a weakness of sight, of longer or shorter continuance, no ill effects will be left. It is manifest, however, that, under these circumstances, the surgeon should not be too bold in promising a perfect cure; for the very commencement of such an inflammation of the whole eyeball, even when the disorder is purely idiopathic, is unavoidably attended with some risk, not only of permanent blindness, but of the eye itself being destroyed in the most painful manner: and, when things turn out rather better, a tolerably favourable termination of the case is uncommon. But, as soon as the power of seeing is totally lost, the pupil nearly closed, and the eyeball prodigiously swelled, it will be fortunate, if the inflammation can be resolved, so as to preserve the shape of the organ; for the restoration of the eyesight is entirely out of the question. But, besides the irremediable loss of vision, the disorder under these circumstances always produces a greater or lesser closure of the pupil, which however has really no share in causing the blindness.

In the second stage of the case, of course, the hope of restoring vision is quite past, and if the eyeball itself, and not merely the conjunctiva, has been considerably swelled in the first stage of the case, the chance of preserving the natural shape of the organ extremely unpromising. But, when the eye bursts, the latter desideratum is impossible. If the first stage should have been so violent as to induce gangrene, the practitioner will have enough to do in preventing sphacelus, and death, the danger of which is considerable, on account of the intimate connexion between the eye and parts in the orbit, and the brain and its membranes.

In the first stage, antiphlogistic treatment, in the general sense of the expression, is indicated, and the case is not to be regarded merely as a local disorder. With respect to topical bleedings, the surgeon, says Beer, should be more active than in other examples of ophthalmia, and, after copious venesection and the use of leeches have produced some relief, the protuberant conjunctiva round the cornea should be deeply scarified with a lancet; a practice not usually deemed advantageous by British surgeons. If, in the first stage, delirium come on, as it sometimes does during the violence of the inflammatory fever, Beer directs one of the external jugular veins to be opened, or blood taken from the temporal artery. Besides free and copious bleeding, repeated according to circum-

stances both generally and locally, the administration of purgatives, and other means of depletion, surgeons of the present day would not omit resorting in cases of ophthalmitis to the quick exhibition of mercury, so as to affect the mouth, and also to the external use of the extract of belladonna to keep the pupil dilated, and the iris in a position less likely to contract adhesions (see *BELLADONNA*), as will be presently explained in speaking of iritis.

In the second stage of the case, when the re-establishment of vision is quite impossible, and the objects are, to endeavour to keep the eye of a good shape, and quickly lessen the suppuration, warm emollient poultices; are the applications on which Beer bestows his praises. This topical treatment is to be assisted with internal means, as explained in the preceding pages, because the disorder is attended with a general disturbance of the constitution. When matter is fully formed, and its fluctuation can be distinctly felt, Beer approves of opening the abscess with a lancet; for it is only by this means that the annihilation of the eyeball can be prevented. If the eye has already burst, the preservation of its form is no longer possible, and, according to Beer, both the topical and general treatment should be partly of a tonic description.

External Ophthalmia. Inflammation of the Outer Coats of the Eye. Ophthalmitis Externa Idiopathica of Beer.—The modifications of this common species of ophthalmia, as the latter author observes, have a variety of names applied to them, as *ophthalmia levis*, *ophthalmia angularis*, *taraxis*, and sometimes *chemosis*, and *ophthalmia sicca*. Together with a preternatural dryness of the eye, and a sensation as if the eyeball were compressed on every side, the white of the eye becomes covered with a general redness, which, though it affect both the sclerótica and the conjunctiva, will be found, on attentive examination, to be much more considerable in the former than the latter membrane, in which only a delicate plexus of blood-vessels is at first perceptible. The motions of the eye and eyelids are not absolutely prevented; yet, the patient never moves these parts, except when he is actually obliged to do so, as every motion of them, if not actually painful, occasions a good deal of annoyances. Though the cornea cannot be said to become opaque, its clearness is always much diminished; and this change is the greater, the redder the white of the eye appears. These effects, which occur almost simultaneously, are followed by pain, which increases every moment, at first extending over the whole eyeball, and then to the surrounding parts, and to the top of the head. As the pain grows more severe, every movement of the eyeball and palpebræ becomes more distressing, the dryness of the eye greater, and the redness of the sclerotic conjunctiva augments, either more slowly, or quickly, according to the degree of inflammation, until the network of blood-vessels, which was at first distinguishable, entirely disappears, and the conjunctiva looks like a piece of red cloth, quite concealing the sclerótica, and forming round the cornea a very painful, firm, uniform circular projection. Thus, the cornea seems as if it lay in a depression, with its margin partly covered by this inflammatory swelling of the conjunctiva. At the period when the protuberance of the latter membrane takes place, the cornea itself always becomes less and less clear, and of a

reddish grey colour, so that neither the iris nor the pupil can be any longer distinguished, and the power of vision is reduced to a faint perception of light. The pain, which was that of heaviness and tension, now becomes of a throbbing description, and the eyelids, which now begin to participate in the effects of the inflammation, are no longer capable of covering properly the swelled conjunctiva. The eyeball and eyelids are perfectly motionless; and, if an attempt be made by the patient to move them, the efforts of the muscles may be perceived, but still no movement of the parts intended is performed. The orbit feels as if it were too small for the eye, and the constitution suffers a severe attack of inflammatory fever. Thus, says Beer, does the first stage of this form of ophthalmia gradually rise to its highest degree, or that of *true chemosis*.

However, idiopathic external ophthalmia does not always become so violent; as, for instance, when the complaint has been excited merely by the lodgment of some small foreign body under the eyelids; for, though, in such a case, the conjunctiva and sclerótica are both reddened together, yet even when no aid is afforded, if no other sources of greater irritation are present, the redness does not readily increase so as quite to conceal the sclerótica, or to be attended with an inflammatory swelling all round the cornea. This milder form of external ophthalmia has sometimes received the name of *taraxis*. It is the *mild-acute ophthalmia* of Scarpa, characterised, as this author says, by redness of the conjunctiva and lining of the eyelids, an unnatural sensation of heat in the eyes, uneasiness, itching, and shooting pains, as if sand were lodged between the eye and eyelids. At the place where the pain seems most severe, Scarpa remarks, that some blood-vessels appear more prominent and turgid than other vessels of the same class. The patient keeps his eyelids closed: for he feels a weariness and restraint in opening them, and by this means he also moderates the action of the light, to which he cannot expose himself, without increasing the burning sensation, lancinating pain, and effusion of tears. If the constitution be irritable, the pulse will be a little accelerated, particularly towards the evening; the skin dry; and sometimes slight shiverings, and nausea and sickness take place.

As the second stage of external ophthalmia comes on, the symptoms vary, according to the degree of the complaint in its first stage; but when what Beer calls a *true chemosis* is produced, the following are described by him as the usual appearances: The circular prominent fold of the conjunctiva, round the cornea, becomes of a dark-red colour, and the swelling increases, but it becomes softer and less painful. The hardly visible portion of the cornea, situated in the depression formed by the circular protuberance of the conjunctiva, seems at first perfectly white, and afterwards yellowish, being the seat of more or less purulent matter. Though the swelled conjunctiva is every where moistened with a thin whitish mucus, this secretion, says Beer, is never so copious as to run over the face, as in the case of ophthalmo-blennorrhœa. In this stage, the lower eyelid is turned somewhat outwards, in consequence of its lining becoming more swelled. While suppuration is taking place in the cornea, attended with the febrile symptoms which usu-

ally accompany the formation of acute abscesses, little collections of matter sometimes occur at different points of the conjunctiva, and after they have burst, a probe may easily be passed rather deeply into them, without any particular pain. (Beer, b. i. p. 412.) The suppuration continually advancing, the swelling of the conjunctiva and of the whole eyeball now diminishes, the effects of the inflammation penetrate deeply into the organ, and the structure of the eye is so altered, as not to be cognizable, the part shrivelling up, as Beer says, into a motionless, whitish mass. However, according to this author, these deep effects of suppuration are sometimes produced only in a certain part of the eyeball, especially when the chemosis is the consequence of an external injury; and, in this circumstance, the rest of the circumference of the globe of the eye exhibits its natural organization, while, in the part above alluded to, there is a funnel-like depression, attended with a considerable diminution in the size of the organ.

But when an idiopathic external inflammation of the eye has only attained the milder degree, expressed by the term *taraxis*; as, for instance, when the complaint is principally owing to the lodgment of some mechanically or chemically irritating substance under the eyelids; the redness of the conjunctiva and sclerotica undergoes a remarkable increase on the accession of the second stage: the first of these membranes becomes somewhat swelled; the pain is lancinating and irregular, and the secretion of tears unusually profuse; but at the point where the extraneous substance lodges, an open superficial suppuration occurs, and, according to Beer, the case, both in the first and second stage, is generally accompanied with no febrile symptoms.

In the first stage, Beer represents the prognosis as very favourable, provided the disorder has not exceeded that degree, to which the name of *taraxis* is applied; for, with the aid of proper treatment, the inflammation, when of a healthy kind, may be soon so favourably removed, as not to leave a vestige of it behind. If the cause of the disorder be not greater than a moderate injury or wound of the eye, any traces of the lesion, which are perhaps still remaining, will disappear as soon as the inflammation subsides. On the other hand, when this kind of ophthalmia is accompanied by *true chemosis*, the prognosis is serious, and must be made with great reserve, especially when the patient is of a weak irritable constitution, a child, unmanageable, or incapable of following strictly the advice which he receives from his medical attendant; for, under these circumstances, it will not be in the power of the latter to prevent the complaint from advancing unremittently to its second stage, in which event, the ill consequences of suppuration will be incalculable. But, if these unfavourable conditions are not present, though the genuine idiopathic chemosis may really have attained a violent, and almost its highest, degree in the first stage, not only the eye may be saved by prompt and judicious treatment, but also the eyesight; nor will the result be different, even when the cornea continues for some time deprived of its transparency, and the power of vision impaired by a slight varicose affection of its conjunctival covering. These effects, says Beer, at length completely disappear, less in consequence of the aid of medicine, than of a proper regimen, the uninterrupted enjoyment of a fresh dry air, &c.

The prognosis in the second stage is under very different circumstances; for, as Beer observes, though the inflammation in the first stage may really not exceed that degree which is implied by the term *taraxis*, yet, if any suppurating point, occasioned by some slight preceding injury, be not efficiently treated, or if there be any loss of substance already produced by the injury itself, a more or less opaque white cicatrix is apt to remain on the cornea, and cause a permanent impediment to vision in a degree determined by the situation and extent of the opacity. And, in addition to this risk, it is to be remembered, that if the suppurating point be entirely neglected, or erroneously treated, the cornea or sclerotica may be penetrated by ulceration, and, in the first case, a prolapsus of the iris, an adhesion of this organ to the cornea (*synechia anterior*), a disfigurement of the pupil, or an irregularity of the cornea, be produced; while, in the second, the consequences may be a partial wasting away of the eye-ball, attended with loss of sight and of the natural shape of the part. (Beer, b. i. p. 417.)

Beer further observes, that when this species of ophthalmia presents itself in its first stage in the form of *true chemosis*, the prognosis in the second stage is very unfavourable; for, when the cornea is generally pervaded by suppuration, the eyesight, and, in some degree, the form of the eyeball are for ever lost, and it will be lucky, if the case can be brought to a conclusion with the mere destruction of the cornea. But, when the matter points at once in several places of the conjunctiva, round the cornea, all idea of preserving the shape of the eye sufficiently for the application of an artificial eye is out of the question, and the surgeon will be very successful, if he can now check in moderate time the suppuration, which continues with a good deal of general indisposition. An extraordinary relaxation of the conjunctiva of the lower eyelid, and a consequent ectropium, are the least disastrous effects of the abscesses of the eye thus produced. Lastly, Beer remarks, that when chemosis is in the second stage, that is to say, attended with suppuration of the eye, it rarely happens, under the most favourable circumstances, that the eyesight and shape of the organ can be preserved entirely free from permanent injury. (B. i. p. 418.)

Let us next consider the treatment of idiopathic external ophthalmia in its modifications of simple inflammation of the conjunctiva, mild acute ophthalmia, or *taraxis*, and severe acute ophthalmia, with chemosis.

Simple inflammation of the conjunctiva, unconnected with injury of the eye, and neither depending upon any established disorder of the system, nor modified by a scrofulous diathesis, may be easily and speedily reduced, even in its most acute form, by bleeding, and some brisk doses of purgative medicine. (See Travers in *Synopsis of the Dis. of the Eye*, p. 247.) For the relief of mild acute ophthalmia, Scarpa recommends low diet, gentle purging, with small repeated doses of antimonium tartarizatum, the removal of any extraneous body lodged under the eyelid, and frequently washing the eye with a warm decoction of mallow leaves, and covering it with a soft emollient poultice, included in a fine little muslin bag. Mr. Travers also expresses his decided preference to a tepid application in the painfully acute stage of inflammation, and considers simple warm water

generally better than medicated lotions, like the aqueous solution of opium, or infusions of poppy and hemlock.

When the disease presents itself in its first stage, in the mild form of taraxis, it usually runs its course, quite uncomplicated with any general indisposition, and may be cured by moderate antiphlogistic treatment, in which, indeed, since the eyeball itself is affected, particular attention must be paid to lessening the action of the light and air upon the organ. But when a true chemosis is present, every antiphlogistic means must be promptly and rigorously put in practice, internal as well as external remedies being employed; and, besides common measures, the conjunctiva, round the cornea, is to be scarified; a proceeding never necessary in the ease of taraxis. Such scarifications, Beer observes, have a wonderful effect, when practised at the proper period, after venesection and topical bleeding with leeches have been fully put in execution, and when the cuts are made deep, so as to produce immediately a copious discharge of blood. "By means of such scarifications (says he) I have seen the inflammation and all its threatening effects recede, as it were, before my face, when no material relief could be effected by other measures." (B. i. p. 419.) In this country the best practitioners rarely have recourse either to incisions, or scarifications, in chemosis; and have more confidence in general, than local treatment. (*Wellbank; note in Frick on Dis. of the Eyes*, p. 15. ed. 2.)

General and local bleeding having been put in practice, the treatment is to be continued by administering purgatives of the mildest description, and, after their operation, applying blisters, according to the directions given in a preceding part of this article. In the first stage of severe acute ophthalmia, Scarpa considers topical emollient applications to the eye most beneficial: such as mallows boiled in new milk; bread and milk poultices; or the soft pulp of a baked apple; all included in fine little muslin bags. Remedies of this description should be renewed at least every two hours. The patient should be directed to observe perfect quietude, and to lie with his head in an elevated position. To keep the eyelids from adhering together in the night time, the spermaceti cerate is proper.

Under the preceding plan of treatment, the first stage of severe ophthalmia commonly abates in about a week. The burning heat and darting pains in the eyes, and the febrile disturbance of the constitution subside. The patient is comparatively easy, and regains his appetite. The eyes become moist again, and can now be opened, without experiencing vast irritation from a moderate light. In this state, notwithstanding they may continue red, and the conjunctiva swelled, all evacuations are to be left off, as well as the use of topical emollients, for which latter, astringent, corroborant collyria are to be substituted. Scarpa recommends the following application: R. Zinci sulphatis gr. vj. Aquæ distillatæ ʒvj. Mucil. sem. cydon. mali ʒss. Spiritus vini camphor. guttas paucas. Misce et. tola. This collyrium may be injected with a syringe, between the eye and eyelids, once every two hours; or the eye may be bathed in it, by means of an eye-cup. Such persons as cannot bear cold applications to the eye, must have the same kind of collyrium a little warmed; but, as

soon as the irritability is lessened, it may be used cold.

Scarpa then speaks of the good effects produced in the second stage of ophthalmia by the application to the eye of two or three drops of the vinous tincture of opium, once or twice a day; a subject already considered in the foregoing columns. The utility of letting the eye be habituated to the light, as soon as it can bear it, is next strongly commended; a rule of great importance, but on which I need not here dwell, because it has been already insisted upon in the general observations.

When idiopathic external ophthalmia has terminated in suppurations of little extent, Beer speaks highly of the benefit derived from a solution of the lapis divinus (see LACHRYMAT. ORGANS), containing the liquor plumbi subacetatis, or from smearing the suppurating points with a little laudanum. In worse cases Beer states that, when such local treatment is combined with the internal exhibition of bark and naphtha, and a diet and regimen conducive to the support of the system, its efficacy is very great. And here, says he, it is worth observing, that while the solution of the lapis divinus is of great service in the second stage of true chemosis, it is more or less detrimental in the kind of chemosis which accompanies purulent ophthalmia, especially if not blended with mucilage, and, even when thus qualified, it cannot be endured by weak and irritable subjects, affected with the latter complaint; a fact not observed in other instances of chemosis. (B. i. p. 420.)

When pustules, or abscesses in the swelled conjunctiva, point round the cornea, a free outlet to the matter must be immediately made in each of them with a lancet; for, if this be not done, as Beer observes, the matter will spread extensively, and the eyeball be in danger of being destroyed. For an account of the method of treating the eversion of the lower eyelid, sometimes remaining as a consequence of the disorder, see ECTROPIUM.

Inflammation of the Sclerotica. Scleritis. Rheumatic Ophthalmia.—This kind of inflammation of the eye has its seat in the albuginea and sclerotica, and occasionally extends to the iris. The modern attempts to class ophthalmies, according to the texture of the eye first or chiefly affected, has certainly led to clearer views of the subject, and sounder practice. One circumstance, particularly adverted to both by Dr. Vetch and Mr. Travers, in inflammation of the sclerotica, is the appearance of a vascular zone at the margin of the cornea. By the latter gentleman this effect is ascribed to the particular distribution of the vessels. "Branches from the straight vessels of the conjunctiva penetrate the sclerotica obliquely towards the margin of the cornea, and the long ciliary vessels pass in sulci of this membrane to the plexus ciliaris at the root of the iris. At the interior border of the sclerotica, where the annulus ciliaris is adhering closely to this tunic, the ciliary communicate with the muscular branches, and being in deep-seated inflammation fully injected with red blood, the condensation of colour gives the well-known and remarkable appearance of a vascular zone at the margin of the cornea." (*Synopsis, &c.* p. 126.) Only a few interspersed trunks are posteriorly observed, "which do not affect the natural appearance of the intermediate space, but these diverging as they come forwards produce a zone, more or less complete, of minute hair-like vessels,

distinguished by their rectilinear direction, and their uniform concentration towards the margin of the cornea; their colour advances, with the progress of the disease, from that of a delicate pink, or damask rose, to a deeper hue, and imparting a faint blush to the part immediately surrounding it." (*Vetch on Dis. of the Eye*, p. 27.)

In catarrhal ophthalmia the redness is reticular, and "the turbid vessels are evidently conjunctival;" in the rheumatic, the chief redness is radiated or zonular, and seated under the conjunctiva." (*Mackenzie on Dis. of the Eye*, p. 477. ed. 2.) Dr. Mackenzie describes the fasciculi of sclerotic vessels as advancing in radii towards the edge, and sometimes even a little over the edge of the cornea. "They are of a bright red colour, and surround the cornea pretty equally on all sides. They are larger and more turbid than the radiating vessels seen in iritis, and rise more from the surface of the sclerotic." The conjunctivitis which attends this ophthalmia is slight, and never such as to mask the radiated inflammation of the sclerotic." (*On Dis. of the Eye*, p. 478. ed. 2.)

According to Mr. Wardrop, the albuginea acquires a brick-red tinge, or an admixture of yellow with crimson red, which colour, he supposes, is probably caused by the serous part of the blood being tinged with bile, "an effect likely to take place from the marked derangement of the biliary organs, which usually accompanies this disease." Contrary to the statement of Beer, who describes the blood-vessels as being in clusters, Mr. Wardrop observes, that they are generally equally numerous over the whole white of the eye, passing forwards in nearly straight lines from the posterior part of the eyeball, and advancing close to the cornea; but neither passing over it, nor leaving the pale circle around it, which is so striking when either the choroid coat or the iris is inflamed. If the vessels be closely examined, the general redness will be found produced more by numerous small ramifications, than a few large trunks. There is frequently a little swelling of the conjunctiva, which sometimes forms a slightly elevated ring round the cornea. In mild cases, little change takes place in the anterior chamber in the early stage; but, as the disease advances, the cornea becomes dull and turbid. Upon close examination, one or more of the layers of the conjunctiva on the cornea will generally be found to be abraded, especially towards its circumference. At the commencement of the disease, there is often a disagreeable feeling of dryness of the eye; but, sooner or later, a very copious secretion of tears takes place. The eyelids are observed to be very little affected. At first, the chief seat of pain is generally in the head, though sometimes in the eyeball itself. Mr. Wardrop describes the pain as usually most severe in the temple of the affected side, but he says, that it is often seated in the brow, the cheek-bone, the teeth, or the lower jaw. Sometimes the pain is precisely confined to one half of the head, and sometimes there is a severe pain in the cavity of the nose, or in the ear. The pains are more of a dull agonizing kind, than acute, and though unceasing, they vary much in degree, coming on at times in severe paroxysms, and with great violence when the head is bent downwards. Sometimes, the pain is excited by merely touching the scalp, and the patient is unable to rest his head on the

affected side, or even lean it on a pillow. In most cases, the pain is said to be remittent, the paroxysm coming on in the evening, continuing during the night, being most severe about midnight, and abating towards morning.

In the eyeball, the patient generally complains more of a sense of fullness and distension, than of pain; and, though there is a great degree of external redness, *the eye does not seem to suffer from exposure to light*; a point, on which Professor Beer delivers a directly opposite statement, at least, in relation to the first stage of the disease. However, these authors both agree in considering the sclerotic as generally the chief seat of rheumatic inflammation; but, Beer sets down the iris as likewise subject to be attacked. He admits, also, that in the second stage, the aversion to light undergoes a considerable diminution. Rheumatic ophthalmia is always accompanied with more or less symptomatic fever, severe paroxysms of which take place towards evening, and the functions of the primæ viæ are much deranged, "the appetite being impaired, and the evacuations always changed in quality." In severe cases, the pain in the head soon becomes agonizing, the redness of the eyeball increases, the whole white of the eye is crowded with blood-vessels, and the conjunctiva swelled. At length, ulceration commences in the cornea, through which the aqueous humour is discharged, and the eyeball collapses, when all pain ceases; or abscesses may form within the posterior chamber, and burst through the sclerotic coat. (*Wardrop, in Med. Chir. Trans.* vol. x.)

Mr. Lawrence observes, that the symptoms are not of a violent kind, as the disorder is chiefly confined to the sclerotic. It is usually accompanied with haziness and dulness of the cornea, and corresponding indistinctness of vision; but, it does not often lead to any serious change in that part. It may slowly creep on to the iris; the conjunctiva is not affected, or only slightly, and the same remark may be applied to the eyelids. There is a dull aching pain, with a sense of tightness; and often more serious pain around the eye, than in the eye itself. Exposure to light is not found very troublesome. (See also *Wardrop in Med. Chir. Tr.* vol. x. p. 6. and *Mackenzie, Op. cit.* p. 479.) This, however, as well as the watering of the eye, depends on the degree of inflammation. More or less febrile disturbance prevails. (See *Lawrence on Dis. of the Eye*, p. 237.)

The causes of rheumatic ophthalmia are change of weather, variation of temperature, exposure to damp, a cold current of air directly striking the eye, and a constitution disposed to rheumatism. Mr. Wardrop states, that both sexes are equally subject to the disease; but that he has observed it most frequently in adults, and persons of rather advanced age. Only one eye is usually affected; and when the second is attacked, the disease is almost always less severe in it than in that which is first inflamed.

Dr. Mackenzie, though he looks upon this case as an inflammation of the fibrous membrane of the eye, and of similar textures around it, excited by cold, believes, that it is not necessarily connected with a rheumatic diathesis. Rheumatic ophthalmia, he remarks, frequently occurs in individuals who have never suffered from rheumatism in any other part of the body. Pure rheumatic ophthalmia he sets down as a comparatively rare disease. For one case of it, says he, we meet with perhaps ten

cases of catarrhal ophthalmia, and six of that mixed kind, called catarrho-rheumatic, in which both the conjunctiva and the sclerótica are affected, and the symptoms of conjunctivitis and scleritis are combined. We seldom find both eyes affected with rheumatic ophthalmia together. When both are attacked, the one is always much more severely inflamed than the other. (*Mackenzie, Op. cit. p. 476.*)

According to Mr. Wardrop, rheumatic ophthalmia resembles syphilitic more than any other kind of inflammation of the eye. But he notices that *the proper vessels of the sclerotic coat are enlarged, which is the cause of the redness being generally diffused over the whole albuginea, whereas, in syphilitic inflammation, it is the anterior ciliary arteries, passing along the sclerótica on their way to the iris, which are chiefly affected; and hence the pale ring, which is always observed between the cornea and the enlarged vessels.* Mr. Wardrop further explains that, though these diseases resemble each other in the pains round the orbit, and their evening exacerbation, *patients, with syphilitic ophthalmia, always have the constitutional symptoms of syphilis.*

When the disease has made much progress, and the symptoms have not yielded to other remedies, Mr. Wardrop recommends the evacuation of the aqueous humour, as a practice from which the most beneficial effects may be expected. After the operation, fomentations are the only necessary applications; but, if the eye continue long irritable, the vinous tincture of opium is to be used. He enjoins attention to the state of the biliary organs in every stage of the disease, and speaks highly of the sudden relief sometimes afforded by an emetic, care being taken to empty the bowels afterwards with calomel and rhubarb, or other purgatives. If the functions of the skin were suddenly interrupted by a chill just before the attack, this author prescribes a couple of grains of antimonial powder, alone, or combined with opium, to be taken every four or six hours. Little advantage, he says, is derived from local bleeding, and where venesection may become necessary on account of the complaint resisting other means, it is to be practised with moderation.

On the other hand, Dr. Mackenzie insists, that it is necessary to take blood from the arm in all cases, and, in general, to follow up this by the application of leeches to the forehead and temple. "The first night, after fifteen or twenty ounces of blood have been taken from the arm, the patient is generally so much relieved as to get some sleep, even though no other remedy be employed. Next day, I am in the habit of applying a dozen leeches around the eye; but, if the pulse be still full and strong, and the circumorbital pain not relieved, I first repeat the venesection, and I have had cases under my care, which required venesection to be repeated five or six times, &c." (*Mackenzie, Op. cit. p. 481.*) Mr. Lawrence is another advocate for venesection in the outset, in most instances, if the patient be plethoric, the pulse full and hard, and the tongue white. Cupping from the temple, or leeches, he says, may follow, or may be sufficient alone. (*On Dis. of the Eye, p. 238.*)

In the early stage, Mr. Wardrop has found, that the pain in the eye and eyebrow is sometimes much alleviated by a fomentation with the decoction of poppy-heads. He also praises blisters to the nape of the neck, or behind the ear; but dis-

approves of their being put near the eye itself. The vinous tincture of opium, he says, is the only local application, which he has ever seen decidedly beneficial; but its use is to be deferred till a late stage of the inflammation, when all febrile symptoms have been subdued. "After the primæ viæ have been well evacuated, the tongue may still remain very white, and the pulse quicker than natural." In this state, small doses of bark, either alone, or with the mineral acids, will be most serviceable. (*Wardrop, in Med. Chir. Trans. vol. x.*) Dr. Mackenzie expresses his belief, that local applications have but little power, except in the chronic stage, when the vinum opii may be dropped into the eye, diluted or undiluted. In the same stage, he approves of sulphate of quinine, and, in old mistreated cases, he is in favour of giving liquor arsenicalis.

Dr. Mackenzie has never failed to find calomel and opium useful in checking the circumorbital pain, and subduing the other symptoms. "Two pills, each containing two grains of calomel, with half a grain of opium, are to be administered every evening till the gums begin to be affected; when the calomel may be omitted, and ten grains of Dover's powder substituted for the opium." (*Op. cit. p. 481.*) Mr. Lawrence joins in commending calomel and opium. "Mercury (he adds) is more especially necessary when extension of the disease to the iris is apprehended. Affection of the mouth is rather advantageous than otherwise." (*On Dis. of the Eye, p. 238.*) Rubbing the forehead and temple with warm laudanum, or with extract of belladonna infused in laudanum, will afford great relief. This is recommended to be done about an hour before the nocturnal paroxysm is expected. In chronic cases, equal parts of laudanum and tincture of caustic ammonia form a useful liniment. (*Mackenzie.*)

During the whole course of the disease, the same judicious practitioner recommends the pupil to be kept under the influence of belladonna.

The pediluvium, and warm diluent drinks, should be employed in the evening to promote perspiration, and, with the opium, they will generally suffice; but, if necessary, antimonials and other sudorifics may be exhibited.

The practice recommended by Mr. Travers is as follows: Obtuse pain in the eyeball, he says, may be materially relieved by blood-letting, and by antimony and ipecacuanha with opiates. Mercury is stated to have much less power over this case, than iritis. In general, the patient is seriously reduced, and very irritable, from suffering rheumatic inflammation in the elbow, knee, or ankle; a state, to the production of which the previous use of mercury has commonly contributed. But, though such is stated to be the case, the moderate and cautious employment of this mineral is set down as generally indispensable in the treatment. And, in the interval of the mercurial action, the nitric acid is alleged to be often of great service. The preparations of mercury preferred by Mr. Travers in these cases, are the bichloride, in doses of $\frac{1}{12}$ or $\frac{1}{8}$ of a grain, and hydragrym cum creta, in doses of from five to ten grains, twice or thrice a day. As auxiliaries for allaying irritation, he prescribes the pulv. ipecac. comp., hemlock, hyoscyamus, and the extract of sarsaparilla, either dissolved in the decoction, or taken solid. (*Op. cit. p. 289.*)

Inflammation of the Internal Textures of the Eyeball, Retinitis and Choroiditis.—According to Beer, internal inflammation of the eye does not always originate in one particular texture, but, in some instances, commences in the retina, choroides, &c.; while, on other occasions, its principal seat is in the iris, from which membrane it quickly extends itself to the corpus ciliare, and the crystalline lens and its capsule, or else in another direction to the sclerotica, cornea, &c. These differences in the seat of the disorder obviously depend upon the way in which the exciting causes have operated; for, when they are such as immediately affect the retina only, the inflammation must have its origin in this texture, as when the disorder is produced by the effect of the sudden entrance of a strong, vivid, or reflected light, into the organ.

The exciting causes, however, may not affect directly the retina, and parts immediately next to it, but may operate chiefly upon the iris, in which event, this part is the chief seat of the inflammation, and the complaint is named, both by Schmidt and Beer, *iritis idiopathica*. This form of inflammation, Beer says, is seen after the extraction of the cataract, and accidental injuries of the eye, where the weapon, with which they were produced, has either penetrated directly to the iris, and more or less contused it, or roughly entered the eyeball near the ciliary edge of this membrane, without actually wounding it. (*Lehre von den Augenkrankh.* b. i. p. 421.)

Symptoms of the first stage of idiopathic internal Ophthalmia.—While a very uneasy sensation of general constriction and tension affects the whole eyeball, and soon changes into an obtuse, deep throbbing pain, increasing every instant, and quickly propagating itself over the eyebrows to the top of the head, the power of vision gradually declines, and, at the same time, the pupil, which plainly loses its clear shining blackness, contracts without being deprived of its circular figure, or drawn out of its natural position, until, at length, it is so completely closed, that the iris seems as if it had no aperture whatever. But, long before this perfect closure of the pupil has taken place, the power of seeing is entirely gone, though, after the faculty of perceiving the external light is extinguished, fiery appearances, which seriously trouble the patient, are seen at each pulsation of the blood-vessels within the eye. As the development of these symptoms is going on, the iris evidently loses its natural colour, becoming, as Beer says, greenish, when it was grey, or blue; and reddish, when it was brown, or black. In consequence of the iris swelling, and projecting towards the cornea, the anterior chamber becomes considerably diminished. Immediately the least mark of the swelling of the iris is seen, together with a moderate degree of contraction of the pupil, the whole sclerotica assumes a pink-red colour; a plexus of innumerable blood-vessels is seen in the conjunctiva; and the cornea loses a good deal of its natural brilliancy, without being actually opaque. The latter symptoms of this form of ophthalmia are attended with manifest general indisposition, and intolerable headach. Sometimes, in the first stage of the case, the pupil, though much lessened, is not absolutely closed, but thickish, and if examined with a magnifying glass, it has a reddish grey appearance, and the

power of vision, notwithstanding the continuance of the aperture, is quite lost.

Symptoms in the second stage.—While the eye is suffering very irregular throbbing pain, attended with a sensation of heaviness and cold in it, an increase of the redness of the conjunctiva, severe constitutional disturbances, and constant shivering, there is suddenly formed at the bottom of the anterior chamber a collection of matter, which above presents a horizontal line, but, on every inclination of the head sideways, changes its position. This matter continues to accumulate more and more, until it not only reaches the pupil, but fills the whole of the anterior chamber, constituting the case termed *Hypopium*. If the disease be left to itself, says Beer, the matter collects in such quantity, that the cornea is rendered more prominent, and afterwards conical, very like an abscess, ultimately bursting during an aggravated attack of pain, when the eye shrinks, and the sufferings gradually cease. This kind of hypopium Beer names *true*, in order to distinguish it from the case, in which the matter passes into the anterior chamber out of an abscess in the cornea, and which he terms a *false* hypopium. When, at the end of the first stage, the pupil is not entirely closed, one may discern in the second stage, at the period of matter presenting itself at the bottom of the anterior chamber (though not easily with the unassisted eye), whitish filaments, extending from the edge of that opening towards its centre, produced by the coagulable lymph effused in the aqueous humour, the secretion of which was interrupted in the first stage, but now commences again. And, continues Beer, one may perceive, with a good magnifying glass, a very delicate cobweb-like membrane, which, when the matter collected lies over the pupil, and remains for a good while unabsorbed, at length becomes quite yellow, the matter being really encysted by it in the form of a small lump, which remains in the pupil, and partly projects into the anterior chamber, forming the case which Beer denominates a *spurious purulent cataract*, to which the edge of the iris is so closely adherent, that sooner than a separation could be effected, the whole of the iris would be torn in pieces. When the pupil has been completely closed in the first stage, these effects of course cannot take place.

With respect to the causes of this form of ophthalmia, Beer remarks, that, as there are not many circumstances which can produce it, the case belongs rather to the less frequent kinds of inflammation of the eye. As predisposing causes, he mentions plethora, and long-continued straining of the eye in the inspection of small, microscopic objects in a strong reflected light.

Respecting the prognosis, Beer represents it as not unfavourable, when the inflammation of the eyeball is moderate, proper treatment immediately employed, the pupil not yet very much contracted, and the power of seeing not considerably impaired. But, if the power of vision should seem as if it were abolished, the prognosis is extremely uncertain. And, if the pupil should close after the entire stoppage of vision, no hope can be entertained of the recovery of the sight; for, if the pupil-open again on the subsidence of the inflammation, it will yet continue very small and motionless, and the eye blind. When the case is mistaken in its first stage, and neglected or erro-

mously treated, Beer says, it changes into a very perilous general inflammation of the whole eyeball; a disorder already considered.

In the second stage, the prognosis is constantly unfavourable; for, the eyesight has been already destroyed at the end of the first one, and the only expectation of the practitioner can now be to preserve the shape of the eye.

Complete rest of the eyes and of the whole body, darkness, abstinence, and active depletion, followed by the rapid introduction of mercury into the system, are the means to be depended upon in the first stage. Belladonna is to be applied in the usual way. (See *Mackenzie, Op. cit.* p. 547. ed. 2.)

In the second stage, a warm poultice may be laid over the eyelids; and instead of puncturing the cornea, it is better to try to disperse the matter with mercury and blisters. Blisters are to be applied alternately behind the ear and on the temple. Beer recommends the eye to be smeared with the vinous tincture of opium, two, or three times a day, by means of a camel-hair brush, or even four times, when the anterior chamber is filled to the extent of one half of it. Beer's experience leads him to approve of opening the cornea only in very urgent cases, that is to say, when the eye is so distended with matter, that the cornea threatens to burst. (See *HYPOPIUM*.)

Idiopathic Iritis.—Together with obtuse, heavy, deep pain in the eye, producing a sensation as if the eyeball were continually pressed upon by one of the fingers, a manifest and incessantly increasing uniform contraction of the pupil takes place, as well as a gradual diminution of the movements of the iris; yet, the pupil neither loses its circular shape, nor changes its position in the eye; and at the same time, an intolerance of light commences. When the pupil is examined with a glass, it is found to have already lost the shining blackness, which is peculiar to it in the healthy state. While these changes are occurring in the pupil, the colour of the iris undergoes a material alteration, first at its lesser circle, which grows much darker, and afterwards at its greater circle, which turns greenish, when it was grey or blue, but reddish, when it was brown or black. At the same time, the margin of the pupil becomes indistinct, and appears not so sharp as natural. As soon as the greater ring of the iris has undergone a considerable change of colour, this membrane becomes evidently swelled, and projects towards the cornea, so that the anterior chamber is much lessened. As early as the period when the contraction of the pupil, and the immobility of the iris, are observable, a serious diminution of vision occurs; because, in all cases, the inflammation extends more or less over the anterior layer of the crystalline capsule; and, afterwards, when the case is somewhat more advanced, says Beer, one may perceive quite plainly, with the unassisted eye, those effects of inflammation on the capsule, which have been so excellently described by Walther. (*Abhandl. aus dem Gebiete der Practischen Medicin*, b. i. Landshut, 1810.) In proportion as the inflammation makes progress, the pain grows more severe and extensive, and, towards the end of the first stage, it shoots particularly up to the top of the head. The redness perceptible in the eye during the whole of the first stage, is inconsiderable, and seems not to be proportioned to the violence and danger of the inflammation; for the sclerotica is

only of a rose-red colour, and even this pale redness fades towards the circumference of the eyeball. (Beer, l. i. p. 484.)

According to Beer, idiopathic iritis is always attended with a corresponding general disturbance of the system; but a good deal depends upon whether the inflammation spreads immediately to the deeper textures of the eye, or to its outer coats, or in both directions at once. In the first case, the constitutional indisposition is always more severe, and the danger of the disease increases every moment; in the second, the augmentation of the general symptoms is less striking; but, in the third, the inflammation, and the corresponding febrile symptoms, soon rise in such a degree, that the possibility of preserving the eyesight becomes very doubtful. The continued operation of hidden exciting causes, neglect, and erroneous management of the disease, also produce considerable differences; and, as Beer observes, it not unfrequently happens, that a genuine idiopathic iritis, which does not appear at first very dangerous, nor rapid in its progress, will suddenly change, under the unfortunate concurrence of such circumstances, into a complete inflammation of the whole eyeball, destroying the organ in a few days.

In the second stage, says Beer, in conjunction with a corresponding still more manifest general indisposition, the pain in the eye grows very irregular; luminous appearances flash within the organ, and seriously annoy the patient, especially in the dark, while the power of seeing the external light undergoes a great decrease; the redness, even in the conjunctiva, increases; and the pupil, which hitherto has been perfectly circular, becomes more or less angular. At these angles, something of a light greyish colour may be seen projecting behind the pupillary edge of the iris, and, on examination with a glass, plainly appears to be a very delicate layer of fibrine, by which, first the lesser ring of the uvea, and (if proper treatment be not expeditiously employed) also its greater ring, are soon rendered adherent to the anterior portion of the capsule of the lens (*synchia posterior*), which membrane, as the disease advances, becomes more and more deprived of its transparency. Under these circumstances, it is evident, that the power of vision must daily decline, and that if this process of the effusion of lymph and its organization be not resisted by powerful measures, the patient will soon be left just capable of faintly distinguishing the light. While the above-described changes are taking place between the uvea and anterior portion of the capsule, very peculiar effects are occurring in the anterior chamber, for, as the iris continues to project further towards the cornea, the latter membrane grows less and less transparent, and the iris seems as if concealed in a mist, at the same time that a small, yellowish red, round prominence is formed at one or more places together, generally between the greater and lesser rings of the iris, and proves afterwards to be a small abscess, which, ultimately bursting, pours its contents into the anterior chamber, and thus occasions a true *Hypopium*. For several days, the flakes of the burst little cyst, still connected with the iris, may be seen floating in the aqueous humour, until they gradually disappear. When there is not merely one, but several of these little abscesses, says Beer, the greater part of the anterior chamber may be filled with matter, so that

little more of the iris can be distinguished. In weak subjects, at this period of suppuration, blood may not unfrequently be perceived in the chamber of the eye; a circumstance regarded by Beer as a very unfavourable omen, in respect to the recovery of sight, as, in such cases, portions of blood and matter are apt to lie in the posterior chamber entangled in the lymph. According to the same author, the matter in the anterior-chamber is at last absorbed; the pupil, if it has been concealed, can again be seen, but it appears angular and very turbid; and in consequence of the layer of lymph in the posterior chamber, the eyesight is exceedingly diminished, or even reduced to the mere power of knowing light from darkness. Such, says Beer, is the course of the second stage of idiopathic iritis, when the inflammation has not extended far beyond its proper focus, and has been principally confined to the iris, corpus ciliare, the lens and its capsule, and the anterior part of the sclerótica. But, if it should spread more deeply to the vitreous humour, the retina, the membrana Ruyschiana, and the choroides, symptoms of internal ophthalmia (strictly so called) then occur with great vehemence in the first stage, and at the termination of the second, the eyesight is for ever destroyed, and not the least perception of light remains; and, even if the patient should think that he can distinguish it, the feel is only a deception, a development of light within the eye itself, of which the surgeon may easily assure himself, by placing the patient with his back towards the light, and asking him to point out where it is; or by putting him directly opposite a window, and moving the hand slowly along before his eyes; of which proceeding the patient will be quite unconscious. The effects left in the eye after such an iritis, and indicating its mischievous extension, are so characteristic, that, on the first inspection of the eye, no surgeon can entertain a doubt of the deeper textures of the eye having been involved. But, when idiopathic iritis extends rather to the external, than the deep textures, the swelled iris, as early as the end of the first stage, approaches so near the cornea, which grows less and less clear, that they seem as if they were adherent, ere the second stage has commenced. And, indeed, on the accession of this stage, they actually adhere together at every point, either directly, or with the intervention of a mass of coagulating lymph. In the first event, at the end of the second stage, the cornea forms a conical protuberance, and a total staphyloma arises (see STAPHYLOMA); but, in the second, the cornea becomes rather flat, and on account of the layer of organised lymph, which fills up the space between the cornea and iris, little of the latter membrane can be discerned, and what can be seen, appears to have its organisation entirely subverted. When idiopathic iritis in its first stage extends its effects directly over the whole eyeball, the eye becomes nearly or quite destroyed in the same manner as in cases of violent acute ophthalmia.

The causes which give rise to idiopathic iritis, must always be such as operate directly upon the iris; and, hence, the disorder is usually a consequence of injuries and wounds of the eye, produced by accident, or in operations. And, says Beer, although rheumatic inflammation of the eye, when neglected, or wrongly treated, may at length affect the iris and adjacent textures, yet, such an iritis is but a secondary effect, derived from the pre-

existing rheumatic ophthalmia. All injuries in which the weapon, or instrument, has more or less pressed against, pushed, irritated, or violently bruised or torn, the iris itself, and all lacerated wounds of the cornea, are to be accounted the principal exciting causes of idiopathic iritis. Hence, extraction of the cataract is not unfrequently followed by this inflammation, when the flap of the cornea is kept too long opened, and the iris is hurt with any blunt instrument; when the incision in the cornea is too small, and a hard cataract pushes the iris between the lips of the wound, and is slowly pressed out of the eye; when many pieces of the cataract break off, and it is necessary repeatedly to introduce Daniel's scoop for their removal; or when, notwithstanding the operator proceeds with the utmost delicacy, the patient is excessively timid, and unmanageable, or particularly irritable and prone to inflammation. This form of iritis is also produced by couching, reclination through the sclerótica, keratonyxis, and operations for artificial pupil.

Prognosis in the first stage.—Serious as the disorder always is; important as the textures are, in which the inflammation is most severe; and quickly as vision may be for ever annihilated by it; yet, the prognosis is very favourable, when the true nature of the case is at once understood, and treated as it ought to be. The prognosis is the most favourable, when the inflammation is not extensive; but it must be very reserved, when the inflammation extends either deeply backward, forward, or in both directions. Beer remarks, that, when iritis is purely idiopathic, and judiciously treated in its first stage, it is incredible with what rapidity its effects recede. When it is produced immediately by an injury of the iris itself, some part of which is torn, the risk of the inflammation is not the only thing for consideration; for the chance of the function of the iris being permanently impaired by the injury must also be taken into the account. And as, in these severe injuries of the eyeball, it is impossible to foretell what may be the result of the inflammation, it is a good maxim always either to defer making any prognosis, or to deliver only a doubtful one. When idiopathic iritis has already changed, either into a complete internal ophthalmia, or into a violent inflammation of the whole eyeball, no incautious promises should be made about the recovery of the eyesight, or even about preserving the shape of the organ.

Prognosis in the second stage.—If it be plain to the naked eye, that no coagulating lymph lies in that chamber behind the contracted pupil, but slight greyish filaments are discernible with a magnifying glass, projecting only a little way from behind the pupillary edge of the iris; if the colour merely of the lesser circle of the iris be changed, while no little cyst of matter is yet formed on the latter membrane, and the sight is lessened only in a small degree, being somewhat cloudy; the complaint may yet be so completely cured by proper means, that not a vestige of it will remain. However, for some time after the termination of the second stage, the motions of the iris will be more sluggish than natural, though the pupil effectually adapt itself to the variations of light. On the other hand, when a considerable, though fine, web-like membrane can be seen, the prognosis is less favourable; when the colour of the larger circle of the iris is

somewhat altered, and the power of vision is seriously lessened; though, by effectual treatment, the sight may be re-established sufficiently to enable the patient to read and write, yet, says Beer, it will for ever continue weak; the papillary edge of the iris will never regain its perfect freedom, but constantly remain more or less angular; and the pupil never assume again the clear shining blackness, which, in persons not of great age, it naturally exhibits. Still more remarkable are the sequelæ of idiopathic iritis, when a small cyst of matter has been formed on the iris, and discharged its contents into the anterior chamber; for, in this case, under the best circumstances, the former colour of the iris never entirely returns. According to Beer, when, at the first visit of the surgeon, vision is quite interrupted by the effusion of lymph in the posterior chamber, so that the patient can no longer perceive any object with the affected eye, though capable of distinguishing the light, and the outlines of some things; when the pupil is at the same time very contracted, and the colour of the greater circle of the iris entirely changed, there is no hope of recovery of the sight at first, though some chance of benefit may be subsequently afforded by the formation of an artificial pupil. If in such a case matter has been effused from several little suppurating points of the iris, so copiously into the anterior chamber, that nearly all this cavity, or at least the half of it, is filled up, though after absorption some power of distinguishing light may return, little or no hope can be entertained of any effectual benefit from a future operation for an artificial pupil. When, at the termination of the first stage, the cornea is so severely inflamed, that the iris almost touches this membrane in its untransparent thickened state, all prospect of saving the eyesight is over, and it will be fortunate if the natural shape of the eye can now be preserved, and the formation of a staphyloma of the cornea prevented. When the layer of lymph between the cornea and the iris is extensive, and considerable blood-vessels can be seen proceeding into it from the iris, nothing will succeed in re-establishing vision. And Beer observes, that when an idiopathic iritis, at the close of its first stage, has changed into a true internal ophthalmia, and the pupil is already quite blocked up, so that even the light cannot be distinguished, the recovery of sight is totally impossible, and the surgeon must make every exertion to prevent the shape of the organ from being destroyed. In this disease, a relapse, even when the inflammation has not been very considerable in the first attack, almost constantly ends in partial or complete blindness, as the progress of the case is so rapid that there is not time enough to render effectual assistance. (Beer.)

Treatment.—The three principal indications, or those of arresting the inflammation of the organ, preventing the further effusion of lymph, and promoting the absorption of that which has been already poured out, and of preventing the contraction of the pupil, may be accomplished by antiphlogistic measures, by the administration of mercury, and by the use of belladonna. (See *Lawrence on Dis. of the Eye*, p. 301.) In few cases ought blood-letting to be neglected, and when the patient is robust, and the inflammation is severe, it must be freely employed. As local bleeding cannot be depended upon for the removal of an iritis even of moderate severity, it should

almost always be preceded by venesection, arteriotomy, or cupping. Beer and Lawrence, however, are content with cupping, or leeches, when the disorder is only moderate, though the latter adds, that the lancet may be advantageously employed in many instances, which, from the duration of the complaint and the local symptoms, would not be considered as of the most acute kind. Generally speaking, iritis requires copious and repeated bleeding, both general and local: saline antimonial medicines, cathartics, low diet, confinement within doors, rest of the whole body, and exclusion of the light from the eyes, will also be requisite measures. The tartrate of antimony is useful in reducing the force of the circulation, and rendering the system more susceptible of the influence of mercury. But tartrate of antimony is less used with the view of producing nausea, and lowering arterial action, than formerly, when the efficacy of mercury in this disorder was unknown. One experienced surgeon declares, I think judiciously, that the nauseating plan ought never to be adopted conjointly with the mercurial treatment. (See *Middlemore*, *Op. cit.* vol. i. p. 648.)

Opiates are generally necessary to appease the nocturnal circumorbital pain. (*Mackenzie*, *Op. cit.* p. 503.) A most important indication is that of putting a stop to the action of the vessels on which the effusion of coagulating lymph depends, which effusion is so likely to produce adhesions of the iris, and other destructive mischief. For this purpose mercury is the great agent. The mercurial action, when effectively and speedily produced, cuts short the inflammation, and puts a stop to the effusion of lymph, when that which is already effused will be absorbed. After the loss of blood, then, and the clearing out of the bowels by purgatives, the use of mercury should be commenced; and the best way of employing it is in the combination of calomel with opium, two, three, or four grains of the former, with one-fourth, one-third, or half a grain of the latter, every eight, six, or, in urgent cases, every four hours. Under particular circumstances, the hydrargyrum cum creta, the bluepill, or mercurial frictions may be employed instead of calomel. (See *Lawrence*, *Op. cit.* p. 302.) Full salivation, quickly produced, is the desideratum. In recent cases the mercury may then be suspended, and its effects allowed to subside slowly. In cases of longer standing, we must persevere until the lymph has been absorbed, the natural colour of the iris has been restored, the red zone round the cornea has faded away, and vision has returned. This will sometimes require several weeks.

After depletion has been duly practised, and the attack has received a check from this and the influence of mercury, a blister on the nape of the neck, or temple, or behind the ear, will often prove of great service.

It is generally agreed, that, though collyria and fomentations may be used in any stage of iritis, they are of secondary importance. If there be much pain in and around the eye, a poppy fomentation, or some mild narcotic lotion may be applied. When patients complain of severe nocturnal pain over the orbit, mercurial ointment, joined with opium, may be rubbed on the forehead and temple. Twelve grains of opium may be mixed with one drachm of the ointment. (See *Beer*, b. i. p. 450.)

Excellent as Beer's description of idiopathic

itis seems to be, his practice is far from being the most efficient. If mercury has the power of arresting acute inflammation of the iris, "both prior to, and after, the effusion of adhesive matter," and of rapidly removing, "by an excitement of the absorbing system, peculiar to itself, the newly-effused matter" (*Travers, Synopsis, &c.* p. 291.), then Beer must delay too long the employment of this powerful medicine, since he does not commence its use until the close of the second stage, when he has found that the absorption of the effused lymph cannot be effected by other means. Beer entirely overlooks the important utility of belladonna and hyoscyamus in producing a dilatation of the pupil, whereby adhesions of the iris to the capsule of the lens, or to the cornea itself, may frequently be prevented, or their ill effects considerably lessened. Belladonna (says Mr. Saunders), "if properly applied to the eye during the adhesive process of inflammation, will cause the inner margin of the iris to expand, and recede from the axis of the pupil, and will thus overcome the restraint arising from the agglutination of lymph, by elongating the organised bands which connect the iris and capsule, if they have not been of long duration. Thus, the adhesions are drawn out to a degree of tenuity, and consequently transparency, and a considerable quantity of light is admitted. If the effect of the inflammation has been slight, the adhesions will be trivial, and the pupil only slightly irregular. The iris will retain a certain power of action, and vision will be very little injured. In general, the pupil is misshapen, and the iris perfectly fixed; but, if the aperture be of sufficient size, and the capsule not rendered too opaque, the patient will enjoy a very useful degree of sight." (*Saunders, p. 32.*) Respecting belladonna, it is observed by Langenbeck, that, as all applications directly to the inflamed eye itself are frequently hurtful, and render it still more painful and irritable, it is a good plan to let the extract of belladonna be smeared upon the eyebrow, instead of putting a solution of it immediately in contact with the conjunctiva. (*Neue Bibl. b. p. 236.*) The same author expresses his attachment to Beer's method of rubbing mercurial ointment with opium into the eyebrows; and, after dwelling, with due force, on the necessity of copious and repeated bleedings, leeches, evacuations, &c. he cautions practitioners not to be led into the supposition that the efficacy of belladonna will supersede the occasion for taking away blood. He even declares that, during the first vehemence of the inflammation, the application is quite inefficient, and that it frequently will not succeed in producing a dilatation of the pupil until bleeding has been practised. "If (says Langenbeck) bleeding is to be useful in iritis, it must be copious and often repeated."

Chronic Iritis.—The disease sometimes arises so slowly, proceeding to effusion of lymph, and its organisation into adhesions, to diminution, or even loss of sight, that no visible vascular distension occurs, no alteration is observed in the eye, and no pain is felt. Here a mild antiphlogistic treatment, followed by the use of mercury, is perhaps the best.

Specific Cause of Iritis.—Iritis sometimes "appears in company with rheumatism of the chronic form; sometimes with gout; with the constitutional signs of the lues venerea; and during, or

following, the action of mercury upon the system." (*Travers, Surgical Essays, part 1. p. 69.*)

Mr. Hunter entertains doubts, whether any inflammation of the eyes are syphilitic, and he appears to found his opinion upon two circumstances: one is, that, if such cases be venereal, the disease is very different from what it is when it attacks other parts, and is attended with more pain than venereal inflammation arising from an affection of the constitution; the second is, that he never saw these cases attended with such ulceration as occurs when the complaint invades the mouth, throat, and tongue. (*On the Venereal Disease, p. 324.*) The iris is now known to be more liable than any other part of the eye to inflammation from syphilis. The case was mentioned by Mr. Saunders, who recommended the vigorous exhibition of mercury, and the use of belladonna. Its symptoms, however, were more particularly detailed by Beer. (*Lehre von den Augenkr. b. i. p. 553.*)

The syphilitic iritis is sometimes considered to be the most frequent description of it, and it is to be regarded as a secondary symptom, taking place in the constitutional stage of the disorder. Although sometimes occurring alone, it is more commonly accompanied by other secondary symptoms, as eruptions, ulcerations of the throat and mouth, pains of the limbs, and swellings of the periosteum. It is seen in conjunction with papular, scaly, tubercular, and pustular eruptions. As it belongs to the earlier class of secondary symptoms of syphilis, it sometimes shows itself, like the other symptoms of that class, before the primary disorder has been cured. It is but rarely seen as a symptom of syphilis in infants; for, amongst numerous children labouring under syphilis, only two examples of iritis occurred. (*See Lawrence, Op. cit. p. 316; and On Ven. Dis. of the Eye.*)

As Dr. Mackenzie observes, it is unnecessary to repeat any description of the zonal redness, discolouration of the iris, contraction, irregularity, and immobility of the pupil, effusion of lymph, and other general symptoms of iritis, as they present themselves in the syphilitic species. In none of them, nor in the dimness of sight and pain which attend them, is there any thing, as Dr. Mackenzie observes, really diagnostic. The gradual displacement of the pupil upwards and inwards is not, as was represented by Beer, peculiar to syphilitic iritis. Such displacement has been seen by Dr. Mackenzie in chronic rheumatic iritis, and still more frequently in choroiditis, unattended by iritis. Mr. Lawrence admits, that the pupil is sometimes so displaced in venereal iritis, but not constantly.

Tubercles or small abscesses on the iris, are rarely met with, except in syphilitic cases. At first, they are of a reddish brown colour, somewhat irregular on their surface, growing frequently from the edge of the pupil, assuming presently a yellowish hue, projecting from the plane of the iris, and enlarging sometimes to such a size, that they press the iris backward, and fill the anterior chamber. Dr. Monteath believed, that they occasionally form on the posterior surface of the iris, pushing it forward, and forcing a passage between its fibres. At length they burst, and discharge their purulent matter into the anterior chamber. After this, the cyst which contained the matter shrinks. (*See Muchensis, Op. cit. p. 513.*) Others describe these

tubercles, not as abscesses, but effusions of lymph. Syphilitic iritis is frequently, but not invariably, accompanied by them. (See *Lawrence, Op. cit.* p. 317.) As for the question whether they occur only in syphilitic cases, it deserves notice, that Dr. Mackenzie has seen a cyst form on the surface of the iris in rheumatic iritis; but this he sets down as a very rare event. "The existence of tubercles, therefore, ought immediately to rouse suspicion that the case is syphilitic."

The pain of venereal iritis is most severe at night, and the patient may have hardly any uneasiness during the day, even though the attack be acute, and the external redness considerable. The following observations on the diagnosis are as good as any which I know of. "The tubercular depositions of lymph, the reddish-brown discolouration of the iris on its inner circle, the nocturnal exacerbations of pain, which is felt either in a much slighter degree or not at all during the day, the angular disfiguration of the pupil, and its occasional displacement towards the root of the nose, together with the previous occurrence of syphilis, and, in most instances, the concomitant existence of other syphilitic symptoms, clearly designate this kind of iritis, and distinguish it from other forms of the affection. The local symptoms alone are not sufficient in all cases to establish the distinction; for, we sometimes see merely a general discolouration of the part, such as might occur in idiopathic or arthritic iritis. In one patient, the complaint exhibited all the characters of the latter affection, including the white ring between the red zone and the margin of the cornea; and the state of the iris was similar in another. Under such doubtful appearances, the age of the patient, with the previous and concomitant circumstances, will best elucidate the nature of the affection. In idiopathic iritis, there is no distinct deposition, or it occurs as a yellow abscess, with the addition of hypopyon, if the abscess breaks. Such yellow abscesses are very seldom seen in syphilitic iritis. Lymph is effused from the margin of the pupil in the arthritic species; but not deposited in a distinct form, and the adhesions are generally white. Both in the idiopathic and arthritic iritis, the pupil generally retains its circular figure, and central position in the iris. (See *Lawrence on Dis. of the Eye*, p. 318.)

The treatment of syphilitic iritis comprehends the same measures as are resorted to in idiopathic cases, especially general and local bleeding; purgatives and low diet at first; opiate frictions with laudanum in an infusion of belladonna, or with extract of opium blended with mercurial ointment, round the orbit, an hour before the nightly exacerbation of pain; the free and quick exhibition of mercury; and smearing the eyebrow and eyelids every night at bed-time with moistened extract of belladonna, in order to keep the pupil dilated, and prevent its edges from becoming adherent to the front layer of the capsule of the lens. Blisters also prove highly advantageous after depletion, and the gums have become sore. (See *Mackenzie, Op. cit.* p. 516.)

Mr. Hugh Carmichael has published several cases, proving that syphilitic iritis may generally be cured by giving internally the oil of turpentine, in the dose of 3j. thrice a day, blended with the mixture amygdal. If it induces strangury, linseed tea and camphor mixture may be administered, or

its use suspended. The tendency to heartburn may be prevented by the addition of ten or fifteen grains of carbonate of soda, to eight ounces of the almond emulsion and an ounce of the turpentine. Of course, the application of belladonna, and, in some cases, bleeding, were not omitted. If a case were to occur in which circumstances rendered the employment of mercury unadvisable, turpentine might be tried.

Arthritic Iritis.—The iris, when attacked with inflammation in gouty and rheumatic subjects, is marked by certain peculiarities, and requires treatment not exactly like that of other forms of the disorder. *Rheumatic iritis*, resulting from an extension of rheumatic ophthalmia, is stated by Mr. Lawrence not to be a serious affection. It will generally yield to cupping, leeching, counter-irritation, and the wine of colchicum in doses of from 3ss. to 3j. every six hours.

In *gouty iritis*, the red zone round the cornea does not advance to the very edge of the latter; but a narrow white ring is left between them. The colour of the zone is alleged by the Germans to be duller than in other forms of iritis. After a violent attack, with great diminution of sight, the symptoms abate, the eye recovers, and vision is completely restored, the iris remaining connected to the capsule of the lens by adhesions of a white colour. The inflammation returns again and again; and yet the eyes generally recover as often, without serious impediment of vision. Sometimes, however, one violent attack closes the pupil, or fills it with lymph; or, if severe or long continued, it may cause complete disorganisation, with puckering and tubercular projection of the iris, and extinction of sight. (See *Lawrence, Op. cit.* p. 320.)

A notion has prevailed, that general bleeding is seldom advisable in arthritic iritis, and that even local bleeding should be resorted to with caution. On the other hand, Dr. Mackenzie states, that he has seen excellent effects follow general bleeding. "With a full hard pulse, hot skin, and loaded tongue, we need not hesitate to bleed, purge, and administer colchicum." In most cases, leeches will prove useful. After bleeding and purging have been employed, twenty-five drops of the vinous tincture of colchicum may be given thrice a day.

Arthritic iritis is not served by the free use of mercury, like other forms of the complaint. Mr. Lawrence has seen cases in which mercurial salivation was injurious, though he approves of mercury in the alternative form, as Plummer's pill once or twice a day, with mild aperients. (Also *Mackenzie*.) After depletion, counter-irritation by means of blisters or the ointment of tartarised antimony, will prove beneficial. Tepid applications are the best.

Dr. Mackenzie has sometimes known striking benefit derived from the exhibition of carbonate of iron, after depletion and mercury had been employed in vain. He speaks also favourably of the liquor arsenicalis, joined with sulphate of quinine. (*Op. cit.* p. 532.)

The periodical fits of pain require friction round the orbit, either with laudanum, tincture of tobacco, laudanum and belladonna, or mercurial ointment and opium.

Scrophulous Ophthalmia.—This is an external inflammation of the eye, exhibiting modifications in

its symptoms, progress, and consequences, derivable from peculiarities of constitution in the individuals whom it affects, and requiring corresponding modifications of treatment. Scrofulous diseases do not usually occur in infants at the breast, which, being kept warm, and having a supply of wholesome food prepared by nature, escape the two great exciting causes. They prevail, however, from the end of suckling to the age of puberty: strumous ophthalmia is seldom seen after puberty, and mostly in children under eight or nine years of age; but other forms of ophthalmic inflammation are often found more obstinate in persons of scrofulous constitution. (*Lawrence, Op. cit. p. 242—244.*)

Scrofulous ophthalmia is remarkable for being attended with slight redness, great intolerance of light, phlyctenulæ at the edge or on the surface of the cornea, and specks resulting from them; a disease to which children are so liable, that out of 100 cases of inflammation of the eyes in young subjects, 90 have been reckoned to be of this kind. (*Mackenzie, Op. cit. p. 448.*) The external redness, which is often inconsiderable, and sometimes more apparent in the lining of the lids than in the eye, is partial in the latter situation. Where the fasciculi of vessels terminate, we observe the pustules or phlyctenulæ. The access of light to the eye is painful, and this constitutes one of the most prominent symptoms. The eyelids are spasmodically closed, and, if they are forced open, the cornea is turned up under the edge of the orbit away from the light. The spasmodic action of the orbicularis, excited by exposure to light, causes actual pressure on the eye, and makes the child scream with pain. The child makes every effort to protect the organ from the painful impression of light, contracts the brows, draws down the skin of the forehead, elevates the lips and alæ of the nose, and puts into action all the muscles of the face, to protect the suffering organ. Hence arises a peculiar and characteristic physiognomy. The child seeks the very darkest corner of the room, and, if in bed, will turn the face against the pillow, or hide it under the clothes. For the same reason, if brought into the light, it presses the hands against the eyes, and holds the head down. The great sensibility of the retina is not the result of inflammation, nor is it in a direct proportion to the increased redness. (*See Lawrence on Dis. of the Eye, p. 245.*) It is a sympathetic, or functional disorder of the retina, dependent, as Mr. Travers believes, upon the state of the secreting surfaces of the skin and alimentary canal; and in the dusk, the child is able to open its eyes, and to see very well. If the inflammatory symptoms are active, with much external redness, there may be considerable pain; but, under other circumstances, the patient only experiences pain on exposure to light. In the beginning of the complaint, there is a copious flow of tears, and when the eye is exposed to light, there is always a copious effusion of them, producing redness of the eyelids and even excoriation of the face. Scrofulous ophthalmia is attended with costiveness, a white furred tongue, often fetid breath, distended abdomen, morbid appetite, and grinding of the teeth during sleep. Sometimes there is heat of the skin, with redness; but, in the progress of the case, the surface becomes pallid, and feels dry and harsh. (*See Lawrence, Op. cit. p. 246.*)

Scrofulous inflammation of the eye often produces serious consequences, especially on the cornea, and may do so, although external redness may not exist in a great degree. Sometimes the pustules or phlyctenulæ subside, leaving a thin opacity, which gradually disappears. Sometimes there is considerable white thickening of the corneal conjunctiva, with a fasciculus of red vessels passing to it; this leaves an opacity, which becomes diminished, but does not disappear. The pustules and phlyctenulæ more commonly ulcerate, extending either superficially, or penetrating into the anterior chamber, attended with prolapsus of the iris. Sometimes the corneal conjunctiva becomes so thickened, opaque, and vascular as to constitute what is termed *pannus*. Frequently there is a general dulness of the cornea from interstitial deposition, and this may present a red tint from enlargement of vessels. Occasionally the effects of strumous inflammation extend to the sclerotic coat and iris, and even to the textures more deeply placed. (*See Lawrence, Op. cit.*)

Treatment.—One primary indication is to rectify the secretions from the skin and digestive organs. The use of purgatives is generally necessary. Mr. Lawrence recommends us to begin by giving a dose of calomel with jalap or rhubarb, or calomel followed by the senna draught or castor oil; and it may be necessary to repeat these purgatives two or three times. These medicines are to be followed up by a mild course of alterative and aperient medicines, as calomel and rhubarb in small doses, every second or third day, calomel with antimony or the hydrarg. cum crota, with some gentle aperient. At the Bloomsbury dispensary we generally prescribe rhubarb and carbonate of soda in equal parts. When the skin is harsh and dry, warm bathing is beneficial.

If there be much redness and pain, a white tongue and hot skin, the application of leeches may be advisable, preceded by an active purgative, and followed by small doses of tartrate of antimony, joined with sulphate of magnesia or calomel.

After the inflammatory symptoms have been removed, a solution of from two to six grains of lunar caustic in an ounce of distilled water, may be dropped into the eye, and will have great influence in lessening the irritability of the organ, healing the ulcers, and clearing the cornea.

In no cases is counter-irritation more conspicuously efficacious than in scrofulous ophthalmia; whether accomplished by means of blisters or antimonial ointment. It should always be resorted to after depletion; but, with respect to general blood-letting, it is hardly ever required.

For the dispersion of opaque conditions of the cornea, the action of the nitrate of silver lotion should be aided with the internal exhibition of mercury.

The sulphate of quinine appears to have considerable influence over scrofulous ophthalmia. "It exercises (says Dr. Mackenzie) a remarkable power over the constitutional disorder which attends this ophthalmia, and thereby over the local complaint. The dose which I employ is generally a grain thrice a day; in very young subjects, half a grain; and in adolescents or adults, two grains. It may be given rubbed up with a little sugar." The use of it is begun as soon as the state of the bowels has been rectified by repeated doses of ca-

lome! with rhubarb, unless the pulse is very quick and the skin hot, when small doses of tartar emetic will be preferable. (See *Mackenzie, Op. cit.* p. 460.)

In consequence of the distress arising from exposure to light, the eyes should be protected with a broad green shade, and they should have the benefit of rest.

Tepid astringent lotions in the early stage have better effects than cold ones. In severe cases, fomentations are proper; and, in this form, belladonna and hyoscyamus are sometimes of great service in relieving the intolerance of light.

The following is the treatment proposed by Mr. Travers, for each form of scrofulous ophthalmia.

1. *Strumous inflammation, without change of texture; vascularity more or less; intolerance (of light) excessive.*—Calomel and opium at night; emetic tartar to continued nausea; gentle alvine evacuants; diaphoretic drinks; large open blister on the nape of the neck; leeches; tepid bath; tepid, or cold water washes, as most agreeable; vapour of opium; large bonnet shade; no bandages; spacious, airy apartments; and light bed clothing.

2. *With recent diffused opacity of the corneal conjunctiva, and vessels raised upon and overshooting the corneal margin.*—Calomel and opium to slight ptyalism; purgatives on alternate days; leeches; blisters alternately behind the ears and on the nape of the neck and temples. As the acute stage passes off, repeated circular sections of the vessels on the sclerótica, near the margin of the cornea.

3. *With herpetic ulcers of the cornea.*—Thesame; blisters on the temples; as the inflammation yields, solut. argent. nitrat.; vin. opii; solut. cupr. sulph.; dilute zinc lotion.

4. *With pustules.*—If partial, weak zinc, or alum lotion; ung. hydrarg. nitrat.; occasional brisk purgatives; infusion of roses with additional acids; tonic bitters; columba; gentian, &c.; blisters behind the ears, repeated if necessary: if the vascularity is diffused by the multiplication of pustules, or the duration of inflammation, with irritability to light, treatment as in strumous inflammation without breach. Ung. subacet. plumbi.

5. *With inflammation of the follicles and puriform discharge.*—Active measures at first, but not long continued. Blisters; when becoming chronic with thickened lids, scarifications; zinc, alum, or copper wash, dilute; ung. hydr. nitrat.; hyd. nit. oxyd.; subacet. cupri; tonics and sedatives: if obstinate, issue or seton.

6. *Convalescent state.*—Infusion of roses; cascarella; columba; decoction of bark, with dilute sulphuric, or nitric acid; steel; rhubarb, and soda or magnesia, as aperients; tonic collyria and gently stimulant ointments; nutritive diet; country air; shower or sea-bath, in the warm months. (*Synopsis*, &c. p. 92—260, &c.)

Intermittent Ophthalmia.—It is the character of certain forms of ophthalmia, like the rheumatic and venereal, to be liable to periodical exacerbations; but, I am not certain, that there are any cases specifically claiming the name of *intermittent ophthalmia*. The late Mr. Ware, however, has noticed some examples, which intermitted, or, at least, remitted at stated periods. In these, he did not find bark so useful as in scrofulous ophthalmia; but, he had seen the most beneficial effects produced by the bichloride of mercury, sometimes joined with the compound decoction of sarsaparilla.

Varolous Ophthalmia.—When the small-pox eruption is very abundant in the face, it causes a considerable swelling of this part of the body; the eyelids become tumefied, the eyes redden, and there ensues a discharge of a very thick adhesive matter, which agglutinates the palpebrae together; so that, if no steps be taken, the eyes will continue closed for several days in succession. The matter confined between the eyelids and globe of the eye seems capable of exciting ulceration of the cornea, and even of irremediably destroying vision. In the active period of the eruption, small-pox causes inflammation of the eyelids, the eye itself, and lachrymal sac; and after the eruption has dried up, it may give rise to chronic inflammation of the eyelids and nasal ducts, or to strumous ophthalmia. After antiphlogistic treatment, should the disease, when treated with topical astringents and corroborants, yet baffle the efforts of the surgeon, setons in the nape of the neck, kept open for a long while, prove one of the most useful remedies. Scarpa has experienced much advantage from giving, every morning and evening, to a child ten years old, a pill, containing one grain of calomel, one grain of the sulph. aur. antim., and four grains of cicuta in powder.

In addition to the general treatment, we should discharge the matter by pricking the pustules; carefully remove incrustations, after softening them with some mild unctuous applications; enjoin frequent ablution with tepid milk and water; and lessen the inflammation by the application of soft rag, moistened with cool or tepid lotions. (See *Lawrence on Dis. of the Eye*, p. 257.) For the purpose of checking the development of the varolous pustule, M. Velpeau recommends touching it in the early stage with a strong solution of nitrate of silver, or the caustic in substance.

Operation of discharging the aqueous humour.—To this practice, some allusion has been already made in the preceding columns; and, as the proposal is intended to apply to several forms of inflammation of the eye, I have not given any particular account of it in treating of the various cases. Mr. Wardrop remarked, that if the eye of a sheep, or ox, be squeezed in the hand, the whole cornea instantly becomes cloudy, and whenever the pressure is removed, this membrane completely regains its transparency.—From this curious phenomenon in the dead eye, it was evident, that, in the living body, the transparency of the cornea might vary according to the degree of its distension; and that, in cases of opacity of the cornea, accompanied with fulness of the eyeball, its transparency might be restored by the evacuation of the aqueous humour. Mr. Wardrop soon met with a case favourable for making the experiment: the cornea was milky and opaque, and the eyeball distended and prominent, attended with acute inflammatory symptoms. The aqueous humour was discharged by a small incision, and the operation produced not only a removal of the cloudiness of the cornea, but an abatement of the pain, and a sudden check to all the inflammatory symptoms. From the success of this case, Mr. Wardrop was led to perform the operation on others, not only with a view of diminishing the opacity of the cornea, but, also, of alleviating the inflammation. Four interesting cases are related by this gentleman, very much in favour of the practice, when the eye is severely inflamed, attended with fulness of the organ, a cloudy

state of the cornea, and a turbidness of the aqueous humour. Mr. Wardrop also advises the operation, whenever there is the smallest quantity of pus in the anterior chamber, accompanied with violent symptoms of inflammation. He thinks that the great and immediate relief which the method affords, is imputable to the sudden removal of tension; and he performs the operation with a small knife, such as is used for extracting the cataract. The instrument is to be oiled, and introduced so as to make a wound of its own breadth, at the usual place of making an incision in the extraction of the cataract. By turning the blade a little on its axis, the aqueous humour flows out. (See *Edinb. Med. Surg. Journal*, Jan. 1807; also *Med. Chir. Trans.* vol. iv.) Mr. Lawrence has tried this plan in some instances; but his opinion of it is by no means favourable; for, he says, that so little benefit resulted from it, that he has not been induced to persist in the practice; and he has been the less inclined to do so in severe inflammations of the eye, because they are completely controlled by ordinary antiphlogistic means.

Consult *Avicenna*, Canon. l. iii. fen. 3. tract. i. cap. 6. *Maitre-Jan*, Traité des Maladies de l'Oeil, 12mo. Paris, 1772. *St. Yves*, Traité des Mal. des Yeux, p. 176, &c. *Janin*, Mém. sur l'Oeil, &c. 8vo. Paris, 1772. *L. F. Grenon*, Traité des Mal. des Yeux, 2 t. 12mo. Paris, 1770. *C. F. Reuss*, Dissertationes Med. Selectæ Tubingenenses Oculi Humani Affectus medico-chirurgice consideratas sistentes, 3 vols. 8vo. Tub. 1783. *Truka de Krzowitz*, Hist. Ophthalmiæ omnis evi observata medica considerata, 8vo. Vindob. 1783. *G. Pover*, Attempt to investigate the Causes of the Egyptian Ophthalmia, &c. 8vo. Lond. 1803. *H. Reed*, On Ophthalmia, 8vo. Portsea, 1806-7. *J. B. Serney*, On Local Inflammation, more particularly applied to Diseases of the Eye, &c. 8vo. Lond. 1809. *J. P. Marat*, An Inquiry into the Nature of a singular Disease of the Eyes, hitherto unknown, and yet common, produced by the Use of certain mercurial Preparations, 4to. Lond. 1770. *James Ware*, Chir. Obs. relative to the Eye, 2 vols. 8vo. Lond. 1805. *Richter*, Anfangsgr. der Wundarz. b. iii. *G. Peach*, and *J. Wardrop*, in *Edinb. Med. Surg. Journal* for January, 1807. Also *J. Wardrop*, in *Med. Chir. Trans.* vols. iv. and x.; and *Essays on the Morbid Anatomy of the Eye*, 2 vols. 8vo. 1808-1818. *John Welch*, An Account of the Ophthalmia which has appeared in England since the return of the British Army from Egypt, 8vo. Lond. 1807. Also *Obs. relative to the Treatment by Sir Wm. Adams* of the Ophthalmic Cases of the Army, 8vo. Lond. 1818. Letter on the Ophthalmic Institution for the Cure of Chelsea Pensioners, 4to. Lond. 1809. And a Practical Treatise on Dis. of the Eye, 8vo. Lond. 1820. *W. Thomas*, On Ophthalmia, and Ophthalmia Purulenta, 8vo. Lond. 1805. *P. Ascalini*, On the Plague, Dysentery, and Ophthalmia of Egypt, &c. Transl. by *A. Neale*, Lond. 1804. Also *Manuale di Chirurgia*, 8vo. Milano, 1812. *F. Vasani*, Storia dell'Ottalmia contagiosa dello Spedale Militare d'Ancona, 8va. In Verona, 1816. Also *Risposta a ciò che la riguarda nel Consl del Dr. Omodie sull'Ottalmia d'Egitto et sulla sua propagazione in Italia*, 12mo. In Verona, 1818. *T. F. Batta*, De Ophthalmia Cataractali Bellica, 4to. Heidelb. 1816. *Arthur Edmonstone*, On the Varieties and Consequences of Ophthalmia, with a Preliminary Inquiry into its contagious Nature, 8vo. Edinb. 1806. *De Wenzel*, Manuel de l'Oculiste, t. ii. 8vo. Paris, 1808. *C. Farrel*, On Ophthalmia, and its Consequences, 8vo. Lond. 1811. On the Utility of Blisters in the Ophthalmia of Infants, in *Ed. Med. Surg. Journ.* No. 58. p. 156. *R. C. Gracie*, Journ. de Chir. b. i. Also *Repertorium augenärztlicher Heilformen*, 8vo. Berlin, 1817. *G. Benedot*, De Morbis Oculi Humani Inflammatoriis, 4to. Lips. 1811. *J. C. Saunders*, On Dis. of the Eye, ed. by *Dr. Forre*, Lond. 1811, or the later editions. *C. Himly*, Ophthalmologische Beobachtungen, &c. 12mo. Bremen, 1801. Also *Einführung in die Augenheilkunde*, 12mo. Jena, 1806, and his *Bibliothek für Ophthalmologie*, &c. 12mo. Hannover, 1816. *F. J. Walther*, Synagoga de Ophthalmologia Veterum, 8vo. Halle, 1816. *C. J. M. Longenbeck*, in *Bibl. and Nouv. Bibl. für die Chirurgie*, in various places. Also *Scopio*, sulle Principali Malattie degli Oculi, Venet. 1801, or the Transl. by *Mr. Briggs*, 2nd ed. *Mém. Voyage fait en Angleterre en 1814, ou Parallèle de la Chirurgie Angloise avec la Chirurgie Française*, p. 112, &c. *J. M. Gregory*, in *Trans.* for the improvement of

Med. and Chir. Knowledge, vol. iii. p. 30, &c. *Larrey*, Mém. de Chir. Militaire, t. i. p. 292, &c. *J. A. Schmidt*, über Nachtstar und Iritis, &c. Weim. 1801. *G. J. Beer*, Lehre von den Augenkrankheiten, b. ii. 8vo. Weim. 1813-1817. *C. H. Weller*, A Manual of the Diseases of the Human Eye, Transl. with notes, by *G. C. Montecat*, 2 vols. 8vo. Glasgow, 1821. *B. Travers*, de Iritis, in *Surgical Essays*, part 1. Also, A Synopsis of the Diseases of the Human Eye, 8vo. Lond. 1820. *E. F. Lloyd*, On Scrofula, 8vo. Lond. 1821. *W. Lawrence*, On Dis. of the Eye, 8vo. Lond. 1833. *G. Frick*, On Dis. of the Eye, ed. 2. by *Weilbank*, 8vo. Lond. 1826. *R. Middlemore*, On Dis. of the Eye, vol. i. 8vo. Lond. 1835. *Wm. Mackenzie*, On Dis. of the Eye, ed. 2. 1835.

I annex to this article the following statements, introduced by Dr. Reese into the American edition of this Dictionary:—

Professor Sewall, of Columbian College, a distinguished practitioner of Washington City, has obtained extensive reputation by his success in the treatment of ophthalmia, and particularly the purulent form of this disease. "By a communication with which he has recently favoured me, I learn that after a previous course of depletion, which he pursues with great energy, in all cases of ophthalmia, he relies chiefly upon pressure in almost every form of the disease, and especially in the purulent kind. So soon as the active symptoms are subdued by the antiphlogistic regimen, he applies over the eye a pad of silk or soft linen, then a bat of carded cotton, or scraped lint, which he confines by a thin light bandage, so tight as to afford gentle and comfortable compression to the eye, so as not to produce pain or uneasiness, however, by its intensity. This compress he removes twice in the twenty-four hours, and replaces it immediately by another of similar material. By this course he thinks he fulfils three indications, viz.:

1st. Effectually to exclude the light from the eye;

2d. The globe of the eye is prevented from rolling; and,

3d. The distended vessels are compressed and disorged.

During the time he is using compression, a minute quantity of a cerate is introduced into the eye, to which Dr. S. attributes great virtues in almost every violent form of the disease. It is prepared in the following manner, viz:

℞. Hydrarg. oxyd. rub. grs. xlv.; Lapis calaminaris, grs. xxx.; Cinnabar nativ. grs. xv.; Litharge, grs. xxx.; Axungie porc. oz. j.; levigate separately and mix. This cerate may, of course, be diluted with lard if it should be thought too active." (Reese.)

OSCEOCLE. (From *ὄσχος*, the scrotum, and *κῆλη*, a tumour.) A hernia which has descended into the scrotum.

OSTEOSARCOMA, or OSTEOSARCOSES. (From *ὀστίον*, a bone, and *σάρξ*, flesh.)

Callisen regards osteosarcoma as a disorder, by which the texture of the bones is converted into a fleshy or lardaceous substance, accompanied with a tendency to carcinoma. (*System. Chirurgiaæ Hodiernæ*, p. 204. vol. ii. edit. 1800.) We are to understand by osteosarcoma, says Boyer, an alteration of the osseous structure, in which, after more or less distension, the substance of the bone degenerates, and is transformed into a diversified mass, but more or less analogous to that of cancer of the soft parts; while the local and general symptoms still more strikingly resemble those of the latter disease. (See *Mal. Chir.* t. iii. p. 587.)

Fungous diseases in the antrum expand the bones of the face, make their way out, and present a frightful specimen of disease. This change of the bones is considered by Boyer as a kind of osteosarcoma, proceeding from carcinomatous mischief in the neighbouring soft parts; and this he adduces as an example of his first species of osteosarcoma, or that arising in consequence of previous disease in other parts. In the second species, the disorder commences in the bones, and the soft parts are secondarily affected.

Most frequently, when the disease has made considerable progress, and the tumour has existed a long while, the bony texture has disappeared more or less completely; in lieu of it, an homogeneous, greyish, yellowish, lard-like substance is found, the surface of a slice of which is smooth, much like that of a very hard white of egg, or old cheese, the consistence varying from that of cartilage to that of very thick bouillie. The surrounding soft parts, which have participated in the disease of the bones, are converted into a similar matter: muscles, tendons, periosteum, ligaments, vessels, cellular substance, all are confounded in the same homogeneous mass, and have undergone the same degeneration.

In some examples the disease is less advanced; portions of the bone are then met with, whose texture and consistence are nearly natural, and which are merely somewhat enlarged. But, in proceeding towards the centre of the disease, the substance of the bone is found softened, and its consistence less than that of cartilage, still manifestly retaining, however, a fibrous texture; while, more deeply, it is converted into a lard-like substance, resembling (says Boyer) that of parts affected with carcinoma. In these tumours cysts are often found; sometimes containing a fetid ichor, — sometimes a matter like clear bouillie; and, in certain cases, a quantity of semi-transparent, tremulous, gelatinous matter is noticed in the middle of the lard-like medullary, or cerebral substance. Boyer records an instance, in which nearly the whole humerus was changed into a gelatinous mass. (See *Mal. des Os*, t. i. chap. 22.)

With the view of removing some of the obscurity of the present subject Dr. Cumin, of Glasgow, proposes that the term, osteosarcoma, should be limited to a degeneration and morbid growth of the lining membranes of the longitudinal canals, or cancelli of bones, accompanied in all cases by absorption of the solid osseous substance. "The disease (he says) is, therefore, essentially one of destruction of the affected bone, which is produced partly by the pressure of the enlarging tumour, and partly by the diversion of the fluid circulating within the bone to the support of this morbid growth. It always originates within the periosteum, and retains that as its investing membrane." It is generally slow in its progress; and, in its commencement, the symptoms cannot be readily distinguished from those of chronic rheumatism, or syphilitic pains. After some time, a tumour is perceived, at first firm, but afterwards becoming softer, and, in certain cases, communicating to the surgeon's hand the feel of a distinct pulsation, synchronous with that of the artery of the limb, and capable of being interrupted by compressing the trunk of the vessel. In time, hectic fever, colliquative perspirations, and diarrhoea come on, and the patient sinks. Towards the close of the

illness, fracture of the bone at the affected part very commonly takes place on some slight exertion, aggravating in a remarkable manner the patient's general distress, but rather lessening, than increasing, the pain in the bone, connected with distention of its texture. (Cumin, in *Edinb. Med. Journ.* No. lxxxii. p. 13.)

This gentleman in considering the question, whether osteosarcoma is of a cancerous nature, expresses his belief, that although all the varieties of the disease are highly formidable, they are not all truly cancerous. One case, which he has himself related, he sets down as cancerous from a view of the whole of the symptoms, and "more especially from the disease having shown itself in two different places at the same time." Another case, described by him, he does not regard as having exhibited any features of the latter disease. The malignant osteosarcoma of Dr. Cumin, Mr. Crampton, and others (*Dublin Hospital Reports*, vol. iv. p. 558.), is, in fact, as they have explained, the *fungous exostosis of the medullary membrane of Sir Astley Cooper*, which is now generally admitted to be medullary cancer of the bones. (See *Edinb. Med. Journ.* No. lxxxii. p. 17.)

Mr. Mayo does not restrict his view of osteosarcoma to the limits adopted by Dr. Cumin. "It consists (says he) in a growth of substance, nearly resembling epiphytic cartilage in texture, originating either upon the surface, or in the cancelli of bone. The form of the tumour is commonly more or less spherical: it may attain so great a volume as to be nearly a foot in diameter. When an osteosarcoma is small, the surface, displayed by a section, is tolerably uniform, or differs from the most transparent cartilage only in exhibiting minute oblong, or irregular cavities. When an osteosarcoma is larger, cavities of considerable size are found in it, which contain a reddish fluid. In parts, the texture grates when cut and contains phosphate of lime. This is distributed so as to form a kind of skeleton of light bony plates, disposed in a manner that looks like a crystallisation. The growth of such a tumour is commonly rapid. When it begins in the interior of bone the disease is attended with pain; when it forms on the outer surface, there is commonly no pain at all. An osteosarcoma has to the touch the firmness and elasticity of cartilage. This disease is ordinarily met with in the bones of the extremities, and in the lower and upper jaw. The cranial bones and vertebrae are less frequently if ever attacked by it. The disease does not, that I know of, pervade any other texture than bone. It bears, however, some external resemblance to gelatiniform cancer of other parts. *It has not much malignity*; so that when all the bones involved in it, with part of the adjacent sound bone, are removed by amputation, the complaint seldom reappears either in the part or in another bone. If the part is not amputated, the skin over the tumours sloughs, or ulcerates, the tumour is exposed, and a discharge, sanious, or ichorous, takes place from it, under which the patient gradually sinks." (See *Outlines of Human Pathology*, p. 50.) I remember that Mr. Stanley, in his lectures at the College, made a similar statement respecting medullary cancer being less likely to return when situated in the bones, and amputated, than when placed in any other texture, or organ. Yet, few experienced surgeons will now venture to amputate the upper

or lower jaw bone for medullary tumours, known beforehand to be of this nature.

Boyer records two cases of osteosarcoma: one of the thigh; the other, of the os innominatum. The first patient was saved by amputation. And Dr. McClellan, of Philadelphia, a few years ago favoured me with the particulars of another case of osteosarcoma of the lower jaw, where the same operation was very skillfully executed. Dr. David L. Rogers, of New York, was among the first in the United States who removed the upper jaw-bone, which he did in a case of osteosarcoma in 1824. This is recorded in the *New York Med. and Phys. Journ.* vol. iii. p. 301. The operation has since been frequently performed in America and Europe. Dr. Mott has performed it thirteen times. (See *Bones and Jaw*.) The same distinguished operator has removed portions of the lower jaw six times, and twice taken out the bone at the articulation. These operations have been as frequently performed by Mr. Liston, I believe, as by any surgeon; but so many of them have now been executed that it would be endless even to name every one of the operators, amongst whom are Crampton, Brodie, Scott, Hetling, Lawrence, Cusack, &c.

See Boyer, *Traité des Maladies Chir.* t. iii. *Haller's Element. Physiol.* t. viii. p. 2. 5. *S. A. Kalmus*, Diss. de Exostoa Steatomatode Claviculae; Gedan. 1732. *S. F. Hundertmark*, Diss. sistens Osteosteatomatia, Casum rariorum; Lips. 1732. *S. G. Hermann*, Diss. de Osteosteatomate, Lips. 1767. *S. C. Plenck*, de Osteosarcomi; Tub. 1781, &c. *Sir B. Brodie*, in *Pathol. and Surgical Obs. on the Joints*, p. 301. *Dr. Cumst*, in *Edinb. Med. Journ.* Jan. 1836. *Ph. Crampton*, in *Dublin Hospital Reports*, vol. iv. 8vo. 1827. *B. Ecll* on Dis. of the Bones, 12mo. Edinb. 1828. *Herbert Mayo*, *Outlines of Human Pathology*, p. 56. 8vo. Lond. 1836.

OVARY. This organ may be converted, 1. into a single cyst, which will sometimes acquire such magnitude as to fill the whole of the abdomen, and to cause a swelling resembling that of ascites. Cruveilhier deems it probable, that in this case the enlargement of one vesicle of the ovary has obliterated the rest of this organ, which is found to be in the state of atrophy at some point of the circumference of the cyst, and confounded with cartilaginous and osseous deposits. 2. There may be a single pouch, as in the foregoing instance, but from its inner surface arise nipple-shaped growths of various dimensions, composed of a substance having the consistence of the vitreous humour, or of that of the crystalline lens, and contained in irregular fibrous cells. In the first example the fluid in the cyst is mostly limpid; in the second, viscid like white of egg, or tremulous as jelly, and incapable of being discharged by puncture. 3. The tumour may be divided into a multitude of cells, or pouches, filled by matters of diversified kinds, as limpid serum, a viscid albuminous fluid, a reddish gelatinous or a bloody purulent fluid. Cruveilhier has found many of these cysts filled with a cretaceous substance. Andral, in noticing the accidental formation of mucous textures, informs us, that he has met with some ovarian cysts, the structure of which was more like that of a mucous than a serous membrane; and Meckel makes a similar remark. (See *Andral, Anat. Pathol.* t. vi. p. 264.) It is not unusual to find one, two, or three of the cysts, forming a half, two-thirds, or three-fourths of the swelling. The cysts may be perfectly distinct from one another, or in groups, with communications between them. 4. Acophalo-cysts, 5.

Cysts, containing hairs and an atheromatous substance. 6. Ovarian cysts, containing a foetus, or portions of it. Mr. Williams, of Denbigh, lately informed me of an ovarian abscess from which he removed a full grown tooth. Under Mr. Gunning, in St. George's, and also under Dr. Blick, of Walthamstow, I have seen cases in which the bones of foetal subjects were extracted from similar abscesses. 7. Cysts, resting upon a cancerous base. (See *Cruveilhier, Anat. Pathol.* t. vii. Livr. 5me.)

This author relates the particulars of a case where an ovary transformed into many pouches, all filled with a gelatinous substance, was mistaken for ascites, and punctured in vain. An encysted dropsy of the ovary in its early stage is easily distinguished from ascites. The circumscribed form of the cyst is the pathognomonic character of it, wherever situated. As for the development of the cyst on one side of the abdomen—a circumstance generally specified as a test—Cruveilhier regards it as theoretical and deceitful, because the cyst, as it increases in size, extends towards the central line, where there is the least resistance. But, when the cyst fills the whole of the abdomen, the criterion of its circumscribed form can no longer be adopted. Then the disease will not admit of being discriminated from ascites, either by the size or shape of the abdomen. The following considerations will here throw light on the diagnosis:—Ascites is seldom an idiopathic affection, being generally dependent upon organic disease of the abdominal viscera, or connected with peritonitis, whereas ovarian dropsy is almost always a local disorder, frequently existing while all the other organs are healthy. In ascites the fluid always gravitates to the lowest situation: hence, when the patient is lying down, the fluid descends towards the pelvis and lumbar region. The small intestines lie, as Frank has explained, in the umbilical region, the arch of the colon, and the stomach in the epigastrium. Tap the belly gently with the finger, or with the ivory plate of M. Piorry, and the sound will be flat in the hypogastrium and loins; and the flat or dull sound will change its place according to the varying situation of the fluid in the different positions of the patient; but the sound will always be hollow in the umbilical and epigastric regions. On the contrary, in encysted dropsy of the ovary, the cyst is developed in front of the bowels, so that the gaseous sound can never be perceived in front of them; an observation first made by M. Rostan. The fluctuation is never so distinct in ovarian dropsy as in ascites, but of a duller kind. In ascites the neck of the womb remains in its natural place. In ovarian cases the uterus is not propelled down, as usually stated, but displaced upwards; and in this case, the cavity of the pelvis is filled with a tumour which is an appendage of the abdominal swelling. Ascites rarely exists without visceral disease and anasarca of the lower extremities, a symptom frequently absent in ovarian cases.

When the ovary is transformed into several cysts, the fluctuation is generally obscure; but, in many cases, the bulgings of the tumour may be discerned, either through the parietes of the abdomen, or through the vagina, or rectum. Cruveilhier advocates the excellent general maxim never to make a puncture unless the fluctuation

be very distinct. A puncture, he thinks, can only be of service when there is one cyst of serous fluid. "The distinctions (he adds) of single and multiplied cysts would be very important if the extirpation of the ovary were to become an approved operation. The latter should not be meddled with; the former alone admitting of extirpation when their contents have been discharged, and a moderate incision is made in the parietes of the abdomen." (See *Cruveilhier*, vol. cit. livr. 5me.)

Ovarial cysts and tumours are exceedingly common; and are often met with in young and middle aged women, both single and married. Dr. Barlow gives an instance in which each ovary was found converted into ten or twelve cysts in a girl only ten or twelve years of age. (See *Prov. Med. Trans.* vol. iv. p. 434.) The rate, at which the disease advances, varies in different cases. Sometimes it does not attain a very large size till some years have elapsed; in other instances its augmentation is rapid: in the latter circumstances, the irritation is usually considerable. A patient under me at the Bloomsbury Dispensary, whom I used formerly to tap about once every two months, has remained with the disease in nearly a stationary condition for the last five years, having become tired of repeated operations. I have generally found, that the danger is more in relation to the quality of the fluid than the size of the swelling. If thick, dark-coloured, and very glutinous, paracentesis only affords temporary relief; and the repetition of it is sooner or later followed by inflammation within the cyst, and fatal disturbance.

The growth of some ovarian tumours, if in their early stage, and, as Dr. Barlow thinks, while the organic transformation of the part has not advanced too far, seems sometimes to admit of being checked. Nay, as some cases reported by this gentleman prove, ovarian dropsy is not always absolutely incurable. The means which he found most useful were moderate local or general bleedings whenever pain and irritation came on; blisters, or issues; belladonna plasters, digitalis, and iodine. In some cases, I have prescribed the hydriodate of potash, but never with decided success. I have often known the pain and irritation relieved by cupping, blisters, purgatives, and the preparations of morphia.

Under the head of *Paracentesis*, I will notice the operative expedients for the relief or cure of ovarian dropsy.

On ovarian cysts, which are most commonly, but not always, of the kind called fibrous, Delpsch offers many cases, accompanied by observations. (See *Chirurgie Clinique*, t. ii. 4to. 1828.) In one of his dissections, a sero-mucous and a horny cyst were both found connected with the ovary; a case, which he deems exceedingly rare. He affirms that the cure of an ovarian cyst has never been observed, whether as the work of nature, or art; and nothing can be cited, that would justify any comparison with the spontaneous or artificial terminations of the sero-mucous and horny cysts. From the cases and dissections of ovarian cysts which he records, he deduces, amongst other inferences, the following:—1. They are the product of a particular and accidental organisation, and by no means of the gradual dilatation of the natural vesicles of the ovary. 2. Observation has not

yet sufficiently proved, whether, under favourable circumstances, this, or any other kind of cyst of the ovary, is ever formed alone, unaccompanied by any other change of this organ. 3. Most frequently cancer is at the same time developed; masses of this nature existing either upon or between the layers of the cyst. Here I must observe, that the sarcomatous substances, so commonly attending ovarian cysts, are not usually regarded by British surgeons as truly carcinomatous; nor can I discover, that Delpsch brings any proof of the correctness of this part of his observations. The question is also a material one, inasmuch as it has great influence on the practical point, whether paracentesis and other active measures should be undertaken or not? 4. The statement, that there are always several cysts, does not agree with Dr. Baillie's account of the whole ovary being sometimes converted into a capsule. (*Works*, by Wardrop, vol. ii. p. 315.) In their structure they are alike, though their parietes may differ in thickness; but the nature of the matter which one cyst contains may be very different from what is included in another, independently of the effect of any incidental inflammation. This remark coincides with what Dr. Baillie has said on the same point. 5. Only one cyst attains a vast magnitude, so as to fill the cavity of the abdomen; and, though the others increase, they do not exceed a middling size. 6. The parietes of the cysts do not become thin in proportion to their distension; but, on the contrary, grow thicker. 7. The cysts communicate with one another only accidentally. This disposition is sometimes remarked after paracentesis, or some other surgical proceeding, calculated to produce an inflammation of some duration in the morbid mass; but Delpsch thinks, that we have no ground for presuming that it ever happens spontaneously, and from the mere effect of distention or ulceration. 8. For the most part, the origin of the disease is quite clandestine; the swelling being the only thing at first taken notice of. If pains are sometimes experienced in the situation of the ovary, or in that of the uterus, it is not till the tumour has made considerable progress, and has been of long standing. Such pains are always exceedingly vague, and only manifested by some sympathetic ailment; and it may be doubted whether they may not rather depend upon distention, than organic disease. At all events, nothing justifies the suspicion of their dependence upon inflammation. 9. Inflammation sometimes originates spontaneously in an ovary containing cysts; but, more frequently, its cause is injudicious treatment. Hence arise particular symptoms, readily distinguished from such as belong to the organic disease. Dissections evince that the inflammation leads to a deposit of different quantities of concrete albuminous matter, or pus, in only some of the cysts. And Delpsch believes that the inflammatory process does not readily establish itself; nor easily spread to the whole mass of an ovary in this state. 10. An ovarian cyst may enlarge in such a degree, that the whole abdomen is filled by it. When the surrounding peritoneum inflames, the cyst may be come adherent to all the viscera, and to the parietes of the belly. Under these circumstances its strength is augmented by the support of all the circumjacent parts; and, if inflammation be kept off, and the accompanying indurated substances should

not increase, the disease may remain stationary for many years. 11. The cyst may burst, and some of its contents pass into the peritoneum, where a dangerous inflammation may be the consequence. Several examples of this occurrence are recorded by Delpech. 12. The accident can hardly be recognised with certainty by the symptoms; but it is to be apprehended when the tumour augments rapidly, attended with acute fixed pain. 13. Here the proper treatment will depend upon the consequences of the rupture. When absorption of the extravasated fluid ensues, the surgeon will be prudent not to interfere much; but, if this desirable event should not take place, Delpech recommends paracentesis to be performed on the opposite side. 14. As no treatment is known, that will cure organic disease of the ovary, and active medicines create serious irritation in the abdominal viscera, which Delpech describes as peculiarly irritable in this disorder, he lays it down as a fundamental rule in practice, that they ought not to be employed. 15. As puncturing the tumour, when a fluctuation is evident, creates a risk of bringing on peritonitis, or such hemorrhage as cannot be commanded, the operation should never be done for the first time, unless the cyst be about to give way. Delpech advises the puncture to be generally made at the side of the hypogastrium, corresponding to the diseased ovary. If, however, the fluctuation should be plain at the bottom of the vagina, and the tumour should not quit this place, in the different attitudes of the patient, he considers, that this is the most advantageous situation for the puncture. If the cyst should form a projection at the navel, as sometimes happens, this part should be selected. 16. A puncture may be undertaken with more confidence, when one has been previously made *without ill consequences*, provided care be taken to make the opening precisely in the situation of the former. 17. In these last cases, if the patient's strength be not too much reduced, Delpech sanctions the attempt to establish an artificial fistula, by leaving a gum catheter in the puncture; but, if inflammation come on, the scheme is to be renounced. 18. Le Dran's operation of making a free incision into the cyst (See *Paracentesis*) is condemned, as likely to excite peritonitis. This consequence, he thinks, the more likely to follow, as experience proves, that such treatment produces extensive mortification of the cyst. 19. An inflammation of the large cavity of the cyst, he conceives, is sometimes the cause of death, even without peritonitis. 20. Every thing, that is known respecting ovarian cysts, proves to Delpech, that they are incapable of undergoing the kind of diminution which takes place in the sero-mucous ones; that, when punctured and kept open, whether they inflame or not, they subside, and are thrown into folds, but still retain their cavity, and the property of secreting the same fluid as heretofore; that, when the puncture closes, the cyst fills and expands again, sometimes with an unusual degree of pain, in consequence of the adhesions formed in its empty state; that the punctured part then generally reopens spontaneously; that the inflammation, caused by opening the cyst with a history, is not more effectual in bringing on a severe inflammation, than what follows either a simple puncture, or this plan, succeeded by that of keeping up a fistulous aperture; that the practice of incision, and its consequent perils, have

most frequently only terminated in the formation of such an opening; that, in a few rare examples, in which the operation produced a complete obliteration of the cavity, the whole cyst was destroyed by gangrene. 21. The project of treating an ovarian cyst, like a hydrocele, is strongly disapproved of by Delpech, with whose opinion the observation of some attempts of this kind leads me fully to coincide. (See *Paracentesis*.)

It appears to me, that notwithstanding the possibility of the accident, Delpech overrates the danger of internal hemorrhage from puncturing an ovarian cyst; and that he ought to have admitted the severe indisposition, the oppression of breathing, the retention of urine, and other urgent symptoms, often produced by the great pressure of the swelling, as circumstances rendering the operation indispensable for the present relief of the patient. Sir Astley Cooper informs me, that he has not met with any fatal case from bleeding into the cyst. In one instance, to which I was called by Dr. Epps, I punctured an ovarian cyst through the linea alba, and the fluid discharged was considerably tinged with blood; but, as the body was not opened after death, it was unknown whence the bleeding had proceeded, or whether any accumulation of blood had taken place in the cyst; an occurrence, of which Delpech had such apprehension. The reader may usefully compare what has been here said with that part of the article *Paracentesis* which treats of ovarian dropsy.

Consult *Andral*, Anat. Pathol. t. ii. *Cruveilhier*, Anat. Pathol. Livr. 5me Fol. Paris. *Seymour's* Illustrations of Dis. of the Ovaries. 8vo, Lond. 1830. *Barlow*, Records of Ovaria Tumours in Prov. Med. Trans. vol. iv. *Liaars*, in Ed. Med. Journ. *Addison*, in Guy's Hospital Reports, vol. i. *W. Jefferson*, Ovarian Tumour successfully removed. Prov. Med. Trans. vol. v. p. 239. *Thos. Hewlett*, case of extensive Ovarian Disease, complicated with Pregnancy, in Med. Chir. Trans. vol. xvii. p. 227. *Dr. N. Smith*, Ovarian Dropsy, successfully removed by Operation. Edinb. Med. and Surg. Journ. No. 73. *B. Travers* in Med. Chir. Trans. vol. xvii. p. 351.

OZÆNA. (from *ὄζη*, a stench.) An ulcer, situated in the nose, discharging a fetid purulent matter, and sometimes accompanied with caries of the bones. Some authors have signified, by the term, an ill-conditioned ulcer in the antrum. The first meaning is that which mostly prevails. The disease is described as coming on with a trifling tumefaction and redness about the ala nasi, accompanied by a discharge of mucus, with which the nostril becomes obstructed. The matter gradually assumes the appearance of pus, is most copious in the morning, and is sometimes attended with sneezing, and a little bleeding. The ulceration occasionally extends round the ala nasi to the cheek, but seldom far from the nose, the ala of which, also it rarely destroys. The ozæna is often connected with scrofulous and venereal complaints. In the latter cases, portions of the ossa spongiosa often come away. After the complete cure of all venereal complaints, an exfoliating dead piece of bone will often keep up symptoms, similar to those of ozæna, until it is detached. Ozæna frequently occurs, as a symptom of deranged state of the health from the injudicious or unsuccessful treatment of syphilis. It may perforate the septum nasi, destroy the ossa spongiosa, and even the ossa nasi. The ozæna must not be confounded with abscesses in the upper jaw-bone. (See *Antrum*.)

The constitutional disease on which the ozæna

generally depends, and which acts as the remote cause, must be relieved, before a cure of the local effect can be expected. The internal medicines, which may be necessary, are preparations of mercury and antimony, iodine, hydriodate of potash, sarsaparilla, elm bark, peruvian bark, muriated barytes, and muriate of lime. Sea-bathing may also do good, by improving the health. The best external applications are lotions of the sulphate of copper, zinc, nitrate of silver, kresote, chloruret of lime, or soda, or the lotion of the chloride, or bichloride of mercury and lime-water, or of diluted sulphuric acid. (*Pearson's Principles of Surgery*, chap. 12. F. A. Mayer, *Commentatio de Oæana*, Frank. Del. op. 11.)

OXYMURIATIC ACID. Besides the nitrous and nitric acids, other medicines containing a large proportion of oxygen, and easy of decomposition, have been recommended as remedies for the venereal disease; viz. oxygenated vinegar, oxalic acid, oxygenated muriate of potash, &c. (See *Caldwell's Medical Theses*, vol. i. p. 111.) But, perhaps, nothing has been put to the test of experiment with greater expectation of success, than the oxygenated muriatic acid. Mr. Cruickshank made a very early trial of it in syphilitic cases, and as is alleged, with the utmost benefit. He also employed the nitric acid, and the oxygenated muriate of potash, and found them eligible remedies. The latter medicine was likewise given by M. Alyon in cases of chancre and secondary ulcers, who found the good effects from it more expeditious and more certain than those of any mercurial preparation. (*Essai sur les Propriétés Médicinales de l'Oxygène*, &c. 8vo. Paris, an 7ième.) On the other hand, with the utmost contrariety of sentiment, respecting the real and permanent efficacy of all these medicines, prevails in the numerous reports about them, as in the accounts delivered of the effects of the muriatic and nitric acid; and therefore, I do not think that the reader, after the copious statements given in this book concerning the nitric and nitrous acids (see these words), would be pleased to hear again a repetition of very similar contradictions respecting the oxygenated muriatic acid. I may observe, however, that if oxygen be the principle, on which the efficacy of many antisyphilitic remedies truly depends, this acid must possess greater virtue than the common muriatic acid. From ʒss. to ʒij. mixed in ʒ viij. of water sweetened with syrup, may be taken in divided doses in the course of the day.

Oxygenated muriatic acid was strongly praised by Guyton de Morveau as a means of disinfecting sick-rooms, and purifying the air of crowded hospitals.

PALATE, CONGENITAL FISSURE OF THE. This presents itself in three forms:—1. Where there is a simple slit in the middle of the velum, without any loss of substance, or any fissure in the bony part of the palate. 2. With partial division of the bony palate, or roof of the mouth. 3. With complete division of the same part, in which case there is always a greater or lesser interspace between the two halves of it; and almost constantly likewise a fissure in the alveolar process and the lip. Hence, there are three kinds of operation, each of which is adapted to the particular variety of this congenital imperfection. 1. *Staphyloraphé*, applicable to examples, in which there is merely a narrow fissure,

in the soft palate. *Staphyloraphé*, when there is a wide rent resembling a loss of substance; and *uranoplastic*, calculated for cases in which there is a real or a seeming loss of substance, in the roof of the mouth.

1. *Staphyloraphé*, process of M. Roux.—The apparatus required, consists, 1. Of three broad flatish ligatures, composed of three or four strong threads. 2. Of six small curved flat needles, two for each ligature. 3. A porte-aiguille. 4. A pair of dressing forceps. 5. A probe-pointed bistoury. 6. Scissors with long handles, and short blades, bent laterally to an obtuse angle.

The patient being seated opposite the light, and the mouth kept open, the surgeon takes hold of the right edge of the fissure with the forceps held in his left hand, while, with the right he conveys into the pharynx the porte-aiguille, armed with a needle, the point of which is of course turned forwards. The point of the needle is then carried back to the posterior surface of the velum, and passed through it from behind forwards, near the lower end of it, and about three or four lines from the margin of the slit. The point of the needle is to be passed out as far as practicable, and then taken hold of with the forceps. The porte-aiguille being now removed, the needle is drawn into the mouth with the forceps, and along with it the ligature, with which it is threaded. After the patient has recovered his tranquillity and washed out his mouth, the other end of the ligature is to be passed in a similar way through the left side of the velum, and the two ends are to be brought out of the mouth at the commissures of the lips. Then a second ligature is to be applied near the angle where the two sides of the velum meet, and a third at the middle point between the other two ligatures. The left side of the fissure is then seized, depressed, and rendered tense with the ring-handled forceps, and the excision of its margin begun with the curved scissors; and completed with a straight probe bistoury applied on the outer side of the forceps, and with its back directed towards the root of the tongue. Thus a slip is to be removed about half a line in breadth. Particular care must be taken to let the slip extend a little above the front angle of the fissure. The same proceedings are to be followed on the opposite side; the two incisions being made to join at an acute angle above the point just now specified. It only remains to tie the ligatures. The surgeon begins with the lowermost one, which is first to be tied in a simple knot. As soon as this has been duly tightened with the forefingers, it is to be taken hold of with the ring-handled forceps, and kept from slipping, until another knot is made. The same plan is to be adopted with regard to the two upper ligatures. Finally, the two ends of each ligature are to be cut off with the scissors as useless.

No dressings are required, but the patient must refrain from talking, and as much as possible from swallowing even his spittle, which should be received in a vessel or on a handkerchief, in proportion as it is secreted. Coughing, laughing, sneezing, &c. must likewise be avoided. Between the third and fourth days, one or both the upper ligatures may be taken away; but the lower one should be left a day or two longer. If the attempt at union fail above, which frequently happens, when the fissure extends into the roof of the mouth, the closure of it may yet be effected by the work of

time, or it may be promoted by touching its edges with the nitrate of silver.

To the foregoing plan it is objected that, by passing the needles from behind forwards with their points out of sight, it is difficult to enter them with precision in the most desirable places. That when the ligatures have been introduced, the removal of the margins of the fissure, as executed by M. Roux, is exceedingly difficult. In fact, says M. Malgaigne, whatever pains be taken to stretch and draw downwards and inwards each half of the soft palate, it is always difficult when the surgeon begins with the loose margin of the velum, to make a clean and regular incision through it; and if scissors are employed, there is a risk of cutting the threads. See *Man. de Méd. Opér.* p. 473—477.

M. Berard's Method.—The surgeon seizes the left margin of the fissure with a pair of tenaculum forceps, held in the left hand. With the right he holds the needle with the dressing forceps, the concavity of the needle being turned towards the free edge of the fissure. The needle is introduced from before backwards on a level with the upper angle of the slit, nearly three lines to the outer side of its free edge, and it is pushed on till the whole of its curved portion has traversed the velum. Its curve permits its point to be directed backwards and inwards, and to become visible in the fissure. The operator now relinquishes the free edge of the velum, and with the same forceps, which serve to keep it tense, he takes hold of the part of the needle projecting backwards. A slight traction backwards and towards the side opposite that of the entrance of the needle, serves to disengage its heel; and the needle is then brought from behind forwards through the fissure, and next out of the mouth, together with the ligature connected with it. Another ligature is now passed in a similar manner through the right lip of the fissure. The second needle draws a ligature after it in the form of a noose, which is detached from the needle, and the deep end of the ligature passed through it. A second or a third noose is made in the same way according to the extent of the fissure, care being taken to enter each needle about three lines from the free margin of the division. The nooses being now drawn down to keep the ligatures out of the way of the knife, the left side of the fissure is once more taken hold of with the forceps, and its edges removed with a bistoury, which is passed through the soft palate one line above the angle of the fissure, with its back towards the roof of the mouth, and its edge downwards. The same proceeding is adopted on the other side; and the ligatures tied.

Mr. N. R. Smith's Method.—This gentleman, a surgeon in the United States, employs a very simple needle, mounted on a handle, and with a curve, the radius of which is about half an inch. At two or three lines from its point is a slit open at its posterior end, extending along one side of the needle to its middle. In front of this eye or slit the needle is broader than behind, which facilitates the passage of the part of the instrument which follows. The eye having had the ligature introduced through it, the curved portion of the needle is conveyed into the mouth beyond the palatine fissure, and its point carried behind the middle of the uvula, and passed through the latter part from behind forwards. As soon as the

point of the needle has passed sufficiently forwards, and the ligature in the slit of the instrument is perceived, the thread is to be taken hold of with a tenaculum, and having been disengaged from the eye, or slit in the needle, the latter instrument is withdrawn. A second ligature is to be passed half an inch higher up; and in some cases a third, at an equal distance from the second. With the ends of the ligature passed through the uvula, this part is now drawn forwards, and the fissure in the soft palate having been thus brought nearly into a horizontal position, its edges are to be cut off with scissors, either straight, or curved laterally, or with the aid of a knife and pair of forceps. After the ligatures have been tied, they are to be cut off near the knots.

Mr. Liston's Method.—A narrow sharp-pointed knife, held by the further end of the handle, is introduced through the edge of the fissure at its anterior margin, "and run back to the apex of the one half of the uvula. This may be laid hold of, and made tense by means of the sharp-pointed forceps. The same proceeding is repeated on the other side." The ligatures are introduced with needles, fixed in handles, and of different sizes and curvatures, the eyes being near their points. They are passed through the velum about a quarter of an inch from its free edge and towards it, and through two-thirds of its thickness. Each needle carries a double ligature, the noose of which is caught by a blunt hook, and pulled out into the mouth, whilst the instrument is withdrawn. A second and smaller ligature is carried through opposite to the first, and by means of this second thread, the first and double one is brought through. By a repetition of this plan, two, three, or more points of interrupted suture are made. After the edges have been put together by one or two points, no difficulty will be experienced in carrying others through both edges by means of a more curved instrument in a handle, or by the use of a small needle carried in the points of a pair of strong and well fitted forceps. Before the ligatures are finally secured, the parts being put upon the stretch, an incision should be made on each side towards the alveolar ridge through the anterior surface of the velum. By this method, Mr. Liston finds that the edges may be more easily brought together, and the strain is taken off the threads, so that there is less risk of their making their way out by ulceration. Mr. Liston deems the operation very liable to failure. (*On Practical Surgery*, p. 472.)

Staphyloplastic.—One modification of it consists in facilitating the approximation of the edges of the fissure to one another, by an incision made along the palate, on each side of the division. The ligatures arranged in the usual way, will now draw the margins of the fissures together, when, without such incisions, this object would be impracticable. This method is followed by Dieffenbach.

The *Indian staphyloplastic* consists in raising up a flap of soft parts from the roof of the mouth, and twisting its pedicle round, so that the flap may be adapted, by means of suture, to the loss of substance in the palate. I do not deem it necessary to enter further into the various plans of repairing deficiencies and apertures in the palate, on Tagliacotian principles. The mode of proceeding in different cases must be decided by the particular nature of them. An account of the method fol-

lôwed by M. Roux and M. Krimer, will be found in M. Malgaigne's valuable work. (See *Man. de Méd. Opér.* p. 482. ed. 2.)

PANARIS. (from *παρά*, near, and *ἄρξ*, the nail.) See *Witlow*.

PANNUS. When two or three pterygia of different sizes occurred on the same eye, with their points directed towards the centre of the cornea, where they met, and covered all the surface of this transparent membrane with a dense pellicle, the ancients named the disease *pannus*. (*Scarpa*, chap. 14.) At present, the term is applied to any opaque thickening of the layer of the conjunctiva covering the cornea.

PARACENTESIS. (from *παράπνευσιν*, to perforate.) The operation of tapping, or making an opening into the abdomen, thorax, or bladder, for the purpose of discharging the fluid confined in these parts in cases of ascites, empyema, hydrothorax, and retention of urine. A similar operation is often practised for the relief of hydrocele and ovarian dropsy. Effused blood may also require an opening to be made into the chest; and so may confined air in the instance of emphysema.

TAPPING, OR PARACENTESIS ABDOMINIS.

When the swelling extends equally over the whole abdomen, the fluid is usually diffused among all the viscera, and is only circumscribed by the boundaries of the peritoneum. The water is occasionally included in different cysts, which are generally formed in one of the ovaries; and, in this case, the tumour which is produced, is not so uniform, and the fluctuation not so distinct, as in peritoneal dropsy, at least, while the disease has not made great progress. The difference also in the consistence of the fluid may render the fluctuation more or less difficult of detection. When the water is contained in different cysts, it is frequently thick and gelatinous; but when it is uniformly diffused all over the cavity of the peritoneum, it is generally thinner, and even quite limpid. Sometimes a considerable number of hydatids are found floating in the fluid. With regard to the symptoms of common ascites, the disease is attended with great uneasiness, from all kinds of pressure on the abdomen; a gradual swelling of this part of the body, not inclining more to one side than the other; a fluctuation perceptible when the surgeon lays his hand on one side of the tumour, and gently taps on the opposite side of it; considerable difficulty of breathing, caused by the collection of fluid interrupting the action of the diaphragm, and obliging the patient to lie with his chest very much raised; constant thirst, &c. The abdomen usually begins to swell very gradually; the swelling is uniform, beginning from the pubes and by degrees extending as high as the ensiform cartilage. As the fluid accumulates in greater quantities, the parietes of the abdomen yield very much in the direction forwards, and also downwards, so that, in some instances, the swelling descends considerably beyond the os pubis. The fluid of ascites consists of serum, exhibiting various shades of colour from a light citrine to a deep brown. Occasionally the serum is mixed with pus, and not unfrequently it contains flocculi of coagulating lymph; a circumstance denoting that there has been inflammation of the peritoneum. (See *Darwall in Cyclop. of Pract. Med.*, art. *Ascites*.)

One common cause of ascites is disease of the liver, which has the effect of impeding the circulation of the blood in the vessels of most of the other abdominal viscera. Sir Astley Cooper enumerates, as other causes, an enlargement of the spleen, which presses upon and irritates the peritoneum, so as to determine an increased flow of blood to it, and an effusion of serum; great debility of the system, induced by fevers, or mercury; diseases of the heart and lungs, in which cases, the ascites is generally combined with hydrothorax. To distinguish pregnancy from dropsy, nothing more is usually required, than an accurate knowledge of the signs of the former; but sometimes ascites is complicated with pregnancy. In this case, as Scarpa observes, the regular form and body of the uterus are not evident to the touch, principally from the enormous distribution and prominence of the hypochondria. The urine is scanty and late-ritious; the thirst is constant; the abdomen upon percussion, presents a fluctuation, obscure in the hypogastric and iliac regions, but distinct in the hypochondria. The previous history of the case, with a proper examination of the neck of the uterus, will enable the practitioner to form a correct judgment. (See *Darwall, Op. cit.*)

Whatever may be the efficacy of bleeding, digitalis, mercury, diuretics and calomel, elaterium, squills, iodine, hydriodate of potash, and other medicines, in ascites, they are rarely of any service in local and encysted dropsies. When such swellings continue to enlarge, notwithstanding the adoption of a few measures which will presently be suggested, and produce much oppression, and functional disturbance, perhaps the sooner the fluid is evacuated, the better. It is also well-known, that all efforts to produce a radical cure even of dropsies which are not encysted, too frequently fail. Dr. Fothergill believed that physicians would meet with much more success in the treatment of ascites if they were to recommend paracentesis to be done sooner than they generally do. On the commencement of an ascites, this celebrated practitioner advises the trial of diuretics and other evacuants. He then adds, that "if, by a reasonable perseverance in this course, no considerable benefit accrues; if the viscera do not evidently appear to be obstructed, and unfit for the purposes of life; if the complaints have not been brought on by a long habitual train of intemperance, and from which there seems little hope of reclaiming the patient; if the strength and time of life are not altogether against us; I desist from medicine, except of the cordial kind; and let the disease proceed, till the operation becomes safely practicable. When this is done, by the moderate use of the warmer diuretics, chalybeates, and bitters, also the preparations of squills, in doses below that point, at which the stomach would be affected, I endeavour to prevent the abdomen from filling again." (*Med. Obs. and Inq.* vol. iv. p. 112.) Desault used to tap dropsical patients once a week, and, in many cases, after he had performed the operation two or three times, the disease was stopped.

However, with respect to early tapping in ascites one fact mentioned by Sir A. Cooper in his lectures, ought to be known, namely, that dropsy arising from the debility caused by fever, or a course of mercury, and not attended with diseased liver, spleen, or disorganisation of other important

organs, may often be cured by medical treatment, without any operation at all; and he therefore disapproves of paracentesis in such cases, so long as the fluid is not sufficiently copious to hinder the risk of the bowels from being hurt by the trocar. When this risk ceases, however, the practice seems commendable, because it will rather promote than retard the good effect of any other means which may be deemed advisable. At the same time I ought to mention the opinion of the above distinguished practitioner, that the operation itself will never bring about a cure, except where the disease has proceeded from the debility left by some kind of fever, or the abuse of mercury.

Since Fothergill's time the operation of paracentesis seems to Dr. Darwall not to have increased in reputation. His own experience is decidedly against it. He has frequently had patients tapped when the effusion was very considerable, and had existed but a short time. Every care was also taken after the operation to prevent inflammation. In all these instances, however, the effusion rapidly recurred, and upon examination of several after death, the bowels were found adhering by old depositions of coagulating lymph. Though he admits, that a cure sometimes follows tapping, he believes, that it often increases the tendency to effusion. He excepts the example of dropsy complicated by pregnancy, where he deems the discharge of the fluid advisable. After all, however, the great oppression of the breathing the suffering from distention and the functional disturbance, frequently, after a time render paracentesis absolutely necessary, whatever may be the conclusion respecting the practice of Fothergill and Desault.

The great number of times that the operation has been repeated in some individuals is surprising: for instance, twenty-nine times (*Schmucker, Wahrnehmungen*, b. ii. p. 102.); forty-one (*Med. Communications*, vol. ii.); fifty-two (*Schmucker*, vol. cit. p. 187.); sixty-five (*Mead*); one hundred (*Callisen, Syst. Chir. Hodierna*, vol. ii. p. 55.); one hundred and fifty-five (*Phil. Trans.* vol. 69.); and if it be possible to credit Bezdard, even six hundred and sixty-five times upon one woman in the course of thirteen years. When the patient died, the peritoneum was found to be three lines in thickness. The omentum, mesentery, and even the liver, gall-bladder, spleen, pancreas, kidneys, and bladder, had almost disappeared, a scirrhous mass containing pus occupying their place towards the right side. (See *Bulletin de la Société Méd. d'Emulation*, No. xii. Dec. 1815.) Some of these cases were certainly ovarian dropsies.

I have already noticed the practice inculcated by Fothergill of tapping in the early stage of ascites. This plan, I think should never be adopted in acute cases, or those dependent upon increased effusion from inflammatory action. I find another advocate for the early performance of paracentesis in M. Dupasquier, who finds that the discharge of the fluid promotes the action of diuretics, which previously often have no effect; and he lays it down as a fact, that the action of diuretics is always in an inverse ratio to the quantity of fluid collected in the peritoneum, and the irritation of the gastro-intestinal organs. (See *Journ. Chir. des Hôpitaux de Lyon*, vol. i. p. 355, dvo. 1830.)

Experience has repeatedly proved, however, how function of the kidney cannot be

re-established, though the fluid be discharged early nor when we reflect upon the visceral, renal, and other organic affections often concerned as causes of ascites, how can any other expectation be entertained in a large number of cases? The following is Mr. Liston's advice: "It becomes necessary when medicines which promote the secretion, more especially from the kidneys, have failed to give relief, and when the distention is very great, causing interruption to the functions of the viscera, particularly of the chest, and the great anasarous swelling of the lower extremities, to draw off the fluid by surgical operation. This is to be avoided as long as possible, more especially in ovarian dropsies: for the operation is only palliative; the secretion always goes on afterwards much more rapidly than before, and the necessity for repeating it becomes more and more frequent and urgent." (*On Practical Surgery*, p. 426.)

Whenever a considerable quantity of fluid is suddenly let out of the abdomen by tapping, the quick removal of the pressure of the water off the large blood-vessels and viscera may produce swooning, convulsions, and even sudden death. These consequences led the ancients to consider paracentesis as a dangerous operation, and, when they ventured to perform it, they only let out the water gradually and at intervals.

Dr. Mead, after considering what might occasion the bad symptoms resulting from too sudden an evacuation of a large quantity of fluid from the abdomen, was led to try whether external pressure would prevent such consequences. It was conceived that, in this way, the same degree of pressure which the fluid made on the viscera might be kept up. The success attending this plan fully justifies the opinion Dr. Mead had entertained; for when the compression is carefully made, the whole of the water contained in the abdomen of a dropsical patient may be safely discharged, as quickly as the surgeon chooses. For this purpose, however, the whole abdomen must be equally compressed, and the pressure maintained as the evacuation is taking place. While the water is flowing out, the pressure is usually made with the sheet which is put round the abdomen. Two assistants, who hold the ends of the sheet, gradually tighten it in proportion as the fluid is discharged. Immediately after the operation some folded flannel, sprinkled with spirit of wine, is laid over the whole anterior part of the belly, and covered with a broad linen roller applied with due tightness round the body. Dr. Monro invented a particular kind of belt for the purpose. Previously to tapping, some surgeons surround the abdomen with a broad band of flannel, the ends of which are split. The middle, which is made to fit better to the convexity, above and below, by triangular pieces being cut out, and the edges joined, is placed over the forepart of the abdomen, and the ends are crossed behind, and intrusted to assistants. The umbilicus is felt for, and openings cut in the bandage a little below it. (*Liston on Practical Surgery*, p. 426.)

The instrument used for tapping the abdomen is called a trocar. (See *TROCAR*.) Of this there are several varieties; but the generality of experienced surgeons give a decided preference to the common trocar. Most of the modern alterations which have been made in the construction of trocars, have only been deteriorations. There is

no reason for the ordinary objection that the common trocar cannot be introduced without considerable force. If the part, into which it is about to be passed, be made tense, very little force will be necessary, especially if care be taken to rotate the instrument gently, as well as push it forward. Richter condemns the trocar with a double-edged point as a bad instrument. The proposal of Mr. Cline, to make a puncture with a lancet first, and then to introduce into it a blunt-pointed trocar, is superfluous. Nay, these innovations are declared to be worse than useless. A cutting instrument is liable to injure blood-vessels, and bring on hemorrhage; and the wound does not heal so readily as that made with an ordinary trocar. That sharp-edged instruments are attended with the inconvenience of being apt to wound enlarged veins, and produce an unpleasant degree of hemorrhage, is a truth of which I have myself met with a convincing example. A female, who had a strong aversion to being tapped with a trocar, prevailed upon me to make the opening with a lancet. The puncture was made in the linea alba, about three inches below the navel. A stream of dark-coloured venous blood continued to run from the wound the whole time the water was flowing out of the cannula, and did not cease until a compress was applied. The quantity of blood lost could not be less than a pint, or a pint and a half. In many cases this loss of blood would prove fatal to dropsical patients, and is what one would always feel anxious to avoid. It is only in doubtful cases of encysted dropsy (see *Liston, Op. cit.* p. 427.), or when the front of the abdomen is covered with a very thick stratum of fat, that I would make a preliminary incision. A man was under me in University College Hospital with ascites, and I introduced a trocar nearly up to the rim of its cannula without reaching the fluid. Having procured a longer trocar, I repeated the puncture on the following day, and, with this instrument, was only just able to get about a quarter of an inch of the cannula within the peritoneum, so great was the quantity of fat in front of the abdomen. In another such case I would make a previous incision. The patient, directly before the operation, should empty the bladder.

The position, commonly selected for the operation, is that in which the patient sits in an arm-chair. However, weakness and other circumstances frequently make it necessary to operate on the patient as he lies on his side sufficiently near the edge of the bed; and this posture has one decided advantage, viz. that it tends to prevent the alarming syncope which the sudden removal of the pressure of the fluid from the diaphragm and abdominal viscera often brings on, in such a patient, in the erect position.

Formerly, the place in which surgeons used to puncture the abdomen, in cases of ascites, was the centre of a line drawn from the navel to the anterior superior spinous process of the ilium, and on the left side, which was preferred, in consequence of the liver not being there. The place for the puncture was usually marked with ink, and was supposed to be always situated just over a part of the linea semilunaris, where there are no fleshy fibres, nor any large blood-vessel, exposed to injury. This calculation, however, was made without considering that, in dropsy, the parietes of the abdomen do not yield equally in every situ-

ation. On the contrary, it is known that the front is always more distended than the lateral parts, and that the recti muscles, in particular, are sometimes very much widened. In consequence of these alterations, induced by the disease, no dependence can be put on any measurement, made with the view of ascertaining the precise situation of the linea semilunaris. The surgeon who trusts to his being able to introduce the trocar exactly in this place from any calculation of the above kind, will frequently wound a great thickness of muscle, instead of a part, where the abdominal parietes are thinnest. But, a still stronger objection is to be urged against the practice of attempting to tap in the linea semilunaris. Men well acquainted with anatomy have frequently been deceived in their reckoning, and, instead of hitting the intended line with their trocars, they have introduced these instruments through the rectus muscle, and wounded the epigastric artery. Patients have died from this error, with large extravasations of blood in the cavity of the peritoneum. In a dropsical person, who has been tapped, it is to be observed also, that an effusion of blood in the abdomen will of course more readily take place, in consequence of the parts not being in the same close, compact state, in which they are in the healthy condition.

Henceforth, therefore, let every prudent practitioner abandon the plan of tapping in the linea semilunaris in cases of ascites; and he may the more easily make up his mind to do so, as there is another place, where the operation may be performed with the utmost facility and safety. The linea alba is now preferred; because, here no muscular fibres need be wounded, the place can be hit with certainty, and no large blood-vessel can be injured. About the middle point, between the navel and pubes, is as good a situation for making the puncture as can possibly be chosen. The surgeon should introduce the trocar in a steady, firm manner, never in an incautious, sudden way, lest parts contained in the peritoneum should be rashly wounded. For the same reason immediately the point of the trocar has entered the abdomen, a thing always known at once by the sudden cessation of resistance to its passing inward, it should be introduced no further, and its office of making a passage for the cannula is already accomplished. The surgeon, consequently, is now to take hold of the cannula with the thumb and index finger of his left hand, and gently insinuate it further into the cavity of the peritoneum, while, with his right hand, he is to withdraw the stilet. The fluid now gushes out, and regularly as it escapes, the sheet, or other bandage round the patient's body, is to be tightened. All the water having been evacuated, a piece of flannel and a roller are to be immediately applied, as above explained, a piece of lint and soap-plaster having been previously put over the wound.

It is not uncommon for the water suddenly to stop long before the full quantity is discharged. Sometimes this happens from a piece of intestine, or omentum, obstructing the cannula. This kind of stoppage may be removed by just introducing a probe or director, and holding the portion of bowel back. When the water is viscid, the only thing we can do is to introduce a large trocar, if doing so should promise to facilitate the evacuation. Also, when hydatids obstruct the cannula, a larger instrument, or the enlargement of the opening,

would allow them to escape. In encysted dropsies the practitioner, of course, can only let the fluid out of those cavities which he can safely puncture. According to Sir Astley Cooper, the water of encysted dropsy is at first contained, not in a single bag, but in several, the partitions between which are in time gradually absorbed, and the number of distinct cavities consequently diminished. Hence another reason why the fluctuation becomes more evident as the disease advances. (*Lectures, &c.* vol. ii. p. 373.) The fact, if established, should also influence the surgeon not to make too early a puncture, which could only discharge the fluid from one cyst, while several others, not having yet any communication with it, would remain distended.

The abdomen of a female was tapped by Dr. Andrew Buchanan through the fundus of the bladder, for which purpose a tube with a stilet was introduced by the meatus urinarius. The method was adopted chiefly for the purpose of trying what would be the result of maintaining, in ascites, a communication between the cavity of the peritoneum and that of the bladder. In the case referred to the water was discharged; but success did not attend the endeavour to keep the puncture in the fundus of the bladder open. (*Buchanan, in Glasgow Med. Journ.* vol. i. p. 195.) It seems to me, that any means calculated to perpetuate the opening would be likely to cause peritonitis. The continuance of an opening between the cavity of the bladder and that of the abdomen, owing to the irritating qualities of the urine, can hardly be viewed as free from serious risk. There is an analogy between this suggestion, and that of Mr. Gny, of Chichester, who proposed leaving the cannula in the wound, and occasionally letting the water flow out after the ordinary mode of paracentesis; a plan, however, which is attended with less risk, and has sometimes been followed by a cure. (See *Sir Astley Cooper's Lectures*, vol. ii. p. 383.)

When dropsy of the ovary is large, it also admits of being tapped in the linea alba; but, in this particular case, it is generally best to make the puncture where the swelling is most prominent. In this disease the ovary is either converted into one large cavity, filled with fluid, or else there are several distinct cysts. Under the name of ovarian dropsy have also been included simple serous cysts, formed in the broad teguments and Fallopian tubes. "All these, confounded together" (as Dr. Seymour observes) "under the name of hydatids, are distinguishable from the latter, by being nourished by vessels, supplying them from the parts in which they are formed; vesicles to which the name hydatid is attached, being nourished by their own blood-vessels, or, in other words, having an independent life." (*On Principal Diseases of the Ovary*, p. 45.) In the early stage, the tumour is situated towards one side of the abdomen, just above Poupart's ligament, and seems to ascend out of the pelvis. This at once distinguishes the disease from a common ascites, which is attended, from the first, with an equal, gradual, universal swelling of the abdomen. The statements of Cruveilhier on the foregoing points have been already noticed in the article OVARY.

The magnitude (which the disease may attain) is judged of by the fact, that twelve or fifteen pints of fluid have sometimes been con-

tained in the cavity, or cavities of the cyst. The cyst of the ovary, when it has attained a large size, generally adheres, in different places, to the inner surface of the peritoneum, and, in this state, the whole abdomen often seems uniformly swollen, in consequence of the immense magnitude of the disease. (See *G. D. Mott, De Structura, Usu, et Morbis Ovariorum*, 4to. Jenæ, 1788.) It is an observation made by Sir A. Cooper, that one of the principal differences between ascites and ovarian dropsy, is that the latter is in itself quite a local disease, just like a hydrocele. This observation, I believe, is perfectly correct; and though great illness frequently arises, it is generally the result of the pressure made by the swelling on the parts within the abdomen and pelvis. The impairment of the health, arising from the pressure of the viscera, and interruption of their functions, and the great difficulty of breathing, produced by the pressure of the diaphragm, indeed frequently make it absolutely necessary to let out the fluid. The disease may be attended with an almost total stoppage of the secretion of urine. (See case by *Barlow, in Prov. Med. Trans.* vol. iv. p. 403.) Sometimes the urine is duly secreted, but a retention occurs, and the use of the catheter becomes indispensable.

The symptoms of ovarian dropsy differ in different instances, but are generally not severe, and principally depend upon the pressure of the tumour on neighbouring parts, or accidental inflammation of the interior of the cyst. "Where the increase of the disease is slow, the patient often suffers no other inconvenience than from swelling of the leg on the side on which the tumour is largest, or from the unsightly bulk of the abdomen, which she is unable to conceal. Patients have lived in this manner thirty or forty years, with a very considerable enjoyment of the comforts of life, and even the pleasures of the world, the accumulation of fluid rendering it necessary from time to time to perform the operation of paracentesis. In cases of this kind, symptoms, dependent on unusually rapid increase of bulk, or pressure on any particular organs in the abdomen, occur. Thus, heartburn, vomiting, and purging, difficulty of passing urine, or violent and severe headache, are met with, which are entirely removed if the bulk of the tumour be reduced. There is a case now under the care of Mr. North, where the patient has for many years been unable to pass her urine, except by the daily use of the catheter; and this appears to arise from the natural situation of the bladder being altered by pressure, and, perhaps, by the adhesion of the tumour. When both ovaria are diseased in this way, the catamenia are always absent; when only one ovary is affected, they are sometimes irregular, sometimes absent altogether. In many cases, the diagnosis is free from difficulty. Pain has been felt in either iliac region, succeeded by a tumour, which can be traced low down in the pelvis, and the uterus is found, on examination, dragged upwards by the morbid growth. The history likewise assists us; it has followed miscarriage, or delivery; at other times, it occurs in females where pregnancy is out of the question, or at a time of life when it is impossible, and yet where the unbroken health renders ascites a very improbable occurrence." (See *Seymour's Illustrations of Dis. of the Ovary*, p. 50.) The circumstances distinguishing it from ascites

and pregnancy, and the fact of its being sometimes complicated with pregnancy, or ascites, should be recollected. See OVARY.

In ovarian dropsy, the swelling does not, like that of ascites, begin from the lower part of the abdomen; nor is it uniform, one side or the other being most protuberant. If several cysts exist, the parietes of the abdomen often feel lobulated. When the patient turns herself in bed, a sensation of a heavy weight within the abdomen falling to the lower side is experienced. Patients generally lie on the side on which the tumour has originated. In some cases, a hard tumour is remembered to have preceded the distention of the abdomen. When, however, the cysts are few and very large, the distinction may be difficult. Cysts, containing abundance of hydatids, are frequently met with connected with the liver or spleen. Such disease, in its earliest stage, is not likely to be mistaken for ascites; but, as the parietes of the abdomen become thinned, the presence of a soft swelling proceeding from the linea, and sometimes exhibiting a slight degree of fluctuation, may be traced. In ascites, the swelling proceeds from below upwards; while, in encysted dropsy of the liver, its progress is from above downwards. A greater prominence may be perceived on the right side. As in ovarian dropsy, the general health is little affected, at all events till the swelling has attained magnitude; the urine is passed in the natural quantity, and no serous effusion in the cavity of the peritoneum, nor any anasarca of the lower extremities occur till a very late period of the disease. (See Darwall, in *Cyclop. of Prac. Med.*, art. *Ascites*.) In a case where the abdomen contained a cyst of this kind, filled with four gallons and a half of serous fluid and hydatids, the abdomen was so uniformly distended, and the fluctuation so plain, that I introduced a trocar; but the cannula became obstructed by the hydatids, and hardly any part of the contents of the cyst were evacuated. The man, who was in a most debilitated state, lived ten days after the operation. The cyst is placed in the museum of University College. I have since heard of cases in which the opening was enlarged with a probe-pointed bistoury, and the hydatids discharged. In one instance, thus treated, a cure was the result.

With few exceptions, tapping can only be regarded as a palliative measure; the water collects again, the same grievances recur, and the operation must be repeated. While an ovarian dropsy is recent, and even after it has been tapped, some attempts may be made to effect a radical cure. But, I believe, this is not to be accomplished with mercury, iodine, or any other medicine yet known. As Dr. Seymour remarks, in simple ovarian dropsy, it would seem reasonable to diminish the quantity of fluid secreted in the cyst, by exciting some increase of the excrementitious fluids, more especially of the urine; but, experience does not show that such an effect can be produced by those remedies, which are found very powerful in serous accumulation in the natural cavities of the body. Dr. Withering found digitalis completely fail. But where ovarian dropsy is combined with ascites, relief may be derived from the infusion of digitalis and *pyrola umbellata*. (*Seymour's Illustrations of Dis. of the Ovarium*, p. 90.) Emetics were recommended by Abernethy to promote the absorption of the matter of chronic abscesses, and by

Dr. Percival, for the dispersion of ovarian dropsy. (*Essays*, vol. i. p. 375.) I believe that few practical men have now any confidence in their use for these purposes. Blistering the surface of the abdomen, keeping up a discharge with the saving cerate, and applying a tight roller, have been known to do good. Long-continued frictions are stated to have lessened an ovarian swelling; but, as is added, only temporarily. (*Seymour, Op. cit.* p. 97.)

Various operative plans have been tried for the radical cure of ovarian dropsies. 1. A considerable incision into the cyst, and keeping a cannula, or bougie, afterwards in the opening, to prevent another accumulation of fluid, and thus promote the contraction of the cyst. 2. Injections into the cyst. 3. Removal of the cyst. A very remarkable and successful instance of the first kind of practice, and perhaps the earliest, is related by Dr. Houston, in the 33d vol. of the *Phil. Trans.*, the particulars of which may also be read in Dr. Seymour's work.

In France, Le Dran laid open the cysts of ovarian dropsies. His patients did not die of the consequent inflammation, and the dropsy, indeed, was cured; but there remained either a sarcomatous enlargement of the ovary, which continued to increase till death, or else incurable fistulae, leading into the cyst. The great size of a wound necessary for this purpose, the danger of inducing inflammation in so extensive a surface as the cyst of a large ovarian dropsy, and the events of Le Dran's cases, are considerations against this practice.

Attempts have been made to cure ovarian dropsies by injections, like hydroceles. I formerly saw two cases in which port wine and water were injected by the late Mr. Ramsden, of St. Bartholomew's Hospital; one patient died very soon afterwards of inflammation, and the other perished more lingeringly from the same cause. Setons have also been tried without success. Leaving in the cannula, or bougie, after paracentesis, has been frequently tried. Mr. Key has notes of three cases: the results were not favourable. (See *Seymour on Dis. of the Ovary*, p. 103.)

In the *American Recorder* a case is published, in which a cure was effected by the excision of the sac. Dr. N. Smith also performed such an operation with success; after exposing the tumour by an incision, and discharging seven pints of a dark ropy fluid, with a trocar, he extracted the whole cyst, and the patient recovered. (See *Edin. Med. and Surg. Journ.* No. lxxiii.) The sac brought out with it a considerable portion of adherent omentum, which required to be separated with the knife, and two bleeding vessels were tied. The omentum was then reduced, and the adhesions of the sac to one point of the parietes of the abdomen also separated partly with the scalpel, and partly with the finger. These few particulars prove that, though the operation may be practicable, and even end well, it is liable to great difficulties in its execution, and dangerous and fatal consequences in its result. In fact, one surgeon, mentioned by Sir A. Cooper, who began an operation of this kind, was prevented by the extent of the adhesions from completing it. Whenever the attempt is made, it ought to be while the cyst is of moderate size. An instance in which the operation was attempted, while the disease did not exist, has been fairly and

candidly laid before the public by Mr. Lizars, with other interesting observations and cases in favour of the practice of extirpating diseased ovaries. (*Edinb. Med. Surg. Journ.* No. lxxxi.)

Some other cases, in which the object was truly and successfully accomplished, have also been published by the same practitioner. (On *Extraction of Diseased Ovaria*, fol. Edinb. 1825.) Dr. David L. Rogers, of New York, on the 14th of September, 1829, removed a large ovarian cyst and solid tumour. The following particulars are taken from Dr. Reese's American edition of this Dictionary. "The abdomen began to swell; first, on the left, and then extending to the right; her stomach became affected, and although unmarried, her friends accused her of being pregnant. In consequence of this impression, the disease was allowed to proceed without any medical advice, until time had satisfied her friends to the contrary, when a physician was called, who pronounced the disease a dropsy, and recommended her to be tapped. A large quantity of water was drawn off, but in two months it had reaccumulated, and the operation was repeated five times previous to my seeing her. It is computed that within the two years eighteen gallons of fluid were drawn off.

"I observed (says Dr. Rogers) in this case, what I have remarked in several others, that the fluid discharged differed from the water in common ascites. It is much more mucilaginous; of the consistence of honey; of a milky colour, and differs from any other secretion that I am acquainted with. After deliberately examining the tumour, and as far as possible ascertaining its character and connections, I suggested to her the possibility of its being cured by an operation, at the same time stating the great risk of life attending the performance, and the slight chance of her recovery. I likewise requested Professor Mott, who was consulted in this case, to make a similar statement. Her good constitution and general health all urged the obligation of making an attempt to save her. After the first suggestion, nothing could alter her determination to forego the chance of relief which even so desperate an operation might afford, and, as she expressed it, 'I would rather die than live in my present situation.'

On the 14th of September, she was laid on a table of convenient height, and with a large scalpel I commenced an incision a little below the ensiform cartilage, carrying it parallel with the linea alba, and terminating at the symphysis pubis. The integuments being divided, the dissection was continued through the tendon of the linea alba to the peritoneum. This was at first supposed to be much thickened; but by a cautious dissection through a membranous texture to the depth of a quarter of an inch, the water gushed out with considerable force. With a probe-pointed bistoury, the opening was enlarged to the full extent of the external incision, and to our surprise we found that a sac was opened which appeared to fill the whole circumference of the abdomen, and at first its attachment appeared commensurate with its size. It lay in connection with the liver, stomach, spleen, and bladder. By pulling up the sac it was found that the adhesions were much less than at first expected. It was determined, therefore, to dissect them from the peritoneum and omentum: some of the adhesions were so slight as to be separated by the finger, others by the handle of the scalpel, but

the greater part required to be separated by a tedious dissection, and in some parts the adhesions were so close that portions of the peritoneal membrane were removed. These adhesions extended for three or four inches around the umbilicus. After completing this part of the dissection, the tumour was drawn out and supported by an assistant, and the dissection continued: separating it from the ovarian ligament, which required much care, from the large and numerous vessels going to it from this source; the largest was at least the size of a goose-quill. After occupying two hours in the operation, this huge mass of disease was safely removed, and laid on the table. The ligatures were all cut close to the knot, and left to absorption. The wound was closed by sutures, dressed with adhesive straps, lint, a compress and a bandage applied firmly to the abdomen. I place some confidence in the close application of a bandage, as it brings the divided surfaces in contact for the purpose of adhesion, and likewise as an important auxiliary in preventing inflammation. She was then removed to bed; her pulse at this time was feeble, but regular. In the course of the evening, considerable reaction came on, with some heat of skin."

Without pursuing the detail of the progress of the case, it will be only necessary to add that the case progressed without any untoward symptom, and in six weeks from the period of the operation, her catamenia had returned and her health entirely recovered.

"The tumour was composed of a large sac, which had contained the fluid drawn off in different operations for tapping. One-third of the tumour was solid, containing a fibro-cartilaginous substance. It weighed three and a half pounds."

In offering this case, it may be proper briefly to sum up a history of the operations for diseased ovaria: it may assist others in forming an opinion of the relative chance of success in future cases. The removal of these tumours by an operation had its advocates in the last century; but the authority of De Haen and Morgagni was raised against them, as doubtful in their results, and impossible in their execution. The first attempt to remove them by an operation was made in 1776, by L'Aumonier, surgeon-in-chief of the hospital of Rouen, and is reported as a successful case. (See *Good's Study of Medicine*, vol. iv. p. 325, ed. 4.)

Dr. M'Dowel, of Kentucky, has reported three cases in which he operated successfully for tumours in the abdomen, ovarian, and hydatid. A doubt exists in relation to these cases; and certainly the mode of describing them is calculated to confirm that doubt. We are bound, however, upon the authority of others, to believe them, notwithstanding the improbabilities connected with their details; and it is much to be regretted that a more circumstantial account of these cases has not been given to the profession. (See *Med. Chir. Rev.* vol. v. p. 216.)

Professor Smith, of Yale College, has given an interesting case of the successful removal of an ovarian dropsy by an operation. The tumour was small, weighing from two to three ounces, and requiring an incision of three inches in length. (See *Am. Med. Rec.* 1822.)

"In the London Medical Gazette, for 1829, Dr. Hopper, of Biberbach, has reported three cases of extirpation of diseased ovaria, by Carysman,

The first was performed in 1819, and proved fatal in thirty-six hours after the operation. The second in 1820. This case was successful, and the woman has since borne children. The third case occurred in the same year, and never recovered from the shock of the operation. Thus of the three cases, but one recovered. (See *Reese's American Edition of his Dictionary*.)

Mr. Jeaffreson, of Framlingham, Suffolk, has published the particulars of a case, in which he removed an ovarian cyst. It appeared to this gentleman, that the danger and difficulties of operations of this kind might be lessened by performing them before extensive adhesions had taken place between the cyst and the surrounding parts, and as soon as the cyst was sufficiently distended to press firmly on the sides of the abdomen. He had an opportunity of trying on the dead body of a lady what could be done with an ovarian sac; and "accordingly exposed it by an incision of about an inch; then evacuating its contents with the trocar, I was enabled to draw out the whole of it, together with a great portion of the Fallopian tube attached, which produced full conviction on my mind, that had her disease been confined to the ovary, her life might have been saved by an operation. On the 8th of May, 1836, he tried the foregoing plan on Mrs. B. In the presence (says he) of my friend, Mr. King (of Saxmundham), I made an incision, of between ten and twelve lines in the course of the linea alba, midway between the navel and the pubes; and having thus carefully exposed the sac, I evacuated by the trocar about twelve pints of clear serum. During the flow of the serum, a portion of the sac was secured in the gripe of a forceps, to prevent its receding; and I afterwards gradually extracted the sac entire from the cavity of the abdomen, together with another sac, containing two ounces of fluid, and indeed the entire ovary; having only to cut through a slight reflection of the peritoneum and ovarian ligament, which, with a small portion of the fimbriated extremity of the Fallopian tube, are the only natural attachments of the ovary to the uterus. But, as this part was the medium of vascular supply to the sac, and the vessels on the surface of the sac were unusually large, we thought it right to include it in a ligature previous to returning it into the cavity of the abdomen. The ends of the ligature were cut off close to the knot. A very small portion of omentum protruded with the sac, but was very readily returned. The external wound was closed with two sutures, adhesive plaster, and a compress of lint." The result was a perfect cure. Further, it appears from Mr. Jeaffreson's statement, that Mr. King, of Saxmundham, has repeated this operation on a lady, where the ovarian sac was more distended, and having discharged twenty-seven pints and a half of fluid, he extracted it entire, together with a tubercular tumour of the size of a turkey's egg. The patient recovered without any bad symptom. Mr. Jeaffreson considers that his method of operating is preferable to that of Mr. Lizaro, whose plan, on account of the greater extent of the incision, must prove hazardous. The same objection, he thinks, is applicable to the case recorded by Dr. C. F. Quittenbaum, which, however, ended successfully. (See *Comment. de Ovarii Hypertrophia*, &c.; and *Jeaffreson*, in *Prov. Med. Trans.*, vol. v. p. 239.)

An example is mentioned by Dr. Granville, in

which several encysted tumours of the right ovary (one as large as a full-grown foetus's head) were discharged, with a collection of matter, through an ulcerated opening in the parietes of the abdomen. (See *Med. Phys. Journ.* June, 1822.)

Though the disease, when once formed, mostly continues throughout life, it occasionally disappears. An adhesion may be formed between the tumour and some portion of the great intestine, and a very large quantity of the most offensive purulent fluid, of various consistence, be passed by stool; in such cases, the patient often recovers. At other times, the same takes place by discharge through the vagina; and several cases are on record, in which the discharge could be accelerated by pressure made on the tumour. Occasionally, after adhesion between the cyst and the parietes of the abdomen, spontaneous rupture takes place at the umbilicus, and the contents of the cyst are discharged through the aperture, and a perfect cure be the result. (*Seymour*, *Op. cit.* p. 52.)

The disease is alleged sometimes to have ended in the cyst bursting, and its contents being discharged into the peritoneal cavity, whence they were absorbed. In the event of such a change in the situation of the fluid taking place, there must always be, however, a risk of a fatal attack of peritonitis. The bursting of the cyst into the cavity of the abdomen has been fatal in three instances within Dr. Seymour's knowledge. Occasionally, the complaint has disappeared after the receipt of an accidental blow; and, as a case related by Dr. Blundell tends to prove, the cure may here arise from rupture of the cyst, and effusion of the fluid in the cavity of the peritoneum, followed by absorption of it.

I have tapped several ovarian cysts, and discharged from them, at repeated operations, incalculable quantities of fluid. In a case, recorded by Mead, a lady was tapped sixty-seven times in five years and a half, and 1920 pints of fluid discharged. In another instance, detailed by Martineau, the patient lost by tapping 6631 pints of fluid in the course of twenty-five years.

Sir A. Cooper has known several examples of the spontaneous cure of ovarian dropsy. In one case, the fluid was for a long time voided through an ulcerated opening at the umbilicus. He has also known the water to be discharged by the Fallopian tube; and he attended a lady, in whom an ovarian cyst burst into the intestinal canal: for several years afterwards, she was subject to occasional returns of the disease, but ultimately recovered. (*Lectures*, vol. ii. p. 384.) In the year 1836, a woman was under my care at the Bloomsbury Dispensary, with an ovarian cyst of immense size filling the abdomen, and protruding partly at the navel, where ulceration had formed an opening into it, from which a pint or two of glutinous fluid was discharged every day. She lived in this state about three months, and was seen by the students of University College Hospital.

Dr. Addison has recorded an instance, in which an ovarian cyst was burst by an accidental blow, and a cure followed. The first symptoms were those of peritonitis. Bleeding, fomentations, calomel, antimony, and opium, were the means employed. (See *Guy's Hospital Reports*, vol. i. p. 41.) The passage of the fluid of an ovarian cyst into the cavity of the peritoneum may prove fatal in a few hours, occasioning sickness, vomiting, giddiness,

colligative sweats, and extreme prostration. A case, related by Dr. Barlow, in which paracentesis had been delayed too long, and the ovarian fluid escaped through an ulceration of the cyst into the cavity of the peritoneum, fully exemplifies the foregoing statement. (See *Prov. Med. Trans.* vol. iv. p. 402.)

PARACENTESIS OF THE THORAX.

The necessity for this operation is indicated when the heart, or lungs, are oppressed by any kind of fluid confined in the cavity of the chest. Everybody knows that the free and uninterrupted performance of the functions of these organs is essential to the support of life. When their action is perilously disturbed by the lodgment of fluid in the thorax, no internal medicines can be much depended upon for procuring relief. The only means from which benefit can be rationally expected, is letting out the fluid by making an opening in the parietes of the chest.

The nature of the effused fluid can make no difference, in regard to the propriety of discharging it in this manner; and though some authors describe this operation as only applicable to cases of hydrops pectoris and empyema, it may also be of the greatest service when air is confined in the chest. (See EMPHYSEMA, and PNEUMOTHORAX.) It is now seldom executed for blood extravasated there. (See WOUNDS OF THE THORAX.) The case in which it is least likely to be followed by a perfect recovery, is hydrothorax; and Sir A. Cooper, in his vast experience, has not known more than one operation performed for it which proved successful. This he considers by no means surprising, as the collection of fluid is the effect of disease of the thoracic viscera, the heart or lungs, &c. (*Lectures*, vol. ii. p. 385.) A case of success, however, is mentioned in the references at the end of the present article; and in the *Berlin. Med. Trans.* a case is recorded, in which a cure was effected by an accidental wound of the chest, by which the whole of the water escaped at once. (*Act. Med. Berol.*, t. x. dec. 1. p. 44.) A case of successful paracentesis of the thorax is recorded by Dr. Archer, where eleven pints of an inodorous fluid were drawn off, and in a few weeks the patient was quite convalescent. (See *Trans. of King's and Queen's College of Physicians, Dublin*, iii.) A patient, under Dr. Croker, of Dublin, was operated upon by Mr. Crampton, and fourteen imperial pints of pus were discharged. (See EMPYEMA.)

The idiopathic form of hydrothorax, or that case in which it constitutes the original disease, is set down by Laennec as very rare. He has often known hypertrophy of the heart, aneurism of the aorta, irregular consumption, and even scirrhus of the stomach or liver, mistaken for this disorder, when there was no coexisting effusion in the pleura, or at least none except what took place immediately before death. Symptomatic hydrothorax, he admits, is frequent. (*On Dis. of the Chest*, p. 484. ed. 2.) In this work the learned translator, Dr. Forbes, recommends the use of the stethoscope for discriminating diseases of the heart from hydrothorax, as the former adapted to the relief of dropsy of the chest would be useless with regard to them.

In this place I shall content myself with describing the methods of performing paracentesis thoracis, referring the reader to the above articles, and the valuable work of Laennec, for the particular

symptoms and circumstances which may render the operation proper, and the rest of the surgical treatment peculiar to each affection.

It has been the common maxim to recommend the space between the sixth and seventh true ribs as the safest and most convenient situation for making an opening into the chest on either side, as circumstances may render necessary. The surgeon should always recollect, that the two cavities of the pleura are completely distinct from each other, and have no communication whatsoever; so, that if fluid were contained on the left side of the thorax, making an opening into the right cavity would not serve for discharging the accumulated matter. The practitioner should also remember that, when there is a fluid on both sides of the chest, paracentesis must never be done for the relief of the two collections, at the same time; because there is great reason to believe that, as the lungs on one side usually collapse when there is a free communication between the air and the inside of the thorax, they would do so on both sides, were an opening made at the same time into each sac of the pleura. It is hardly necessary to remark, that in this condition the patient could not breathe, and would die suffocated. The operation consists in making an incision, about two inches long, through the integuments which cover the space between the sixth and seventh true ribs, just where the indigitations of the serratus major anticus muscle meet those of the externus obliquus. Here it is unnecessary to divide any muscular fibres, except those of the intercostal muscles, and, by putting the patient in a proper posture, the opening will be depending enough for any purpose whatsoever. The surgeon, avoiding the lower edge of the upper rib, where the intercostal artery lies, is then cautiously to divide the layers of the intercostal muscles, till he brings the pleura into view, when this membrane is to be very carefully divided with a lancet or bistoury. The instrument should never be introduced deeply, lest the lungs be injured. For this reason, few modern surgeons would choose to plunge a trocar into the pleura when the opening can be so much more safely made with a bistoury. The only reason, assigned for the trocar, is that the intercostal artery is less likely to be hurt by it than a cutting instrument, and that the cannula is useful in maintaining the opening, and for the occasional use of injections. A refutation of these pretended reasons seems unnecessary. The size of the opening in the pleura should not be larger than necessary. The discharge of blood and matter will of course require a freer aperture than that of air or water. If requisite, a cannula may be introduced into the wound, for the purpose of facilitating the evacuation of the fluid; and it may even in some cases be proper to let this instrument remain in the part, in order to let the water or pus escape, as often as another accumulation takes place. It is obvious, however, that a cannula for this object should only be just long enough to enter the cavity of the pleura, and should have a broad rim to keep it from slipping into the chest. A piece of sticking-plaster would easily fix the cannula, which might be stopped up with a cork, or any other convenient thing, or left open, according as the circumstances of the case, and the judgment of the surgeon, should direct.

Laennec preferred the space between the fifth and sixth ribs. "Many reasons (he says) point

out this spot as the best for the operation. We know that the upper lobe adheres to the ribs more frequently than any other part of the lungs, and the lower lobe is frequently attached to the diaphragm, while adhesions very seldom exist at the central part of the chest; and even should there chance to be any old adhesions in this point, they may be readily and certainly discovered by some remains of respiration over their site, and the place of the operation may then be varied accordingly. Besides, we know that the thickest false membranes exist at the junction of the diaphragm with the walls of the chest, and that on the right side an enlarged liver frequently reaches as high as the sixth, or even the fifth rib; in which case, when the operation is performed in the usual situation, the instrument, instead of entering the chest, would transfix the diaphragm and penetrate the abdomen. This accident happened to Laennec himself in a case of pneumo thorax; La Motte committed a similar blunder. (See *Traité Comp. de la Chir.* t. ii. obs. 77. p. 292.) The only reason for operating between the sixth and seventh ribs is to have a depending opening; but this object may be attained by operating between the fifth and sixth ribs, and directing the patient to lie on the diseased side. Some practitioners deem it prudent not to let out the whole of a large collection of fluid at once, but gradually, lest dangerous syncope should be induced. (See *Townsend, in Cyclop. of Pract. Med.* art. *Empyema*.) Few practical surgeons would now think of endeavouring to draw air out of the chest with a piston-cupping glass, as proposed by Laennec, after paracentesis.

Paracentesis of the abdomen, and of the thorax, are described in all treatises on the operations of surgery. The works of Sharp, Le Dran, Bertrand, Callicien, Richter, Sabatier, Larrey, and Boyer, are particularly deserving attention. A case, in which eleven pints of a fluid resembling whey, were discharged from the chest by paracentesis, and the patient recovered, is detailed by Dr. Archer in the *Trans. of the King's and Queen's Colleges of Physicians in Ireland*, vol. i. art. 1. Jackson, in *Philadelphia Journal of the Med. Sciences*, vol. i. new series, p. 149.: Operation performed in a Case of Effusion. N. *Friedreich, Vorzüge des Bauchstiches in der Bauchwassersucht*, 12mo. Würzburg, 1816, 1817. *Laennec on Diseases of the Chest*, ed. 2, by *Forbes*. *Good's Study of Medicine*, vol. iv. ed. 4.

For an account of paracentesis of the bladder, refer to *Bladder*. Puncture of. Consult also *Empyema*, *Empyema*, *Pericardium*, *Pneumothorax*, and *Wounds of the Thorax*.

PARAPHYMO'SIS, or PARAPHIMOSIS (from *παρά*, back, and *φίμωσις*, to bridle.) This signifies the case in which the prepuce is drawn quite behind the glans penis, and cannot be brought forward again. See *PHYMOSIS*, with which it will be considered.

PARONY'CHIA. (from *παρά*, near, and *ὄνυξ*, the nail.) An abscess at the end of the finger, near the nail. See *WHITLOW*.

PAROTID DUCT. Every one acquainted with anatomy is aware that, behind the jaw, on each side, a large conglomerate gland is situated, the principal of such as are destined to secrete the saliva, with which the cavity of the mouth and the food which we swallow are continually moistened. The parotid duct crosses the cheek, being situated about one-third from the zygoma, and two-thirds from the basis of the jaw. After passing over the masseter muscle, it pierces the buccinator, and terminates in the mouth by a considerable orifice, opposite the space, between the second and third molar grinders of the upper jaw. As soon as it

has passed the masseter, it dives deeply into the fat of the cheek, and, as M. Louis observes, makes an angle before it opens into the mouth. (*Mém. de l'Acad. de Chir.* t. iii. p. 457.)

On account of its situation, the parotid duct is liable to be wounded, and this has even been done with the surgeon's lancet through ignorance. (See *Monro's Works*, p. 520.) In cases of this kind, the continual escape of saliva may prevent the wound from healing, and what is called a *salivary fistula* would be the perpetual consequence, if no steps were taken to afford relief. The parotid duct has sometimes been ruptured by blows. (*Œuvres Chir. de Desault*, t. ii. p. 221.) Cases also occur, in which the face becomes considerably swollen, in consequence of the saliva insinuating itself into the cellular substance, just as air does in *emphysema*. Respecting the last circumstance I shall only just mention, that mischief of this kind may always be prevented from becoming very extensive, by making a depending opening for the ready escape of the fluid.

With regard to the treatment of salivary fistulae, if the division of the parotid duct is recent, the sides of the wound should be brought into contact, and a steady pressure maintained on that part of the cheek by means of suitable compresses, and a roller. In this manner a salivary fistula may often be prevented altogether; either the divided ends of the duct reunite, and the spittle resumes its original course into the mouth; or, what is more probable, the wound in the face heals at every part, with the exception of a small fistulous track, which serves as a continuation of the duct into the cavity of the mouth. The latter kind of cure, however, can only take place when the wound extends quite through the cheek; but the chance of the two portions of the duct uniting, and becoming continuous again, should always be taken in recent cases.

When a salivary fistula is actually formed, a seton, introduced from the external fistulous orifice into the mouth, is a method which has justly received considerable approbation. Monro adopted it with success: he kept in the seton till the channel which it had formed had become fistulous, after which it was withdrawn; the external orifice, being touched with the *argemum nitratum*, healed up, and the saliva in future flowed through the artificial fistulous channel into the mouth.

Desault used to practise the seton as follows. He introduced two fingers of his left hand into the patient's mouth, and placing them between the teeth and the cheek, opposite the fistula, thus kept the integuments tense and the gums from being injured. He then introduced a small hydrocele trocar, with its cannula, just before the opening of the posterior part of the duct, and pushed it through the cheek in a direction a little inclined forward. An assistant now took hold of the cannula, while Desault withdrew the perforator, and passed through the tube a bit of thread into the cavity of the mouth. The cannula was then taken out, and a seton, which was then fastened to the end of the thread in the mouth, was drawn from within outward, but not so far as to come between the edges of the external opening, where the thread alone lodged, and this was fastened with sticking-plaster to the outside of the cheek. The outer wound was dressed with lint and compresses. Desault used to change the seton daily, introducing regularly rather a larger one, and taking especial care not to bring

it between the of the wound, which was afterwards covered with sticking-plaster. He joined the patient not to move the jaw much, and only allowed him, for some time, liquid food. In about six weeks he used to omit the seton, leaving in the thread, however, for a little while longer. This being taken away, he used to finish the cure, by touching the little aperture remaining with caustic.

For keeping the opening distended, cannulae were employed by Duphenix, who used to make a suture over them: a plan objectionable, inasmuch as it was attended with the inconvenience of a solid body left in the parts, and also that of the instrument being apt to slip into the mouth. M. Beclard cured a salivary fistula by the formation of a new passage at the inside of the cheek, by means of a leaden style, which was made to reach the excretory duct, at the point where its continuation was interrupted. The outer opening was then made a fresh bleeding wound, and united with the twisted suture. When the case will admit of the employment of the twisted suture, Beclard's plan is a good one, because the cure will be more speedily effected by it than the seton. (See *Monro's Works. Œuvres Chir. de Desault, par Bichat*, t. ii. p. 221. Also *Mém. de l'Acad. de Chir.* t. iii. J. B. Siebold, *Dis. sistens Historiam Systematis Salivaris Physiologiae et Pathologiae considerati*, fol. Jenæ, 1797. Beclard, in *Archives Gén. de Méd.* Juin, 1823.

PAROTID GLAND, EXTIRPATION OF. (See Tumours.)

PARULIS. (from *παρά*, near, and *ὄλον*, the gum.) An inflammation, boil, or abscess in the gums.

PENIS, AMPUTATION OF. No part of the penis should ever be amputated, on account of a mortification, because the dead portion will be naturally thrown off, and the ulcer heal, without the least occasion for putting the patient to any pain by the employment of the knife. Some cancerous diseases, and aneurism of the corpus cavernosum, are the cases, in which it is often really proper and necessary to amputate more or less of this organ. However, before a surgeon ventures to do the operation, he ought to be certain that it is the substance of the penis which is incurably diseased; for, as that judicious surgeon, Callisen, remarks, tumours, excrescences, ulcers, and gangrenous mischief of the prepuce, sometimes present appearances which may lead an inexperienced practitioner to fancy the whole thickness of the part affected with irremediable disorder, while the glans is actually in a sound state. Hence, whenever the least doubt exists, it is better to remove first the prepuce and skin, in order that the true condition of the glans may be detected. (*Systema Chir. Medice*, p. 446. Hafnial, 1800.)

When cancer attacks the prepuce, the swelling produced in its loose and extensible texture may be such as to push the glans far backwards, and occasion an appearance as if the body of the penis were diseased, while the disease is entirely restricted to the prepuce. M. Lisfranc, moreover, has asserted, even when cancer is situated on the body of the penis, or at its root, or even on the skin, if it commences in the skin, and that its fibrous textures constitute for a long time an impediment to its deeper extension. The practical inference, deducible from this, is, in many instances, it is only neces-

sary to remove the integuments, and the organ itself may be preserved. After dissecting away the disease seated in the integuments, M. Lisfranc carefully removes any portion of the fibrous covering of the corpora cavernosa at all changed in structure, and even cleans and scrapes the surface of the corpora cavernosa themselves. If the disease is found to reach too deeply, he resorts to amputation. (See *M. Malgaigne, Man. de Méd.* p. 625.)

Amputation may be performed in the following manner:—With a long narrow bistoury a circular incision is to be made through the skin, about a finger-breadth from the cancerous part. As Callisen observes, it is hardly ever requisite to draw the skin back, before it is cut; because after the corpora cavernosa are divided they retract so considerably, that there is always a sufficiency of the integuments. As soon, therefore, as the circular incision through the skin has been made, the corpora cavernosa and urethra are to be cut through by one stroke of the knife, on a level with the cut edges of the integuments. The generality of surgeons advise us to draw the skin towards the glans penis before we employ the knife. Sabatier was convinced of the inutility of saving any of it, and of the inconveniences which might result from its lying over and obstructing the orifice of the urethra. His mode of operating is also particularly simple, as he cuts through the integuments and penis together by one stroke of the knife, without making any preliminary circular division of the skin. (*Méd. Opératoire*, t. iii. p. 305. ed. 2.) M. Malgaigne, also remarks, that amputation of the penis differs from all others; for, instead of endeavouring to save more of the skin than of other soft parts, one object is to remove more of it than of the corpora cavernosa. (*Man. de Méd. Opér.* p. 626. ed. 2.)

The bleeding arteries are to be immediately tied; the chief or the dorsal, and one or two in each corpus cavernosum, near the septum pectiniforme. When a general oozing from the wound still continues, some recommend (*White, Hey, &c.*) applying sponge to its surface; others (*Latta*) finely-scraped agaric, with a small proportion of pounded white sugar, or gum arabic. Perhaps, however, lint dipped in cold water and supported with compresses, would be quite as effectual as any styptics, and certainly the latter applications should be avoided, if possible, because stimulating and productive of pain and inflammation. A surer and preferable method of stopping the oozing of blood, and at the same time of healing the wound, might be to bring the skin forward over the end of the stump, with two strips of sticking-plaster, after introducing a flexible gum-catheter into the continuation of the urethra, so as to keep its orifice unobstructed, and the urine from coming into contact with the wound. The gum-catheter would be better than a silver one, because productive of less irritation. It is but justice to Callisen to state, that he seems to be one of the few good surgical writers who have particularly recommended in these cases a gum-catheter, in preference to that made of silver. (*Op. cit.* p. 421.) The French method of fixing the catheter in the urethra has been described in the article *Catheter*. In one case in which Mr. Hey operated, he made a longitudinal division of the integuments, at the inferior part of the penis, so as to make them cover its extremity

without puckering, or lying over the orifice of the urethra. The corpora cavernosa, however, do not readily granulate, and unite to the skin by the first intention. (Hey, p. 452.) After the first dressings have been removed, the part may be dressed with any simple ointment, or with water dressing.

In consequence of the introduction of a cannula being neglected, Le Dran saw the orifice of the urethra close a few hours after the operation, so that the patient could not make water; and it could not be discovered without great difficulty. A lancet being introduced at the point, against which the urine seemed to be forced, a quantity of it gushed out, and, as a cannula was not at hand, a sound was introduced till one could be procured.

Mr. Pearson advises the skin not to be drawn back, because, when saved in this manner, it impedes the free exit of the urine. He also disapproves of introducing cannulae, as painful and unnecessary (*On Cancerous Complaints*, p. 103.); but Le Dran's experience, and that of several modern practitioners, will not justify the latter statement.

When the penis is amputated near the pubes, the remainder shrinks under that bone and within the integuments so far, that it is difficult to tie the arteries. In order to obviate this inconvenience, Schreger recommends the skin to be drawn forwards, and fixed with a band; then an incision to be made just deep enough to divide the dorsal arteries, which are to be tied before the knife is used again. The incision is then to be continued perpendicularly till the two arteries of the corpora cavernosa are cut. These are now to be tied. Then the corpus spongiosum and its two arteries are to be cut through, which last are to be secured. Lastly, the rest of the skin of the penis is to be divided. In this way Schreger amputated a diseased penis, of which only a part, about an inch in length, was sound.

When the stump retains a certain length, the patients afterwards make water without difficulty; but when amputation has been performed towards the pubes, the urine dribbles over the scrotum; and, in order to avoid this, the patients are obliged to squat down whenever they empty the bladder. This inconvenience may be remedied by the use of a conical ivory tube, the base of which is applied to the pubes. (See Malgaigne, *Op. cit.* p. 627.)

Sharp, Le Dran, Bertrandi, Sabatier, C. Bell and Liston's books on the operations, may be consulted. Hey's Practical Obs. in Surgery, p. 445. Pearson, *On Cancerous Complaints*, p. 103, &c. Warner's Cases in Surgery, p. 278. ed. 4. E. C. Biener, *De Exstirpatione Penis per Ligaturam*, 4to. Lips. 1816. P. Roux, *Voyage à Londres*, &c. fait en 1818. Wadd, *Cases of Dis. of the Prepuce and Scrotum*. J. H. Thaut, *Diss. de Virgine Viridis Statu Sano et Morb. ejusdem imprimis Amputatione*. B. G. Schreger's, *Chir. Versuche*; Neue Methode den Penis zu Amputiren, b. 1. p. 242. 8vo. Nurnberg, 1801. Felpaw, *Nouv. Elém. de Méd. Opér.* t. iii. p. 567. 8vo. Paris, 1832.

PENIS, CANCER OF. A wart, or a tubercle, on the prepuce, the frænum, or the glans penis, is generally the first symptom; and it often remains in a quiet state for many years. When irritated, however, it becomes painful, and enlarges, sometimes enormously, in a very short time. At the same time, ulceration, and a discharge of sanious fetid matter, take place. The disease sometimes also occasions in the urethra fistulous openings, out of which the urine escapes, and as the disease advances, the lymphatic glands in the

groin become affected. Mr. Pearson says, that "cancerous excrescences have a broad base, often more extensive than their superficies; they seem to germinate deeply from within, or rather to be a continuation of the substance of the part; and, in their progressive state, the contiguous surface has a morbid appearance." What he considers as a venereal wart, has a basis smaller than its surface: its roots have rather a superficial attachment, and the contiguous parts have a natural appearance. (P. 97.) Such are this gentleman's marks of discrimination.

Foul, spreading, sloughy ulcers of the penis, should be discriminated from cancer; and likewise from diseases produced, and kept up, by local irritation of the prepuce. (See Earle's Obs., in *Med. Chir. Trans.* vol. xii. p. 287. &c.) Almost all the cases of cancer of the penis, recorded by Mr. Hey, were attended with a congenital phymosis. The same complication also existed in another example, in which Boyer performed amputation of the penis, in La Charité, on account of a cancerous affection of the part. The examples under M. Roux, were likewise accompanied with a natural phymosis. Hence, this author considers such a state of the prepuce particularly conducive to cancer of the penis, and earnestly enjoins surgeons to recommend their patients to have the first inconvenience rectified, so that no risk of the other more serious affection may be encountered. (See *Parallèle de la Chirurgie Angloise*, &c. p. 306, 307.) In two out of three cases, which were considered to be cancerous, and for which amputation was done under my notice, phymosis did not exist; yet I believe that the statements of Hey and Roux are correct.

Mr. Travers has given an excellent description of the warty cauliflower fungus of the prepuce, within which the glans is found at first shrunk and entire; but afterwards diseased and incorporated with the fungus. He has seen in other instances the ulceration confined to the glans, and the inflamed prepuce thrown back, and discoloured from excessive distension; and, although he never met with a Jew, who was the subject of cancer of the penis, he operated on a man, who had been cut for phymosis ten years previously, in whom a pimple on the frænum ulcerated, and assumed the form of cauliflower fungus, completely environing the glans, while the latter remained sound. The pain of this disease is very acute at intervals. There is much tumefaction of the organ, and a great hardness extending along the corpora cavernosa and septum penis. The glands in the groin are as often unaffected as not. (See *Med. Chir. Trans.* vol. xvii. p. 337.) In University College is a penis taken from an old man, a patient of mine. The preparation exemplifies many of the circumstances described by Mr. Travers, especially the great induration of the corpora cavernosa, and the enlargement of the organ. "If the penis be amputated at some distance beyond the disordered part, and before the disease has long existed, the patient may escape a return of it; but, according to Mr. Travers, this is a rare instance of good fortune. Slight symptomatic enlargement of the glands should not be accounted a bar to the operation. On the other hand, the absence of all glandular affection is no security against its return, and fatal termination in three months. I hold it to be quite useless (says Mr.

Travers), to remove the prepuce alone in every case of malignant sore, or excrescence, however the glans may be free from ulceration. The warts of gonorrhoea cannot, while they retain their peculiar character, be mistaken for the cauliflower cancerous fungus, I should think, in any case; but there is an intractable fungus of the prepuce, as well as ulcer of the glans, strictly speaking, neither venereal nor cancerous, occurring in younger men, as from the age of twenty to thirty, for which, owing to the extent of the disease, and the utter irrecoverableness of the parts, amputation is advised, and commonly resorted to. The complaint, however, is so connected with, or depending upon, organic visceral disease, indicated by advanced hectic, that the life of the patient is scarcely prolonged by the operation, perhaps abridged." (*Travers, Op. cit. p. 338.*) This gentleman mentions two instances, in which he operated, and in both death speedily followed, and the lungs were found loaded with tubercles; the hectic preceding the operation having been erroneously supposed to depend upon the external disease. Mr. Travers afterwards remarks: "Wherever the disease begins in irritable pimple, whether of the glans or prepuce, and this breaks into a hard based and spreading ulcer, with a disposition to fungate, the case must be viewed with great suspicion, whether the glands in the groin be affected or not; especially if the patient be turned of fifty years. If, on the contrary, the warty excrescence of the prepuce or glans be its original character, though it may be necessary and judicious to sacrifice the latter, there is reason to hope, that the operation may be permanently effectual." This disease, after amputation of the penis, may reappear on the stump, or in the inguinal glands. (*See Travers, in Med. Chir. Trans., vol. xvii. p. 340.*)

PERINÆUM FISTULÆ OF. (*See FISTULE IN PERINÆO.*)

PERIOSTITIS. Inflammation of the periosteum. Is sometimes an idiopathic affection excited by cold, or mechanical injuries; sometimes a secondary complaint, produced by various deranged states of the general health, as by rheumatism, syphilis, and the abuse of mercury. In the idiopathic form, the treatment should be antiphlogistic, comprising bleeding, leeches, calomel, saline aperient, and diaphoretic medicines, and poultices and fomentations. In the chronic stage, blistering, and light tonic alterative medicines, are indicated. If no relief be experienced from these, mercury, or incision down to the bone has been found to answer. The treatment of periostitis occurring as a symptom of some constitutional disease, must be treated differently, according to the nature of the original complaint: calomel and opium, hydriodate of potash, with sarsaparilla, and colchicum, are remedies, whose usefulness in such cases is universally known.

PERNIO. (*from πρῖνα, or πρίμα, the heel.*) A chilblain, especially one on the heel. (*See CHILBLAIN.*)

PESSARY. (*from πῖσσω, to soften.*) The insertion of pessaries, among the old practitioners, was a keep medicinal substances applied within the vagina. They are now never made use of, except for preventing a prolapsus of the uterus or vagina, or for keeping up a vaginal hernia. (*See VAGINA.*)

M. J. Cloquet gives the particulars of a case, in which a pessary was met with in the body of an old woman, the broad lower end of which had perforated the rectum, while the upper narrower one had produced ulceration in the vaginal septum, and entered the bladder for fourths of the interior of its wider part were filled with a white crystallised concretion, strongly adherent to it, with brownish stercoraceous matter between the large crystallisations. The upper narrower end was incrustated with a concretion, of irregular shape but smooth surface, and yellowish colour, composed of uric acid. (*See Jules Cloquet, in Pathol. Chir. p. 100. 4to. Paris, 1831.*)

PHAGEDÆNA. (*from φάγω, to eat.*) An ulcer which spreads, and, as it were, eats away the flesh. Hence the epithet *phagedænic*, so common among surgeons. For an account of the *phagedæna gangrenosa*, see HOSPITAL GANGRENE.

PHARYNGOTOMUS. (*from φάρυγξ, the throat, and τομή, an incision.*) An instrument for scarifying the tonsils, and for opening abscesses about the fauces. It was invented by Petit, and is nothing more than a sort of lancet, enclosed in a sheath. By means of a spring the point is capable of darting out to a determinate extent, so as to make the necessary wound, without risk of injuring other parts.

PHLEBITIS. (*from φλέψ, a vein.*) Inflammation of a vein. See VEINS.

PHLEBOTOMY. (*from φλέψ, a vein, and τέμνω, to cut.*) The operation of opening a vein, for the purpose of taking away blood. (*See VENEFLECTION.*)

PHLEGMASIA DOLENS. A swelling of the lower extremities, the consequence of crural phlebitis. It is mostly seen in puerperal women, but sometimes in other women, who have not been pregnant; and now and then in the male sex. I have had two male patients of this kind; one of them was a soldier, in a military hospital at Cambray, during the war; the other was a man who died in the Queen's Bench Infirmary. In the *post mortem* examination, the external iliac and other veins were found completely obstructed. Dr. Davis, of University College, was the first, who proved by dissection, that phlegmasia dolens depended on inflammation of the iliac and femoral veins. (*See Med. Chir. Trans. vol. xii. 1823.*) One of his cases occurred in 1817, considerably prior to the examples recorded by M. Bouillaud in 1823. The latter states, however, that Chaussier and Muekel had related still earlier instances of phlegmasia dolens in puerperal women, where the crural veins had been found inflamed and obstructed. (*See Archiv. de Méd. t. ii. Janv. 1823.*)

PHLEGMON. (*from φλέγω, to burn.*) Healthy inflammation. (*See INFLAMMATION.*)

PHLOGOSIS. (*from φλογω, to inflame.*) Inflammation.

PHRENITIS. (*from φρένις, the diaphragm, supposed by the ancients to be the seat of the mind.*) Inflammation of the brain is a frequent consequence of injuries of the head. Its general symptoms are an increased and disordered state of the sensibility of the whole nervous system: the retina cannot bear the usual stimulus of light; the pupils are contracted; the pulse is frequent and small; the eyes are red and turgid, and the iris sometimes actually inflamed (*Wardrop, Essays on the Morbid Anat. of the Eye, vol. ii.*); the

countenance is flushed, and the patient is restless, mutters incoherently, and grows wild and delirious. The symptoms, however, are modified by the degree, extent, and stage of the disorder. Whoever wishes to have a correct conception of the subject ought to consult Abercrombie's excellent work, entitled, *Pathological and Practical Researches on Diseases of the Brain*, p. 5. 8vo. Edin. 1828.

Phrenitis is to be treated on the antiphlogistic plan. Copious bleeding, and other evacuations are highly proper. The skin ought to be kept moist with antimonials, and, after free bleeding and purging, counter-irritation should be excited on the scalp with blisters, and mercury given so as to affect the gums. (See *Head, Injuries of the*.)

PHYMA. (from *φύω*, to grow.) Tubercles comprehend eight genera; and we learn from Dr. Bateman, that, under the genus *phyma*, the late Dr. Willan intended to comprise the terminthus, the epinyctis, the furunculus, and the carbuncle. (See *Bateman's Synopsis of Cutaneous Diseases*, p. 270. ed. 3.) According to Pott, this term was formerly applied to an inflammation near the anus.

PHYMO'SIS, or rather PHYMOSIS. (from *φύμις*, a muzzle.) A case, in which the prepuce cannot be drawn back, so as to uncover the glans penis. It is of two kinds, viz. *accidental and natural or congenital*. Both the accidental phymosis, and paraphymosis, arise from a thickening of the cellular tissue of the prepuce, in consequence of an irritation, capable of producing considerable and diffused inflammation. A chancre is a frequent cause; but a mere inflammation and discharge from the glans and prepuce, and also a gonorrhoea, may bring on these affections. The inflammation often runs high, and is frequently of the erysipelatous kind. The cellular tissue being loose, the tumefaction becomes considerable; and the end of the prepuce being a depending part, the serum often lodges in it. A congenital narrowness of the aperture of the prepuce is very common, and persons so affected have a natural and constant phymosis. Such a state of parts (says Mr. Hunter) is often attended with chancres, and it produces great inconveniences during the treatment. When there is considerable diffused inflammation, a diseased phymosis, similar to the natural one, unavoidably follows; and whether diseased or natural, it may produce a paraphymosis, simply by the prepuce being brought back upon the penis. This tight part, then acting as a ligature round the body of the penis, behind the glans, retards the circulation beyond the constriction, so as to produce an oedematous inflammation on the inverted part of the prepuce.

When the prepuce is long, phymosis may also arise from the swelling of the glans penis, produced by sores on the latter part, or the irritation of a severe gonorrhoea. (*Travers, in Surgical Essays*, part i. p. 132.)

In some children, the *natural or congenital* phymosis is so considerable, that the urine cannot pass with ease; but the aperture of the prepuce generally becomes larger as they grow older, and the bad consequences, which the phymosis might have occasioned in disease, are thus avoided.

In certain individuals the prepuce sometimes contracts without any visible cause whatever, and becomes so narrow as to hinder the water from

escaping, even after it has passed out of the urethra, and, consequently the whole cavity of the prepuce becomes filled with urine, attended with great pain.

In phymosis, when the prepuce swells and becomes thickened, more and more of the skin of the penis is drawn forwards over the glans, and the latter part is at the same time pushed backwards. From such a cause, Mr. Hunter has seen the prepuce projecting more than three inches beyond the glans, with its aperture much diminished.

As Mr. Hunter notices, the prepuce often becomes in some degree inverted, by the inner skin yielding more than the outer, and the part seems to have a kind of neck, where the outer skin naturally terminates. From the tightness and distention of the parts, the prepuce now cannot be drawn back, so as to expose any sores which may be situated under it. This state is frequently productive of bad consequences, especially when chancres are situated behind the glans; for, the glans being between the orifice of the prepuce and the sores, the matter sometimes cannot get a passage forward, between the glans and prepuce, and, consequently, it accumulates behind the corona glandis, so as to form a kind of abscess, which produces ulceration on the inside of the prepuce. This abscess bursts externally, and the glans protruding through the opening, the whole prepuce is thrown towards the opposite side, and the penis seems to have two terminations. On the other hand, if the prepuce is loose and wide, and is either accustomed to be kept back in its sound state, or is pulled back to admit of the chancres being dressed, and is allowed to remain in this situation, till the above tumefaction takes place, the case is then named a *paraphymosis*. Also, when the prepuce is pulled forcibly back, after it is swelled, it is then brought from the state of a phymosis to that of a paraphymosis. The latter case is often attended with worse symptoms than the former, especially when it has originally been a phymosis. The aperture of the prepuce is naturally less elastic than any other part of it; therefore, when the prepuce is pulled back upon the body of the penis, that part grasps it more tightly than any other portion of the skin of the penis. Hence, there are two swellings of the prepuce; one close to the glans, the other behind the stricture. The constriction is often so great, as to interrupt the circulation beyond it. This increases the swelling, adds to the stricture, and often produces a mortification of the prepuce itself, by which means the whole diseased part, together with the stricture, is sometimes removed, forming a natural cure. In many cases the skin and prepuce are not the only parts affected; adhesions, and even mortification, may also take place in the glans, corpora cavernosa, &c. (See *Hunter on the Venereal Disease*, p. 221, &c.)

An accidental phymosis should always be prevented, if possible; and therefore, says Mr. Hunter, upon the least signs of a thickening of the prepuce, which is known by its being retracted with difficulty and pain, the patient should be kept quiet; if in bed, so much the better, as, in a horizontal position, the end of the penis will not be so depending. If confinement in bed cannot be complied with, the end of the penis should be kept up, though this can hardly be done when the

patient is walking about. The object of this plan is to keep the extravasated fluids from gravitating to the prepuce.

When phymosis is recent, and attended with swelling of the glans, or prepuce, from inflammation, Mr. Travers recommends injections of tepid water, or milk and water, beneath the foreskin; and the immersion of the penis, three or four times a day, in a tepid bath, keeping the end of the penis upwards; and the use of leeches; which I think with him and other writers (see *Dict. des Sciences Méd.* t. xli. p. 334.) should never be put exactly on the swelled prepuce itself. As the inflammation subsides, injections of weak goulard, or the solution of alum, or liquor calcis and calomel, may be substituted. (Travers, *Surgical Essays*, part. i. p. 138.) Instead of warm applications, some practitioners prefer cold; and it is yet an unsettled question which remedies answer best.

When the inflammation is of longer standing, the swelling compresses the urethra, and there is tendency to abscess, ulceration of the latter passage, extravasation of urine, and gangrene of the skin, Mr. Travers advises the employment of emollient poultices and fomentations (the common practice, I believe), and the introduction of a small elastic gum catheter into the bladder. "This (says he) is not a practice indicated by the degree of stricture, which is seldom considerable enough to require it; but by the approaching danger of extravasation. It should not, therefore, be taken up, unless the cellular membrane of the penis has advanced to suppuration."

As, when there are sores, they cannot be dressed in the common way, injections must frequently be thrown under the prepuce, or the operation for phymosis performed. Mr. Hunter advises mercurial injections; either crude mercury, rubbed down with a thick solution of gum arabic; or calomel with the same, and a proportion of opium; or else a solution of one grain of the bichloride of mercury in one ounce of water. He also recommends the application of emollient poultices, with laudanum in them, and to let the part, previously to the application being made, hang over the steam of hot water, with a little vinegar and spirit of wine in it.

When, in a case of phymosis, chancres bleed, Mr. Hunter recommends the oil of turpentine as the best stimulus for making the vessels contract; but, when the hemorrhage proceeds from irritation, he recommends sedatives. Whatever is used, he says, must be injected under the prepuce. Under such circumstances, it has always been a rule with me to avoid irritating applications; and on this account I have never used turpentine, particularly as any troublesome bleeding from chancres may always be effectually checked by covering the penis with linen kept wet with very cold water. When the inflammation has abated, Mr. Hunter advises moving the prepuce occasionally, so as to prevent its becoming adherent to the glans. He says, he has seen the opening of the prepuce so much contracted, from the internal ulcers healing and uniting, that there was hardly any passage for the water. If the passage in the prepuce, so contracted, be in line with the orifice of the urethra, a lancet may be used. If otherwise, the operation of taking up, or removing part of the prepuce, becomes necessary.

When matter is confined under the prepuce, Mr. Hunter recommends laying the prepuce open, from the external orifice to the bottom, where the matter lies; as in a sinus, or fistula. However, he thinks the performance of this operation for the mere purpose of applying dressings unnecessary; as the sores may be washed with injections, by means of a syringe.

I happened to serve my apprenticeship at St. Bartholomew's, at a time when the fashion of cutting every phymosis, inflamed or not, was far too common, and I had abundant opportunities of witnessing the irreparable gangrenous mischief frequently thus produced. It gives me pleasure, therefore, to find this villainous practice justly disapproved of by a surgeon of judgment and experience:—"It is not advisable (says Mr. Travers) to cut the inflamed prepuce, nor, indeed, any inflamed part. I lately saw a phymosis induced by a thickened and rigid state of the membrane of the prepuce, during the free use of mercury, constitutionally and locally, for the cure of two sores, each of the size of a split pen, situated one on each side of the anterior fold of the prepuce. It was the opinion of an eminent surgeon, that those sores, which were thoroughly intractable, would not heal unless the prepuce was freely divided; and, impressed with the same idea, after poulticing for some days, I slit it up. The sores immediately healed; but the wound as quickly assumed the same indolent and intractable character which had belonged to the sores, and was so slow in healing, that it seemed to be only a transfer of the disease from one part to another." (P. 139.) I have not only witnessed the same fact, in several cases under the late Mr. Ramsden, and in St. Bartholomew's Hospital, but have seen mortification brought on by the still more rash practice of cutting the prepuce, either when the part was in a state of acute inflammation, or there were ulcers within it, when the constitution was in a reduced and very disordered state from the injudicious and immoderate use of mercury.

The common operation, for the cure of phymosis, consists in slitting open the prepuce, nearly its whole length, in the direction of the penis. This plan is certainly the most eligible, when the matter of a chancre cannot escape from under the prepuce; because circumcision, which many surgeons, since Mr. Hunter's time, have preferred, would not suffice for giving vent to the accumulated pus. In many cases of phymosis, says Mr. Hunter, an operation is improper; for, while the inflammation is very considerable, such a measure might bring on mortification. He acknowledges, however, that there are cases, in which a freedom given to the parts would prevent the latter event. When matter is confined under the prepuce, he deems an opening indispensable; and, if the patient should object to the common operation, he advises an opening to be made with a lancet directly through the prepuce, or else with caustic. (See *Hunter on the Venereal Disease*, p. 232. et seq.)

When the prepuce is to be slit open, a director is first to be introduced under it, and the division is then to be made with a curved pointed bistoury, from within upward. This, after having been introduced along the groove, as far back as the corona glandis, with its edge turned upwards, is

then pushed through the prepuce over the corona, and the division is completed by the surgeon cutting forwards. After this, some surgeons apply a suture on each side for the purpose of preventing the skin and lining of the prepuce from becoming separated; while others dispense with sutures altogether. As the skin is usually divided further than the mucous membrane, which is apt to form a small *cul de sac* beyond the incision, it should be divided with scissors. If the frænum reach over the orifice of the urethra, it also should be divided.

Many surgeons object to this operation, because the prepuce continues afterwards in a very deformed state; and they perform circumcision, or amputation of the prepuce, in the following manner:—The prepuce is first taken hold of with a pair of forceps, as much of the part being left out, as is judged necessary to be removed. The removal is then accomplished by one sweep of the knife, which, directed by the blades of the forceps, is sure of making the incision in a straight and regular manner. A fine suture is next passed through the edges of the inner and outer portions of the skin of the prepuce so as to keep them together. The only necessary dressings are lint, and over it an emollient poultice.

A few years ago, Dr. Ryan mentioned to me a new plan of operating on phymosis, which is less severe than the common ones, attended with no mutilation. It consists in drawing back, as far as practicable, the external skin of the prepuce, and then insinuating a director, with an open termination, under its internal duplicature, and dividing it with a curved bistoury. In some cases, I have no doubt, that this method would completely answer, and enable the surgeon to throw a lotion under the prepuce, and even to uncover the glans sufficiently to bring a chancre into view. The method of M. J. Cloquet also merits notice: it consists in slitting the lower portion of the prepuce upon a director, in a line parallel with the frænum. When this latter part is very short, it is to be divided with the scissors. The longitudinal wound, thus made, becomes transverse, when the prepuce is drawn back; and scarcely any deformity is the consequence. This method, which is advocated by Mr. Wallace of Dublin, is sometimes practised in University College Hospital. In performing this operation, great care is to be taken not to let the director enter the urethra, instead of passing the side of the frænum; a serious mistake, which is alleged to have really happened. (See *Liston on Pract. Surgery*, p. 479.)

With the view of preventing the deformity resulting from the angles of the wound, occasioned by slitting up the superior portion of the prepuce longitudinally, M. Lisfranc has recommended the mere excision of a semicircular slice from the anterior and dorsal part of it, by means of a pair of laterally curved scissors; and of repeating this proceeding, if the first excision should prove insufficient. M. Velpeau approves of this plan when the prepuce is long, and the phymosis is slight; but, under other circumstances, when a loss of substance is desirable, he prefers the removal of a triangular piece of the prepuce. This practice he deems, indeed, positively necessary in operating upon a phymosis attended with chronic induration, as he once did at the hospital St. An-

toine, in which example the whole of the lining of the prepuce was transformed into a fibro-cartilaginous sac. (See *Nouv. Élém. de Méd. Op.* t. iii. p. 657.)

At the period when I first entered the profession, it was the custom to salivate every patient who happened to have a phymosis. However, now that the fact of any irritation about the prepuce and glans penis, even that of common warts, being capable of producing the complaint is well known, such absurd practice has been relinquished, and the cause and condition of the disease are always considered previously to the determination for any particular method of treatment. Nay, even when phymosis does arise from chancres, if there be a great deal of inflammation, the use of mercury may rather do harm than good, and the practitioner should not be precipitate in its administration. On this point, I fully coincide with Mr. Travers:—"Upon many occasions, (says he) practitioners are too anxious to contend with the specific character of the venereal disease, to the neglect of the inflammatory state of the affected parts exhibited during its height. The abuse of administering mercury for an acute gonorrhœa, and recent sores, accompanied by phymosis, or an approach to that state, is of common occurrence; and it is far from being recognised by the profession, as an established rule of practice, that its constitutional administration is inadmissible during the existence of active inflammation, in cellular textures." (*Surgical Essays*, part i. p. 131.)

In nine cases out of twelve, in which the experienced Mr. Hey had occasion to amputate the penis for cancerous disease, the patients were also affected with a natural phymosis. (*Pract. Obs. in Surgery*.) M. Roux has noticed the same thing in three similar examples; and, as he conceives that phymosis may be conducive to carcinoma of the penis, he thinks, that it should always be remedied in time. (*Parallèle de la Chir. Angloise*, p. 306. Also *Travers*, in *Med. Chir. Trans.* vol. xvii.)

TREATMENT OF PARAPHYMOSIS.

The removal of the stricture in this case should always be effected, because its continuation is apt to produce a mortification in the parts, between the stricture and the glans. It may be done in two ways; either by compressing with the fingers all the blood out of the swelled glans so as to render this part sufficiently small to allow the constricting prepuce to be brought forward over it, with the aid of the two fingers; or by dividing the stricture with a knife. In a former edition of this work, as Mr. Dunn of Scarborough has reminded me, the power of cold applications, in promoting the reduction of the glans, should have been mentioned. This method should always be put in practice, before the reduction by compression is attempted, as a preliminary measure, which sometimes succeeds of itself, and renders unnecessary any painful handling of the parts. From the great success which I have seen attend the first mode, I should not conceive the second one to be so frequently necessary, as Mr. Hunter seems to lay down. This operation is always troublesome to accomplish, because the swelling, on each side of the stricture, covers or closes the tight part, which cannot be got at

without difficulty. The directions given by Mr. Hunter for its performance are the best: he advises the surgeon to separate the two swellings as much as possible, where he means to cut, so as to expose the constricted part; then to take a curved and sharp pointed bistoury, and to pass it under the constriction, and divide it. None of the swollen skin on each side should be cut. The prepuce may now be brought forward, unless it be thought more convenient, for the purpose of dressing the chancres, to let it remain in its present situation. (See *Hunter on the Venereal Disease*, p. 238, 239.) In recent cases, the reduction is then easily accomplished; in others, it will follow gradually under the use of cold or warm applications and antiphlogistic treatment; but, as the stricture has ceased, the dangers from that cause are obviated.

The original disease producing phymosis and paraphymosis must always be attended to, and the employment of mercury must be necessary or unnecessary, according to the nature of the affection, of which these are only effects.

One of the most interesting of the old writers on Phymosis and Paraphymosis, is *J. L. Petit*, *Traité des Mal. Chir. t. ii.* Consult also *J. Hunter*, *On the Venereal Disease*. *Sabatier*, *Médecine Opératoire*, t. iii. 8vo. Paris, 1810. *Travers*, in *Surgical Essays*, part 1. 8vo. Lond. 1818. There is a valuable chapter on this subject in *Richter's Anfangsgr. der Wundarzn.* b. vi. Also, *R. Liston*, *On Practical Surgery*, p. 477. 8vo. Lond. 1837.

PILES. HEMORRHOIDS. (From *αἷμα*, blood, and *πίω*, to flow.)

The lower end of the rectum is frequently the seat of tumours, which in many persons bleed from time to time, and hence are called *hemorrhoids*, or, in common language, *piles*. Such as had not this hemorrhagic character, were termed by the old surgeons *blind piles*; while those which bled were named *open*. More important practical distinctions are those of *external* and *internal* piles.

With respect to the nature of these swellings various opinions have been entertained. Some writers express their belief, that the blood discharged from them comes neither from arteries, nor veins, but from the intermediate capillary vessels. (*Montegre*.) Laennec and Abernethy espouse the doctrine, that piles are the result of the formation of new vessels. Duncan, Le Dran, Recamier, and Delaroque, represent them as composed of cysts, in which the arterial blood is effused. Lastly, Stahl, Alberti, Vesalius, Morgagni, J. L. Petit, and Pinel, regard them as dilated veins, true *varices*, and such was the opinion of Dupuytren. (See *Léon's Orales de Clinique Chir.* t. i. p. 340.)

The latter is the view most commonly entertained. Thus, Sir Benjamin Brodie observes:—"A patient consults you, complaining of swelling, pain, and tenderness, in the neighbourhood of the anus. You examine the part, and find on its verge a number of tumours, about the size of the end of the thumb, or finger, with broad bases, not very distinct from, but running one into the other, covered by the common integuments, and of a more or less purple appearance." If you cut into one of these tumours, there is immediately a flow of venous blood, followed by a small quantity of arterial blood; such as might arise from a cut anywhere else. On making a section of the tumour, it presents to the eye the appearance of dilated and tortuous veins. In fact, you cannot doubt, that they are dilated veins; they are exactly like

varicose veins of the leg. The tumours, which I have described, are situated below the sphincter muscle, and we call them *external piles*.

"Another patient consults you, complaining also of a swelling at the anus, accompanied by pain and tenderness. You examine the part, and find a number of tumours of a different kind. These, too, have broad bases, and run one into the other, forming a circle, which projects below the anus. They are covered, not by the common integument, but by the mucous membrane of the rectum, protruded from above the sphincter muscle. On making a section of one of these tumours, there immediately flows venous blood, and arterial blood may flow afterwards. On looking at the divided surface, it is evident that the tumour was composed of a large tortuous vein. It is the accidental enlargement of these tumours, which causes them to protrude externally; but, they are formed above the sphincter muscle, and we call them *internal piles*, or *hemorrhoids*." (See *Lond. Med. Gaz.* vol. xv. p. 742.)

Sir Benjamin Brodie afterwards explains, that the ultimate changes, which take place in cases of piles, are exactly similar to those, which occur in connexion with varicose veins of the leg. At first, these vessels are simply varicose, or dilated; at last, they become inflamed; lymph is deposited in the cellular tissue surrounding them; and at length there is a great mass of induration, in which the diseased blood-vessels are imbedded. So it is with the veins of the anus. At first, they become simply dilated; repeated attacks of inflammation cause an effusion of lymph into the adjacent cellular texture; and then the pile appears like a solid tumour; in the centre of which, however, the dilated vein, in which the disease originated, is still found.

Such is doubtless the structure of piles in ordinary cases. Dr. Carswell has given a correct representation of the morbid anatomy of the parts in this disease, of which he notices two species. The more common one (he says) depends on dilatation of the veins of the rectum; the other, on a transformation of the dense cellular tissue of the margin of the anus into erectile tissue. (See *Illustrations of the Elementary Forms of Diseased Fasciculus*, p. 7.)

M. Andral also joins in considering the generality of piles as varicose veins (*Précis d'Anat. Pathol.* t. ii. p. 402.), and liable also to the several modifications, exemplified in the latter disease. (See **VEINS**.)

The blood sometimes coagulates in the dilated vein, and the swelling becomes hard, inflamed, and very painful. The coagulum is subsequently absorbed, but the thickened coats of the vein, and the surrounding parts form a tumor, which is liable to inflame, and afford great distress. (*Hodgson*, on *Dis. of Arteries*, &c. p. 566.) This observation agrees with the statement of Sir E. Home, that in cases of long standing the contents of hemorrhoidal tumours "coagulate and become solid; their coats increase in thickness, and they resemble pendulous excrescent tumors in other situations in the body." (*On Ulcers* &c.) The transformation which the dilated veins undergo, and the disease of the contiguous cellular tissue, have no doubt been the cause of the erroneous ideas, which have been taken up, respecting the nature of piles. Thus Mr. Kirby, after having examined them by dissection,

observes:—"I cannot say that they seemed to be formed of a varicose distention of the great hemorrhoidal vein, even in a single instance. In every case of external hemorrhoids, the tumour appeared to be composed of a prolongation of the cellular substance in a state of unusual firmness, surrounded by some veins, and covered by the integuments. The veins were branches of the internal iliac. In every case of internal hemorrhoid, the structure was pretty similar; the veins, however, seemed enlarged, and were branches of the hemorrhoidal." (*On Hemorrhoidal Excrecence*, p. 40.)

The opinion, that piles are formed of cells filled with blood, is adopted by Dr. Ribes. The distention of the hemorrhoidal veins with blood, he observes, gives rise to varices; but, if any of their blood is extravasated in the cellular membrane, at the inferior and internal part of the anus, hemorrhoids are the result. If the inferior mesenteric vein be dissected in hemorrhoidal patients, the ramifications of the vessel are seen terminating in these cysts of blood, and, on completely removing the whole, the hemorrhoids appear suspended from the branches of the vein, as grapes from the vine. (See *Révue Méd.* t. i. 8vo. 1820.) Mr. Syme divides hemorrhoids, or the tumours which grow at the verge of the anus, into three kinds:—1. Those which depend on enlargement of the veins at the extremity of the rectum. 2. External hemorrhoids formed by enlargement of the thin skin and subjacent cellular texture at the verge of the anus. 3. Those which consist of a vascular development of the mucous membrane, constituting tumours much disposed to bleed, when protruded from the anus. Of this character appear to Mr. Syme to be those named internal hemorrhoids. But though vascular swellings do sometimes grow from within the rectum, and tumours of erectile tissue, constituting a certain form of hemorrhoidal excrecence, are sometimes produced below the sphincter, I believe, with Sir Benjamin Brodie, that internal, as well as external, piles are mostly, in their original form, dilated veins.

When piles consist of distinct cysts or sacs of blood, they are originally varicose enlargements of the branches of the hemorrhoidal veins. Were this not the fact, how could cases like the following ever take place? "One of my patients (says M. Delatour) had several of these tumours, of very large size, and, at every contraction of the sphincter ani, the blood issued from them *per saltum*." (*Hist. Phil. Obs.* 212.) Montegre has likewise seen two instances, in which the blood spouted out of the tumours in a continued stream. (*Dict. des Sciences Méd.* t. xx. p. 453.) And Richerand mentions a merchant who lived to the age of eighty-nine, quite free from infirmity, and whose good health was ascribed to periodical bleedings from piles, during fifty years of his life; the evacuation being very regular, and so profuse, that the blood was thrown some distance, as from a vein opened in phlebotomy. (See *Nosogr. Chir.*) If many piles were not either varices, or cysts in direct communication with the large veins of the rectum, Petit would not have succeeded in taking blood from them by puncture, as he often did, in lieu of the ordinary mode of venesection. (*Mal. Chir.* t. ii. p. 134.) The colour of the blood, when voided by puncture, as described by Sir B. Brodie, is a proof of common piles being dilated veins.

Hemorrhoids vary in number, size, form, and

situation: some being *external*; others, *internal*; and some hardly larger than a pea, while others exceed a hen's egg in size. Though piles are divided into *external* and *internal*, the same veins are affected in both cases. "The veins run on the inside of the sphincter muscle; and, where the muscle compresses them, there can be no dilatation of them; but, above and below the muscle, the veins become dilated." (*Sir Benjamin Brodie*.) Sometimes they bring on serious complaints, either by bursting and discharging blood so profusely as dangerously to reduce the patient; or by exciting inflammation of the adjacent parts, and causing abscesses and fistulæ; or, lastly, by becoming strangulated by the contraction of the sphincter ani, so as to occasion great agony. Piles, which bleed but little, and remain in a quiet state, are not of much consequence; but those which bleed profusely, cause violent pain, or which induce inflammation, and all its effects, demand the greatest attention. Lieutaud mentions a person, who lost three quarts of blood from some piles in the course of a couple of days; and both Arius, and the celebrated philosopher Copernicus, thus bled to death.

I do not know what credit ought to be given to the extraordinary case cited by Panaroli, in which a Spanish nobleman voided every day, for four years, a pint of blood from some hemorrhoids, and yet enjoyed perfect health! (See *Obs. Chir. pentec.* ii. obs. 46.) For other curious facts of this nature, see *Dict. des Sciences Méd.* t. xx. p. 458.

The symptoms produced by piles differ according to the external or internal situation of the swellings; and also, as Sir Benjamin Brodie correctly observes, according to the stage of the disease:—"At first, while the tumours are small, the patient complains of a sense of heat and itching about the anus; and, every now and then, when he is costive, the external piles become a little swollen and tender. The internal piles become swollen also, so as to fill up the cavity of the gut, thus exciting a sensation as though a stick, or some other foreign body, were lodged in it. The external piles sometimes inflame, swell, and become tender, so that the patient can scarcely bear them to be touched, and cannot walk without difficulty. They may continue thus inflamed for some considerable time, and then the inflammation may subside. The piles generally, but not always, returning to the condition in which they were before the attack of inflammation came on.

"Sometimes an abscess forms in one of these external piles, and bursts externally. The abscess may be troublesome to heal; but, when it is healed, it is found that the cavity of the vein is obliterated, and that it is, in fact, cured. Such an abscess is essentially different from a fistula in ano. Sometimes, when an external pile is inflamed, the blood in it becomes coagulated, and it is then hard to the touch. If, under these circumstances, you slit open the pile with a lancet, there comes out a mass of hard coagulum, perhaps as large as a pea, or a horsebean: the cavity inflames, suppurates, and granulates. The same thing happens as though suppuration had taken place in the first instance, and the pile is obliterated. But, if you do not slit open the pile, and leave the disease to take its own course, the cavity being blocked up by the coagulum, the

vein becomes obliterated; after which the coagulum is gradually absorbed, and the pile is cured; that which was a pile before being now converted into a flap of skin. Just the same circumstance happens with varicose veins of the leg, where sometimes there is a natural cure, in consequence of the coagulation of the blood in the dilated vessels. Sometimes, when a pile is thus distended with coagulated blood, the skin becomes so much attenuated, that it gives way in some one point, and the blood being gradually squeezed out, suppuration probably takes place; and the case proceeds just the same as if you had opened the pile with a lancet." (Sir B. Brodie.) The folds of skin, the remains of former piles, are at first large, loose, and pendulous, but may afterwards diminish so as to give no inconvenience.

Internal piles sometimes protrude through the anus, forming a tumour covered by the mucous membrane. If of considerable size, they always protrude when the patient goes to the water-closet, and afterwards recede again of themselves. If their size be yet more considerable, they descend at other periods, and especially when the patient is walking, so that he cannot well take any exercise. Sometimes, one small internal pile is seen permanently protruded, forming a red vascular tumour; this is painful, and keeps up a great and constant discharge of mucus. Sometimes large internal piles protrude for several days, then gradually diminish, and return within the sphincter. Whenever the protrusion happens, there is an abundant secretion of mucus from the rectum.

Internal piles sometimes occasion frequent desire to make water; or, by bringing on spasm of the muscles which surround the membranous part of the urethra, they may cause complete retention of urine. They are also liable to discharge a great quantity of blood, which, according to Sir Benjamin Brodie, is not venous, but arterial. "Piles (he says) do not bleed in the early, but in the advanced stage of the disease, when there is an increased determination of blood, not only to the veins, but to the mucous membrane, and cellular texture, by which they are surrounded."

In general, piles situated in the rectum are less painful than when lower down, and sometimes the patient is not conscious of having them till he begins to void blood from the rectum. In the former case, the veins or tumours are surrounded by soft and yielding substances, which do not make any painful pressure on them; but, when they are situated towards the anus, they are liable to suffer painful constriction from the action of the sphincter muscle. Mr. Heaviside met with two examples, where hemorrhoidal swellings were attacked with inflammation, and so violently strangled by the spasmodic action of the sphincter ani, that the parts underwent a spontaneous mortification, and a radical cure was the result. (*J. Houshiep, On Dis. of the Lower Intestines, &c.* p. 210. ed. 3.) Sir Benjamin Brodie has known several cases cured in this manner; and observes, that there is little or no danger in the process. Amongst the patients of the Bloomsbury Dispensary, I have noticed similar occurrences: one of these was a man who suffered from internal piles, which, in its inflamed and protruded state, aggrivated. The strangulation of it produced, followed by immediate relief, by cure.

With regard to the cause of hemorrhoids, anything capable of retarding the return of blood through the inferior mesenteric and hemorrhoidal veins, may occasion the disease. The pressure of the gravid uterus, costiveness, and the retention of hardened feces in the colon and rectum, are very frequent causes: obstinate constipation, indeed, is the most common of all the causes, for "when the colon becomes loaded, and especially the sigmoid flexure, with hardened feces, there is a pressure on the trunk of the inferior mesenteric vein, which interrupts, in some degree, the return of blood from its branches." (Brodie.) Persons who lead sedentary lives are often troubled with the complaint. In reflecting on the various circumstances here adverted to, it is readily conceivable, why women are more subject to piles than men. The pressure of serous fluid, accumulated in the cavity of the peritoneum, may occasion piles. Individuals, whose livers are diseased, are often troubled with piles, because certain morbid changes in the liver may prevent the free return of blood from the abdominal viscera through the vena portæ; but, as Sir Benjamin Brodie has very truly observed, a great many persons have piles, who have not diseased livers; and it may be added, that many individuals who have diseased livers, have not piles. Another fact, well known to all experienced surgeons, is, that piles are more frequent in the upper classes of society, than in the lower. "The reason of this difference is to be found in the different mode of life in the various classes of society. The better classes take but little exercise, and they are more liable to constipated bowels, than the lower classes, who take much exercise, and live a great deal in the open air." (Sir B. Brodie, *Op. et vol. cit.* p. 743.)

Some persons suffer from the complaint at puberty; but it seldom proves troublesome until the frame is fully developed, and is generally most distressing from the age of twenty to fifty. (*Syme, On Dis. of the Rectum*, p. 49.) Gluttony and hard drinking, by bringing on plethora, and deranging the functions of the chylopoietic organs, often seem to act as exciting causes.

When piles are produced by the pressure of the gravid uterus, no cure can be expected till after delivery, one generally then following spontaneously. Women, however, who have borne many children, are liable to piles ever afterwards; the veins, which have been repeatedly kept in a state of dilatation, not returning afterwards to their proper size; also, when piles are an effect of dropsy, they cannot get well before the pressure of the fluid in the abdomen has been removed by tapping.

When piles are in their early stage, and the patient has merely a slight protrusion, or none at all, but is complaining of heat and itching about the anus, the bowels are to be kept gently open. The best medicine for this purpose seems to Sir Benjamin Brodie to be an ounce and a half of confectio sennæ, half an ounce of sulphur præcipitatum, and a sufficient quantity of mel rosæ, to make an electuary, a teaspoonful, or any requis to quantity, of which is to be taken every evening. The patient should also avoid taking wine freely, and all sedentary habits. If this plan should not afford relief, Sir B. Brodie recommends the injection of half a pint of cold pump water, as a lavement, every morning after breakfast. In some cases, the injection may be rendered astringent with

flüm, or the tinct. ferri muriatis, or cold lime-water may be used. In certain instances, the confectio piperis comp., which resembles Ward's Paste, proves beneficial, the dose being a piece of about the size of a nutmeg, three times a day. According to the observations of Sir Benjamin Brodie, this substance passes into the large intestines, and gets into contact with the piles, acting directly upon them. As it is apt to accumulate in the bowels, its employment should always be accompanied by the occasional exhibition of some mild aperient. Cubebs pepper, he believes, acts in the same way as Ward's Paste. In some cases, where there is a great deal of irritation, the patient will derive benefit from taking, thrice a day, 3 ss of balsam of copaiva, and 15 drops of liquor potassæ, rubbed down with two or three drachms of mucilage and cinnamon water. (*Brodie, Op. et vol. cit. p. 747.*)

Gentle laxative medicines, and an horizontal position of the body, commonly alleviate the uneasiness resulting from hemorrhoids. The application of an ointment, composed of equal parts of the powder of oak-galls, and of elder-ointment, or hog's lard, contribute to the same beneficial effect. The application of warm water by means of a bidet, or semicupium, is also frequently productive of great ease. When piles are constricted by the sphincter ani muscle, the pain may often be at once removed, by pushing the swellings into the rectum, and using fomentations, or even the warm bath. When the disease is in a state of inflammation, leeches applied to the vicinity of the anus, and puncturing the dilated hemorrhoidal vessels with a lancet, for the purpose of taking away blood, and the application of cold lotions, are measures occasionally employed to procure ease. The usefulness of leeches was particularly noticed by Schmucker. (*Vermischte Chir. Schriften, b. i. p. 107.*) Petit prefers the lancet; Sir Benjamin Brodie, acupuncture, and cooling lotions.

According to Mr. Howship, when there is "frequent hemorrhage from the veins within the sphincter, with perhaps little or no external tumour, one of the best means of relief is the metallic bougie, regulated by the patient's feelings, and also by the promptitude with which inflammation and consolidation take place." (*On Dis. of the Lower Intestines, &c. p. 215. ed. 3.*) Of the merits of this practice I cannot speak from experience.

When the number and size of hemorrhoids are so considerable, as materially to obstruct the discharge of the feces; when they are severely painful, and subject to profuse bleedings; when the patient is disabled from following his usual occupations; and when the above means afford insufficient relief, the surgeon should recommend their removal.

The extirpation of piles with the actual cautery and caustics, as practised by the old surgeons, is now altogether relinquished. The only plan ever followed, in the present state of surgery, is either to cut the tumours off with a pair of scissors or knife, or to apply a tight ligature round their base, so as to cause them to slough away. If possible, the opportunity of doing either of these operations should always be taken when the disease is in a tolerably quiet state.

As I have explained (see ANUS, PROLAPUS &c.); the late Mr. Hey used to remove extensive

folds, about the verge of the anus, with great success. J. L. Petit followed the same practice, (*Mal. Chir. t. ii. p. 134.*); and, more recently, Mr. Kirby. (*Obs. on the Hemorrhoidal Excrescence, Lond. 1817.*)

It is observed by Sir Benjamin Brodie, that the rule respecting the kind of operation was correctly settled by Sir Everard Home (*On Ulcers of the Legs, &c.*): external piles, which are covered by the skin, ought not to be removed by ligature, but by excision. On the other hand, internal piles, which are covered by the mucous membrane, ought, for the most part, to be removed by ligature. "The grounds of this distinction are as follow: the application of a ligature to external piles gives the patient extraordinary pain at the time, and afterwards excites much inflammation, swelling, and disturbance of the general system; whereas, if they be removed by excision, these ill consequences are avoided. After the excision of external piles, there can be no danger of hemorrhage, because the parts are entirely within your reach, so that the bleeding vessels can be easily secured; and though some little inflammation may supervene on the operation, yet it is not of any real consequence. If, however, you remove large internal piles by excision, there may be copious and even dangerous hemorrhage, since the parts which bleed are out of reach, above the sphincter muscle, where you cannot expose the cut surface so as to be enabled to take up the bleeding vessel. On the other hand, the application of a ligature to internal piles in general causes but little pain, and only a slight degree of inflammation follows: for the mucous membrane has nothing like the sensibility of the skin." (*See Brodie, in Lond. Med. Gaz. vol. xv. p. 843.*)

The excision of internal piles is liable to be followed by dangerous bleeding. Encouraged by the advice of Mr. Cline, Sir B. Brodie formerly tried the practice of removing internal piles by excision. In the first case or two, he found no inconvenience follow; but a case soon occurred, in which the patient lost a great deal of blood; in another case, the hemorrhage was so great, that the patient nearly died; and a third case occurred, in which also the patient lost an enormous quantity of blood, so that Sir B. Brodie now only wonders that death was not the result. Sir Astley Cooper has related the case of a Scottish nobleman, who perished in this way. On one occasion, Mr. Syme cut away an internal hemorrhoid, which was partially protruded, and manual pressure was required to be kept up for several hours before the bleeding ceased. (*On Dis. of the Rectum, p. 73.*) Petit had a patient with hemorrhoids, which were supposed to be external, but were internal ones temporarily protruded. Almost immediately after they had been cut off, they were drawn inward. An internal hemorrhage ensued, which could not be suppressed, and proved fatal in less than five hours. The rectum and colon were found full of black coagulated blood. Sir E. Home refers also to some instances, within his knowledge, where, after the removal of internal piles with the knife, the bleeding endangered life. (*On Ulcers, p. 365.*)

When external piles are accompanied by internal ones, the removal of the former is seldom necessary, as the cure of the latter usually brings about the cure of the others. The following are the circumstances, under which the removal of external

piles is proper. Where they are enlarged and inflamed, and much time will be required to subdue the inflammation, during all which period the patient will be experiencing pain. Here, as Sir B. Brodie observes, two, or three snips of the curved knife-scissors will give him immediate relief. Or, if an abscess has formed, which bursts, discharges, and closes at its orifice, and then bursts and discharges again, it may be expedient to cut off the pile and abscess with it. The excision of external piles may be readily accomplished either with the curved knife-scissors, or a common bistoury, the swellings being first taken hold of with a double tenaculum.

Sir B. Brodie lays it down as a general maxim, that internal piles should be mostly extirpated with the ligature. If they are small, however, he admits that it is not necessary to tie them; and they may be cut away with perfect safety. If a pile, not larger than the end of the little finger, protrude, or lodge in the orifice of the anus, covered by mucous membrane, the surgeon may take hold of it with a double tenaculum and apply the scissors to the base, and no inconvenience will follow the operation. But, whenever there are large internal piles, Sir Benjamin Brodie deems the removal of them by ligature the only safe plan.

In order to prepare the patient for the application of ligatures to internal piles, he should be directed to take a dose of castor oil, or rhubarb, the day before the operation, so that the bowels may be first emptied, and no necessity occur for disturbing them again for two or three days afterwards.

Another requisite measure is that of bringing the descent of the piles. For this purpose, the patient is to sit over a pan of hot water, which will relax the sphincter muscle, and at the same time, cause the veins of the rectum to be filled with blood. If this be not sufficient, Sir B. Brodie directs a pint or two of warm water to be thrown into the rectum, as an enema, and when this comes away, the piles will probably descend. Then the patient may incline over a table, or lie on one side in bed, with his knees drawn up, and the nates held apart by an assistant. Each pile must be separately tied. If it be of small size, it may be raised with a double tenaculum, and a ligature at once placed round its base. But if the piles are of more considerable size, a large curved needle, armed with a strong double ligature, is to be introduced through the base of each of them. The needle is then cut off, and the double ligature thus converted into two single ones, which are to be tied round the base of the pile; one on one side, and the other on the other, with a single knot. When each pile has been thus secured, Sir Benjamin Brodie cuts off the convex portion of each pile, and by thus discharging the blood confined in it, is enabled to tighten each ligature in a still greater degree. In fact, the ligature should be drawn as tight as possible; for, then the subsequent pain will be less, and the separation of the slough quicker. A double knot having been made on each ligature, the threads are to be cut off close to the knot, and the piles and the remains of the ligatures returned into the rectum.

In about a week, the ligatures are generally detached; and, at this period, the bowels should be kept gently open with lenitive electuary and sulphur, and cold water be thrown up the rectum

every morning, in order to prevent a recurrence of the disease. (*Brodie, ib.*)

The removal of internal piles with ligatures is, generally, a safe proceeding. Untoward cases will, however, sometimes happen. Petit frequently practised this method, without any ill effects. In other instances, the consequences were bad. A woman, in whom he had tied three hemorrhoids with narrow pedicles, did not at first complain of much pain; but, in five hours, she was attacked with violent sufferings, like those of colic, extending along the colon. She was bled four times without material relief. At last, Petit cut the ligatures, which could not be otherwise loosened. The pain then soon subsided. The ligatures had only been applied twenty-four hours; but the piles had become black, and they were then cut off without any effusion of blood.

Petit also relates a case, in which a patient, after having had some piles tied, died of symptoms resembling those of strangulated hernia, and this notwithstanding the prompt removal of the ligatures.

Mr. Kirby mentions two cases, where bad and fatal effects followed the operation of tying piles: in one, the patient's life was saved with great difficulty; and, in the other, tetanus and death were the consequences. (*On Hemorrhoidal Excrescence*, pp. 1st-3, 8vo. Lond. 1817.) I have known patients attacked after the operation with frequent vomiting, and pain and difficulty in passing the urine. "Difficulty in making water, sometimes amounting to complete retention, and requiring the catheter to be introduced (according to the observation of Mr. Syme), very frequently occurs, but seldom continues beyond the first twenty-four hours. In two cases, I have found it last for nearly a fortnight." (*See Syme, On Dis. of the Rectum*, p. 85.)

With the exception of two instances, Sir B. Brodie never knew any ill consequences arise from tying piles. He saw one patient, who died after the operation, in consequence of diffuse inflammation of the cellular tissue running up on the outside of the gut, as high as the mesentery; but, it was in a constitution, broken down by long continued hemorrhage; and in whom any slight accident might have produced equally bad consequences. He saw another patient, who, a week after the operation, and, after having been quite well in the interval, had an attack of pain in the abdomen, and shivering, attended with fever, and who died. An examination of the body not having been allowed, the precise cause of death was not ascertained.

The following is the treatment, recommended by Mr. Syme for the alleviation of some of the unpleasant consequences occasionally following the operation:—"An opiate, containing thirty or forty drops of the solution of muriate of morphia, should be administered to the patient, if he complains of pain, and be repeated from time to time, if it continues severe; or a somewhat larger dose may be injected into the rectum with a teaspoonful or two of warm water. Fomentations may be at the same time applied to the anus. And if, notwithstanding these means, much suffering is still experienced, the hip-bath of poppy-head decoction should be employed. The retention of urine, if slight, may be relieved by giving the spir. ætheris nitrici, or the camphor mixture; and, if more obstinate, will require the catheter to be

introduced occasionally as long as it lasts. The patient should restrict himself to the antiphlogistic regimen, and drink freely of simple diluents, such as barley water, or linseed tea. He should also confine himself to the horizontal posture, until the ligatures separate." (*Op. cit.* p. 86.)

Notwithstanding the risk of hemorrhage from the excision of internal piles is recognised by some of the best surgeons in France, this seems to be their usual practice, the bleeding being afterwards suppressed by distending the rectum with a mass of charpie, to which a ligature is attached, as recommended by Boyer; or by long continued pressure on the bleeding point by the finger of an assistant, or by the introduction of M. Bermond's cannula, which at once regulates the pressure on the bleeding vessels, and, when its central tube is taken out, enables the surgeon to ascertain whether effusion of blood is going on within the bowel. With it, also, the patient is able to empty the rectum as often as nature requires. (See *Velpeau, Nouv. Elém. de Méd. Opér.* t. iii. p. 995.)

Dupuytren preferred excision:—"My maxim (he observes) is only to cut off the part of the tumour projecting externally; because, if the whole of it were removed, there would be a risk of dangerous bleeding, and a subsequent contraction of the anus. In this proceeding, it seems as if a very considerable mass were left at the margin of the anus, and not enough of the tumour cut off; but, as the part heals, every thing becomes right, and the anus recovers its proper condition." He afterwards states, that whenever he removes internal piles, which he accomplishes with scissors curved laterally, after the tumours have protruded and been taken hold of, he leaves with the patient an assistant, who is directed to apply the cautery if any bleeding come on. Indeed, he expresses his opinion, that, as two fifths of his patients, whose internal piles had been removed with scissors, were attacked with subsequent hemorrhage, it would be better to apply the cautery directly after the operation.

The introduction of a pig's bladder, which is then filled with lint, is another expedient for stoppage of the bleeding. Dupuytren found it succeed in one instance; but acknowledges that it is a great annoyance, and usually cannot be retained. (See *Légnis Orales de l'in. Chir.* t. i. p. 349.)

When I add to these statements the recollection, that a cautery of particular construction is necessary, and that few surgeons will ever be provided with it, it is needless for me to remark, that the candid account of the subject, given by Dupuytren himself, amounts to as complete a condemnation of this part of his practice as could be drawn up by any of its opponents.

I cordially join, however, in Dupuytren's advice, that piles should not be interfered with when the patient is debilitated from organic disease of the intestines, liver, and especially the lungs. He adopts the opinion, that the progress of phthisis is often suspended by the presence of piles, and accelerated by their injudicious removal. They should not be meddled with in pregnant females, as after delivery they spontaneously subside. Where the inconveniences of the tumours are but trivial, he also recommends them not to be taken away. (*Clin. Chir.* t. i. p. 342.)

The old practice of attempting to cure piles by means of compression may be said to be revived

in the occasional use of metallic bougies for this purpose. I have never found any necessity for resorting to this practice, which is disapproved of by Dupuytren, and the generality of the best modern surgeons, as ineffectual.

An opinion has commonly prevailed, that the bleeding from piles is of a salutary or critical nature; an evacuation, by which some peccant or morbid matter is thrown off from the body. Hence, many patients have been advised to submit to all the pain and uneasiness which the disease occasions, rather than seek a cure. If the fact, that some patients lose their health after their piles have been cured, be received as sufficient proof of the disease having had a salutary effect, the doctrine must remain fully established. But before this inference should be drawn, it ought to be known whether the frequency of the fact is such as to warrant the conclusion; for it is not to be supposed that the removal of piles places the patient altogether beyond the reach of disease and illness; and no one will deny, that such operation frequently leads to improvement of the health. Were a patient to appear to suffer from the cessation of an habitual bleeding from piles, he ought to be occasionally cupped or bled.

It should be distinctly remembered, that the rectum is subject to other kinds of swellings besides piles. (See *Rectum*.)

Consult *Petit, Œuvres Posthumes*, t. ii. *Callisen, Systema Chirurgiæ Hodiernæ*, t. ii. p. 108. ed. 1800. *Sabatier, De la Médecine Opératoire*, t. ii. *Latta's System of Surgery*, vol. ii. *Ware, On the Treatment of Hemorrhoids*. *Truka de Krzowitz, Historia Hemorrhoidum*, 3 vols. 8vo. Vindob. 1794, 1795. *Sir J. Earle, Obs. on Hemorrhoidal Excrescences*, 2d ed. 8vo. Lond. 1807. *T. Copeland, Obs. on the Principal Diseases of the Rectum and Anus*, 8vo. Lond. 1814. *Schreger, Chirurgische Versuche*, b. i. p. 233, &c.; *Ueber Tuberculöse Excrescenz des Afterdarms*, 8vo. Nürnberg, 1811. *John Kirby, Obs. on the Treatment of certain severe Forms of Hemorrhoidal Excrescence*, 8vo. Lond. 1817. *Abernethy, On Hemorrhoidal Diseases, in his Surgical Works*, vol. ii. p. 221. &c. *Lassus, Pathologie Chir.* t. i. p. 331. ed. 1809. *Recher. Anfangsgr. der Wundarzneikunst*, b. vi. p. 395. ed. 1802. *W. Hey, Pract. Obs. in Surgery*, p. 439. &c. ed. 2. 8vo. Lond. 1810. *Dict. des Sciences Méd.* t. xx. p. 441, &c. 8vo. Paris, 1817. *Montegre, Des Hémorrhoides, ou Traité Analytique de toutes les Affections Hémorrhoidales*, nouvelle edit. Paris, 1819. *W. White, Obs. on Strictures of the Rectum*, &c. 3d ed. Bath, 1820. *J. Houshup, On Diseases of the Lower Intestines and Anus*, ed. 3. 8vo. Lond. 1824. *G. Calvert, On Hemorrhoids*, &c. 8vo. London, 1824. *Alf. A. L. M. Velpeau, Nouv. Elém. de Méd. Opér.* t. iii. 8vo. Paris, 1832. *Sir Benjamin Brodie, in Lond. Med. Gaz.* vol. xv. 8vo. 1835. *L. Liston, On Practical Surgery*, p. 357. 8vo. Lond. 1837. *James Syme, On Dis. of the Rectum*, 8vo. Edin. 1838. *Baron Dupuytren, in Leçons Orales de Clinique Chirurgicale*, t. i. art. xiv. 8vo. Paris, 1832.

PILULÆ ARGENTI NITRATIS. R. Argenti nitratis gr. iij. Aquæ distillatæ gutt. aliquot. Mice panis q. s. ut fiant pil. xx. The author of the *Pharmacopœia Chirurgica* suggests the trial of these pills in obstinate leprous and other cutaneous affections, and phagedenic, anomalous ulcers connected with constitutional causes. Two or three may be given twice a day. Dr. Powell gave the argentum nitratum internally in a case of hydrophobia, but without any sensible effect.

PILULÆ COLOCYNTHIDIS CUM HYDRARG. CHLORIDO. R. Extracti colocynth. comp. ʒij. Hydr. chloridi. gr. xii. Saponis ʒj. Misce ut fiant pilulæ duodecim. Two of these pills operate as a purgative.

PILULÆ CONII. R. Extracti conii ʒss. Pulv. herb. cicutæ q. s. fiant pil. lx. These are the hemlock pills in use at Guy's Hospital. They

are occasionally given in scrofulous, cancerous, and venereal cases. The surgeon should begin with small doses, and increase them gradually till nausea and headache arise. From one to a greater number of these pills may be given in this manner every day.

PILULÆ CUPRI SULPHATIS. R. Cupri sulphatis gr. xv. Olibani, extracti cinchonæ, sing. 3 ij. Syrup. simpl. q. s. fiant pil. lx. From one to four of these pills may be given in a day for gleet. (*Pharm. Chirurg.*)

PILULÆ HYDRARGYRI. Of these I need only observe here, that the full dose is ten grains (See *MERCURY*), but when prescribed as an alternative, from three to five grains will suffice.

PILULÆ HYDRARGYRICUM CONIO. R. Hydrargyri purificati drach. j. Arabici gummi pulverisati drach. ij. Extracti conii drach. j. Conii foliorum in pulverem tritorum, q. s. The quicksilver is to be first reduced by triture with the gum arabic, moistened with a little rain-water. The inspissated juice of hemlock is afterward to be added, and lastly, the powdered leaves in sufficient quantity to make a suitable mass for pills. These, with a slight variation in the proportion of the hemlock, are the *pilulæ mercuriales* of Plenck, who directs three or four pills, each of three grains, to be given every night and morning.

PILULÆ HYDRARG. CHLORIDI. R. Hydrarg. Chloridi gr. xij. Conservæ cynosbati quod satis sit. M. fiant pil. xii. These are the calomel pills in common use. Surgeons give one or two of them daily, as alternatives in numerous cases. Three grains of the pulvis opiatum may be added if necessary, to each pill, and syrup used instead of the conserve.

PILULÆ HYDRARG. CHLORIDI CUM CONIO. R. Hydrarg. submur. gr. vj. Extracti conii 5 j. M. fiant pil. xii. One may be given thrice a day, in scirrhus, cancerous, scrofulous, and some anomalous diseases, resembling venereal diseases.

PILULÆ HYDRARGYRI CHLORIDI CUM ANTIMONIO FARTARIZATO. R. Hydrarg. Chloridi 5 j. Antimon. tart. gr. xv. Opium pur. 3 ss. Syrupi simpl. q. s. fiant. pil. lx.

PILULÆ HYDRARG. CHLORIDI COMPOSITÆ. R. Hydrarg. Chloridi Sulph. antim. præcip. sing. gr. xii. Guaiaci gummi resinæ gr. xxiv. Saponis q. s. M. fiant pil. xii. Similar to Plummer's pills.

PILULÆ OPII COMPOSITÆ. R. Opii purif. Camphoræ, sing. 3 j. Antim. tart. gr. xv. Syrup. simpl. q. s. fiant pil. lx. They alleviate pain, keep up gentle perspiration and prevent painful erections in gonorrhœa, chordee, &c. (See *Pharm. Chir.*)

PILULÆ QUININÆ. R. Quininæ sulphatis gr. xxiv. Confect. rosæ. 3 ss. Misce et div. in pilulas duo leuim. When an alterative treatment is necessary, in conjunction with a tonic plan I frequently join the sulphate of quinine with the pil. hydrarg. chloridi comp., the extractum conii, or the blue pill; and in other cases with opium, the pill scillæ c., or the extractum hyoscyami, according to circumstances.

PILULÆ SODÆ CUM SAPONE. R. Sodæ subcarbonatis exsiccata 5 j. Saponis. 5 j. M. fiant pil. xii. Four may be given thrice a day in bronchocœle, and induration; of the absorbent scrofula.

PILULÆ ZINCI SULPHATIS. R. Zinci sulphatis, 3 ij. Testib. binthina q. s. fiant pil. lx. One or two are occasionally given in gleet, thrice a day.

PLANTARIS MUSCLE. This long slender muscle is sometimes ruptured in dancing and leaping. The surgeon can do little more than advise rest, antiphlogistic remedies, and the same posture of the limb, as in the rupture of the tendo achillis. (See *Tendon.*)

PNEUMOTHORAX; (from *πνευμα*, and *σπῆξ*) An accumulation of air in the sac of the pleura. Air may pass into this situation either from the lung or bronchial tubes, or through the parietes of the chest. An example of the former is afforded by the rupture of the pleura pulmonalis by the bursting of a tubercular cavity communicating with the bronchial tubes; and an instance of the latter is afforded by the pneumothorax consequent to certain penetrating wounds of the chest. Air is also stated by M. Hurd to be sometimes generated within the sac of the pleura. This last occurrence is rare: and Dr. Houghton considers that the doctrine of pneumothorax being ever formed by the decomposition of a pleuritic effusion, by no means satisfactorily proved. (See *Cyclop. of Pract. Med.*, art. *Pneumothorax.*) According to Laennec, the pleura, in some very uncommon instances, secretes air: and the air so produced is occasionally accompanied by an effusion of serous or purulent fluid. "This variety (Dr. Houghton remarks) has not been decidedly established by the observation of other pathologists, and we record its existence merely on his authority and on that of Andral, who relates a case of it (*Clin. Med.* t. ii. p. 512), in which, however, this origin was not unquestionably proved." (*Op. cit.*)

In cases of pneumothorax produced by the bursting of a tubercular abscess into the pleura, the existence of a large cavity, or even of numerous tubercles, is by no means essential. Dr. Houghton has known pneumothorax occur, where the cavity, which led to the perforation, was smaller than a nut. Andral and others met with cases, where only five or six tubercles existed in the lung; and Dr. Townsend had one remarkable case, where it followed the bursting of a single tubercle which had been formed immediately under the pleura, all the rest of the lung being perfectly free from tubercles. The passage of the contents of the tubercle, and of the air, into the sac of the pleura, which mostly happens on the left side, always brings on a severe attack of acute pleuritis. If this be not speedily mortal, the effused lymph soon becomes organised, and forms a facitious membrane, overlying the whole surface of the compressed lung, as a deposition upon the pleura, which lies under it, of its natural thickness. The lung itself lies compressed and flattened against the spinal column and mediastinum; and in cases which have lasted some time, it generally becomes reduced to about one fourth of its natural dimensions; and then, if cut into, its substance is found to be so condensed as to present the appearance of what is termed carnified lung. The perforation, by which the air escapes from the lung into the sac of the pleura during inspiration, becomes fistulous; and as for the air itself, if it be discharged by puncturing the thorax, it is found to be generally an inodorous gas, little different from the atmospheric air, whence it was originally derived. (See *Dr. John*

Davy, in *Phil. Trans.* 1824; and Dr. Apjohn, in *Trans. of Assoc. of College of Physicians, Dublin*, vol. v.)

In the majority of cases, the air, although it has a free passage into the sac of the pleura, cannot return into the lung during expiration, owing to the valvular disposition of the fistula; and if this impediment did not exist, still the air could not return into the lung, because the arecels are full of air. The fistula is closed, exactly in the same manner as the valve of the bellows prevents the air from going out by the aperture through which it entered. The consequence is, that the air exerts a pressure within the sac, and that such pressure continues to increase so long as the communication remains open. The space, occupied by the air, is much greater than that occupied by pus, or other fluid: and it seems evident to Dr. Houghton, that the chief part of the pressure must be produced by the air, and not by the other fluid.

This species of pneumothorax is almost invariably preceded by the usual symptoms of phthisis, cough, hæmoptysis, emaciation, night sweats, &c. Then, at the moment, when the air first insinuates itself into the sac of the pleura, the patient is sometimes conscious of the occurrence, or has a sensation of something having suddenly given way in the chest. Empyema, as Dr. Houghton observes, being constantly an accompaniment of this variety of pneumothorax, the symptoms of the latter are necessarily joined with those of the former. Hence, the insufficiency of the rational symptoms for the diagnosis. "We find the symptoms of empyema set down as dyspnoea and pain (cough and expectoration) decubitus on one side, dilatation of the side, displacement of the heart, depression of the diaphragm, and hectic fever." (See *Empyema*) The same catalogue precisely makes up the rational symptoms in pneumothorax.

The dyspnoea and pain which immediately follow the bursting of the tubercle, and the first entrance of air into the sac of the pleura, are nearly simultaneous with the sensation above described; but they are still more constantly present and therefore (as Dr. Houghton observes) of more value in the diagnosis. Yet, pneumothorax has been known to take place without either violent pain, or sudden dyspnoea. (Townsend, in *Trans. of Dublin College*, vol. v.; and Houghton, in *Dublin Journ. of Med. Science*, No. 3.)

The dyspnoea, which usually continues during the whole course of pneumothorax, is more urgent and distressing than that attending chronic empyema. This is accounted for by the great elasticity and condensation of the air, so that even the greatest expansion of the thorax in inspiration can but very partially overcome its reaction, and therefore dyspnoea, resulting from the compression, is thus but trivially mitigated. (See *Cyclop. of Pract. Med.* art. *Pneumothorax*.)

Different writers give different accounts of the side, on which a patient with pneumothorax prefers to lie. In empyema (Dr. Duncan observes), the patients commonly lie on the affected side; and in pneumothorax, on the sound one." (*Ed. Med. Journ.* No. 28. p. 327.) In relation to this point, Dr. Houghton admits the fact, that, in empyema, the dyspnoea is caused by the pressure of fluid alone, and that it is chiefly for the purpose of relieving the mediastinum, and opposite lung, of its weight and pressure, that decubitus takes place on

the affected side. (See *Empyema*.) But, he observes, in pneumothorax, the compression of the internal organs is as complete, if not more so, although caused by air; and, if the weight of even an inconsiderable quantity of fluid should be added to them, already suffering under this great compression, the patient will instinctively obviate this by lying on the affected side. According to Dr. Houghton's experience, this position, *ceteris paribus*, is always preferred.

The side where pneumothorax exists, is but slightly or not at all elevated during inspiration; and, on being measured, generally is found to be larger than the opposite one. But in other disorders and in empyema, the intercostal spaces are widened and occasionally protrude beyond the level of the ribs. But, the oedema of the integuments of the side, sometimes noticed in empyema, is not observed in pneumothorax, although M. Louis and others, have remarked an cedematous state of the corresponding arm.

According to Dr. Houghton, less compression seems requisite to produce displacement of the heart, and depression of the diaphragm than dilatation of the side; for the latter has been absent where the heart has been thrust considerably out of its place, and a sensible fullness produced in the corresponding hypochondrium by the depression of the diaphragm.

In addition to the foregoing rational symptoms, of pneumothorax, is the febrile disturbance, which always speedily follows the escape of air by perforation of the tubercular cavity, and is in fact the fever of pleuritis. If the immediate consequences of it are not fatal, this fever subsides into the hectic of phthisis, which existed previously to the bursting of the tubercle.

The physical symptoms of pneumothorax are highly deserving of attention. Whenever air and fluid exist together in the sac of the pleura, if the trunk be shaken abruptly, the splash of the liquid against the walls of the thorax is often, distinctly heard by the patient, or by any one who places his ear on, or near, the chest. This sound can only be produced where air and fluid are both present: if either is absent, no splashing sound is heard. The action of suddenly shaking the trunk to acquire this information, is termed *succussion*.

One of the positive signs of pneumothorax is a metallic tinkling, or ringing sound, discerned with the naked ear, and still better with the stethoscope. It is compared to the sound occasioned by the dropping of a pin into a large wine-glass, or touching gently a sonorous porcelain vase with a quill. It is audible during coughing, speaking, and sometimes during respiration.

The general result of pneumothorax from perforation of the lung by tubercle, is death. Lænnec is well known to have believed in the possibility of the cicatrization of tubercular cavities; and hence it has been conceived, that, in this case, a recovery is not absolutely prohibited. The chances of it, however, appear exceedingly poor. Even Lænnec himself admits, that the effusion of air cannot exist for any length of time, without giving rise to very severe symptoms, and even death. M. Louis only speaks of the result, with the view of calculating the time which elapses between the period of perforation and death. (*Récherches sur la Phthisie*, p. 487.) Dr. Stokes relates a case, which lasted five months, as the longest at that

time on record. (*Trans of King's and Queen's College*, vol. v.; and *Houghton*, in *Cyclop. of Pract. Med.*)

These circumstances are very discouraging to the performance of any operation for the discharge of the air. Cases will occur, where venesection, leeches, anodynes, &c. will fail to prevent the dyspnoea from increasing to such a pitch as to threaten the patient with suffocation. Then the only means of enabling the patient to live longer, is making a small puncture in the chest. This is mostly followed by great relief; which, however, is only temporary. The failure of the operation is ascribed by Dr. Houghton to the rediness, which, in such cases, the false membrane and pleura have to inflame and become gangrenous.

Pneumothorax, from the bursting of an abscess of the lung, is rare; and when it happens, the empyema is generally circumscribed. Dr. Houghton suspects, that this must have been the case in the examples of recovery recorded by Dr. Archer (*Trans. of King's and Queen's College*); and Dr. Hawthorne (*Edinb. Med. Journ.* No. 61.)

For additional information, see EMPHYSEMA and EMPYEMA.

POLYPUS. A tumour, generally of a pyriform shape, most commonly met with in the nose, and uterus, but sometimes in the vagina, antrum, rectum, larynx, and meatus auditorius, and named from an erroneous idea, that it has several roots, or feet, like polypi.

Polypi more frequently grow in the cavity of the nose, than in any other situation, and are visibly of different kinds. One polypus is of a pale red colour, and consistence, and free from pain; this is the *fleshy polypus*. When this kind of polypus is of yet softer consistence, semitransparent, and of a pale yellowish or grey colour, in consequence of being less vascular, it is called the *gelatinous polypus*, and usually arises from the mucous membrane of the side of the antrum, or the middle of the cavity of the nostril, between the upper and lower turbinated bones. Sir Astley Cooper has never seen a polypus growing from the mucous membrane of the septum narium. (*Lectures, &c.* vol. ii. p. 348.) Other polypi are called *malignant*, being hard, scirrhous, and painful: *carcinomatous polypi* are regarded by Sir Astley Cooper as a disease of old age. Another malignant polypus, which he calls *fungoid*, and is in fact the medullary cancer, may occur at any period of life. It is more frequent than a true scirrhous tumour within the nose; and, though like the latter in bleeding copiously, it is less painful. (*Lectures, &c.* vol. ii. p. 354.) This distinguished surgeon likewise describes *hydatid polypi*, which generally occur in young people, and the cysts of which may be burst by pressure, and the fluid in them discharged. Richter describes another kind of nasal polypus, which is pale, very tough, and secretes a viscid discharge; which undergoes an alteration of its size with every change of the weather; and which is rather a relaxation, or elongation of a part of the Schneiderian membrane, than a polypous excrescence. The whole membranous lining of the nostrils is sometimes thus relaxed and thickened. (*Anfanggr. der Wundarzn.* b. I. kap. 21.) Besides the preceding varieties of polypi, children are subject to red projections within the nose, which are liable to be mistaken for polypi, but are of a different nature, and may

be cured by touching them with the end of a bougie, armed with the *argentum nitratum*. (Sir Astley Cooper.)

Mr. Pott has taken great pains to explain, that there is one kind of polypus originally *benign*; another originally *malignant*. He states, that those which begin with, or are preceded by, considerable or frequent pain in the forehead and upper part of the nose, and which, as soon as they can be seen, are either highly red, or of a dark purple colour; those which, from the time of their being first noticed, have never been observed to be sometimes bigger, sometimes less, but have constantly rather increased; those, in which coughing, sneezing, or blowing the nose, gives pain, or produces a very disagreeable sensation in the nostril, or forehead; those which, when within reach, are painful to the touch, or which, upon being slightly touched, are apt to bleed; those which seem to be fixed, and not moveable by the action of blowing the nose, or of driving the air through the affected nostril only (when the polypus is only on one side); those which are incompressibly hard, and which, when pressed, occasion pain in the corner of the eye and forehead, and which, if they shed any thing, shed blood; those which by adhesion occupy a very considerable space, and seem to consist of a thickening, or of an enlargement of all the membrane covering the septum narium; those which sometimes shed an ichorous, offensive, discoloured discharge, and those, round whose lower part, within the nose, a probe cannot easily and freely be passed, and that to some height, ought not to be attempted, at least by the forceps, nor indeed by any other means; and this for reasons obviously deducible from the nature and circumstances of the polypus. On the one hand, the very large extent and quantity of adhesion will render extirpation impracticable, even if the disease could be comprehended within the forceps, which it very frequently cannot; and on the other, the malignant nature of the distemper may render all partial removal, all unsuccessful attacks on it, and indeed any degree of irritation, productive of the most disagreeable consequences.

But, the polypi, which are of a palish or greyish light brown colour, or look like a membrane just going to be sloughy; which are seldom or never painful, nor become so upon being pressed; which have appeared to be at one time larger, at another less, as the air has happened to be moist or dry; which ascend and descend freely by the action of respiration through the nose; which the patient can make to descend by stopping the nostril which is free, or even most free, and then driving the air through that which the polypus possesses; which when pressed give no pain, easily yield to such pressure, become flat thereby, and discharge a clear fluid; and round whose lower and visible part a probe can easily, and that to some height, be passed, are fit for extraction; the polypus, in these circumstances, frequently coming away entire; or, if it does not, yet it is removable without pain, hemorrhage, or hazard of any kind.

Of the benign kind of polypus, fit for extraction, Mr. Pott notices two sorts, whose principal difference from each other consists in their different origin or attachment. That which is most freely moveable within the nostril, upon forcible respiration; which has been found to be most liable

to change in size at different times and seasons; which has increased the most in the same space of time; has its origin most commonly by a stalk or peduncle, which is very small, compared with the size of the polypus. The other, which, although plainly moveable, is much less so than the one just mentioned, which has been less liable to alteration from air and seasons, and which has been rather slow at arriving at a troublesome size, is most frequently an elongation of the membrane covering one of the ossa spongiosa. These latter may be extracted with no kind of hazard, and with very little pain and hemorrhage: but the former require the least force, and mostly come away entire; while the others often break, come away piecemeal, and stand in need of the repeated use of the forceps.

Mr. John Bell criticises the division of polypi into *benign* and *malignant* ones, and declares that time, and the natural growth of the tumour, and the pressure it occasions within the soft and bony cells of the nostrils and jaws, must bring every polypus to one invariable form, in its last and fatal stage. Polypus, he admits, is indeed a dreadful disease; but it becomes so by a slow progression, and advances by gradations easily characterised. Every polypus in its early stage is, according to this writer, a small moveable tumour, attended with a sneezing and watering of the eyes; swelling in moist weather; descending with the breath; but easily repressed with the point of the finger. It is void of pain, and not at all alarming; it may also be easily extracted, so as to clear for a time the passage for the breath. Yet this little tumour, simple as it may appear, is the germ of a very fatal and loathsome disease, and this easy extraction often the very cause of its appearing in its most malignant form. The more easily it is extracted (says Mr. J. Bell), the more easily does it return; and whether carelessly extracted, or altogether neglected, it soon returns. But, when it does return, it has not really changed its nature; it has not ceased to be in itself mild; it is then to be feared, not from its malignity, but from its pressure, among the delicate cells and membranes of the nose. It soon fills the nostrils, obstructs the breathing, and causes indescribable anxieties. The tears are obstructed, and the eyes become watery from the pressure on the lachrymal sac; the hearing is in like manner injured, by the pressure of the tumour against the mouth of the Eustachian tube; the voice is changed, and its resonance and tone entirely lost, by the sound no longer passing through the cells of the nose and face. The swallowing is in some degree affected by the soft palate being depressed by the tumour. The pains, arising from such slow and irresistible pressure, are unceasing. From the same pressure, the bones become carious, and the cells of the face and nose are destroyed by the slow growth of the swelling. It is not long before the tumour begins to project from the nostril in front, and over the arch of the palate behind. One nostril becomes widened and thickened; the nose is turned towards the opposite side of the face, and the whole countenance seems distorted. The root of the nose swells, and becomes puffy, the features become tumid and flabby, the face yellow, and the parts round the eye livid. The patient is affected with headaches, which seem to rend the bones asunder, and with perpetual stupor and

dozing. The bones are now absorbed, and the membranes ulcerate; a foul and fetid matter, blackened with blood, being discharged from the nostrils, and excoriating them. The blood-vessels next give way, and sudden impetuous hemorrhages weaken the patient; the teeth fall from the sockets, and, through the empty sockets, a foul and fetid matter issues from the antrum.

Now the disease verges to its conclusion. The patient has terrible nights, and experiences a sense of suffocation. The repeated loss of blood renders him so weak, that he cannot quit his bed for several days together; and when he does get up, he is (to use Mr. Bell's words) pale as a spectre, his lips colourless, and his face like wax, yellow, and transparent. He now suffers intolerable pain, while his saliva is continually dribbling from his mouth, and a fetid discharge from his nose. In this state, he survives a few weeks; during the last days of his illness, lying in a state of perpetual stupor, and dying lethargic. Mr. J. Bell afterwards observes, that "if horrid symptoms could establish the fact of malignity, there is not to be found in all nosology a more malignant disease than this: but aneurism, though it destroys the thigh-bone, the sternum, or the cranium, is not accounted malignant; neither is polypus malignant, though it destroys the cells of the face, and penetrates even through the ethmoid bone to the brain. These consequences result merely from pressure." (*John Bell's Principles of Surgery*, vol. iii. part 1. p. 90—92.) That this talented writer erred in not recognising some polypi, as originally cancerous, and of the nature of fungus hæmatodes, or the medullary tumour, requires at the present day no observations of mine to render doubtless.

In April 1817, there was a boy in St. Bartholomew's Hospital, only twelve years old, who fell a victim to the ravages of this form of disease. The tumour before death had expanded the upper part of the nose to an enormous size, while below the left nostril was immensely enlarged. The distance between the eyes was extraordinary, being more than four inches. The left eye was affected with amaurosis, brought on by the pressure of the swelling; the right retained to the last the faculty of seeing. The tumour nearly covered the mouth, so that food could only be introduced with a spoon, and an examination of the state of the palate was impossible. About a fortnight before death, the legs became paralytic, and during the last week of the boy's existence, an incontinence of the urine and feces prevailed. On examination of the head after death, a good deal of the tumour was found to be of a cartilaginous consistence, and, what was most remarkable, a portion of it, which was as large as an orange, extended within the cranium, where it had annihilated the anterior lobe of the left hemisphere of the brain. Yet, notwithstanding this effect, the boy was not comatose, nor insensible, till a few hours before his decease. All the surrounding bones had been more or less absorbed, and the place from which the excrescence first grew could not be determined.

Richter has denied the validity of the objections, urged by Pott against attempting to relieve some forms of nasal polypi: and he declares, that neither the malignant nature of a polypus, its adhesions, immovableness, ulcerations, nor disposition to hemorrhage, &c. are any just reason for leaving the

disease to itself. (See *Anfanggr. der Wundarzn*, b. i. kap. 21.) This declaration, however, at least with reference to any operation, is quite repugnant to the advice delivered by all the most experienced surgeons in England, who, in cases of decidedly malignant polypi, always restrict their interference to palliative means.

Mr. J. Bell refutes the common notions, that polypi may be caused by picking the nose, blowing it too forcibly, colds, and local injuries. He asserts, that a polypus is not in general a local, solitary tumour: he has only found it so in three, or four instances. Both nostrils are usually affected. He states, that no finger can reach that part of the nostril, where the root of the swelling is situated, as it is deep and high in the nostrils, towards the throat, and near the opening of the Eustachian tube. The finger cannot be introduced further than the cartilaginous wing of the nose extends, and can hardly touch the anterior point of the lower spongy bone. The anterior and posterior chambers of the nostril are separated from each other by a narrow slit, which the finger can never pass, and which is divided, in consequence of the projection of the lower spongy bone, into two openings, one above, the other below. Through these the heads of the polypus project. These tangible parts of the tumour, however, are very distant from its root, which is in the highest and narrowest part of the nostril. (See p. 103, 104.) Mr. J. Bell also says, that three or four polypi are often crowded together in one nostril, while more are formed, or forming, in the other.

He dwells upon the difficulty and impracticableness of tying the root of a polypus; and explains, that, in all attempts to extirpate such tumours, the surgeon's aim should be to reach a point nearly under the socket of the eye, in the deepest and highest part of the nostrils, and that instruments can only do good when introduced beyond the narrow cleft, formed by the projection of the spongy bone. (P. 108.)

Though Mr. John Bell is probably right in his opinion; that polypi do not proceed from the several circumstances which have been above noticed, yet most of them seem to be diseases entirely local. Certainly, in general, it is very difficult to describe what is the cause of a nasal polypus. Frequently the patient is, in other respects, perfectly well; and, after the removal of the tumour, no new one makes its appearance. In this circumstance, it must originate from a local cause, though it is generally difficult to define what the nature of this is.

Four modes of extirpating nasal polypi have been practised: viz., extracting them with forceps; tying them with a ligature; cutting them out; and destroying them with caustic.

Extraction is the most common method, and performed with forceps, the blades of which have holes in them, and are internally rather rough, in order that they may take hold of the tumour more firmly, and not easily slip off it. Some are straight; others slightly curved. The make of them has been of late years greatly improved, and especially by the construction, which lets them be opened without expanding the nostril too much.

It is generally deemed of importance to take hold of the polypus with the forceps close to its root; and, indeed, when this rule is observed, the whole of the polypus, together with its root, is

extracted, and there is less reason to apprehend hemorrhage, which is naturally more profuse when the polypus is broken at the thick, middle portion of its body. When the polypus is not too large, the foregoing plan is often practicable. With respect to common fleshy, or gelatinous polypi, they usually originate from between the upper and lower turbinated bones, on the side of the antrum; and the best plan is, first to endeavour to ascertain with a probe the precise situation of the pedicle, which the forceps, guided by the probe, will then more readily grasp. Sir A. Cooper has never known an instance of the growth of a gelatinous polypus from the septum narium; a fact highly worthy of recollection. In many instances, the tumour is so large, and the nostril so completely occupied by it, that its root can neither be felt, nor taken hold of with forceps. The polypus should then be grasped as high as possible. The consequences are of two kinds. The tumour sometimes gives way at its root, though it be only taken hold of at its anterior part; and, in other cases, breaks where it is grasped, a portion being left behind, and a profuse hemorrhage ensuing. This is, however, void of danger, if the surgeon does not waste time in endeavouring to suppress the effusion of blood; but immediately introduces the forceps again, grasps the remnant piece, and extracts it. The most infallible method of diminishing the bleeding, is to extract what remains behind at its root. In this way, a large polypus is frequently extracted, piecemeal, without any serious loss of blood.

After the polypus has been propelled as far forward, into the nostrils, as it can be by the patient blowing his nose, and the place of its root felt with a probe, its anterior part is to be taken hold of with a tenaculum forceps, held in the left hand; and is to be drawn gradually and slowly out, to make room for the introduction of the polypus-forceps into the nostril. The more slowly we proceed in this manœuvre, the more the polypus is elongated, the narrower it becomes, the greater is the space in the nostril for the introduction of the polypus-forceps, and the higher can this instrument grasp the tumour. After the root of the polypus has been taken hold of with the polypus-forceps, or if this cannot be done, after the tumour has been grasped with the latter forceps, as high as possible, it is to be twisted slowly round, and, at the same time, pulled outward, till it breaks. When the body of the polypus, and not the root, is grasped, it is a very important maxim, rather to twist the instrument than to pull it; and thus, rather to writh the polypus off, than to drag it out. The longer and more slowly the polypus-forceps are twisted, the more the part where the excrescence separates is bruised, the less is the danger of hemorrhage, and the more certainly does the tumour break at its thinnest part, or root. When the extraction is done with violence, and celerity, only a piece is usually brought away. Sir A. Cooper recommends tearing polypi from their attachment with a sudden jerk, as the most likely mode to bring away the whole of the root, and even a portion of the Schneiderian membrane and bone, so as to hinder a relapse: a piece of advice, however, which he seems to intend for cases, in which the pedicle is grasped by the forceps, as it ought always to be, if possible; but, when circumstances oblige the surgeon to take hold

of any other more accessible portion of the tumour, the rule of slowly and gradually twisting off the polypus, instead of using a sudden jerk, is what I consider the most likely method of extracting the tumour in a mass.

As soon as the polypus has given way, the surgeon is to examine whether any part remains behind. When the polypus is very narrow at the place where it has been broken, and the patient can breathe through the nose freely, there is reason to presume that the polypus has given way at its root, and that none continues behind. The finger, if it can be introduced, procures the most certain information; or the probe, when the finger, for want of room, cannot be employed. When a piece of the root is left, it is best to introduce the forceps again, under the guidance of the finger, or probe, and thus pinch and twist off the remnant of the disease.

Some hemorrhage always follows the operation; and by many writers it is represented as perilous. But this is not the case in common fleshy gelatinous polypi, which are not furnished with large vessels, and are the instances in which the operation is most proper. Cases are met with, however, in which the bleeding is really serious; and therefore the surgeon should take care to furnish himself, before the operation, with the most effectual means for its suppression. The risk of profuse hemorrhage may always be lessened by slowly twisting the polypus at its root, in preference to pulling it directly out. When only a portion of the tumour has been extracted, the surest mode of stopping the effusion of blood is to extract the remaining part without delay. After the polypus has given way at its root, if the bleeding should still be profuse, ice-cold water or strong brandy may be sucked or injected into the nose. These applications mostly prove effectual. If the hemorrhage should still prevail, it may usually be checked in the following manner. Twist a dossil of lint round the extremity of a probe; wet it completely through, with a strong solution of the sulphate of zinc; introduce it into the nostril, and press it against the part whence the blood issues.

When this method fails, a piece of catgut or wire may be introduced into the nostril, and, by means of a pair of forceps, be brought out of the mouth, or what is still better, a ligature may be attached to the end of a bougie and passed by means of this instrument, through the nostril, to the back of the pharynx, where it is at once seen, and, with a pair of forceps, brought out of the mouth. A roll of lint is then to be attached to it, and drawn through the mouth into the nose; thus the posterior aperture of the nose may be stopped up. Then the nostril is to be filled with lint. (See *Nostr.*)

Sometimes, the greatest part of the polypus extends backward, hanging down behind the soft palate, towards the pharynx. If there should be but little of the polypus visible in the nostril, its extraction must be performed backward, in the throat. This is usually done with a pair of curved polypus-forceps, which is to be introduced through the mouth, in order to seize and tear off the tumour as high as possible above the soft palate. As, by this mode, the polypus is not twisted, but pulled away, the hemorrhage is generally copious. If a fragment of the tumour should remain behind, it may now be extracted through the nose.

Some recommend, for the extraction of polypi in the throat, a ring, consisting of two semi-circular portions, with a kind of groove externally, which are capable of being opened and shut, by being fixed on the ends of an instrument constructed like forceps. A ligature is to be placed round the ring, and its end is to be brought to the handle of the instrument, and held with it in the hand. The instrument is to be introduced into the mouth, under the polypus, and expanded as much as the size of the tumour requires. Its ring is then to be carried upward, over the polypus, so as to embrace it; and afterwards is to be shut, whereby the noose, after being carried upward, is disengaged from the ring. The noose is to be pushed as high as possible over the tumour, by means of forceps, and the extremity of the packthread is then to be drawn, so as to apply the noose tightly round the polypus. When this is done, the ring of the instrument is to be turned round, firmly closed, and placed in front of the polypus, on the noose, in such a way, that the packthread is to lie between two little pegs, made for the purpose, at the ends of the ring. On drawing the packthread firmly, and pressing the instrument, at the same time, downward, so as to make it act like a lever, the polypus generally breaks. Another peg projects in the direction of the ring, so as to prevent the ligature from insinuating itself within the circle. (See *Theilen's Bemerk.* part ii.; and plate 6. fig. 1. in *Richter's Anfangsgr.*) This instrument is at present rarely, or never employed.

When the polypus is situated partly in the throat and partly in the nostril, it admits of being extracted, in the same way, through the mouth; but its anterior part often continues attached, and must afterwards be separately removed through the nostril. It is sometimes advisable to twist off the anterior portion of the polypus first, by which the mass in the throat is rendered so loose, that it can be easily extracted. Whenever it is conjectured, that the polypus will come away in two pieces, it is always preferable first, to extract the part in the nostril, and afterwards, that in the throat; because the separation of the last is constantly productive of more bleeding than the removal of the first. Sometimes, the following plan succeeds in detaching the whole polypus at once. Both the part in the nostril, and that in the throat, are to be firmly taken hold of with tenaculum forceps, and drawn at first gently, and then more forcibly, backward and forward. By such repeated movements, the root is not unfrequently broken, and the whole polypus brought away from the mouth.

Frequently the polypus grows again. Some of the root remaining behind, may often be a cause of the relapse. Hence, after the operation, the surgeon should carefully examine the part at which the root of the polypus was situated, and separate, and twist off, most diligently, with the forceps, any fragments that may still continue attached. Or if, in the operation itself, the root can be grasped with the forceps, it may be torn away with a sudden jerk, as recommended by Sir A. Cooper, for the express purpose of bringing away with the root the portion of Schneiderian membrane and even a scale of bone from which the tumour originates, so as to prevent its growing again. The recurrence of the disease, however, may occasionally arise from other causes. The polypus, sometimes ob-

served subsequently to the operation, is frequently not a new substance, but only a part of the original tumour. Sometimes a smaller and a larger polypus are found in the nose at the same time. The larger one is extracted, while the other remains undiscovered; and, when it has increased in magnitude, it is apt to be mistaken for a reproduction of the one previously extirpated.

Ligature.—The plan is to tie the root of the tumour, by which means the polypus is thrown into the state of sphacelus, and at length becomes detached. Many instruments have been invented for this purpose, but Levret's double cannula, or the ligature-encircling apparatus of Graefe, seems to be the best. Through Levret's double cannula a silver wire is to be introduced, so as to form a noose at the upper end of the instrument, proportioned in size to the anterior part of the tumor, situated in the nostril. The two ends of the wire are to hang out of the two lower apertures of the double cannula; and one of them is to be fastened to a small ring on its own side of the instrument. The other is to remain loose. The wire must be made of the purest silver, and ought to be as flexible as possible, that it may not readily break. It must, also, not be too thin, lest it cut through the root of the polypus. The cannula is to be somewhat less than five inches long. By the assistance of this cannula, the noose is to be introduced into the nose, and put round the polypus. But, as the cannula, which is usually constructed of silver, is straight and inflexible, while the inner surface of the nostril is preternaturally arched, especially when much distended by the polypus, its introduction must be attended with considerable difficulty. In fact, it can seldom be introduced as deeply as the root of the polypus.

The noose is to be applied in the following manner. The polypus is to be taken hold of with the forceps, and drawn a little out of the nose. The noose is then to be carried over the forceps and polypus, into the nostril. In order to carry it as high as possible, it is necessary not to push the cannula straight forwards into the nose, but to move it from one side of the polypus to the other. The more deeply the instrument has entered the nose, the more of the loose end of the wire must be drawn out of the lower aperture of the cannula, so as to contract the noose, which otherwise might stop in the nostril, and not be carried sufficiently high. The elasticity of the silver wire tends to raise it over the polypus, and, hence, it is more easy of application than a more flaccid kind of ligature. When there is cause to conclude, that the polypus is complicated with adhesions, they must be previously broken.

After the noose has been introduced as deeply as possible, the loose extremity of the wire is to be drawn out of the lower aperture of the cannula, and rolled round the ring on that side of the instrument, or tightened by means of the small windlass on Graefe's apparatus. Thus the root of the polypus is constricted. As the noose gradually makes a furrow, where it surrounds the polypus, it grows slack after a short time, and no longer constricts the tumour. The wire, therefore, is to be tightened daily. The more tense it is kept, the sooner the separation of the polypus is brought about.

When the tumour has begun to slough, and a fetid discharge has commenced, a solution of alum, or of chloride of lime, or soda, should be repeatedly

injected into the nostril, for the sake of cleanliness; and immediately the dead mass is sufficiently loose, it should be removed.

The ligature is attended with so many difficulties, that, in the majority of cases, the use of forceps is infinitely preferable. Hemorrhage is the only inconvenience, for which extraction is abandoned for the employment of the ligature. But this is much less dangerous than is represented; while the inconveniences of the ligature are serious, and numerous. The cure by the ligature is always accomplished with much less expedition than that by extraction. When the polypus is of such a size as to occupy the whole of the nostril, it is generally impracticable to introduce the noose to a sufficient depth. The figure of the polypus renders it almost impossible to tie its root; for, commonly, the tumour expands very much anteriorly and posteriorly, and the wire must be brought over the posterior part of the polypus, ere it can be applied to its root. In general, also, the noose only includes the front of the polypus, while the root and back portion remain untied, and consequently are not destroyed. As soon as the noose is drawn tight, not only the polypus inflames, but the whole extent of the Schneiderian membrane. The pain and inflammation frequently extend even to distant parts, as the throat, eyes, &c. attended with a great deal of fever.

Hence, it is not surprising, that the plan should now be hardly ever adopted by any good surgeons in this country. Amongst other authorities, I may cite that of Sir A. Cooper, who has tried the ligature unavailingly, and pronounces its application to these cases to be decidedly inadvisable.

Caustics.—The cautery, formerly recommended for the cure of the polypus nasi, is now entirely rejected; but red projections, not of a polypus nature, sometimes noticed within the nostrils of children, Sir A. Cooper cures by touching them with a bougie armed with the argenti nitratum. The cysts of the hydatid polypus, he also destroys by applying the muriate of antimony to them with a camel-hair pencil.

Excision.—Sir A. Cooper has sometimes removed polypi by dividing their pedicle with a pair of probe-pointed scissors; but, his experience has taught him, that the disease, when thus extirpated, is more likely to return, than when cured by extraction. When a polypus is very large, and the pedicle grows from the side of the antrum, he also sometimes cuts through the root with a pair of curved scissors, and presses down the polypus at the back of the mouth with his finger, from over the velum pendulum palati, and thus removes it. He has never seen danger or difficulty arise from the plan, but, on the contrary, has known it answer in several instances, in which the forceps had been employed through the nostrils in vain. (*Lectures, &c.* vol. ii. p. 352.)

Mr. Whately, after failing in several attempts to extract, and tie, a considerable polypus of the nose, succeeded in cutting it out. He used "a narrow straight bistoury, with a probe-point, having a sheath fixed upon its edge, by a screw put into a hole in the handle. An eye was made at its point, to receive one end of a thread intended to be passed round the polypus, for the purpose of directing the knife to the extremity of the tumour. There was also a contrivance by which the knife could be unsheathed at its extremity, the length of three quarters of an inch. This was done by means of

the screw, which might be fixed in another hole, by drawing back the sheath. By exposing such a length of edge only, the anterior parts of the nose were defended from the danger of being wounded." Whoever wishes for a more particular account of the manner of using the instrument, must consult Mr. Whateley's *Cases of Two extraordinary Polypi*, &c. 1805.

In the polypus, which arises from a relaxation of the Schneiderian membrane, external astringent applications may be first tried; such as ice-cold water, solutions of alum, muriate of ammonia, the tincture of muriate of iron, &c. These remedies (says Richter) commonly lessen it and frequently, when it is not very large, accomplish its entire removal. If this should not happen, there is no reason against putting a ligature round it. Here, also, we may venture to employ a cutting instrument, if it be in our power to do so. But the practice of extraction is justly prohibited. A strong solution of alum, introduced into the nostril with a dossil of lint, will also remove the hydatid polypus of young persons, as Sir Astley Cooper has explained. These polypi he compares to wet bladders hanging within the nose: they are not attended with pain, though with the inconvenience of obstruction. When pressed with the forceps, they burst, and discharge a fluid resembling mucus. The nose may be frequently cleared of them by instruments; but they are always regenerated. Whether astringents will cure them permanently, he cannot say positively. (*Lectures*, &c. vol. ii. p. 353.)

POLYPI OF THE UTERUS.

Polypi of the uterus grow either from the fundus, the inside of the cervix, or the lower edge of the os uteri. The first case is the most frequent: the last, the most uncommon.

That the uterus is liable to the formation of tumours of very different kinds, is now a fact universally admitted. Some, though small, are exceedingly vascular, and, if excision be practised, bleed profusely, as exemplified in the case recorded by Z. Lusitanus. Some polypi, which form in the neck of the womb, are of the soft mucous, or gelatinous description, similar to those met with in the nose. M. Velpeau noticed in the bodies of three women, brought for dissection, tumours of the uterus, which were of different sizes, continuous with the texture of the womb, and without any pedicle. Dance, Berard, Cruveilhier, Mayer, and Meisner, have seen others, which were the result of partial hypertrophy either of the body or neck of the uterus, that is to say, which were not separated by any line of demarcation from the fibres of this organ, or distinguished from it by any difference of structure. M. Velpeau has a specimen of such a tumour, preserved in spirits. There are others which are likewise continuous with the texture of the uterus, but are manifestly a transformation of it, being hard, elastic, and of a greyish colour. When a section is made of them, they present a lardaceous, or semi-cartilaginous, homogeneous, and white appearance, entirely destitute of vessels, and in which no vestiges of fibres can be traced. Many other tumours of the uterus are those which are termed *fibrous*, and are originally developed in the very substance of the uterus. Their structure exhibits greyish or whitish fibres

running in various directions: they do not seem to M. Velpeau to be vascular; and are covered by a layer of the substance of the uterus, which is thinner, the larger they are, and more evident towards their root. (See Velpeau, in *Nouv. Elém. de Méd. Opér.* t. iii. p. 596.)

Mr. Langstaff has published the particulars of a polypus, which formed at the superior part of the fundus uteri, and seemed to have its origin in the muscular coat. It had projected into the mucous surface, and proceeded along the cavity in the form of a large pedicle, nearly equal in size to its base. The growth had passed through the os uteri into the vagina, where it had acquired the magnitude of a large peach. The mucous surface of it in the vagina had been destroyed by the ulcerative process; and as this part was covered with coagulated blood, Mr. Langstaff inferred, that the hemorrhages to which the patient had been subject, proceeded chiefly from the tumour, and not from the inner surface of the uterus. The neck of the polypus was dense, and resembled the uterus in structure; but, in the centre of the part of the tumour projecting into the vagina, grumous blood was found, contained in a dense cyst, surrounded by coagulated blood. (See Langstaff, in *Med. Chir. Trans.* vol. xvii. p. 63.)

Dr. R. Lee refers to a specimen of a large fibrous tumour, imbedded in the walls of the uterus, which was removed from the body of a woman, who died in the St. Marylebone Infirmary, and in which there was a considerable cavity containing a coagulum of blood. (*Med. Chir. Trans.* vol. xix. p. 96.)

In this gentleman's paper, much valuable information will be found respecting fibro-calcareous tumours and polypi of the uterus. It appears that fibrous tumours are developed either in the cellular tissue under the peritoneal coat of the uterus, or between the layers of its muscular, or middle coat, or immediately between its middle and mucous coats. "When situated between the peritoneum and muscular coat, they give rise to no irritation, hemorrhage, or derangement, either in the uterine functions, or general health; and even their existence can only be guessed at during life. But, when they attain a large size, and occupy a great part of the abdominal cavity, they produce all the injurious consequences of enlarged ovaria, from which, indeed, during life, they are distinguished with difficulty, and death takes place usually from interrupted circulation and long continued pressure on the bladder and other contiguous viscera. Retroversion of the uterus and retention of urine have taken place in the latter stages of the disease. When situated under the peritoneum, fibrous tumours do not prevent impregnation, because they do not interrupt the communication between the vagina and ovaria; but, when adherent to the posterior part of the body or neck of the uterus, they sometimes produce fatal consequences, both to the mother and child, by impeding its progress through the pelvis." (*R. Lee*, vol. cit. p. 107.)

When fibrous tumours are situated in the proper tissue of the uterus, women are frequently barren, or, if they become pregnant, abortion takes place in consequence of the uterus being incapable of undergoing the necessary development in the latter months of gestation. When the ovum is not prematurely expelled, death may happen

in such cases from uterine hemorrhage soon after delivery. There are no symptoms, by which the existence of a fibrous tumour between the muscular strata of the uterus can be positively ascertained. The presence of such a tumour may be suspected "in those individuals, who, being advanced beyond the middle period of life, suffer habitually from leucorrhoeal discharge, who menstruate profusely, and have frequent attacks of hemorrhagia, with sense of weight and irritation in the region of the uterus and adjacent organs. No alteration of structure can be discovered in the cervical portion of the uterus; but, when an examination is made, the uterus is felt larger and heavier than natural. The os uteri is neither irregular, indurated, nor painful on pressure, as it is found to be when affected with malignant disease.

"But, the fibrous tumour is sometimes developed between the mucous or lining membrane of the uterus and the muscular coat; and, as it enlarges, it gradually distends the cavity like an ovum, and pushes before it through the orifice that portion of the lining membrane by which it is covered, in a manner somewhat analogous to what takes place in hernia, when the peritoneum is pressed forward by the intestine through the inguinal and crural canals. By the constant and powerful action of the uterus, the tumour is gradually forced into the vagina, where after the lapse of a longer or shorter period, it undergoes various changes of structure in its covering membrane, peduncle, and central portion. The mucous covering of the tumour sometimes presents no sensible alteration; but more frequently it becomes highly vascular, thickened and inflamed, or it ulcerates and sloughs, and thus gives rise to a fetid sanious discharge from the vagina, and to all the other symptoms of malignant disease. In a few rare instances, the tumour has formed adhesions with the vagina." (Lee, in *Med. Chir. Trans.* vol. xix. p. 110—114.)

According to the investigations of the same gentleman, when a fibrous tumour is formed between the muscular strata, and consequently is covered both by the lining membrane of the uterus, and a layer of muscular fibres, the peduncle is proportionably thick and short. A longer continuance of uterine action is also required to force a tumour in this condition into the vagina, and the patient not unfrequently dies from irritation and loss of blood, before it has been expelled from the cavity of the uterus. The dissections, which Dr. Lee has made, induce him to believe, that it is not on the situation, or primitive state of the polypus, as Herbiniaux and Dupuytren have supposed, that the consistence and form of the peduncle depend, but on the quantity of muscular fibres carried before the tumour; and that in those cases, where the root of a uterine polypus is thick and short, it is composed, not only of mucous membrane, but of the muscular coat of the uterus. This account of uterine polypi will explain (Dr. Lee adds) why it is unnecessary to pass the ligature close to the uterus, and accounts for the root of a polypus never growing again, after the general mass of the tumour has been removed.

Though the greater number of uterine polypi appear to Dr. Lee to be fibrous tumours, formed under the lining membrane and a stratum of the muscular tissue of the uterus, he does not regard them as the only tumours, which make their way

from the cavity of the uterus into the vagina, and which are not of a malignant nature. On the contrary, he recognises a tumour, which grows occasionally from the mucous membrane of the uterus, and is analogous to a common nasal polypus. He describes also another kind of tumour formed under the lining of the uterus, and consisting of a congeries of small vesicles, or cysts, filled with a clear or yellowish ropy fluid, which cysts are embedded in a soft fibrous substance. An additional variety of tumour of the uterus, enumerated by Dr. Lee, and to which the term polypus has been extended, is produced by a morbid enlargement of the glandulæ or ovula Nabothi. These enlarged glands sometimes hang from the cervix by long slender and flattened stems, and, when cut open, are found to contain a curdlike, or viscid matter. They keep up great irritation and give rise to copious sanguineous and mucous discharges. (*R. Lee, in Med. Chir. Tr.* vol. xix. p. 114—130, &c.)

A polypus of the fundus uteri is difficult to detect in its incipient state. While small, it may not produce the smallest perceptible change in the organs of generation. As it enlarges, it distends the uterus, and often excites a suspicion of pregnancy, which, however, an attentive inquiry soon dispels. The swelling of the abdomen does not, however, take place in the degree and space of time which it does in pregnancy; the menstrual discharge generally continues, though often irregular and profuse; the breasts do not become full; and, in the progress of the case, no motion is to be felt. While the polypus lies in the uterus, its growth is slow. At this early period, it frequently occasions profuse bleeding. Women, afflicted with the disease, are seldom pregnant, and when they are so, a miscarriage mostly follows. However, they sometimes hold out till the end of the regular time, and the labour is easy and safe. Dr. Gooch, in noticing the fact, that women who have polypi sometimes become pregnant, observes, that this may be the case, especially when the polypus grows from the neck or lip of the uterus. He knew of two instances of it; in one, the tumour was discovered in the fifth month of pregnancy, and removed by ligature. The pregnancy went on to the ninth month, when the patient was safely delivered. In the other case the tumour was not discovered till the commencement of labour, and it occasioned death a few hours after delivery. Leveret, Bach, and Jürg have recorded cases in which the fœtus reached its full term. In Bach's case, the placenta was attached to the polypus; a fact, I should think, quite sufficient to dispel all doubt about the vascularity of uterine polypi.

In some instances, the case is perplexing; the catamenia disappear, and other marks of pregnancy are present, such as nausea, vomiting, and enlargement of the breasts. By degrees, the uterus, and sometimes even the abdomen, become distended. The cervical portion of the uterus is shortened, and becomes thick and tumid, but, instead of the softness peculiar to pregnancy, it retains a solid feel. A sensation of weight about the genitals and of bearing down is also experienced: frequently the bowels are constipated, and there is difficulty in voiding the urine. (*Mayer, De Polypis Uteri: Berolini, 1821.*)

As the polypus increases, it may dilate the os

uteri, and, at length, protrude into the vagina. This change happens sooner or later, according as the polypus is attached to the cervix, or the fundus uteri; for, in the first case, the polypus generally protrudes, when it has attained the size of a finger, but, in the second, it may remain in the uterus several years, and be as large as a child's head before its protrusion commences. The dilatation of the os uteri by the swelling is also mostly attended with a discharge of mucus mixed with blood, and sometimes with dangerously profuse bleeding. The protrusion happens either suddenly, from an accidental concussion of the body; or slowly and gradually, attended with pains similar to those of labour. As soon as the tumour has arrived in the vagina, and is no longer confined and compressed by the uterus, it begins to grow more rapidly, and gives rise to far more troublesome complaints; for it presses the bladder and rectum, and seriously disturbs the evacuation of the urine and feces. But, in particular, it causes repeated and profuse hemorrhages, which weaken the patient exceedingly, and often bring her to the brink of the grave. The root of the polypus is situated in the os uteri, and is there so compressed, that the blood in the tumour is prevented from returning through the veins; consequently all the vessels become turgid, and the above effusions of blood are the result. Though they generally cease spontaneously, the least circumstances cause their recurrence; such as slight concussions of the body in riding, walking, &c. In the meanwhile, a quantity of mucous and aqueous fluid is voided, by which the patient's strength is more reduced; and at length hectic fever and anasarca come on. The polypus, the source of the bloody and mucous discharge, as well as of all the patient's illness, is frequently misunderstood, and the case is really attended with great danger, from its nature not being comprehended by the practitioner: so necessary is it, in cases of preternatural discharge from the uterus, always to examine with the finger, *per vaginam*.

At length, after the polypus has been some time in the vagina, it begins to protrude externally. This happens gradually or suddenly from some effort or concussion of the body. Additional grievances are now excited. As the polypus cannot descend so low, without dragging the fundus of the uterus downward with it, and occasioning a prolapsus of this organ, the patient in walking, or standing, commonly experiences a very painful sense of dragging, or stretching, in the pelvis. As the bladder and ureters are also forced into a deranged position, the evacuation of the urine is more or less disturbed, or rendered difficult. Lastly, the dribbling of the urine over the polypus, and the friction which the part accidentally suffers, frequently cause it to inflame, and become painful and ulcerated.

A polypus situated in the vagina, or protruding from it externally, is liable to be mistaken for a prolapsus uteri: an error, which, though not difficult to avoid when a careful examination is made, may have very perilous consequences. The polypus is softer and less sensible than the uterus in the state of a prolapsus. The imperfect prolapsus uteri, in which this viscus is not turned inside out, is betrayed by the os tincæ, which it is plainly perceptible at its lower part.

In this situation, the polypus may occasionally have a depression resembling the mouth of the womb, but easy of discrimination from it. A probe can be passed deeply into the os tincæ; but not so into this other opening. The polypus resembles an inverted pear; that is, it is thickest below, and becomes gradually thinner upward. The above species of the prolapsus uteri is thinnest below, and gradually increases in width upward. The fallen uterus may easily be pressed back, and when it is so, the patient experiences relief. The polypus does not admit of being pressed back, and, during an attempt to do this, the patient is put to much inconvenience. A probe may be introduced by the side of the polypus deeply to the fundus uteri. When passed by the side of the fallen uterus, it is very soon stopped at the upper part of the vagina, which has sunk down with the cervix of this organ.

A polypus, protruding externally from the vagina, may be much more easily distinguished from a perfect prolapsus uteri, without inversion. The os tincæ at once characterises the uterus, as it can not only be felt, but seen. A probe may be passed deeply into the vagina, along the side of the polypus; but not so by the side of the uterus for reasons easy of comprehension. The figure of the tumour, and the state of the patient, on an effort being made to reduce the protruded part, also betray its real nature.

With the exception of a few examples, in which an inversion of the uterus is caused by the descent of a large polypus into the vagina, it happens only in women who have been recently delivered, and has generally been preceded by a very rapid delivery, or the use of too much violence in the extraction of the placenta. While the inverted uterus lies in the vagina, its shape is broad above, and narrow below; whereas the polypus is thin above, and broad below. Hence, in cases of very large polypi in the vagina, the os uteri is but little dilated; while it is extremely distended by the incomplete descent of the inverted uterus itself. Here, likewise, the reduction of the part is attended with relief; while every effort to push back a polypus causes an aggravation of all the complaints.

When the inverted uterus hangs out of the vagina, its figure, like that of the polypus, is thin upward, and broad downward; and, like the latter tumour, has no aperture at its lowest part. An attentive observer, however, will easily avoid a mistake. The inverted uterus includes a circular fold at its upper part, next to the orifice of the vagina. This fold is nothing less than the os uteri itself, through which the body of this viscus has descended. There is nothing of this kind to be felt in cases of polypi. By the side of a polypus the finger or probe may be passed deeply into the vagina; but not so by the side of the uterus. The root of the polypus is firm and hard to the touch; the upper thin part of the uterus, which is hollow, has a soft flabby feel. Useful light is also generally thrown on the case, by the common occasional cause of prolapsus uteri with inversion. The symptoms of a complete inversion are a red, fleshy tumour, as large as a fist, or a child's head, protruding from the genitals, with violent pains, and profuse hemorrhage, often causing syncope, convulsions, and death. The uterus feels rough, elastic, and painful; the uterine tumour, ordinarily felt above

the pubes, is wanting; the inversion, though with difficulty, may be returned. On the other hand, a polypus is insensible, hard, and smooth; it may be returned into the vagina with considerable pain, but is immediately expelled again. On the inverted uterus the mouths of the bleeding vessels, and the placenta, or place of its insertion, may be seen. (Mayer, see *Quarterly Journ. of Foreign Med.* vol. iv. p. 476.) Yet, in particular cases, the diagnosis is much more difficult, and the observations of a modern writer fully prove, that it is always difficult, and perhaps sometimes impossible to distinguish a *partial* and *chronic* inversion of the uterus from a polypus. (W. Newham, on *Inversio Uteri, with the History of the successful Extirpation of that Organ, during the Chronic Stage of the Disease*, p. 82, &c. 8vo. Lond. 1818.)

Under Professor Siebold, however, Mayer has had several opportunities of seeing *chronic incomplete inversion*, and he mentions the following circumstances, in addition to some others already specified, as forming the diagnosis between it and polypus. Polypus not unfrequently occurs in women who are barren; inversion in those who have borne children. The symptoms of polypus, commencing with disorder of the menses, and frequently with their suppression, increase constantly, and when the tumour is passing into the vagina, are accompanied with pains like those of labour. On the contrary, the symptoms of inversion date their origin from the time of delivery; menorrhagia, unusually violent pains, and excess of the lochia in quantity and duration, succeeding to a very rapid labour, or to a rough and violent extraction of the placenta. In cases of polypus, a discharge of mucous fluids, mixed with blood and membranous fragments, is always present, occasionally alternating with copious hemorrhage; while, in examples of inversion, there is, in fact, an excess of the menses; the hemorrhage appears every second or third week, is very copious for some days, and is succeeded by a serous, thin discharge, as clear as spring water. A polypus is altogether insensible, but the uterus, however its sensibility may be lessened by the duration of the disease, the effect of astringent applications, &c., is always capable of sensation when gently scratched with the nail. (See *Mayer's Work*, and the *Quarterly Journ. of Foreign Med. &c.* vol. iv. p. 477.)

In cases of uterine polypus, situated either on the inside of the cervix, or at the margin of the os uteri, the disease is, as it were, from its commencement in the vagina, and the tumour, when large, produces all the complaints attending polypus of the first kind, except frequent profuse bleedings. These seldom occur, and when they do, are slight, because the root of the polypus suffers no constriction in the os uteri. The discharge of mucus, however, is more profuse, than when the polypus is attached to the fundus uteri. As the tumour descends out of the vagina, it occasions a prolapsus uteri without inversion, in addition to the other inconveniences. Cases sometimes occur, in which polypus of the uterus are detached by sphacelation, and a cure is thus spontaneously produced. These are facts well calculated to obviate the doubts, entertained by Mayer, respecting the vascularity of such tumours. Indeed, the mode of cure by ligature can only be explained by its interrupting the supply of blood to them.

* With regard to the treatment of uterine polypus,

and the various tumours, noticed in this article, iodine, mercury, and all other remedies, prove ineffectual, either in arresting their growth, or promoting their absorption. "Women who have fibrous tumours formed in the walls of the uterus, should avoid mechanical pressure of the hypogastrium, violent bodily exertion, and every other cause which may excite inflammation, or a determination of blood to the organs within the pelvis. Where congestion has taken place, it should be removed by local bloodletting, mild cathartics, and anodynes. Profuse uterine hemorrhage should be controlled by rest in the recumbent posture, cold applications to the hypogastrium, and the internal use of the acetate of lead." (R. Lee.) No attempt can generally be made to extirpate uterine polypus, until the os uteri is sufficiently dilated to permit the application of a ligature, or the practice of excision. When, however, hemorrhage endangers life, and cannot be stopped by the plans already recommended, the os uteri should be dilated, and the polypus immediately removed. Constipation and retention of urine may also sometimes require special attention, before the os uteri has become dilated enough for the extirpation of the tumour. (Mayer.) According to the latter experienced practitioner, the best period for undertaking either to tie, or cut away a polypus of the uterus, is soon after the menses, or after hemorrhage, the genitals being then lax, and the flow of blood to them diminished.

"Several polypi of the uterus (Mr. Crosse remarks) have been removed, whilst still within this organ, after ergot, or lobelia inflata, had been administered. Although the ligature was employed in these cases, I observe excision to have been often preferred, and found equally safe from hemorrhage." (See *Prov. Med. and Surg. Trans.* vol. v.)

Experience proves, that uterine polypus, when once extirpated, have not that propensity to be reproduced, which those of the nose have.

For the extirpation of polypus of the uterus, all the methods mentioned for the eradication of nasal polypus have been proposed; but modern practitioners hardly ever employ more than two, viz. the ligature and excision. If, however, "the root is soft and slender, the tumour may easily be twisted off with the forceps." (R. Lee, in *Med. Chir. Tr.* vol. xix. p. 132.)

The ligature has been generally preferred, and is here more easy of application, than in the nose. Large as the polypus may be, there is abundance of room for the introduction of the necessary instruments. Mr. Crosse informs me, that he finds the application of a ligature more difficult, if the os uteri, as sometimes happens, is twisted much to one side. On account of the greater room, and more yielding nature of the parts, the swelling of the tumour, after the ligature has been applied, produces less inconvenience, than in the same mode of treatment of nasal polypus. The inconveniences which do arise, are easy of removal; for instance, the retention of urine may be relieved by the catheter; costiveness by glysters, &c. Uterine polypus are always less sensible than those of the nose, and hence, less pain and fever follow the application of a ligature to them. The fetid matter, formed as soon as the polypus sphacelates, has a free vent out, and may easily be washed away by injections.

That the polypus cannot in general be tied,

while it lies in the uterus, is easily comprehensible. But, immediately it has descended into the vagina, the operation may be undertaken, and may be performed with the double cannula, which should not be curved, but straight, as advised by the late Dr. Gooch.

Levret's instrument consists of two silver cannulae, which are curved in such a manner, and so united by a joint, that they are shaped like a pair of forceps. After introducing a ligature through the two tubes, so that its ends hang out of their lower apertures, the instrument is to be shut, and passed upwards into the vagina, over the polypus, on whichever side seems most convenient: Then it is to be opened, and the polypus is to be pushed through the two branches of the instrument, which is to be brought over to the opposite side of the tumour. In doing this, the ligature becomes applied round the root of the polypus, and forms a noose. The extremities of the ligature are next drawn as tightly as possible out of the lower openings of the cannulae, and tied first in a surgical knot, and then in a slip-knot. The instrument is next shut, and the ligature constricts the root of the polypus. Afterwards it is to be tightened daily until the tumour separates.

Another instrument described by Nissen, *De Polypis Uteri* (see *Richter's Chir. Bibl.* b. ix. s. 613.), is sometimes preferred. It consists of two silver tubes, twelve inches in length, and as thick as an ordinary writing pen. Both are curved about as much as the os sacrum; but, as they are made of pure silver, the curvature may easily be increased or diminished, according to circumstances. Through each of the cannulae a strong ligature is to be passed, so that its ends hang out of the lower apertures, while its middle portion forms a noose between the upper apertures of the cannulae.

The tubes are to be kept together, until they have been introduced into the vagina, as far as the root of the polypus. One is then to be held fast, while the other is to be carried round the tumour, to the opposite side of the cannula that remains stationary. Thus the ligature becomes applied round the root of the polypus. After introducing the finger into the vagina, to ascertain that the ligature lies in its proper situation, its ends are to be drawn through a small double cannula, which is only one-third of an inch long, but so wide that it can be pushed over both the tubes a certain way with the finger, and the upper end of the long cannulae with the aid of a sort of long probe, with a forked extremity. Then a third double cannula, through which the ends of the ligatures have likewise been passed, and the width of which is sufficient, is to be pushed over the lower ends of the long cannulae, so as to unite them. The ligatures are next to be drawn tight in the ordinary way, and fastened to the rings. The management of this instrument is so easy, as to need no further explanation. Dr. Gooch, as I have stated, preferred straight cannulae. The ligature-encircling apparatus of Professor Graefe is a perfect contrivance for the application of a ligature to any tumour, admitting of the practice, wherever situated.

Besides the above instruments, many others have been devised, and recommended for tying polypus. One, invented by Desault, and another, preferred by Mayer, deserve to be remembered.

Mr. Crosse finds it more easy to tie a polypus

of the uterus, when the patient is placed on her knees and elbows, than on her back or side.

The ligature sometimes brings on acute symptoms of an inflammatory, or spasmodic kind. The former require antiphlogistic treatment. Sometimes fever arises, and the polypus becomes exceedingly painful: in this case, venesection is necessary. Spasmodic symptoms require large doses of morphia, or other preparations of opium. When these are ineffectual, and the symptoms severe, it may be proper to slacken the ligature a little. As the polypus at first always swells, it produces great pressure on the adjacent parts. For this reason, it is generally necessary, for the first few days, to draw off the urine with the catheter, and to open the bowels with clysters. Sometimes hemorrhage takes place. This may generally be suppressed by the means already specified; but, when they prove ineffectual, the ligature must be tightened.

During the sphacelation and separation of the polypus, the frequent use of injections will be necessary for the sake of cleanliness, and, as soon as the mass is loose enough, it should be removed with a suitable pair of forceps.

Many writers and lecturers disapprove of cutting instruments as generally improper for polypi of the uterus, because likely to injure the vagina, and occasion a dangerous hemorrhage. The use of the knife, or scissors, is only sanctioned by Richter, when the polypus has a ligamentous pedicle, and cannot be made to separate with a ligature. In this instance, he says, the surgeon may either cut off the polypus closely to its root in the vagina, or he may first draw it gradually downward out of this situation, and then remove it: the first object may be performed with a sharp hook, somewhat curved at its side, or, with what seems better, a pair of long curved, blunt-pointed scissors. The last object may be accomplished with an instrument resembling Smellie's midwifery forceps, which is to be introduced into the vagina in the ordinary way. The polypus is then to be taken hold of, and very gradually drawn so far out of the vagina, that its pedicle may be divided with a knife. This is, indeed, not done without pain, and a forcible inversion of the uterus; but it has been successfully practised. (See *Herbimiaux, Parallèle des différents Instrumens pour la Ligature des Polypes.*)

Dupuytren removed about two hundred uterine polypi by excision. In all these cases, hemorrhage only occurred twice, and in both instances, it was permanently arrested by plugging up the vagina. In eight or ten cases, after the application of the ligature, death took place, as is alleged, from the absorption of pus into the system. "Where the root of the tumour is large and vascular (says Dr. Lee), I am of opinion, that a ligature should previously be passed around it; at as great a distance down the os uteri as is compatible with the removal of the disease." (*Med. Chir. Tr.* vol. xix. p. 132.) Mr. Arnott lately published some observations, and a case very favourable to the practice of excision. (See *Lond. Med. Gaz.* vol. xviii. p. 411.)

When a polypus, with a pedicle attached to the fundus uteri, suddenly falls downward, it occasions a sudden inversion of this viscus. In order to relieve, as speedily as possible, the great pain and danger of this case, the surgeon must tie the root of the polypus, as soon, and as firmly as he can, and pass the ligature, by means of a needle, through

the pedicle, before the place where it is tied, allowing the ends afterwards to hang down for some length. Then the polypus is to be amputated below the ligature, and the uterus immediately reduced.

Siebold and Mayer, of Berlin, only approve of the ligature in two cases: 1st, when an artery can be felt pulsating in the neck of the polypus; 2dly, when the neck of the tumour is so thick, that it probably contains large vessels. In all other examples, they prefer excision, on the ground of the difficulty of applying a ligature, and, because, when applied, the symptoms are apt to be more severe, and the annoyance greater, than after excision. They operate with round-pointed scissors, curved like a Roman S both in the blades and handles, and from 9 to 10½ French inches in length. The division of the neck of the tumour is to be effected not all at once, but by repeated strokes of the instrument. In Mayer's work, six cases are related, in which polypi of the uterus were thus successfully removed by Siebold and himself.

I will conclude these observations on uterine polypi with a brief notice of some of the opinions of the late Dr. Gooch on the subject. The disease, he observes, is commonly mistaken for a long time for profuse menstruation; the patient, instead of menstruating regularly and moderately, has frequent and profuse hemorrhages from the uterus, and, in the intervals, a pale discharge. These gradually drain her circulation and injure her health, until she acquires the deadly paleness, and suffers the complaints, which are the ordinary effects of deficiency of blood. The absence of pain from the uterus, or pelvis (for there is often none, and never that degree which attends the malignant diseases of this organ), prevents all suspicion, that the hemorrhages depend on a disease of structure. Tonics and astringents are given in various forms; one practitioner is consulted after another; till at length, the uterus is examined, and a polypus is discovered. In ascertaining the nature of the tumour, for the purpose of determining the propriety of removing it by an operation, Dr. Gooch considers the mode of its attachment as one of the chief guides; and, in this respect, what is true of polypus of the fundus, is not so of polypus of the neck and orifice. In polypus of the fundus, the stalk is completely encircled by the neck of the uterus, and, if the finger can be introduced into the orifice, it passes easily round between the stalk and the encircling neck. In polypus of the neck, the finger cannot be passed quite round the stalk; it may be passed partly round it; but, it is stopped when it comes to that point, at which it is attached to the neck. In polypus of the edge of the orifice, the stalk does not enter the orifice, but grows from the edge of it, and is not encircled by it. With respect to the structure of polypi, Dr. Gooch describes it, when cut open, as presenting a hard whitish substance, intersected by membranous partitions; but, he adds, that they are sometimes of a much softer and looser consistence, and sometimes have considerable cavities in them. Their external covering is the mucous membrane of the uterus. Their size differs greatly in different cases. Dr. Gooch has removed several, which were as large as the head of a new-born child. They are commonly of a much more moderate size; and he has known several cases, in which frequent hemorrhages were occasioned by a polypus, not larger than a filbert,

attached just within the cavity of the neck of the uterus.

According to Dr. Gooch, a polypus of the fundus uteri sometimes passes through the orifice of the womb gradually and insensibly; sometimes suddenly, during the action of the bowels. He has known several instances, in which patients, after this action, were suddenly seized with retention of urine, and, on examination, a polypus was found in the vagina compressing the urethra.

Another observation, made by Dr. Gooch, is, that the bleeding comes from the tumour, and not from the uterus itself; for, "as soon as a ligature is applied, and tightened round the stalk, the hemorrhage from that time ceases, although it may be several days before the tumour comes away." He notices the opinion of M. Levret, that a polypus does not bleed, while it remains within the uterus; but that after its expulsion into the vagina the orifice of the uterus, by compressing its stalk, impedes the return of blood in its veins, which consequently bursts and bleeds profusely. The incorrectness of the first part of this statement, he convincingly proves.

The tumours, which are likely to be mistaken for polypi, are; 1st, the prolapsed uterus; 2dly, the inverted uterus; 3dly, malignant excrescences from the uterus. In a prolapsus, besides the distinctions, usually noticed, Dr. Gooch adverts to the sensibility of the tumour, as a criterion; a polypus being insensible, so that, if pricked, or scratched, the patient does not feel it. With regard to inversion, when this is only partial, that is, when only the fundus descends through the os tincæ into the vagina, and the patient has survived for many months, the tumour feels exactly like a polypus of the fundus. Here the distinguishing circumstances are its sensibility, and the time of its first appearance, which must have been immediately after delivery.

When there is doubt, whether the case is a polypus, or a malignant excrescence, Dr. Gooch recommends the application of a ligature, if the swelling has a stalk, which can be tied, without any danger of including the neck or fundus of the uterus. According to his experience, the plan succeeds in an immense proportion of cases; and he has known it succeed in several attended with a cauliflower roughness of the tumour. Even if the excrescence should return, the patient, he says, would not be worse off, than she was previously.

This excellent physician strongly enjoins the constant observance of the practical rule, commended by all men of good judgment and experience; namely, that whenever hemorrhages from the uterus resist the ordinary means, the nature of the case should be certified by manual examination.

For the extirpation of polypi, Dr. Gooch prefers two tubes, resembling those described and engraved in Richter's "Elements of Surgery," and my "First Lines of the Practice of Surgery;" but they are straight, instead of being curved, which last shape he finds very inconvenient. The danger of including the uterus in the ligature, he thinks, may always be avoided by the following rules:—1. Instead of aiming at passing the ligature, as high as possible on the stalk, it is to be passed as low as possible, care being taken, however, to pass it over the body of the tumour. He knows by experience that the portion of stalk, left above the ligature, will not grow again, but, like the remnant of the

umbilical cord, dies and falls away. 2. When the stalk grows from the cervix, the os uteri, if it can be felt, will best denote where the neck ends and the stalk begins. The ligature ought to be applied a little below the orifice; but if this cannot be felt the next best guide is the ordinary length of the projecting part of the neck, that is, about two-thirds of an inch. When the polypus is very large, and the vagina closely contracted, it is difficult, or impossible, to reach the stalk and the cervix, so as to make an accurate measurement, and the first rule only is practicable. 3. To attend to the sensations of the patient when the ligature is tightened; for, if it give much pain, a part of the uterus is most probably included.

Fleshy excrescences occasionally form in the vagina, some of which have a broad basis, and others a thin pedicle. The last merit the appellation of polypi. Their existence is easily ascertained by the touch. By making pressure on the bladder, and rectum, they occasion several impediments to the evacuation of the urine and feces. They may be conveniently tied, by means of the double cannula. Should the polypus be situated at the lower part of the vagina, this instrument would not be required. The ligature might be applied with the hand, and the tumour cut off below the constricted part.

A polypus in the œsophagus renders deglutition difficult; and when of large size, puts an entire stop to it. When an inclination to vomit is excited by irritating the throat with the finger, or a feather, the polypus, if situated towards the upper part of the tube, ascends into the mouth, so as to become visible. But, as it impedes respiration during its residence in the mouth, the patient is soon necessitated, as it were, to swallow it again. When it is situated far down the œsophagus, of course it cannot be brought into the mouth, and is very difficult to detect. The difficulty of swallowing, its only symptom, may result from other causes. In this case, it is also incurable; for it is impossible to take hold of it with instruments. An operation can only be practised, when the polypus is situated at the upper part of the œsophagus. The tumour cannot be extracted; and the tying of it is difficult. Sir Astley Cooper, however, succeeded with a ligature in two examples. (*Lectures &c.* vol. ii. p. 356.)

Polypi in the rectum may be tied with the aid of the cannula. Excrescences in the meatus auditorius externus, resembling polypi, have been successfully extirpated by extraction, or rather by twisting them off.

Richter, Anfangsg. der Wundarzn. b. i. kap. 21. *J. B. de Lamsvoerde, Historia Naturalis Malorum Uteri,* 12mo. Lugd. 1700. *P. G. Schaefer, Programma de Polypis,* Lips. 1721. *C. F. Katschmidt, De Mola Scirrhusa in Utero Inverso extirpata,* Jenæ, 1754. *C. Schenk, De Polypo post Febrim Epidemicum ex Utero egresso,* Wittemb. 1739. *A. Levret, Obs. sur la Gorge, et du Ner,* 8vo. Paris, 1749. *M. G. Herbmantz, Traité sur divers Accouchemens laborieux, et sur les Polypes de la Matrice,* &c. 2 tom. 8vo. Bruxelles, 1782-1794. *E. Grainger, Medical and Surgical Remarks, including a Description of a simple and effectual Method of removing Polypi from the Uterus,* &c. 8vo. Lond. 1815. *Dennan's Plates of a Polypus, with an Inversion of the Uterus, and of a Polypus of the Uterus,* fol. 1801. *F. A. Waller, Annotationes Academicæ,* 4to. Berol. 1786. *W. Newenham, An Essay on the Symptoms, &c. of Inversio Uteri, with a History of the successful Extirpation of that Organ,* 8vo. Lond. 1818. *Wessel, Krankheiten des Uterus,* Maluz. 1816. *C. G. Mayer, De Polypis Uteri,* 4to. Berol. 1821. *Pott's Remarks on the Polypus of the Nose.* *Whately's*

Two Cases of extraordinary Polypus, 8vo. Lond. 1808. *John Bell's Principles of Surgery,* vol. iii. part 1. *Encyclopédie Méthodique,* art. POLYPE. *J. G. Haase, De Narium Morbis Comment. Libs.* 1794-1797. *Lassus, Pathologie Chir. t. i. p. 328-338, &c.* edit. 1809. *Calisen, Systema Chirurgiæ Hodierne,* vol. ii. p. 169, &c. *J. L. Deschamps, Maladies des Posses Nasales, et de leur Sinus,* 8vo. Paris, 1804. *Nauche, Mal. de l'Uterus,* 8vo. Paris, 1816. *S. Schneider, De Polypo Œsophagi vermiciformi rarissimo,* &c. Delitil, 1717. *Sir Astley Cooper's Lectures,* &c. vol. ii. 8vo. Lond. 1825. *Dr. Robert Lee, in Med. Chir. Trans.* vol. xix. *R. Gooch, On some of the most important Diseases peculiar to Women,* 8vo. Lond. 1829.

PORRIGO, TINEA CAPITIS (*Scalped Head, &c.*) In some of its forms a contagious disease, principally characterised by an eruption of the pustules denominated *favi* and *achores*. The *achor* is defined to be a small acuminated pustule, containing a straw-coloured matter, which has the appearance and nearly the consistence of honey, and is succeeded by a thin brown, or yellowish scab. The *favus* is a larger, flatter, and not acuminated, and contains a more viscid matter; its base, which is often irregular, is slightly inflamed; and it is succeeded by a yellow, semi-transparent and sometimes cellular scab, like a honey-comb: whence it has obtained its name. (See *Bateman's Synopsis of Cutaneous Diseases*, p. 24. and 159. edit. 3.)

M. Rayer, after carefully discriminating *ptyriasis*, *psoriasis lepra*, *impetigo*, *chronic eczema*, and *syphilitic eruptions on the scalp from porrigo*, admits only four kinds of the latter; namely, *tinea favosa*, *tinea annularis*, *tinea granulata*, and *tinea mucosa* (*porrigo larvalis*.) Rayer regards these four pustular inflammations as very distinct from one another, and not as species, or varieties of the same affection. Some of them are contagious; others, not so; and they are rarely complicated together. (*Mal. de la Peau*, t. i. p. 496.) On the other hand, Bateman describes the following six forms of porrigo.

1. *Porrigo larvalis*, or *crusta lactea* of authors, begins with an eruption of numerous minute whitish *achores*, upon a red surface. These pustules soon break, and discharge a viscid fluid, which concretes into thin yellowish or greenish scabs. The disease increases in extent, and the scabs become thicker and larger, until the forehead and cheeks, even the whole face, excepting the eyelids and nose, become enveloped, as it were, in a mask, whence the epithet *larvals* suggested by Willan. Small patches of the disease sometimes appear about the neck and breast, and on the extremities; and the ears and scalp are usually affected in the progress of the case. The complaint is attended with excessive itching, which prevents sleep. It is not contagious, and its attack is most common at the period of the first or second dentition. In children at the breast, the bad quality of the mother's milk has a decided influence in the production of the disease. (See *Rayer, Mal. de la Peau*, t. i. p. 531.)

When the discharge is copious and acrid, Dr. Bateman recommends the part to be washed two or three times a day with tepid milk and water, and the application of the unguentum zinci alone, or mixed with the saturnine cerate. The latter, he says, will be useful for the relief of the excoriation left after the cessation of the discharge. Small doses of the submuriate of mercury, either alone, or in combination with a testaceous powder, will also expedite the cure. If the bowels are very irritable, the hydrargyrum cum creta, or the cine-

reous oxide, may be exhibited instead of calomel. When the health is good, soda, precipitated sulphur, and the testacea, will lessen the local inflammation and discharge.

When the irritation is removed, and the crusts are dry and falling off, the unguentum hydrarg. nitrat., much diluted, may be used, and the decoction of bark, or the vinum ferri prescribed.

If a child at the breast be attacked, Rayer recommends the warm bath, and bathing the part with emollient decoctions, milk, &c., as capable of gradually accomplishing the cure. When the child is older, and the affection of the face produces irritation and loss of sleep, he is in favour of applying two, four, or six leeches, under the ears or jaw. If no decided benefit result from this plan, he advises an issue to be formed in the arm. If the disease occupy the scalp, he recommends the hair to be taken away, and an emollient poultice to be applied, care being taken to wash the head two or three times a day with a decoction of linseed, and, if the child be strong, to apply leeches to the temples or nape of the neck. Then, after a few days, an issue is to be made in the arm. In the acute stage of the disease, he generally abstains from the employment of zinc and lead ointments; and he pronounces mercurial medicines dangerous. In the chronic stage, he resorts to sulphuretted lotions, or the ung. hydrarg. nitrat. (Vol. cit. p. 533.)

2. *Porrigo furfurans* begins with an eruption of small *achores*. the excoriation is slight, and the discharge, which is not abundant, soon concretes, and falls off in innumerable thin laminated scabs. At irregular periods fresh pustules arise, and follow the course of the preceding. The complaint is confined to the scalp, which is affected with itching and soreness; and the hair which partly falls off, becomes thin, less strong, and sometimes of a lighter colour than natural. This species of porrigo occurs principally in adults, and it is sometimes attended with swelling of the glands in the neck. Dr. Bateman observes, that the treatment requires the hair to be closely cut off the scalp. The branny scabs are then to be gently washed away with some mild soap and water twice a day; and an oil silk cap should be worn. In the beginning, when the surface is moist, tender, and inflamed, the zinc ointment, or one made with 5 ij. of the cocculus indicus and ʒ j. of lard. Afterwards when the scalp is dry and free from irritation, it may be washed with common soft soap and water; or with a mixture of equal parts of soft soap and unguentum sulphuris. Then the unguentum hydrargyri nitratis, the ung. hydrarg. nitrico-oxydi, the tar and sulphur ointments, or the ung. acidi nitrosi of the Edinb. Pharm. may be employed. These last stimulant applications, however, must be left off, if the inflammation and discharge return.

3. *Porrigo Lupinosa* is characterised, according to Dr. Bateman, by dry, circular, yellowish-white scabs, set deeply in the skin, with elevated edges, and a central depression, and somewhat resembling, on the whole, the seeds of lupines. These scabs are formed upon separate clusters of *achores*, and attain on the scalp the size of a sixpence; but when on the extremities, they are not more than two lines in diameter.

In the treatment the scabs are first to be gently washed off with some soap and water, and the

scalp is to be shaved, if it be the part affected.

When the scabs are difficult of removal, the liquor potassæ, or a weak lotion of muriatic acid, may be used for loosening them. Then the ointment of cocculus indicus is to be applied to the red cuticle, and afterwards more stimulant ointments.

Rayer treats recent cases on the antiphlogistic plan, followed by issues in the arm; while, for examples of longer standing, he prefers depilatory ointments and powders, whose activity depends upon their containing a proportion of lime, subcarbonate of potash and charcoal. (See Rayer, *Mal. de la Peau*, t. i. p. 508.)

4. *Porrigo scutulata*, or *Ringuorm of the Scalp*, makes its appearance in separate patches, of an irregular circular shape, upon the scalp, forehead, and neck. It commences with clusters of small, light-yellow pustules, which soon break and form thin scabs, which, if neglected, become thick and hard. If the scabs are removed, however, the surface underneath is left red and shining, but studded with slightly elevated points or pustules. When the disorder is neglected, the patches become confluent, and the whole head affected. Where the disease is situated the hair becomes lighter in its colour, it falls off, and its roots are destroyed. The porrigo scutulata generally occurs in children three or four years old and upwards, and frequently proves exceedingly obstinate. According to Dr. Bateman, it seems to originate spontaneously in children of feeble and flabby habit, who are ill fed, uncleanly, and not sufficiently exercised; but he thinks that it is chiefly propagated by contagion, i. e. by the actual conveyance of the matter from the diseased to the healthy, as may happen in the frequent contact of the heads of children, the use of the same towels, combs, caps and hats.

While the patches are inflamed and irritable, it is necessary to limit the local applications to washing the parts with warm water. Even shaving the scalp, which must be repeated at intervals of eight or ten days, produces a temporary irritation. Nothing but a light linen cap is now to be worn, and it must be often changed.

The disease afterwards forms dry scabs, and becomes for a time less irritable; but a fresh eruption of *achores* soon follows, and the inflammation and redness return.

In the inflamed states, Dr. Bateman recommends the use of ointments, made either with the cocculus indicus, submuriate of mercury, oxide of zinc, superacetate of lead, opium, or tobacco; or else the infusion of poppy-heads or tobacco. When there is an acrimonious discharge, the zinc, or saturnine ointments, the ung. hydrarg. præcip., calomel ointment, or a lotion of lime water and calomel, may be prescribed.

In the less irritable stages, the ung. hydrarg. præcip., the ung. hydrarg. nitrico-oxydi, and especially the ung. hydrarg. nitrat. are often effectual remedies. So are the ointments of sulphur, tar, hellebore, and turpentine, and lotions of the sulphates of zinc and copper, or the oxymuriate of mercury. I have often seen a solution of ʒ j. of the sulphuret of potash in a pint of lime water, succeed when most other applications had failed. In the very dry and inert state of the patches, Dr. Bateman has seen the disease removed by a lotion, containing from three to six grains of the nitrate of silver in an ounce of distilled water. The application of the diluted mineral acids, or of a blister

has also been known to put a permanent stoppage to the morbid action.

The cure may often be expedited by cinchona, chalybeate, and alterative medicines: and attention must be paid to the patient's diet, exercise, &c.

5. *Porrigo decalvans* consists in bald patches, surrounded by hair, which is as thick as usual. It is not known, whether any eruption of minute achoræ actually precedes the detachment of the hair.

Dr. Bateman remarks, that if the scalp be regularly shayed, and some stimulating liniment be applied to it, this obstinate affection may at length be overcome, and the hair will regain its usual strength and colour. Two drams of oil of mace, in three or four ounces of alcohol, are said to make an excellent liniment.

6. *Porrigo favosa* consists of an eruption of the large, soft, straw-coloured flattened pustules, denominated *favi*; which may occur on any part of the body; but most commonly spread from the scalp, especially behind the ears, to the face, or from the lips and chin to the scalp. They are attended with considerable itching, and are most frequently seen in children from six months to four years of age, though adults are also often affected. The pustules pour out a viscid matter, which concretes into greenish or yellowish semi-transparent scabs. When the hair and moist scabs are matted together, pediculi are often generated in great numbers, and aggravate the itching and irritation. If the disease be allowed to increase, the scabs are thickened into irregular masses, not unlike honey-comb; and considerable ulcerations sometimes form, especially when the heel and toes, or other parts of the lower extremities, are affected. The ulcerating blotches are generally soon followed by irritation and swelling of the lymphatic glands, which sometimes slowly suppurate. The contact of the discharge inoculates the disease: thus in young children, the breast is inoculated by the chin: and the arm and breast of the nurse may be infected in the same way; though adults do not take the complaint so quickly as children.

Porrigo favosa requires the same alteratives internally as *porrigo larvalis*. The diet should consist of milk, puddings, and a little plain animal food. When the habit is bad, and the glands swelled, bark, chalybeates, and a solution of the muriate of barytes, are proper.

As local applications, Dr. Bateman prefers the unguentum zinci, or the ung. hydrarg. præcip. mixed with this or the saturnine ointment, especially when the discharge is copious. He also speaks favourably of the ung. hydrarg. nitrat., the strength of which is to be diminished by an addition of simple cerate, according to the degree of irritation present.

For checking the pustular inflammation of the skin, Rayer prefers antiphlogistic treatment and issues in the arm, and fomentations and emollient poultices to loosen the scabs. But, as soon as the inflammation reaches the bulbs of the hair, he prefers the depilatory treatment. The scalp is to be kept as clean as possible. The hairs, whose bulbs are inflamed, are to be separated without pain. With these objects in view, the hair is to be cut, so as to leave it only two inches in length. The scabs are then to be loosened and removed by means of lard or a linseed poultice, and the head

afterwards washed with soap and water. This plan is to be continued for four or five days, at the end of which a depilatory pomatum is applied every other day, for a month, or two. On the days, when the pomatum is not used, a fine comb is passed through the hairs, by which means they are detached without pain. In a fortnight a depilatory powder is sprinkled amongst the hairs once a week. The next day, the fine comb is used, and the depilatory powder employed again. The depilatory pomatum and powder derive their activity from the lime and carbonate of potash in them. (See *Rayer, Mal. de la Peau*, t. i. p. 493.)

A very effectual ointment for *porrigo* in general, after the beneficial effects of mild antiphlogistic soothing and emollient means, is one composed of an ounce of lard, 3½ grs. of bichloride of mercury, and 5j. of the white precipitate. This application, and a moderate dose of rhubarb and carbonate of soda, with or without a small proportion of hydrargyrum cum creta, according to circumstances, will mostly bring about a cure.

POTASSA CUM CALCE. A powerful caustic, used for making issues, and for the destruction of fungous growths, the hard callous edges of certain ulcers, &c. It is also sometimes used, though not so often as it was formerly, for opening buboes and other abscesses. Some are in the habit of making it into a paste with soft soap; they cover the part affected with adhesive plaster, in which there is a hole of the size of the eschar intended to be made; and into this aperture they press the paste till it touches the skin. A pledget and bandage are then applied to secure the caustic substance in its situation, till the intended effect is produced.

Before injections were found to answer best for the radical cure of hydrocele, the same caustic was often used, as a means of cure. (See *HYDROCELE*.)

POTASSA FUSA. *Caustic Potassa.* Besides being employed in the same cases, as the *potassa cum calce*, it was recommended to be used in a particular manner by Mr. Whateley, for the cure of strictures in the urethra. It is also prescribed for internal use in the form of liquor *potassæ* in cases of stone, gonorrhœa, scrophula, and various cutaneous diseases.

POTASSÆ SULPHURETUM. *Sulphuret of Potash, Liver of Sulphur.* Two drams, dissolved in a pint of lime or distilled water, make an excellent lotion for the cure of *porrigo*. Many other cutaneous affections yield also to the same remedy. When arsenic has been swallowed as a poison, twenty grains of the sulphate of zinc may be given as an emetic of the quickest operation: and, after keeping up the vomiting by drinking warm water, and, what is better, sweet oil, some authors recommend making the patient drink copiously of a solution of the sulphuret of potash.

PREGNANCY is set down by some writers as preventive of the union of broken bones; but many exceptions to the remark present themselves in practice: I attended a female, six months gone with child, who broke both bones of her leg, yet they grew together again in the usual time. (See *FRACTURES*.) Pregnant women frequently bear operations much better than might be expected. Thus M. Nicod has recorded an instance of successful amputation of the left leg during pregnancy, in a case where the right tendo Achillis was also ruptured. Both the wound and the broken ten-

don united very well. (See *Annuaire Méd. Chir. des Hôpitaux de Paris*, p. 509. 4to. Paris, 1819.) However, though a severe accidental injury may justify an operation in pregnancy, I consider the removal of a diseased joint, breast, or other important part, quite unjustifiable in this state of the constitution.

PROBANG. A long slender piece of whalebone, with a bit of sponge at its extremity, intended for the examination of the œsophagus, or the removal of obstructions in it.

PROSTATE GLAND, DISEASES OF. It is an observation, made by Mr. Hunter, that the use of this gland is not sufficiently known to enable us to judge of the bad consequences of its diseased state, abstracted from swelling. Its situation (says he) is such, that the bad effects of its being swelled must be evident, as it may be said to make a part of the canal of the urethra; and, therefore, when it is so diseased that its shape and size are altered, it must obstruct the passage of the urine. (*On the Venereal Disease*, p. 169.) A swelling of the prostate gland, however, may be of very different kinds: thus it may depend either upon common inflammation of the part, abscesses, calculi formed within its substance, a varicose enlargement of its vessels, or a chronic swelling of it. (See *Œuvres Chir. de Desault*, t. iii. p. 220.)

The prostate gland is more subject to chronic than to acute disease, to which, however, it is also liable. We have the authority of Desault, Hunter, and Dr. Baillie, for setting it down, as the occasional seat of scrofula. The latter physician, after stating that he has seen a common abscess situated in it, adds, that it is also subject to scrofulous disease, as, on cutting into it, he has met with the same white curdy matter which is formed in a scrofulous absorbent gland: he has likewise forced out of its duct scrofulus pus. (*Morbid Anatomy*, &c.)

Mr. Lloyd has met with fleshy enlargements of the gland, in the substance of which several small abscesses were formed, containing "a complete scrofulous matter." He has also known enormous enlargements of this gland happen in young men, who were labouring at the same time under other scrofulous disease. Other instances of supposed scrofulous swelling of the same part in young patients are likewise cited by this author, one of which is particularly remarkable, as in it the gland was found after death to be of the size of a child's head, though its natural consistence was not much changed. (*On Scrofula*, p. 107.) Other chronic enlargements of the prostate gland, rarely occur in subjects under the age of fifty.

Like every other part of the body, the prostate gland is sometimes, but not often, the seat of common phlegmonous inflammation. Mr. Wilson has known two or three instances of this kind take place soon after puberty: one case was from a fall; the others arose without any assignable cause. (*On the Male Urinary and Genital Organs*, p. 327.) Inflammation of the prostate gland is sometimes exemplified in cases of gonorrhœa: the discharge from the urethra suddenly ceases, and the inflammation, leaving the part originally affected, attacks the prostate. At the same time, the patient experiences a frequent inclination to void his urine, and a difficulty in voiding. He complains of uneasiness and pain

about the neck of the bladder, extending forward along the perinæum and urethra; and aggravated on each attempt to make water. In some cases, there is a complete retention of urine, attended with great suffering. There is a sense of fulness in the perinæum and rectum, and the prostate is tender when examined from the rectum with the finger. In some instances, an abscess forms, which, if left to take its own course, may burst into the urethra, but more frequently makes its way outward through the fascia, cellular tissue, and muscles in the perinæum. The late Mr. Wilson believed, however, that such abscesses mostly burst into the urethra behind the verumontanum. (*On the Male Urinary Organs*, p. 329.)

The pulse is frequent, the skin hot, the tongue furred, and the formation of matter is often indicated by shiverings. (See *Brodie, on Dis. of the Urinary Organs*, p. 110. ed. 2.)

Here, the first indication is to endeavour to prevent suppuration. "The patient should remain in bed in the horizontal posture; blood is to be taken from the loins, or perinæum, by cupping; and the cupping should be repeated or not, according to circumstances. Cupping on the perinæum, however, can be performed only by a dexterous cupper; and when such an one cannot be procured, leeches must be applied. The bowels should be thoroughly opened by the exhibition of calomel and a scenna draught; and afterwards an enema should be administered, of two ounces of thin starch and half a drachm, or a drachm of laudanum. This will require to be repeated probably every night, or even oftener, and a gentle aperient may be given in the intervals. If there be a retention of urine, the gum catheter, without a wire or stilet, may, in almost every case, be readily passed into the bladder. It is better to use a very small catheter, and to introduce it again whenever it is necessary to do so, than to leave it constantly in the urethra and bladder." If an abscess form, it should be opened directly its formation is known to have begun, and frequently the lancet must be introduced very deeply ere it reaches the matter. (See *Brodie, Op. cit.*) There is also a phlegmonous swelling of the prostate gland, sometimes an effect of strictures. As Desault observes, the retention of urine, arising from such a cause, comes on very suddenly, and rapidly increases. The patient at first complains of a sense of heat and weight about the perinæum; and, soon afterwards, of a continual throbbing pain about the neck of the bladder. The pain is severely increased when the patient goes to stool; and there is tenesmus, and frequent inclination to make water. The patient feels also as if a large mass of excrement filled the extremity of the rectum, and were ready to come out. If a finger be introduced within the rectum, the swelling of the gland is plainly distinguishable; and according to J. L. Petit, the projection of the prostate gland in the bowel makes a corresponding hollow groove along the concave side of the excrement, as may be noticed when what is voided is hard. However, as Bichat believes, such an appearance must generally be obliterated as the excrement is passing through the sphincter. When the patient attempts to make water, it is a long while before the first drop comes out; and as straining has the effect of propelling the swelled prostate more against the neck of the bladder, it only increases

the difficulty, and no urine will come out until such efforts are discontinued. The more violent the inflammation is, the smaller is the stream of urine, and the more acute the pain felt during its expulsion. If an attempt be made to introduce a catheter, the instrument passes without the least resistance as far as the prostate gland, and then it stops, and causes great pain. The pulse is hard and frequent; and the patient thirsty and feverish.

In cases of phlegmonous inflammation of the prostate gland, antiphlogistic treatment is indicated; especially venesection, leeches to the perineum and near the anus, the warm bath, emollient clisters, poultices, and fomentations, and a low regimen. However, as Desault admits, the efficacy of these means is often too slow, and the symptoms too urgent, to allow the surgeon to wait for the urine to flow of itself. Frequently, also, the distention has so weakened the bladder, that this organ cannot expel its contents; in which event, the catheter must be used. The practical observations, respecting the best kind of catheters, and the mode of introducing them in cases of enlarged prostate gland, will be more conveniently introduced when the chronic enlargement of this part is considered. (See also CATHETER, and URINE, RETENTION OF.)

When an abscess follows inflammation of the prostate, the body of the gland itself does not suppurate, but only the surrounding parts, and the cellular substance, which connects its lobes together. This, at least, was what Desault observed in several subjects, which were publicly opened in the Hôtel-Dieu.

Morgagni has taken notice of retentions of urine arising from calculi in the prostate gland. The nature of these concretions will be described in the article URINARY CALCULI. Calculi also sometimes form in or about the prostate gland, when, after lithotomy, the outer part of the wound heals sooner than the bottom. A kind of urinary fistula then ensues; and, as the extraneous substance is constantly exposed to the contact of fresh urine, it may increase to a large size. The diagnosis of prostatic calculi is seldom very clear. A retention of urine, or pain about the neck of the bladder, and frequent desire to make water, are the only symptoms, and these are common to several other affections of the prostate gland and urethra. When the finger is introduced into the rectum, the gland may indeed be felt to be enlarged; but the nature and cause of such enlargement cannot in general be distinguished. In one instance, however, recorded by Dr. Marcet, the calculi could be plainly felt through the coats of the rectum, and a proposal was made to extract them by an incision in that situation; but the patient did not accede to so judicious a measure. (*Med. and Chem. Hist. of Calculus Disorders*, 8vo. 1817.) When a calculus projects from the prostate gland into the urethra, the end of a sound will strike against it; but then it can rarely be known whether the extraneous substance may not be a calculus that has passed out of the bladder into the urethra, or lies close to the neck of this viscus.

Whether the case be of one description or the other, however, the treatment should be the same; viz. the calculus should be extracted by an incision; and, if the situation of the calculi will admit of their being taken out, without the bladder itself being cut, this plan should be pursued.

The most frequent disease of the prostate gland, and, of course, that which is most interesting to the practical surgeon, is a slow enlargement of it, whereby its natural size, which is that of a common chestnut, is sometimes gradually changed to that of a man's fist. Such hypertrophy of the prostate gland may be partial, or general. If partial, it may affect — 1. Only the middle portion of this body, or the third lobe. 2. The left lobe. 3. The right lobe. 4. The middle portion and one of the lateral lobes, the other remaining unchanged. 5. Both lateral lobes, the middle portion retaining its natural size. The general enlargement may be uniform, or irregular, and either with or without a prominent tumour within the bladder. In some cases, it is not the middle portion of the prostate, but the lateral lobes, which project into the bladder. (See Cruveilhier, *Anat. Pathol.* livr. xvii.)

The prostate generally becomes harder than natural; but, in a few instances, it is the reverse. (See Brodie, on *Dis. of Urinary Organs*, p. 119.) This latter occurrence was well exemplified in the case of a man who died in University College Hospital, and whose prostate gland I examined with my friend Dr. Carswell. This chronic swelling of the prostate gland is most common in the decline of life; one circumstance in which it differs from scrofulous diseases of the same part, which are well known to happen chiefly in youngish persons. It is observed by Mr. Hunter, that, when the prostate gland swells, "it does not lessen the surface of the urethra at the part, like a stricture; on the contrary, it rather increases it; but the sides of the canal are compressed together, producing an obstruction to the passage of the urine, which irritates the bladder, and brings on all the symptoms in that viscus, usually arising from a stricture or stone. From the situation of the gland, which is principally on the two sides of the canal, and but little, if at all, on the fore part, as also very little on the posterior side, it can only swell laterally, whereby it presses the two sides of the canal together, and at the same time stretches it from the anterior edge or side to the posterior, so that the canal, instead of being round, is flattened into a narrow groove, and sometimes the gland swells more on one side than the other, which makes an obliquity in the canal passing through it.

"Besides this effect of the lateral parts swelling a small portion of the gland which lies behind the very beginning of the urethra, swells forwards, like a point, as it were, into the bladder, acting like a valve to the mouth of the urethra, which can be seen even when the swelling is not considerable, by looking upon the mouth of the urethra from the cavity of the bladder in a dead body. It sometimes increases so much as to form a tumour projecting into the bladder some inches. This projection turns or bends the urethra forwards, becoming an obstruction to the passage of a catheter, bougie, or any such instrument; and it often raises the sound over a small stone in the bladder, so as to prevent its being felt." (Hunter on the *Veneral Disease*, p. 169.) Sir Benjamin Brodie concurs also in representing the canal of the urethra, where it passes through the enlarged prostate, as being generally flattened; "and when the latter is divided transversely, the urethra appears like a slit, rather than like a cylindrical canal. Not unfrequently, the enlargement of the

prostate so alters the form of the urethra, that instead of pursuing a straight course through the gland, it is inclined first to one side and then the other." (*On Dis. of the Urinary Organs*, p. 120.) The same gentleman notices the occasional enlargement of the prostatic portion of the urethra in this disease into a kind of sinus, which he has known to be of sufficient size to hold two or three ounces of fluid.

Two other effects are produced on the urethra by chronic enlargement of the prostate gland; one is the sudden increase of the curve of the urethra upwards as it approaches the bladder; and the other is the addition made to the length of the prostatic part of the urethra, the passage becoming thereby sometimes two or three inches longer than natural. The neck of the bladder is also carried sometimes upwards as high as the pubes, and so removed away from the perinæum. (See Stanley, *on the Lateral Operation*, pl. 6 and 7.)

The valvular production just behind the beginning of the urethra, described by Hunter, particularly merits attention, because it is represented by Sir Everard Home as arising from the enlargement of what he considers a newly discovered part in anatomy, viz. a third, or middle lobe, of the prostate gland. (See *Phil. Trans.* 1806.)

Langenbeck, the present distinguished Professor of Anatomy and Surgery at Göttingen, in a review of Sir Everard's account, declares, however, that he has never, in the natural state of the parts, found the middle lobe, as it is called, which he considers as a partial induration, rising up in the shape of a lobe. (*Neue Bibl.* b. i. p. 360. 12mo. Hanover, 1818.) This dissent would seem extraordinary, if it were not possible to suppose, that it may proceed, not from all the subjects at Göttingen differing from Londoners in being destitute of, what Sir Everard Home has named, the middle lobe of the prostate gland, but from Langenbeck's not having traced, in the healthy state of gland, any portion which he thought deserving of that name. Cruveilhier also deems it incorrect to reckon a third lobe, maintaining that between the part so named and the rest of the gland, there is no marked division, no interruption of continuity. (*Anat. Pathol.* livr. xxvii.) But though differences of opinion may be entertained about the name, none, I presume, can remain about the thing itself, which appears to have been long ago mentioned, though not perfectly described, by Morgagni. (*Adversaria Anat.* 4. *Animad.* 15.) The paper by Sir Charles Bell, illustrating how far our predecessors had a knowledge of this portion of the gland, is an interesting document on this disputed point. (See *An Account of the Muscles of the Ureters*, in *Med. Chir. Trans.* vol. iii. p. 171, &c.)

According to Sir Everard Home, the third lobe, in the earlier periods of life, when the body of the gland is in a sound state, is small; nor does it appear to become enlarged, even when the body and the lateral lobes have been considerably increased in size; but, in subjects of advanced age, this part, as well as the rest of the gland, is usually found somewhat enlarged, even in cases where no disease has been suspected during life. (P. 17.) When the middle lobe begins to enlarge, it presses inwards towards the cavity of the bladder, putting the internal membrane upon the stretch, and communicating to it by immediate contact the inflammation, which occasioned its own enlargement.

Hence, pain in making water, particularly after the last drops are voided, and a desire and straining to discharge more, after the bladder is empty.

As this organ cannot now retain much urine, the desire to make water becomes frequent, and there is commonly more or less constitutional disturbance, or symptomatic fever. In proportion as the middle lobe increases in size, it projects into the cavity of the bladder in the form of a nipple; but after a further augmentation, it loses the nipple-like appearance, becomes broader, and forms a transverse fold by pushing forward, and stretching, the membrane, connecting it to the lateral lobes. "As the tumour, and the transverse fold, are situated immediately behind the orifice of the urethra, they are pushed forwards before the urine in every attempt that is made to void it, acting like a valve, and closing up the opening, till the cavity of the bladder is very much distended, when, the anterior part of the bladder being pushed forward, and the tumour being drawn back, in consequence of the membrane of the posterior part of the bladder being put on the stretch, the valve is opened, so that a certain quantity of water is allowed to escape, but the bladder is not completely emptied." (P. 19.) Sir Everard Home afterwards explains, that, as the tumour enlarges, the quantity voided at each time becomes smaller, and that which is retained is increased; until at length the disease becomes so much aggravated, that there is a complete retention of urine. The body of the gland, and the lateral lobes, though less disturbed than the middle lobe by the patient's repeated efforts to void the urine, become more or less enlarged; but, it is remarked, that they do not preserve either their natural, or any regular proportion, to the middle lobe, nor do they always swell equally together, the left in some instances becoming much larger than the right. (P. 22.) When he published his first vol. on diseases of the prostate gland, he had seen only the left lobe form the greatest projection within the bladder; but, in his second vol., published in 1818, there is an engraving, representing the right lobe thus altered; and he mentions two instances, in which a similar enlargement of the same lobe had taken place. Mr. Wilson has also more than once met with this greater swelling of the right lobe. (*On the Male Urinary and Genital Organs*, p. 336.) The recollection of these facts will often enable the practitioner to incline the beak of a catheter in the direction, by which it may be conducted into the bladder; and thus, as Sir Everard Home has remarked, the surgeon, after trying gently on the left side, and not succeeding, is not to persevere in that direction, but try whether the passage will offer less resistance on the opposite side.

The tumour, formed by the projection of the middle portion of the prostate gland within the bladder "varies in size from that of a horse-bean to that of an orange. When small, it is of a conical form, with the apex of the cone projecting into the bladder, and the basis being continued into the rest of the prostate. When large, the basis is often the narrowest part, and it swells out so as to have a pyriform figure towards the bladder. In some instances (continues Sir Benjamin Brodie) by the side of that which I have just mentioned, there is another tumour, formed by one of the lateral portions, also projecting into the bladder." (*On Dis. of the Urinary Organs*, p. 119.) The last fact is well

illustrated by several preparations in University College Museum ; and the particulars of a case in which there were more than one longitudinal projection of this kind within the bladder, have been lately recorded by Cruveilhier. (*Anat. Pathol. livr. xxvi.*) This last pathologist, in making some reflections upon a case which he dissected, states, that he was able in this, as well as in numerous other instances, to demonstrate that the prostate gland is contained between two muscular planes, the external of which is thick, the internal derived from the muscular fibres of the bladder, very thin, and interposed between the mucous membrane and the proper texture of the prostate ; and likewise that the prostate is itself pervaded by the muscular fibres derived from the muscular coat of the bladder. The thickness of the external muscular stratum, and the thinness of the internal one, seem to Cruveilhier to account for the lobulated projections of the prostate in the state of hypertrophy always taking place within the bladder and never in the direction outwards. (See Cruveilhier, *Anat. Pathol. livr. xxvi.*)

The diseased state of the body of the prostate gland, and of the lateral lobes, above alluded to by Sir Everard Home, he says, is very different from that which is met with in earlier periods of life, in consequence of strictures of the urethra, and which subsides when the obstruction in that canal is removed. This enlargement of the prostate gland from strictures, he observes, may not be unaptly compared to the swelling of the testicle in gonorrhoea, a case of accidental inflammation in a healthy testicle ; while the other disease of the prostate is analogous to the more permanent disease of the latter organ. This author adverts, however, to a few instances, in which the enlargement of the body of the prostate gland from strictures, in persons 50 years of age, did not subside immediately the latter affection was cured, a common bougie stopping at the neck of the bladder, although a catheter, which had a regular curve, readily passed. According to Sir Everard Home, as, in such cases, the patients were able to empty their bladders, it is evident, that there could be no enlargement of the middle lobe. In cases like these, no symptom of importance is produced, and whether the swelling of the prostate readily subsides, or not, is of no consequence ; though, if the stricture do not return, it will always ultimately diminish. (*On Diseases of the Prostate Gland, vol. i. p. 24.*) In the Museum of University College, I believe there is no example of chronic enlargement of the prostate gland, attended with stricture in the urethra ; and I mention this, because Cruveilhier has never seen partial or complete hypertrophy of the prostate accompany stricture in the urethra. Nay, he adds, a stricture in the membranous part of the urethra is almost constantly attended with more or less complete atrophy of the prostate, which atrophy is frequently the consequence of chronic inflammation. (*Anat. Pathol. livr. xxvi.*) In patients under 60 years of age, Sir Everard Home rarely found the middle lobe so swelled as to produce retention of urine, or an inability to empty the bladder, notwithstanding the rest of the gland might be much enlarged. (P. 23.) When the middle, and one of the lateral lobes, project considerably into the bladder together, their surface is sometimes excoriated, and has an ulcerated appearance. Under such circumstances, the pain,

after voiding the last drops of urine, is severe, and attended with spasmodic affections of the neck of the bladder, of the most distressing kind.

Another effect of a similar enlargement of the prostate gland is to render its secretion extremely viscid and very abundant. A question might arise about the real source of this ropy mucus, and some might infer, that it was secreted by the bladder ; but that it comes entirely from the inflamed prostate gland is proved, says this gentleman, by its having been found in one instance with one extremity floating in the bladder in the dead body, while the other extremity appeared divided into small filaments, terminating in the orifices of the excretory ducts of the gland at the verumontanum. The quantity of secretion is observed to depend more upon the degree of irritation, than the actual enlargement of the gland, and, as this increased secretion happens in cases of swelling of this part from strictures, where the body and lateral lobes are alone affected, it is inferred, that the disease of the middle lobe only contributes to this effect by keeping up a straining, and disturbance of every part of the gland. (*Home, p. 32.*) The internal membrane of the bladder inflames, and becomes extremely irritable, so that, even when the quantity of urine is small, there is a great deal of straining. When the size and form of the tumour are such as to allow the greater part of the urine to pass, though with great effort, Sir Everard states, that the symptoms may continue nearly the same for months ; liable, however, to occasional aggravations from slight causes, and becoming more or less relieved, when these are removed. Nay, he observes, that the symptoms may even lessen, although the disease is not at all diminished ; a circumstance, which is ascribed to the muscular coats of the bladder having acquired greater strength, and the internal membrane having lost, from habit, the sensibility which it possessed in the earlier stage. (P. 34.) He further explains, that, in this disease, when the inside of the bladder is inflamed, filamentous portions of coagulating lymph are thrown off from it, which, when the inflammation increases, subside in the urine evacuated, looking not unlike white hair-powder ; and, when the irritation is very violent, perfectly formed pus is met with in the urine. (P. 35.) After the inflammation subsides, the bladder becomes again capable of retaining a larger quantity of urine, though its power of completely emptying itself is still further diminished.

According to Mr. Wilson, the symptoms, which generally attend an enlarged prostate gland, are similar to those of an irritable bladder :— constant, heavy, dull pain in the gland, and sometimes sharp lancing pains, darting from it to the urethra, and occasionally to the bladder and ureters. Frequent calls to void the urine, which is passed with difficulty, only a small quantity being discharged at a time, as more or less remains behind in the bladder. A complete retention of urine may be produced, so that not one drop will pass, although much straining is used. Great difficulty in expelling the feces, and, after each evacuation, a feeling is still experienced, as if the gut were not yet emptied. During the efforts to expel the urine and feces, a quantity of the mucous secretion of the prostate gland is not unfrequently forced out. Most of these symptoms, as Mr. Wilson observes, are similar to those produced by stone, and, there-

fore, when they occur, the gland should be examined by the rectum, and, if it be not found diseased, a sound should be introduced into the bladder. (*On the Male Urinary and Genital Organs*, p. 339.) The particular differences, between the symptoms of stone, and those arising from disease of the prostate gland, are explained in the article LITHOTOMY.

Mr. Hunter first pointed out a fact, which the practical surgeon should never forget, viz. that the swelling of what Sir E. Home calls the middle lobe of the prostate gland, often raises the sound over a small stone in the bladder, and prevents it from being felt. (*On the Venereal Disease*, p. 170.) Hunter also first noticed another circumstance well deserving recollection, viz. that an enlargement of the same part may account for the disappearance of all the symptoms of stone in patients, who have already suffered greatly from them, as the swelling prevents the calculi from falling down upon, and irritating, the neck of the bladder. These truths are exemplified by cases, which are highly interesting. It appears also probable, from the observations of Sir Everard Home, that an enlargement of the middle lobe conduces to the formation and lodgment of calculi in the bladder, partly by preventing the evacuation of small ones through the urethra, and partly by hindering the bladder from completely discharging its contents. (Vol. i. p. 40.) Lastly, it is explained, that, in disease of the prostate gland, patients secrete less urine than natural, and that death is sometimes produced by the retention of urine suppressing the secretion altogether. Sir B. Brodie has known the secretion of urine to be completely suppressed, even under the continued use of the catheter; and, in one example, opened by Mr. Stanley, the stoppage of the secretion of urine, was found to depend upon a medullary fungus immediately behind the vesical orifice of the urethra, and extending to the orifices of the ureters, which tubes were considerably enlarged, and distended with urine. (See Brodie, on *Dis. of the Urinary Organs*, p. 134.) There is not, however, in all instances a diminished secretion of urine; in many cases, the quantity of this fluid is increased. In one case, where this had taken place for some years before the patient died, "both kidneys were found of a very pale colour, and the glandular structure of one of them was much diminished in bulk, the pelvis being at the same time considerably dilated." (Sir B. Brodie, *Op. cit.* p. 132.) In enlargement of the middle lobe, one symptom, on which Sir Everard Home lays great stress, is hemorrhage produced by riding on horseback. (Vol. ii. p. 27.) Inflammation and even ulceration of the membrane covering the middle lobe, he says, are more frequent than he was at first aware of, and are produced by the rough introduction of instruments. In University College Museum are several preparations taken from bodies of individuals in whom these changes had happened. Hence, the burning heat at the neck of the bladder, the great pain and distress attending the passage and the continuance of an instrument, the occasional necessity of taking it out, and the duration of the pain for some time afterwards. (Vol. cit. p. 29.) Hence, also occasionally profuse hemorrhage.

A prostate which is extensively ulcerated (as Sir Benjamin Brodie has explained) is liable to bleed; but this may be the case also with a pro-

state which is not ulcerated, or which is ulcerated only to a small extent. A gentleman who had had been in the habit of introducing a gum catheter himself, on account of disease of the prostate gland, one evening observing that blood flowed with the urine, sent for Sir B. Brodie. On this gentleman's arrival, the bladder was enormously distended, prominent, as high up as the navel, and blood was still flowing from the urethra. A large catheter was introduced, but no urine issued. The bladder was distended with blood. The patient was ordered to be cupped on the loins, and to remain quiet. Under this treatment, the hemorrhage ceased. The catheter was afterwards introduced three or four times daily. By degrees the blood was dissolved in the urine, which, in two or three weeks, became clear again; febrile symptoms continued, however, and the patient only survived the hemorrhage a month. In the *post mortem* examination, Sir Benjamin Brodie found the mucous membrane of the bladder extensively inflamed; a large tumour of the prostate projected into the bladder: and the exact spot in which the vessels of the swelling had given way, and from which the hemorrhage had proceeded, was discernible. (*On Dis. of the Urinary Organs*, p. 131.)

The enlargement at first takes place slowly, attended with pain, and no particular alteration of the structure is apparent in the gland, when examined in this stage after death, nor is any change discoverable, when the part is felt from the rectum in the living patient. As the disease proceeds, the structure of the whole gland changes, and the part enlarges, sometimes regularly, so as to preserve its shape, to the size of a moderate orange; sometimes very irregularly, projecting in a lobulated manner. When the gland in this state is cut into, its substance feels firm, the cut surface is of a whitish brown colour, and the membranous septa, extending through it in various directions, are often strongly marked. In general, before the urethra and bladder are opened, the gland appears most enlarged laterally. It also swells backwards towards the rectum, producing that appearance of the excrement particularly noticed by J. L. Petit. Its anterior part is generally least enlarged, because its connection with the pubes prevents it from passing far forward. However, Mr. Wilson met with instances, in which the enlargement above, or in front of the urethra, was considerable. The extent of the lateral and posterior swelling may be readily felt with the finger, introduced within the rectum. That these very irregular windings in the prostatic portion of the urethra are frequently occasioned by the disease, is also confirmed by Mr. Wilson's experience, and numerous preparations in the museum of the College of Surgeons. "In the progress of the enlargement, the two sides do not always swell equally; one often enlarges most, and often swells more in one particular part than another. This produces a lateral bend, or obliquity in the passage, which will of course increase the difficulty of passing the urine, and of introducing the catheter. I have seen, from the irregularity of the lateral swelling, the passage through the gland bend in succession to both sides." (Wilson, on the *Male Urinary and Genital Organs*, p. 332.) A case under me in University College Hospital afforded an instance of the latter fact.

As every considerable enlargement of the pro-

state gland is attended with great difficulty of voiding the urine, the muscular coat of the bladder always becomes more or less thickened, in consequence of the efforts, which it is obliged to make, and the observations of Cruveilhier prove, that it is thickened in a much greater degree than the mucous coat. (See *Anat. Pathol.* liv. xxvi.)

The mucous membrane, however, becomes affected with chronic inflammation, and it secretes a thick tenacious mucus, that has an offensive ammoniacal smell. This complication adds greatly to the patient's sufferings and danger. Indeed, as Sir Benjamin Brodie correctly observes, chronic inflammation of the mucous membrane of the bladder is one of the most frequent causes of death in neglected cases. (See *Brodie, on the Urinary Organs*, p. 125. ed. 2.)

When the lining of the bladder is affected with chronic inflammation, the researches of Dr. Prout prove, that the mucus, which it forms, is sometimes blended with phosphate of lime, small deposits of which becoming cemented together constitute the nuclei of calculi, frequently met with in these cases in the bladder. In University College Museum may be seen fine specimens of such formations. Another effect often noticed in persons, who have long suffered from repeated retention of urine from stricture, or enlarged prostate, is the protrusion of the inner coat of the bladder in one or more places in the interspaces of the muscular fibres, occasioning what is termed a sacculated bladder, of which there are some capital specimens in the same Museum. Sometimes these cysts contain pus, and often calculi. "The cysts (Sir Benjamin Brodie observes) are generally small, but occasionally they attain a large size; and it is remarkable that they sometimes contain what appears to be pure pus, while the bladder, with which they communicate, contains only urine. An old gentleman consulted me, labouring under disease of the prostate gland. He had a frequent inclination to void his urine; and, on introducing the catheter, immediately after he had voided it, about three or four ounces of urine were found to have been left in the bladder." But what he chiefly complained of, was an uneasy sensation in the rectum. One day, after the usual quantity of nearly clear urine had been drawn off, half a pint of pus came away. The same thing happened two or three times afterwards, and was at first attributed to an abscess, which the catheter was supposed to have entered; but in the *post mortem* examination, three cysts were discovered of various sizes, all communicating with the bladder, and consisting of protrusions of its inner membrane. The largest was situated between the bladder and the rectum. (See *Brodie, on Dis. of the Urinary Organs*, p. 126.)

Now and then an abscess forms in the enlarged prostate, and, on its bursting into the urethra, the symptoms are relieved.

In some cases, the chronic inflammation of the mucous membrane of the bladder extends along the ureters to the pelvis, and infundibula of the kidneys, and leads to the same kind of mischief in the latter organs, as sometimes results from old and neglected strictures (see URETHRA); and the ureters are dilated, manifestly from the impediment which the loaded state of the bladder presents to the passage of urine into it. In proportion as the kidneys become diseased, the urine becomes

more and more albuminous, and at length purulent. (*Sir B. Brodie, Op. cit.* p. 137.)

In relation to the third, or middle lobe, it would appear that, from some dissections made by Mr. Shaw, that, in many cases, the enlarged portion of the prostate, projecting into the bladder, is not the third lobe, but a part of the gland situated more forwards. (See *Bell's Surgical Obs.* vol. i. p. 223, &c.)

According to Sir Everard Home, a stricture may be distinguished from an enlargement of the prostate gland, by the following circumstances: The distance of the obstruction from the external orifice is to be determined by passing a soft bougie, which is to be left in the canal for a minute, so as to receive an impression from the obstruction. If the bougie does not pass further than seven inches, and the end is marked by an orifice of a circular form (it is immaterial as to the size of the orifice), the disease is certainly a stricture; but if it passes further on, and the end is blunted, a disease in the prostate gland is to be suspected. This in general may be ascertained by the possibility of passing into the bladder a flexible gum catheter with a stilet, very much curved, which in most cases of enlargement of the gland, may be accomplished.

I have never seen a case in which a retention of urine from chronic enlargement of the prostate gland, terminated in extravasation of urine from rupture of the bladder. Sir Astley Cooper never met with but one instance of it. Desault remarked long ago, that, in every case of retention, where the urethra is free from obstruction, the urine after distending the bladder to a certain point, generally dribbles away through that canal, and the patient may live a good while in this condition. But the case is different, when the retention depends upon any stoppage in the urethra, for the urine then does not partially escape; the distension increases, and if relief be not speedily afforded, the urethra gives way behind the stricture or obstruction. Speaking of retention from chronic enlargement of the prostate gland, Sir Benjamin observes, "I never saw, nor have I heard of, a case, in which, under these circumstances, the bladder had given way, as sometimes happens when there is a retention from stricture; and it is evident, that the urethra itself cannot be ruptured, as the urine does not even enter it, the obstruction being altogether posterior to it. But the patient cannot survive a complete retention of urine from this cause, any more than he can survive a retention of urine from other causes, beyond a certain period of time. The powers of his nervous system become exhausted; there is a cessation of local suffering; the tongue becomes dry and black, coma supervenes, and the symptoms terminate in death." (*Op. cit.* p. 122.)

On the subject of the causes of chronic enlargement of the prostate gland, it appears to me, that little certain is known, excepting that it is a disease seldom met with under the age of fifty. Desault suspected that it was sometimes venereal, and common in individuals, who had repeatedly had gonorrhœa. (*Mal. Chir.* t. iii. p. 238.) I believe neither of these suspicions is entertained at the present day. According to Sir Everard Home, it is a rare occurrence for a man to arrive at eighty years of age, without suffering more or less under disease of this part. "The more common causes (say: he) of inflammation of the prostate

gland, are full living of every kind, inebriety, indulgence to excess with women, a confined state of the bowels, and exposure to the effects of cold; indeed, whatever increases the circulation of the blood in these parts (the genitals, I suppose) beyond the healthy standard, may become a cause of inflammation in this gland, the blood-vessels of which lose their tone in the latter periods of life." (*On Dis. of the Prostate Gland*, vol. i. p. 18, 19.) If we are to credit another statement, the disease occurs most frequently either in persons who have not used the genital organs so much as nature intended, or in others who have led a life of excess. (*Wilson, on the Urinary and Genital Organs*, p. 332.) It seems to me better to confess, that the etiology of this complaint is unknown. Nor are we rendered much wiser by conjectures about the effects of horse-exercise, or those of a retarded venous circulation in old subjects, in creating a tendency to the disease. I have known several persons afflicted, who had led very sedentary lives.

I am afraid that the observation, formerly made by Mr. Hunter, still continues true, which is, that a certain cure for chronic enlargement of the prostate gland has not yet been discovered. But, though such is the fact, surgery is undoubtedly capable of affording a great deal of relief, so as to lengthen the patient's days, and render them more comfortable. This is accomplished principally by anodyne medicines, and drawing off the patient's water, when he cannot void it himself either at all, or but imperfectly, and with considerable straining and suffering. As a temporary relief from pain, and also as a means of removing spasm, opiate clysters should be administered once or twice a day. (*Hunter*, p. 174.) Serofulous enlargements of the prostate gland, occurring in younger subjects, are probably more under the control of judicious treatment. Thus, Mr. Hunter informs us, that, in several cases, he had seen hemlock of service. "It was given upon a supposition of a serofulous habit. On the same principle (he adds), I have recommended sea-bathing; and have seen considerable advantages from it, and, in two cases, a cure of some standing." In one case, burnt sponge had reduced the swelling; and, in another, the same effect was produced, and the irritability of the bladder lessened, by means of a seton in the perineum. After the healing of the seton, however, the symptoms returned, and on a trial of the plan again, the former good effects were not experienced from it. Many years ago I visited a gentleman under Mr. Lawrence, who was trying the effect of an issue in the same situation. In these cases, the pilulæ hydrargyri cum opio (*see PILULÆ*), have often been prescribed, but with little, or no benefit. The influence of iodine over chronic enlargement of the thyroid gland, has led to trials of it in that of the prostate; but it has been productive of no more benefit than mercury and various other means previously resorted to. (*See Brodie*, *Op. cit.* p. 141.) Sir Everard Home mentions an instance, in which suppositories of opium and hemlock, passed up the fundament, and allowed to dissolve there, gave more relief than any other plan; not only lessening the irritation, but producing a diminution of the projection of the gland. The latter part of the observation can hardly be said to be confirmed by later experience.

In the first stage of the enlargement of the middle lobe, when there is no absolute obstruction to the passage of the urine, Sir Everard recommends bleeding from the loins, opiate clysters, and the pulv. ipecac. comp. (*On Diseases of the Prostate Gland*, vol. i. p. 70.) Catheters and bougies, he observes, should on no account be introduced, more especially those of the metallic kind, since they produce a degree of disturbance, which the parts are not in a state to bear, and, if unskillfully employed, they will increase the swelling, and bring on a complete retention of urine. Sir Everard is an advocate for keeping the bowels open, for which purpose he prefers the infusion and tincture of senna, with the tartrate of potash. (*Vol. ii.* p. 84.) If, in defiance of these means, the patient becomes unable to make any water, or, although able to pass a few ounces, is every hour obliged to make the attempt, and, after much straining, discharges only the same quantity, Sir Everard directs a flexible gum catheter, without a stilet, to be passed into the bladder, in the gentlest manner possible. This instrument is to be kept introduced with the catheter bracelet, or retainer, made and sold by Mr. Weiss of the Strand, and the water drawn off at regular intervals, not only till the first symptoms go off, but till the bladder can retain the urine for the usual length of time, and what is voided has the appearance of healthy urine. If, when the catheter is withdrawn, the patient should not be able to empty his bladder, it must be re-introduced, and, after six or seven days, taken out again. When the disease is somewhat more advanced, and the patient cannot keep himself quiet, the above practice of course cannot be adopted, and it becomes necessary to pass the catheter three or four times a day. But, even in such a case, when irritation is brought on by accidental circumstances, Sir Everard recommends keeping the instrument in the bladder until the attack has subsided. (*Vol. ii.* p. 92, 96.) This gentleman finds that, for cases of diseased prostate, the common flexible gum catheters, originally made straight, are disadvantageous, as it is a long while before they can be made to keep a permanently curved form. "When (says he) the curvature of the catheter is no part of its original formation, although it may have been produced by being long kept in a curved state, yet, when allowed to remain in the bladder, it gradually returns to its straight form by being moistened, and when it has acquired it, the point is no longer kept directed upwards in the cavity of the bladder, but is constantly pressing against the posterior coats, pushing itself out of the urethra, and the irritation it gives the muscular coat of the bladder, will often be the means of its being expelled by a spasm with considerable violence." (*On Diseases of the Prostate Gland*, vol. ii. c. 5.) Sir Everard further informs us, that Mr. Weiss has succeeded in making flexible gum catheters, originally curved, so that they always retain their shape. Their polish is great, and they can be had of any size: they are also made particularly strong, a quality necessary to secure them from being broken in violent attacks of spasm. Sir Everard states that he has kept them fifteen days in the bladder, without their being spoiled by the urine or mucus; whereas, common French and English catheters become in a shorter period so rough as to be unfit for further use. Metal catheters, he asserts,

should never be employed but in cases of necessity, where the patient cannot be relieved by milder means. (Vol. ii. p. 87.) To such instruments, he ascribes the frequently noticed ulceration of the middle lobe, the abrasion of its surface, the wounds through its substance, the general inflammation of the whole internal membrane of the bladder, and quick destruction of the patient's life. The gum catheter, however, is to be as large as the urethra will easily admit, in order that it may more readily disengage itself at the turns into the bladder. (Vol. i. p. 75.)

Notwithstanding the statements of Sir Everard Home, it is conceived by M. Cruveilhier, that the wearing of a large catheter a long time, by dilating the neck of the bladder, and altering the shape of the portion of the prostate which projects into the bladder, may restore, for a greater or lesser time, the passage for the urine; and Cruveilhier believes that he has seen several instances of this fact in his own practice. M. Leroy has also proposed an ingenious contrivance (*le redresseur*) for effecting this object; it consists of a bent sound, which admits of being rendered straight after its introduction. (See Cruveilhier, *Anat. Pathol.* liv. xxvi.)

Desault always advocated the correct maxim in practice, that a large catheter generally answers better than a small one; it may either be of silver or elastic gum. The latter, though the best for the purpose of being kept in the passage, he says, has not always sufficient firmness to get through the obstruction in the canal, not even with the aid of a stilet. In this respect, a silver catheter is sometimes preferable. The truth of these two remarks, I think, will be forever acknowledged by the practical surgeon. But, whatever may be the kind of catheter employed, it generally passes as far as the prostate with perfect facility, where it is stopped, not only by the narrowness, but also by the new curvature of the passage. For the prostate cannot be enlarged without pushing forward and upwards, or to one side, that portion of the urethra behind which it is situated. This circumstance ought never to be forgotten in regulating the direction of the catheter, which should also be longer, have a more considerable curvature, and be more elevated, at the time of its introduction than in other cases of obstruction in the urethra.

In chronic enlargement of the prostate gland, Mr. Hey particularly pointed out one advantage, which belongs to elastic catheters, viz. that their curvature may be increased while they are in the urethra. This gentleman was introducing an elastic gum catheter in a patient, whose prostate gland was much enlarged, and finding some obstruction near the neck of the bladder, he withdrew the stilet, in doing which, he accidentally repressed the tube, which then went into the bladder. In fact, he found, that the act of withdrawing the stilet increases the curvature, and lifts up the point of the catheter. (*Pract. Obs. in Surgery*, p. 399, ed. 2.) I have frequently found that a silver catheter, if it cannot be made to pass by inclining the beak of it duly upwards, and also if requisite towards one side, will glide into the bladder when the fore-finger of the left hand has been introduced into the rectum for the purpose of promoting the passage of the instrument. Except when the instrument is to remain intro-

duced, I generally prefer a long silver catheter of full size, for a shorter one will sometimes not reach the bladder. Sir Benjamin Brodie rarely uses any but a gum catheter; and I have already noticed Sir Everard Home's preference of the same kind of instrument. For further remarks connected with this subject, see CATHETER and URINE, RETENTION OF.

See J. Hunter, on the Venereal Disease, p. 169, &c. 2d edit. 4to. Lond. 1788. *Brillie's Morbid Anatomy* P. J. Desault, Œuvres, Chir. t. iii. p. 220, &c. 8vo. Paris, 1803. Sir Everard Home, On Diseases of the Prostate Gland, 2 vols. 8vo. Lond. 1811—1818. Also on Strictures, 3 vols. 8vo. 3d ed. 1805—1821. Sir C. Bell, On the Muscles of the Ureters, in Med. Chir. Trans. vol. iii. J. Shaw, On the Structure of the Prostate Gland, in G. Bell's Surgical Obs. vol. i. 8vo. 1816. F. A. Lloyd, On Scrofula, p. 107, &c. 8vo. Lond. 1821. J. Horseship, Obs. on Dis. of the Urinary Organs, &c. 8vo. Lond. 1816; also, On Complaints affecting the Secretion and Excretion of Urine, Lond. 1823. Sir B. C. Brodie, On the Diseases of the Urinary Organs, &c. 2. 8vo. Lond. 1835. Cruveilhier, *Anat. Pathol.* t. i. liv. xviii. fol. Paris, 1822—1836, and t. ii. liv. xxvi. J. Wilson, On the Male Urinary and Genital Organs, 8vo. Lond. 1821.

PSUEDOSYPHILIS. (From *ψευδής*, false, and *sypphilis*, the venereal disease.) Disease resembling the venereal, but not really of this nature. (See VENEREAL DISEASE.)

PSOAS ABSCESS. (See LUMBAR ABSCESS.)

PSORIASIS. *Scaly Tetter*. A disease of the order Squamæ, in Dr. Bateman's Synopsis. It is attended with more or less roughness and scalliness of the cuticle, and a subjacent redness. The skin is often divided by deep fissures; and the complaint is generally attended with constitutional disorder, and liable to cease and return at certain seasons. For a particular account of its varieties and treatment, see the above work.

PSOROPHTHALMY. (From *ψώρα*, the itch, and *ὀφθαλμία*, an inflammation of the eye.) An inflammation of the eyelids, attended with ulcerations which itch very much. Heer actually understands by the expression, such a disease, from the sudden repression of the itch, or the infection of those parts with psoric matter: (*Lehrb. von den Augenkr.* b. i. p. 566.) Welker not only adopts the same notion, but makes an addition to it, by extending the term also to cases in which the eyelids are affected with psoriasis, porrigo, and impetigines. (*Manual of the Dis. of the Eye*, vol. ii. p. 264.) By psorophthalmia, the late Mr. Ware meant a case, in which the inflammation of the eyelids is attended with an ulceration of their edges, upon which a glutinous matter lodges, incrusts, and becomes hard, so that in sleep, when they have been long in contact, they become so adherent, that they cannot be separated without pain. He has remarked, that "the ulceration in the psorophthalmia is usually confined to the edges of the eyelids; but, sometimes, it is seen to extend over their whole external surface, and even to excoriate the greater part of the cheek. In cases of the latter kind, the inflammation which accompanies them, has often much the appearance of an erysipelas, and will receive most relief from cooling applications. The use of the citrine ointment, which will hereafter be recommended, must, in such instances, be deferred, until the irritability of the skin is in a good degree abated.

"This disorder is also, sometimes, attended with a contraction of the skin of the lower eyelid; in consequence of which, that lid is drawn down and the inner part turned outward, so as to form a

red, fleshy, and most disagreeable appearance, called ectropium. Whenever this happens it proves the complaint to be of the most obstinate nature; though it is generally removed by the cure of the psorophthalmia, which is the occasion of it." (*Remarks on Ophthalmia*, &c. p. 112.) Mr. Ware recommended, for the cure of this disease, the unguentum hydrargyri nitratis melted, and rubbed with the end of the forefinger, or the point of a small pencil brush, into the edges of the affected eyelids, every night at bedtime. A plaster of ceratum album was then put over the eyelids to keep them from adhering together. If they still adhered in the morning, they were cleaned with milk and butter well mixed together. In a few cases it is necessary to touch the ulcers formed on the edge of the eye-lid, after the small-pox, with the argentum nitratum. When the globe of the eye is inflamed, the vinous tincture of opium is applied, as directed in the article OPTHALMIA. In scrofulous subjects, alterative medicines, an issue, or perpetual blister, and attention to diet, &c. are necessary.

PTERYGIUM. (Dim. of πτερόν, a wing.) As Scarpa remarks, surgeons usually apply the term "*pterygium*" to that preternatural, reddish, ash-coloured, triangular little membrane, which most frequently grows from the internal angle of the eye, near the caruncula lachrymalis, and gradually extends over the cornea, so as to cause considerable impediment to vision. The disease, however, presents itself sometimes in the form of a semitransparent thin, greyish membrane, not furnished with many visible vessels, and sometimes as a thick, red, fibrous mass, very like muscle, being very prominent even on the cornea, where it seems to terminate in a substance-like tendon, and it is observed to be pervaded by numerous blood-vessels. The first is the *pterygium tenue* of Beer; the second, the *pterygium crassum* (*Lehre von den Augenkr.*, b. ii. p. 636.), or the membranous and fleshy pterygia of other writers.

Though the pterygium most commonly proceeds from the internal angle (also Beer, b. ii. p. 637.), sometimes it arises from the external one, and, in rare instances, from the superior or inferior hemisphere of the eyeball. But, whatever be its origin, its figure is almost invariably that of a triangle, with its base on the white of the eye, and its apex more or less advanced over the cornea, towards its centre, and that of the pupil. Indeed, there are a few cases in which two or three pterygia of different sizes occur on the same eye, and are arranged round its circumference at interspaces of various breadths. Their points are directed towards the centre of the cornea, where, if they unfortunately conjoin, the whole of that transparent membrane becomes covered with an opaque veil, and a total loss of sight is the consequence. The occurrence of more than one pterygium on the same eye is very rare. Beer, in all his practice, met with but two cases of double pterygium, and with only one of three pterygia on the eye. (Beer, b. ii. p. 638.)

According to Scarpa (whose observations apply chiefly to the membranous form of the disease) chronic varicous ophthalmia, with relaxation, and thickening of the conjunctiva, opacity of the cornea, and the pterygium, only differ in degree. All the three complaints seem to him to consist of a more or less extensive varicous state of the ves-

sels of the conjunctiva, combined with a degree of preternatural relaxation, and thickening of that membrane. On the contrary, Mr. Guthrie does not agree with Scarpa, that chronic varicous ophthalmia, with relaxation and thickening of the conjunctiva, nebula of the cornea, and pterygium, are diseases differing only in degree. On the contrary, he asserts that a true pterygium is very rarely the consequence of chronic inflammation. The nebula, he observes, is never of the spear-shaped shape of the pterygium, but always irregular, its progress rather from than towards the cornea, and the width of its base not equal to that of the latter disease. (See *Operative Surgery of the Eye*, p. 128.)

The pterygium is observed by Mr. Travers to be most prevalent in warm climates. (*Synopsis*, &c. p. 101.) It is also said to be most frequent in old people, though Mr. Wardrop and Dr. Montanelli have seen it in very young infants. (*Weller's Manual of the Dis. of the Eye*, vol. i. p. 218.)

The triangular figure of the pterygium, with its basis on the white of the eye, and its apex on the cornea, is one of its principal diagnostic characters, by which the true disease may be discriminated from every other soft, fungous, reddish excrescence obscuring the cornea.

Another distinguishing character of pterygium, as Scarpa has observed, is the facility with which the whole of it may be taken hold of with a pair of forceps, and raised into a fold on the cornea. Every other kind of excrescence attached to this membrane, continues firmly adherent to it, and cannot be folded, and raised from the surface of the cornea, in any manner whatever. This particularity is of the highest importance in the treatment; for the genuine pterygium may be cured by simple means, while fungous excrescences of the cornea can only be radically removed, and perfectly cicatrised with the utmost difficulty.

Scarpa's belief in the reality of a *malignant* or *cancerous* pterygium must appear a doctrine requiring confirmation, when it is considered, that Mr. Travers makes no mention of such form of the disease, and Beer distinctly states, that, in a practice of thirty-two years, he had cured 376 pterygia, of various sizes and thickness, without one bad symptom, or consequence. And hence, he concludes, that the disease is strictly local. (Beer, b. ii. p. 641.)

The true benign pterygium, says Scarpa, which has a triangular figure, and is ash-coloured, or pale red, is free from pain, and admits of being raised in the form of a fold on the surface of the cornea, may be cured by cutting the opaque triangular little membrane accurately from the surface of the cornea, which is in part covered by it. But, as the pterygium is nothing but a portion of the delicate, transparent layer of the conjunctiva, converted into a thick, opaque tunic, it follows, that the pterygium cannot be removed in any way, without the spot which it occupies on the cornea, being bereft of its natural external covering, and this part of the membrane rendered more or less opaque. Scarpa's experience enables him to state, however, that the superficial, indelible speck, remaining on the cornea, after the removal of the pterygium, is always less extensive than the space previously occupied by the disease.

In the treatment of pterygia with bases extending far in the white of the eye, Scarpa prefers

detaching them at their apex, as far as the junction of the cornea with the sclerotica, and then to separate them at their base by a semicircular incision, comprehending one line in breadth of the substance of the conjunctiva, and made in a direction concentric with the edge of the cornea. Scarpa has observed, that, in this mode of operating, the subsequent cure takes place sooner than when the common method is adopted; the cicatrix occasions no sort of frænum, and the conjunctiva, circularly stretched by the cicatrix, lies smoothly over the white of the eye, and loses that relaxation, and varicose state, which he considers as the ground-work of the pterygium. Such attention, however, is not requisite when the pterygium is small, and its base does not extend far in the white of the eye.

The operator, after desiring the patient to move his eyeball towards the part corresponding to the base of the pterygium, is to take hold of the membrane with a pair of forceps held in his left hand, and pinch it into a fold, at about one line from its apex. The duplicature is now to be raised, and drawn out gently until a sensation of something giving way is felt, which indicates the detachment of the pterygium from the delicate cellular texture, by which it is connected with the subjacent cornea. Next, by means of a pair of scissors, the surgeon must dissect this fold, as closely as possible, from the cornea, proceeding from the apex towards the base of the pterygium. The section being completed to where the cornea and sclerotica meet, the fold is to be again elevated still more, and, with one stroke of the scissors, the pterygium, and the relaxed portion of the conjunctiva, forming its base, are to be detached, as concentrically, and closely to the cornea, as possible. This second incision will have a semilunar shape, the horns of which ought to extend two lines beyond the relaxed part of the conjunctiva, and follow the curvature of the eyeball.

When the operation is finished, the surgeon must promote the hemorrhage by washing the part with warm water, and then cover the eye with dry lint, or lint moistened in the liquor plumbi acet. dilutus.

Unless pain, tension of the eye, and considerable tumefaction of the eyelids, follow, it is sufficient to wash the eye, and inside of the eyelids, three or four times a day with warm water, and carefully keep the parts from being exposed to the air without compressing them. If the symptoms just mentioned should occur, antiphlogistic treatment must be adopted. On the fifth or sixth day, at latest, after the operation, all the surface, from which the pterygium has been cut, appears yellowish, and covered with a fluid like mucus. The edges of the wound, and the adjoining part of the conjunctiva, assume a reddish colour. Afterwards, the wound contracts daily, and at length completely closes.

All local stimulants are to be avoided, and it is not till the wound is healed, that the zinc collyrium, containing a few drops of camphorated spirit of wine, should be used three or four times a day, for the purpose of obviating the relaxation of the conjunctiva and its vessels.

In the early stage of pterygium, while the membrane is as thin as a cobweb, Scarpa considers it unnecessary to deprive the cornea of its natural

covering; and that it is quite enough to cut off a portion of it, in order to intercept all communication between the dilated venous ramifications of the pterygium and the varicose trunks in the white of the eye. This is accomplished by cutting out, with a pair of forceps and scissors, a semilunar piece of the conjunctiva, at the point where the cornea and sclerotica conjoin, and exactly at the base of the incipient pterygium, just as is practised for opacity of the cornea. The recent pterygium is observed to disappear gradually after the operation, or to change into a slight dimness of the cornea, extending over a part of the space previously occupied by the disease. This opacity is commonly much more trivial than what follows a cicatrix. Acriel, in his *Surgical Observations*, mentions having successfully treated an incipient pterygium in this manner. Scarpa has also tried the plan several times with success. Such treatment must be better than merely making two or three deep cuts, or scarifications, in the membrane, near the edge of the cornea, as advised by Beer, (b. ii. p. 641.) And, in proof of the uncertainty of the latter method, we find Beer himself speaking of the necessity of using stimulating applications, like powdered sugar, alum, the vinous tincture of opium, &c. if the operation is not of itself sufficient. In the *pterygium crassum*, Beer recommends the knife, as the best means of cure; but he differs essentially from Scarpa, not merely in preferring a knife to the scissors, but in beginning the operation by making a deep cut through the base of the pterygium in the white of the eye, from which point he continues the dissection of the pterygium, till this is all removed as far as its apex on the cornea, when he uses either the knife or scissors, as most convenient. (Beer, b. i. p. 643.)

Mr. Guthrie, who acknowledges the correctness of Scarpa's objections to removing a large pterygium to a great extent towards the caruncula lachrymalis, adopts a middle course, between the methods of Beer and Scarpa, and removes half of the pterygium from the apex, towards the base. (Vol. cit. p. 130.)

Beer mentions, that it sometimes happens, especially in cases of thin pterygia, that the disease stops at the edge of the cornea, and spreads no further, as long as the patient lives. (Beer, b. ii. p. 641.) Under such circumstances, of course, the complaint will give no trouble, and may be left to itself, as particularly advised by Mr. Travers. (*Synopsis*, &c. p. 274.) When, however, it encroaches upon the sight, this gentleman says, that "it should be raised by dissection, as close as possible to the margin of the cornea, and the relaxed portion of the membrane removed by an incision, midway between the base of the pterygium and the cornea, and concentric to that membrane."

For further information, consult *J. Wardrop, Essays on the Morbid Anatomy of the Human Eye*, vol. i. p. 22, &c. 8vo. Edinb. 1808. Scarpa, *Sulle Malattie degli Occhi*, cap. xl. *Richter's Anfangsgr. der Wundarzneikunst*, b. iii. p. 141, &c. Göttingen, 1795. Beer's *Lehre von den Augenkr.* b. ii. p. 638, &c. 8vo. Wien, 1817. B. Travers, *Synopsis of the Diseases of the Eye*, 8vo. Lond. 1820. *Weller's Manual*, vol. i. 8vo. Glasgow, 1821. G. J. Guthrie, *On the Operative Surgery of the Eye*, p. 124, &c. 8vo. Lond. 1823. R. Middlemore, in *Trans. of Prov. Med. and Surgical Association*, vol. iii. p. 236.

PTOSIS. (From πτερω, to fall down.) Ble-
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phoroptosis. An inability of raising the upper eyelid. According to Beer, ptosis always arises from a considerable relaxation and extension of the common integuments of the upper eyelid, which hang down in a kind of fold over the fissure of the closed palpebræ; and, when the levator muscle has been more or less weakened by the same causes, which have produced this state of the skin, the weight of the redundant integuments prevents the eyelid from being properly opened. Hence, when the patient tries to raise the eyelid, the efforts of the levator muscle may be seen; but the object cannot be perfectly accomplished. With the exception of the inability of raising the upper eyelid, the patient has not the slightest ailment; the eye is not at all red, though, when opened, it does not bear the light well, on account of not being accustomed to the stimulus; no stillitidium lachrymarum is observable; and the edge of the eyelid, with all the eyelashes quite dry, is seen directly the part is elevated with the thumb. When the relaxed fold of the skin is taken hold of between the thumb and forefinger, without pulling or stretching it, but only just so as to take off the weight opposed to the levator muscle by the redundancy of skin, the patient is immediately able to raise the eyelid without any difficulty; but, as soon as the surgeon relinquishes his hold of the skin, the part falls down again. The relaxed fold of skin is sometimes situated rather over the outer commissure than the middle of the eyelid, in which case, the latter part can be opened towards the nasal commissure, and the eyeball becomes habitually rotated towards the nose for the purpose of vision, whereby strabismus, and, if the disorder be not soon rectified, an obliquity of sight, are occasioned.

A prolapsus of the upper eyelid may be the consequence of any inflammation of the part, accompanied with considerable œdema, or ecchymosis, as happens from severe wounds of the forehead, eyebrow, or the eyelid itself, particularly when no attempt is made to unite the parts by the first intention. The infirmity may also be the consequence of ophthalmia, that has been either long neglected, or badly treated with relaxing poultices, and it is said, that scrofulous patients have a disposition to the complaint. (*Beer*, b. ii. p. 109—111.)

The case, as described by this author, may be cured by the excision of a long slip of skin from the eyelid, just broad enough for the removal of the redundant quantity. For taking hold of the portion of integuments, Beer employs forceps, the extremities of which are broad, with a somewhat concave edge. As much of the superfluous skin is to be taken hold of, and raised, as will enable the patient to open the eyelid, which circumstance is the criterion of the quantity selected for the removal, being enough. The excision may then be performed with scissors, as Beer directs, or with a knife, as others may prefer; and the wound is to be closed with a suture. The slip of skin chosen for removal should not be too near the edge of the eyelid, for then the skin of the lower edge of the wound would be too narrow for the application of the suture. (*Beer*, b. ii. p. 115.) Some writers refer particular cases of ptosis altogether to paralysis of the levator, and other instances to spasm of the orbicular muscle.—When the disease depends on paralysis, it is mostly an

effect of apoplexy, upon the relief of which its cure also depends. The treatment, directed particularly against the paralytic affection of the levator, consists in frequently bathing the eye and surrounding parts with cold spring water, and rubbing the eyelid and eyebrow with the camphor liniment, to which a little of the tinctura lyttæ is added. The shower bath, bark, and other tonics, are also indicated. If these means fail, an issue may be made with the moxa, or potassa, between the mastoid process and angle of the jaw, and kept open two or three weeks. The cure of spasmodic ptosis, which is rather a symptom of other diseases, like hysteria, chorea, worms, &c. than a distinct affection, consists in the removal of the original complaint. However, generally speaking, antispasmodic medicines, blisters on the temple, or behind the ear, an issue between the mastoid process and angle of the jaw, as recommended by J. A. Schmidt, on account of some nervous ramifications of the third branch of the fifth pair, which give twigs to the eyelids lying in that situation; and fomenting and bathing the eye, eyelids, and face, with a decoction of poppy-heads and cicuta; are the means which merit the consideration of the practitioner.

See *Richter's Anfangsgr. der Wundarzn.* b. iv. p. 489, 8vo. 3d edit. Güt. 1802. *J. A. Schmidt*, in *Abhandl. der Königl. Med. Chir. Jos. Acad. zu Wien*, b. ii. p. 365, 1801. *Sillier's Manuel*, Transl. by Montault, vol. i. p. 97, &c. 8vo. Glasgow, 1821. *G. J. Beer*, *Lehre von den Augenkr.* b. ii. p. 109, &c. 8vo. Wien, 1817. *G. J. Guthrie*, *Operative Surgery of the Eye*, p. 41, &c. 8vo. Lond. 1823.

PUNCTURED WOUNDS. See WOUNDS.

PUPIL. When the opening in the centre of the iris is preternaturally large, and this organ more or less deprived of its power of motion, the disease is technically named *mydriasis*, which is either *symptomatic* or *idiopathic*. The first form of the complaint is exemplified in hydrocephalus, hydrophthalmia, pressure on the brain from various causes, worms, amaurosis, &c. The second often presents itself as a paralytic affection of the iris; a state frequently induced by the application of certain narcotics, like belladonna, and hyoscymus. Congenital cases of mydriasis are also met with, as well as instances brought on by a long residence in darkness. A dilatation of the pupil may likewise be the consequence of an adhesion of the uvea to the anterior capsule of the lens. When the retina continues sensible, the inconveniences, produced by mydriasis, are intolerance of light, complete blindness in the daytime, and, in the end amaurotic mischief, occasioned by the irritation of the immoderate quantity of the rays of light admitted within the eye. The kind of prognosis, and the mode of treatment, must often depend entirely upon the primary affection, of which many cases of mydriasis are only symptomatic. Of course the original disorder must always be cured if possible. When mydriasis appears to arise from paralysis of the iris, blisters may be applied over the eyebrows, and the same remedies tried, which are usually employed in other local paralytic disorders. The entrance of too much light into the eye may be moderated with shades, and tubulated spectacles.

The case, which is the reverse of the preceding, is a preternaturally contracted, more or less immovable state of the pupil, termed *myosis*. According to Weller, it is sometimes congenital. It is often met with as a symptom of other disorders.

especially ophthalmia, inflammation of the dura mater, phrenitis, concussion of the brain, &c. Persons whose business is to be looking at small shining objects, as watchmakers, often acquire a myosis from habit, and they cannot be cured of it, unless they avoid the causes which brought it on, keep themselves in a darkish room, and use a green shade, or tubulated spectacles. (See *Weller's Manual*, &c. transl. by Montenth, vol. ii. p. 54.) It is noticed by Beer, that myosis, when a sequel of ophthalmia, is less obvious than most other consequences of ocular inflammation; for though the iris is motionless, and the pupil considerably diminished, this opening is perfectly clear and black, and not drawn out of its usual position, nor its pupillary edge in the slightest degree angular. The patient, though he is continually complaining of weakness of sight, is able to distinguish (with some trouble indeed) even the smallest objects in the daytime, and in very light situations: but, his sight is evidently worse in the evening, and in darkish places in the daytime; for when both his eyes are affected, he is in the dusk nearly blind, and can scarcely find his way. Beer remarks, that almost every considerable internal ophthalmia, or iritis, however favourably the disorder may be cured, and the eyesight restored, always leaves after it more or less contraction of the pupil, which affection, though not the least portion of coagulating lymph can be perceived in the posterior chamber, is combined with a partial or complete immobility of the iris. Beer assures us that every expedient, which he has yet tried for the permanent removal of this complaint, has failed; the dilatation of the pupil thus produced being but temporary. And with respect to the most powerful narcotics, he states, that in two cases, they were worse than useless, as they caused a still greater contraction of the pupil, which however, after a few hours, resumed its former diameter. Hence, Beer is disposed to set down the myosis, following internal ophthalmia, as an incurable complaint. (See *Lehre von den Augenkr.* b. ii. p. 261, &c.)

The next case demanding some notice in this work, is a closure of the pupil (*atresia pupillæ*). According to Beer's observations, there is only one exception, in which in the adult patient a closure of the pupil is not the consequence of ophthalmia, and the case here signified is termed a *collapse of the pupil*, or *synchysis pupillæ*, the causes of which are said to be, either a very considerable loss of the vitreous humour from a wound of the eye, or else a dissolved, or rather disorganised state of the same humour, known under the name of *synchysis*. (*Lehre*, &c. b. ii. p. 190.) Every internal ophthalmia, extending to the retina and choroides, when in its highest degree, is apt to produce a complete closure of the pupil. However, the obliteration of this opening is not the only cause of blindness; for long before this state of the iris happens, the sight is destroyed by considerable, and frequently irreparable injury of the retina, and neighbouring textures, in which the inflammation is directly situated. An incomplete closure of the pupil, Beer says, is still more disposed to take place at the period when iritis passes from its first into its second stage; and syphilitic iritis is said to be particularly apt to leave after it this disagreeable consequence. (Vol. cit. p. 191.) In cases of the latter description, vision is not always quite prevented, but only more or less diminished, the coa-

gulating lymph, effused in the posterior chamber, having formed only a delicate semitransparent web. However, if, in the second stage of the inflammation, such lymph should be converted into a dense membrane, with opacity of the lens, and its capsule, the eye then only retains more or less perfectly the faculty of just distinguishing the light. But when, in such a case, the patient is completely insensible of the difference between light and darkness, the blindness, as in the examples mentioned above, is not owing to the closure of the pupil, or to the cataract, but to other morbid changes, resulting from the same inflammation, which caused the defect in the pupil itself, and capable of being ascertained by peculiar appearances in the eye. Passing over obstructions of the pupil by the unabsorbed matter of hypopyum, and by the continuance of effused blood in the chambers of the eye, I come to the case next noticed by Beer, in which a closure of the pupil arises from a partial adhesion of the iris to the cornea (*synechia anterior*), and will inevitably happen, when a considerable portion of the iris, or a great part, or the whole, of its pupillary edge protrudes through an opening in the cornea, and becomes adherent to it. However, sometimes, in these cases, the pupil becomes completely obstructed, though the protrusion of the iris is inconsiderable, and its pupillary edge not engaged in the cicatrix, a circumstance exemplified, when the cicatrix over the adherent part of the iris expands very much, and has an extensive leucomatous surface, so that, though the pupil may be of considerable size, it is concealed, and vision impeded. And, even when there is no adhesion of the iris to the cornea, no *synechia anterior*, as it is termed, and no distortion of the pupil, a large dense cicatrix of the cornea may obstruct vision by lying exactly over that aperture. Lastly, as Beer has explained, the greater part of the cornea may be in an opaque, spoiled condition, so that the healthy iris can be discerned only at certain points behind its circumference, no vestige of the pupil itself being distinguishable; and such concealment of this opening may be either combined, or not, with a partial adhesion of the iris to the cornea. In such cases the patient can frequently perceive the light very well. (Beer, b. ii. p. 194, 195.)

From what has been stated, it is manifest to Beer, that, in many cases of *atresia pupillæ*, the prognosis must be highly unfavourable, and that no attempt to form an artificial pupil should ever be made, when the patient's blindness proceeds from other causes besides the imperforate state of the iris. Such an operation, Beer observes, can only be proper when the blindness is entirely owing to the closed, or concealed state of the pupil: when the different degrees of light can be plainly distinguished; when the case is uncomplicated with any disease of other important textures of the eye, capable of rendering the manual proceedings difficult, or impracticable; when the eye has been for a long time perfectly free from inflammation; when the patient is healthy, without any tendency to scrofula, syphilis, or gout; and both his eyes are completely blind. (Beer, b. ii. p. 196.) Some questions may be entertained, respecting this absolute prohibition of the operation in unhealthy subjects, because the line between the degrees of health and disease, requisite for the success of the operation, is diffi-

cult to specify, and gout, syphilis, and scrofula, are often vague expressions. Yet, no doubt can exist, I think, about the propriety of Beer's advice, never to attempt the formation of an artificial pupil, when the patient enjoys vision with one of his eyes; for, when the new opening is made, as it is not in the axis of vision, the sight is confused in the other eye, unless the imperfect eye be kept closed; and the operation can never be done, without exposing the patient to the risk of more or less inflammation in the eye, which is at present so useful to him. Whatever may be the differences of opinion about operating in cases of single cataract, I believe that all surgeons will unanimously join Beer in the foregoing advice, respecting the imprudence of attempting to make an artificial pupil, when the patient can see with one eye.

When vision is totally lost in one eye, and materially impaired in the other, Mr. Guthrie judiciously observes, that the question, whether an operation ought to be performed or not, is important; for, if the patient still enjoys sufficient power of vision to guide himself, the surgeon must be more than hardy who would put that portion of the faculty of sight in jeopardy by attempting an operation: which may fail, however skilfully done. Yet, Mr. Guthrie does not absolutely denounce the operation; he adds, "In such circumstances the operation should not be attempted upon any grounds, unless the case is so simple as to require only an opening in the cornea, and the removal of a portion of the iris, for the purpose of enlarging the natural pupil. If the patient cannot see sufficiently well to guide himself, the conditions are very essentially altered, since an unsuccessful operation involves the loss of very little, whereas much is to be gained by the successful issue of it. Where opacities in the centre of the cornea occasion the impediment to vision, it is prudent to dilate the pupil beyond the edge of the opacity, by the daily application of the belladonna, which may possibly enlarge the sphere of vision so as to supersede, in a doubtful or dangerous case, the necessity of an operation." (See *Operative Surgery of the Eye*, p. 444.)

Beer represents the event of the operation as being very uncertain, when the patient cannot plainly discern the various degrees of light; when the cornea is affected with leucoma, or scarred and spoiled nearly to its very circumference; when there is only a partial staphyloma of it; or the constitution is unhealthy, or impaired by the effects of former attacks of scrofula, syphilis, or gout. Lastly, Beer sets down the operation as certainly useless, or even as likely to cause an entire destruction of the eye, when the patient is quite insensible of light; when the iris and neighbouring textures, such as the corpus ciliare, corona ciliaris, the membrane of the vitreous humour, this humour itself, and the blood-vessels of the organ, are in a morbid state, or the whole eyeball manifestly in a preternatural condition. However, an opacity of the lens and its capsule, even when the latter is completely adherent to the uvea, forms no prohibition to the formation of an artificial pupil, though it is a circumstance that has great weight in the selection of the method of operating. (Beer, *loc. cit.* p. 197.)

The following information, from the same source, is highly important to the practitioner: "The morbid state of the iris, and other adjacent textures of the eyeball, prohibiting the operation, may be known by the annexed circumstances. Together with the smaller circle of the iris, the larger one is strikingly changed, in respect to its colour, its consistence, and its layers. Its radiated fibres are collected into dark-blue, or blackish fasciculi, between which there is an appearance of empty interspaces, produced by the indentations of the iris, and actually semi-transparent, in consequence of the tapetum of the uvea having always been in these cases more or less annihilated by the previous inflammation. Around the cornea, the sclerotica seems bluish, or rather of a smutty greyish blue colour; and sometimes certain points of this membrane are protuberant. The morbid states of the whole eyeball, which may complicate the atresia iridis, and render the operation not only useless, but hazardous to the preservation of the eye, are its dropsical enlargement (see *HYDROPTHALMIA*); its atrophy; its preternatural firmness, from a general varicose affection of its blood-vessels; and its morbid softness, from a disorganisation of the vitreous humour. (Beer, vol. cit. p. 198.)

Numerous as the plans are of making an artificial pupil, if we except the occasional practice of forming a kind of artificial prolapsus of the iris, in order to change the position or shape of the imperfectly closed pupil, they may all be classed into three principal methods. 1. The simple transverse, perpendicular, or otherwise-directed incision in the iris, now termed *corotomia*, performed either through the sclerotica, or the cornea. 2. The excision of a piece of the iris, technically named *corectomia*. 3. The separation of a part of its circumference from the ciliary ligament, called in the language of oculists *corodialysis*, with which the last method, or the operation of *corectomia*, is combined in the plans suggested by Assalini and Reisinger. The excision of a portion of sclerotica, close to the cornea, with the view of forming an inlet for the rays of light to the retina, as proposed by Autenrieth, when the cornea is entirely opaque, may be considered a hopeless proceeding. With respect also to the three other methods, it is now well understood by all impartial surgeons, that the choice of them must depend upon the particular circumstances of the case, and that here it would be as absurd to think of employing in all instances only one plan, as to have the idea of extending the same principle to all the forms and varieties of cataract.

When the thing is possible, it is considered by Beer most advantageous to make the artificial pupil rather towards the inner canthus; though others express a preference to the centre of the iris. But, as he truly remarks, since the new opening must be where the cornea is transparent, the operator is frequently obliged to form it either below, or towards the temple, or quite above; for there is often only just room enough left at one point for conducting the necessary manœuvres, with any degree of precision.

The following remarks by Mr. Guthrie I consider interesting: "An opening must be made in the iris, of an extent equal, at least, to the natural size of the pupil when moderately dilated; for, if it be less, there will not be sufficient room for

the rays of light to act with effect on the retina in a moderate light; and it must not be forgotten, that the artificial pupil never acquires the motions of dilatation and contraction, so eminently useful in the natural one. It should not, on the other hand, be too large, because it would prove detrimental to vision, by admitting too many rays of light to the retina. It should resemble the natural opening in form, as nearly as possible; for there cannot be a doubt of the advantage derived in man from a circular pupil, where the axis of vision is directly forwards; and, although an artificial one is seldom made in a circular form, and in the centre of the iris, still that process will be the best, the result of which most nearly resembles the natural state.

"When an artificial pupil cannot be made in the centre of the iris (from whatever cause), the other parts of it are eligible in the following order: 1. The inferior part of the iris inclining inwards; 2. The internal, a little below the transverse diameter of the eye; 3. The inferior and external; the upper part being the least eligible, from the eyelid covering that portion of the cornea in the natural state of the eye." (*Operative Surgery of the Eye*, p. 442.)

Mr. Guthrie agrees with Beer, that the place, in which the iris is to be perforated, generally depends more on the transparency of the cornea, than the choice of the operator. It is also remarked, that a small artificial pupil, at the lower part of the iris, is infinitely more valuable than a large one at any other, which, in the natural state of the eye, is covered by the eyelid, or much out of the axis of vision. If the state of the cornea will permit it, Mr. Guthrie says a sound part of the iris should be selected. (P. 443.) He considers the external and internal margins of the iris, immediately on a line with the central transverse diameter, particularly unfavourable for the method in which the iris is separated from the ciliary ligament, because there the long ciliary arteries enter, and the attachment of the iris is firmer than at other points.

Cheselden first devised a section of the iris, for the purpose of forming an artificial pupil. He proposed the introduction of a couching needle, with a sharp edge only on one side, through the sclerótica, about half a line from the cornea, into the posterior chamber. After the iris had been perforated towards the external angle, and the point of the needle then pushed through the anterior chamber, as far as that side of the iris which is nearest the nose, the edge was turned backward, and the instrument withdrawn, so as to make a transverse division of that membrane.

The account of the proposal, given by Cheselden himself in the *Philosophical Trans.* for 1728, is very incomplete; and, according to Mr. Guthrie, he did not actually perform the operation on the person, whose history he there relates, but only annexed to it an account of a particular operation which he considered worthy of record: a circumstance which, from not being attended to, has been the source of considerable errors. (*Operative Surgery of the Eye*, p. 395.) Morand, when he was in London, saw Cheselden form an artificial pupil; but the process, as described by Morand, differs from the above, inasmuch as the needle passed as far across the

posterior chamber as two-thirds of the iris, when its edge was turned towards this membrane, which was thus cut, and as much of it divided in withdrawing the instrument horizontally, as left an artificial pupil of an oblong form.

Janin performed Cheselden's method as described by Morand, on two subjects with the utmost care possible, but not the smallest benefit followed; for, after the subsidence of the symptoms produced by the operation, the transverse section, made in the iris by the edge of the needle, reunited. (*Mém. sur, l'Œil.*) Mr. S. Sharp also saw a failure from the same cause. (*On Operations*, chap. 29.)

An accident occurred to Janin, in the act of extracting a cataract; viz. he included the iris together with the cornea, in Daviel's scissors, and cut it perpendicularly, and the division remained permanent. This led him to propose a perpendicular incision as the best expedient for making an artificial pupil. His plan consisted in opening the cornea, as is practised for the extraction of the cataract, and in dividing the iris perpendicularly with scissors, near that part of the pupil which is next to the nose; for he affirms, that he has seen strabismus result from making the section towards the external side, on account of the too great divarication of the optical axes.

Although the practice of making an incision in the iris, or corotomia, is severely disapproved of by Beer, who states that it admits of being practised only in very few cases, and is rendered quite unnecessary by, what he denominates, the two other better plans (*Beer* b. ii. p. 199.), it is still considered by some men of experience as having recommendations, and they have therefore endeavoured to improve it. However, it will only be in my power to notice in this work a few of its modifications.

In 1812, Sir W. Adams recommended the revival of Cheselden's method of forming an artificial pupil, with the difference of using for the purpose a particular sort of knife. "With a cataract needle (says this oculist) I could not cut through the iris by a gentle force; and, if I ventured to apply a greater force, the iris separated from its attachment to the ciliary ligament, which rendered all further attempts to effect a central aperture useless. The same accident appears to have happened to Mr. Sharp in his trials of this operation. In the hopes of procuring an appropriate instrument, I twice went to London, at the interval of a few months; but, though I described to different instrument-makers the purposes for which it was intended, still I could only procure the needle, which cuts on one edge, and the spear-pointed knife, of different sizes, described by Cheselden. At length it occurred to me that the curved edge of the common dissecting scalpel was well adapted to cut with facility. I therefore, when in London, a third time, got a small knife made, two-thirds of an inch in length, and nearly a line in width, with a straight back, sharp point, and a curved edge, which cuts back towards the handle for about three lines." (*Adams's Pract. Obs. on Ectropium, &c.* p. 30.) According to this writer, in all cases, where there is no crystalline lens, and the cornea is free from opacity, the division of the iris should be made in the centre, and should extend across at least two-thirds of its transverse diameter. In a later work, however,

he states, that experience has "convinced him, that so extensive a division of the iris is unnecessary for the prevention of the reunion of this membrane, and that a cut through one-third of its diameter is sufficient. The eye being gently fixed, either with the finger of the assistant, who supports the upper eyelid, or with a concave sort of speculum, placed under the upper eyelid, the artificial pupil knife is to be introduced through the coats of the eye, about a line behind the iris, with its cutting edge turned backwards. The point is next to be brought forward through the iris, somewhat more than a line from its temporal ciliary attachment, and cautiously carried through the anterior chamber, until it has nearly reached the inner edge of that membrane (or, as is expressed in a later description) "until it has traversed more than two-thirds of the width of the iris," when it should be almost withdrawn out of the eye, gentle pressure being made with the curved part of the cutting edge of the instrument against the iris, in the line of its transverse diameter. If, in the first attempt, the iris should not be sufficiently cut, the point of the knife is to be again carried forward, and similarly withdrawn, until the incision is of a proper length. After the operation, the eye is to be covered with a plaster of simple ointment, and the patient put into bed, with his head raised. (P. 36, 37.) When the closure of the pupil is attended with a cataract, the primary steps of the operation are the same; but Sir W. Adams takes care also to cut the cataract in pieces, some of which he brings forward into the anterior chamber, while others he leaves in the opening of the iris, where they at first serve as a plug, hindering union by the first intention (p. 38.), and are afterwards absorbed. For an account of his particular methods for all the various complications of cases, the reader must consult his publications, where many successful examples of the operation are recorded.

That Cheselden's method ought not to be entirely rejected, there can now be no doubt. Like all other modes of forming an artificial pupil, it certainly does not merit exclusive preference. In addition to the testimony of Sir W. Adams, we have that of Mr. Ware, to prove, that Cheselden's operation frequently succeeds. When the pupil had become closed, after an unsuccessful extraction of the cataract, Mr. Ware in several instances made a new pupil, agreeably to Cheselden's mode, with the most perfect success. "The fibres of the iris retracted as soon as they were divided, and left the pupil very nearly of its natural size. Its shape was not quite round; but the sight was immediately restored, and to so great a degree, as to enable the patient, by the help of suitable convex glasses, to see distinctly both near and distant objects, neither pain nor inflammation being consequent to the operation."

Where there is a prolapsus of the iris, through a breach of the cornea, involving more or less of the pupillary margin, Mr. Travers considers Cheselden's method the most applicable, viz. "the transverse division of the stretched fibres of the iris, and which, if the section be made in front of the membrane, i. e. from before backwards, admits of no improvement. The edges of the section instantly recede and form an excellent pupil." However, he afterwards adds, "that a partial at-

hesion of the pupillary margin may be combined with a healthy lens. In this case, the removal of the free border of the pupil, drawn by means of forceps, through an incision in the cornea, will be preferable, on account of preserving the transparency of the lens." (*Synopsis of the Dis. of the Eye*, p. 343.)

Professor Maunoir, of Geneva, published a successful case, in which an artificial pupil was formed, and a caseous cataract extracted. "I operated (says he) on the right eye in the following manner. The patient being seated on a chair, and having the head inclined upon a cushion, I placed myself behind him, and with the forefinger of the left hand confining the upper eyelid, whilst an assistant depressed the lower, I made with the right hand a semicircular incision in the lower and external part of the cornea. This incision occupied a full third of the circumference of the membrane. On re-opening the eye, the iris was seen projecting a little from the wound in the cornea. I replaced it with the blunt point of my scissors. Introducing the two blades closed into the anterior chamber, and then opening them, I caused the pointed blade to penetrate the iris, leaving the blunt blade between that membrane and the cornea; then closing the scissors, a perpendicular incision of the iris resulted, describing a little more than half the chord of an arc of two-fifths of the circumference of the iris, traced on the side of the temple. The first incision not having occasioned the formation of a pupil of the necessary size, I introduced the scissors into the iris, a second time a little obliquely, and immediately the pupil appeared of a satisfactory form and size, but exhibiting the crystalline entirely opaque. The second stroke of the scissors had divided the capsule; I therefore introduced the small curette, in order to endeavour to destroy what adhered of the crystalline to the shrunk and contracted circumference of the old pupil. This attempt did not succeed. Lastly, I effected a passage of a portion of the opaque lens, by means of a slight pressure with a large scoop, exercised on the lower part of the globe of the eye. The crystalline, which was of a cheesy consistence, came out with the greatest ease, and though it was not entirely removed, yet a sufficient quantity was discharged to leave the artificial pupil of a most perfect black. This new pupil was on the side of the temple; and at the exterior and lower part of the iris." (See *Med. Chir. Trans.* vol. vii. p. 305, et seq.) In this communication are also two other cases, in which Maunoir operated with success, though they were complicated with cataracts, and adhesions of the lens to the iris. In some remarks, annexed by Scarpa to the preceding account, the latter expresses his opinion, that it is not necessary to be scrupulous, whether the crystalline be partly, or entirely opaque, whenever the capsule is opaque, and adheres to the iris, behind the edge of the interior and inclosed pupil. "In this case only one remedy can be pointed out, namely, the removal of the opaque adherent capsule, and consequently of the crystalline, whether it be transparent, or opaque. In the second place (says Scarpa), I think there is no reason to doubt, that, in similar cases, it is advisable to make an incision upon the iris, proportioned to the size of the body to be extracted, rather than to make it small, which obliges the operator to divide the crystalline

and the capsule, with the intention of extracting a part, and of abandoning the rest to the powers of absorption. Thirdly: I would establish as a fundamental principle, in similar cases, that, after the complete extraction of the crystalline, with its opaque capsule, by means of the least possible introduction of the instruments, the artificial pupil ought not to be too near the incision in the cornea, and consequently not too near the cicatrix occasioned by it. (P. 317.) Scarpa then recommends a particular method of operating, in cases where there are cataracts: after having made, in the manner of Wenzel, a transverse incision in the iris, and in the cornea, he would introduce Maunoir's scissors, blunted at both points, into the anterior chamber of the aqueous humour, and make an incision in the iris, diverging from the cut made with the knife. The aperture thus made, Scarpa thinks, would be large enough for the easy passage of the opaque lens.

Amongst other late opinions, professed by Scarpa, we find the following: that no instrument is so proper as the scissors for making an incision in the iris; that, when the case is not complicated by cataract, a very small wound in the cornea is sufficient; that the formation of a triangular edge in the iris, by means of a double incision with the scissors, is the most easy and least painful of all the methods hitherto proposed for obtaining a permanent artificial pupil; and lastly, that specks of the cornea present no obstacle, because the artificial pupil may be made opposite the transparent part of that membrane. (*Med. Chir. Trans.* vol. vii. p. 320, 321.)

As I have already noticed, the contraction of the natural pupil is sometimes occasioned by the iris being stretched towards some point of the cornea, to which it is adherent. This state, as Scarpa observes, is most frequently accompanied with partial opacity of the cornea, around the adhesion, or prolapsus of the iris, as well as with opacity of the lens and its capsule. At other times, however, these internal parts preserve their natural transparency, notwithstanding the deviation of the natural pupil. In the latter case, the pupil, though removed from its situation, is not in reality obliterated, but merely very much contracted, and incapable of admitting the quantity of light necessary for vision, especially if the opposite part of the cornea be slightly opaque. In such an example Scarpa recommends making a small incision in the cornea at the most commodious part, when with Maunoir's scissors closed, and constructed with little buttons at the ends of both the blades, an endeavour is to be made to break the adhesion existing between the iris and the cornea. If this can be effected, the natural pupil generally recovers its former situation and size; but, if the adhesion be very firm, Scarpa introduces one of the blades within the contracted pupil, behind the posterior surface of the iris, until the other blade has reached the confines of the cornea with the sclerótica. The iris is then to be divided in the form of the letter V, without at all injuring the capsule, or lens, both of which are transparent. (*On Diseases of the Eyes*, p. 384. ed. 2. transl. by Briggs.) When, after extraction of the cataract, the pupil has been dragged down in this manner by adhesion to the lower third of the cornea, the upper two-thirds of which are transparent, Dr. Monteath, of Glasgow, has succeeded five times in forming an artificial pupil, and restoring vision

by making a small opening in the upper and outer part of the edge of the cornea, capable of admitting Maunoir's eye-scissors, with which the over-stretched fibres of the iris are to be cut across by one simple incision, three lines in length. The cut edges instantly recede, and leave an oval pupil of sufficient size. (See *Weller's Manual*, vol. ii. p. 70.) In the cases above specified by Scarpa, Sir Wm. Adams, instead of performing corectomia, endeavours to separate the iris from the cornea, and then to alter the position of the pupil by drawing it towards that part of the cornea which has remained transparent. For this purpose, he punctures the cornea about one line in front of the iris, separates the adhesion, and then makes the disengaged portion of the iris protrude through the puncture, and leaves it there, even using the forceps, if necessary, for drawing it out as far as is deemed necessary for its being securely fixed. This method is disapproved of by Scarpa, because a second prolapsus of the iris in the same eye appears to him a very serious disease, and rather calculated to increase the opacity of the cornea, and augment the contraction of the pupil, than afford relief.

According to Beer, the excision of a portion of the iris, *corectomia* is particularly indicated in all cases, in which there is a sound transparent lens, as in many examples of synechia anterior, or a realment of the natural pupil by a central opacity of the cornea, &c. Beer admits, however, as an exception, the instances in which the transparent portion of the cornea is so small that no opening can be made in it with the knife, large enough to permit the iris to be taken hold of with a small hook or forceps, and a piece of it cut out above the ciliary processes. (*Beer*, b. ii. p. 200.) The reason here given does not appear to me very strong, because it may be asked, why not acquire more room by cutting a portion of the opaque part of the cornea? Weller assigns a better reason against *corectomia*, viz. when he refers to the risk of a sufficient piece of the cornea not being left transparent, opposite the new pupil, after the cicatrization of that membrane. (Vol. ii. p. 65.) Beer further states that *corectomia* may be performed, in cases of atresia iridis consequent to the operation of extracting the cataract, when the surgeon is certain that no coagulating lymph, effused, during the previous inflammation, in the posterior chamber, reaches above the lesser circle of the uvea, or is conjoined with opacity of the remaining capsule of the lens. The first state may be learned from the singular colour and form of the greater ring of the iris; the second, from the very indistinct manner in which the patient is sensible of the different degrees of light. (*Beer*, b. ii. p. 200.)

The excision of a piece of the iris, says Beer, requires the preliminary formation of a flap in the cornea, one line in length, with the cataract-knife, and as close as possible to the sclerótica, so that no subsequent opaque cicatrix may interfere with the success of the operation. The second part of the business, viz. the excision of a piece of the iris, must be done in three ways, according to circumstances: 1. The iris may not be anywhere adherent to the cornea, in which case, after an opening has been made in the latter membrane, the iris is propelled out between the edges of the wound by the aqueous humour, yet left in the posterior chamber, which opportunity the surgeon must immediately avail himself of for taking hold of the projecting

piece of the iris with a very fine hook, and cutting it off with David's scissors; the remainder of the iris is instantly retracted behind the cornea, and a well-formed pupil is immediately seen. 2. Only the part of the edge of the pupil may remain not adherent to and drawn towards the cornea, where it is intended to form the artificial pupil; a state best ascertained by a lateral inspection of the eye. In this case, after opening the cornea, Beer says, the operator is directly to introduce a small hook between the iris and cornea, so as not to injure either of these parts with its point, and he is then, with the instrument directed obliquely, to get hold of the pupillary edge of the iris, and, while the iris is drawn out between the edges of the incision, the projecting piece is to be cut off with David's scissors. Thus, the natural pupil is to be extended behind the transparent part of the cornea, towards the edge of this membrane. 3. The pupillary edge of the iris may be adherent to the cornea exactly in the situation where the artificial pupil is to be formed: in this case, Beer directs the iris to be taken hold of at its greater circle with the hook, or (if this should tear its way out) with a pair of fine-pointed forceps with teeth, drawn out between the edges of the wound, and the point of the cone, thus produced, cut off somewhat within the edges of the wound, as drawing the iris further out might tear it, and have a prejudicial effect. In all these cases, says Beer, the undiseased lens and its capsule will not be injured, if the patient keep tolerably steady, and the operator have already acquired dexterity in the extraction of the cataract. The operation being finished, the subsequent treatment is like that generally adopted after the extraction of the cataract. (See CATARACT.) When corectomia is to be performed for a closure of the pupil, consequent to extraction of the cataract, Beer particularly recommends the forceps to be used, though he adds that such operation is applicable only when the remaining capsule has not been spoiled by inflammation, and the quantity of lymph in the posterior chamber is not so great as to reach above the lesser circle of the uvea.

The only other species of corectomia which I deem it necessary to notice, is what was proposed in the year 1811, by the late Mr. Gibson, of Manchester. It is described as follows: "The first step of the operation is to secure the eyelids, as in the operation for extracting a cataract. A puncture is then to be made in the cornea, with a broad cornea knife, within a line of the sclerótica, to the extent of about three lines. All pressure is now to be removed from the eye-ball, and the cornea knife gently withdrawn. The consequence of this is, that a portion of the aqueous humour escapes, and the iris falls into contact with the opening in the cornea, and closes it like a valve. A slight pressure must now be made upon the superior and nasal part of the eyeball, with the fore and middle finger of the left hand, till at length by an occasional and gentle increase of the pressure, or by varying its direction, the iris gradually protrudes, so as to present a bag of the size of a large pin's head. This protruded portion must be cut off with a pair of fine curved scissors, and all pressure at the same time removed: the iris will then recede within the eye, and the portion, which has been removed, will leave an artificial pupil more or less circular." (Gibson on Artificial Pupil, &c., Lond. 1811.) Such was this surgeon's mode

of operating, when the closure of the pupil was attended with central opacity of the cornea, uncombined with adhesions. The effect of a slight adhesion of the inner border of the iris to the cornea, will be to prevent the protrusion of the first of these membranes through the puncture in the cornea, which protrusion so much facilitates the operation. In this case, a portion which does not adhere, must be drawn out with a small hook, and then removed. Sometimes the adhesion may be separated at the time of making the puncture, and then the iris will protrude. When the whole, or greater part of the inner border of the iris, is involved in adhesions to the cornea, these must be separated with the cornea-knife, after making the puncture, and the iris may then either be drawn out with the hook, or a portion of it be removed by means of very minute scissors. In every case, however, the removal of a portion is essential to success.

When a cataract is known to exist, Mr. Gibson recommends it to be depressed or broken to pieces with the needle, before making the artificial pupil; and when the whole cornea is transparent, he directs the flap to be made in the centre of the iris with the cornea-knife, and then cut off with the iris scissors. (Gibson, *Op. cit.*)

Coredialysis, or the mode of forming an artificial pupil by detaching a portion of the iris from the ciliary ligament is said to have been devised by Ad Schmidt and Searpa about the same time, and has been variously modified by Reisinger, Langenbeck, Himly, Graefe, and others. (Weller, on Diseases of the Eye, vol. ii. p. 65.) According to Beer, this plan of operating is indicated first, only when the coagulating lymph, effused in the posterior chamber after the extraction of the cataract, or reclinatio (see *this word*), reaches from above the lesser circle of the uvea towards the ciliary processes; a circumstance, which may be known by the considerable change of colour in the greater circle of the iris, and by the indistinct manner in which the patient perceives the light. Secondly, when the uvea is everywhere adherent to a secondary capsular cataract, or capsulo-lenticular cataract, or the closure of the pupil has been occasioned by a purulent, or bloody cataract. Whenever the attempt is made in these last cases, however, the patient should be capable, as he sometimes is, of plainly discerning the light. Lastly, coredialysis is sanctioned by Beer, when the cornea is everywhere incurably opaque, excepting so small a part of it, that it could not well be opened for the excision of a portion of the iris. (Beer, b. ii. p. 203.)

When the closed pupil is the result of inflammation from an injury, the lens has been absorbed, and the anterior capsule, or both the anterior and posterior, are thickened and firmly attached to the iris, with only an indistinct perception of light, and a discolouration of the lesser circle of the iris, indicating a deposition of lymph behind it, Mr. Guthrie sets down coredialysis as the proper operation, "for, the formation of a triangular opening by the scissors would not be easily accomplished to a sufficient extent; and the simple division of the central part of the iris would, in general, be ineffectual, in consequence of the thickened capsule preventing the necessary retraction of the fibres of the iris. (*Operative Surgery of the Eye*, p. 466.)

The feeble union of the iris with the ciliary ligament, and, consequently, the greater facility of detaching its edge from that ligament, with which it is connected, than of lacerating its body, induced Scarpa to try a new method of forming an artificial pupil when the natural one had become too much contracted, or quite obliterated after the extraction, or depression of the cataract. His method of operating consists in detaching, by means of a couching-needle, a certain extent of the circumference of the iris from the ciliary ligament, without dividing the cornea. The attempt met with success.

The patient being seated, and supported, as if he were about to have the operation for the cataract performed, a straight slender couching-needle is to be introduced through the sclerótica, at the external angle of the eye, about two lines from the union of this membrane with the cornea; and its point is to be pushed as far as the upper and inner edge of the iris; in other words, as far as that side of the iris which is nearest the nose. The needle advances nearly to the ciliary ligament, and the surgeon perforates the internal edge of the iris, at its upper part, so that the point of the instrument scarcely appears in the anterior chamber, because, that part of it being very narrow, the point of the instrument, however little it advance beyond the iris, would enter the substance of the cornea. The moment the needle appears in the anterior chamber, the instrument must be pressed on the iris from above downward, and from the internal towards the external angle, so as to bring it in a parallel line to the anterior surface of the iris, for the purpose of detaching a portion of the edge of this membrane from the ciliary ligament. This separation being effected, the operator must depress the point of the needle, in order to apply it to the inferior angle of the slit, that he has begun to make. Then the aperture may be enlarged at pleasure, by pushing the iris towards the temple, and withdrawing the needle from before backward, parallel to the anterior surface of the iris, and the greatest axis of the eye. If when this detachment has been accomplished, no opaque body appear at the bottom of the eye, the needle is to be withdrawn altogether. If any portion of opaque capsule left behind after the depression, or extraction of the cataract, should afterwards advance and present itself in the vicinity of the new pupil, the little opaque membrane must be reduced to fragments, and pushed through the artificial opening into the anterior chamber, where they will in time be dissolved and absorbed.

This separation of the iris from the ciliary ligament invariably occasions an extravasation of blood which always renders the aqueous humour more or less turbid; but the turbidness is afterwards absorbed, and the eye recovers its original transparency.

The patient, says Scarpa, complains, during the operation, of a vast deal more suffering, than at the time when he undergoes the extraction or depression of a cataract. It cannot be otherwise; for, in detaching a part of the edge of the iris from the ciliary ligament, some filaments of the ciliary nerves which proceed to be distributed to the iris, must at least be dragged, or lacerated. However, on the whole, the symptoms consequent to this operation, were neither obstinate nor fatal in the two cases which Scarpa has seen. From some experiments made on the dead subject, Scarpa

thinks the curved needle, which he uses for the depression of the cataract, would also be better than the straight one, for making an artificial pupil. (*Scarpa, Sulle Malettie degli Oocchi*, cap. 16.)

The celebrated Ad. Schmidt performed corectomy with a lancet-pointed curved needle, which was introduced, through the sclerótica, into the posterior chamber, with its concavity towards the uvea. Its point is to pass as far as the portion of the ciliary ligament, where it is designed to make the artificial pupil. The iris is then to be pierced from behind forwards, about the fourth part of a line from the ciliary ligament, from which it is to be separated, the surgeon taking care at the moment to catch well hold of the iris with the point of the instrument, which is then to be withdrawn a little from the eye. If the new pupil should not be now large enough, the iris is to be again hooked with the needle, near the ciliary ligament, and the opening enlarged at its upper or lower angle, as may appear most advantageous. This plan is said to be advisable, when the whole cornea is opaque, excepting a small spot.

When, however, the diseased state of the cornea does not forbid it, Beer and Schmidt very properly recommend the needle to be introduced into the anterior chamber, and the iris thus separated from the ciliary ligament; a plan, which, as Weller observes, has proved more successful than the preceding method. In both modes, the lens will be pushed away from the new pupil by the movement of the needle, so that whether it be opaque already, or become so afterwards, vision will not be obstructed by it. (*See Beer's Lehre*, &c. b. ii. p. 204—206; and *Weller's Manual*, transl. by Dr. Montearth, vol. ii. p. 66, &c.)

With the view of removing all risk of the new opening becoming closed again, Reisinger forms an artificial pupil by making a small incision in the cornea, and introducing a minute double hook, which opens and shuts like a pair of forceps. After passing the hook closed into the anterior chamber, as far as the greater circle of the iris, he turns the points of both the small hooks towards this membrane, then opens the instrument a little, and hooks hold of the iris, which is to be separated from the ciliary ligament, when the instrument is to be shut again, and the part of the iris, taken hold of, drawn a little through the opening of the cornea, where it adheres, and cannot recede again towards the ciliary ligament. (*See Darstellung eines neuen Verfahrens die Mastdarmfistel zu unterbinden, und einer leichten und sichern Methode Künstliche Pupillen zu bilden*. 12mo. Augsburg, 1816.) Under certain circumstances, however, as there may be difficulty in drawing the iris through the cornea, or apprehensions may be entertained of the opacity of the cornea being increased by the protrusion and adhesion of the iris (the great consideration unquestionably against this method), Reisinger approves of obviating the chance of the new opening being closed again, by removing a part of the iris, after its detachment from the ciliary ligament; a combination of *corectomy with corectomy*. Were I a patient, and corectomy were deemed most applicable to the circumstances of my case, I should dispense with any excision of the iris, preferring the chance of the new opening being permanent, to the dangers of too complicated and protracted an operation.

Langenbeck is the inventor of an instrument for the formation of an artificial pupil; it is a silver tube, to one end of which is attached a very small gold one, containing a minute hook, capable of being moved backwards and forwards, to the extent of only two lines, by means of a spring in the silver tube. The following is the account of Langenbeck's method, as extracted by Mr. Guthrie from his writings. "A very small opening is to be made in the cornea, in order that the iris, when brought out, may not recede. The hook, inclosed in the golden tube (to prevent its bending from its tenuity), is to be directed to the spot, where the iris is to be laid hold of. The hook is then to be pushed out by the spring to the extent of one line, which will be sufficient to enable it to penetrate the iris. As soon as the hook is affixed, it is to be allowed to recede to its usual place in the golden tube, drawing with it the iris, which will be caught between it and the end of the tube, something in the manner of a pair of forceps. As soon as the hook begins to recede, a small black spot will be seen at the edge of the iris from its incipient separation; and care should be taken to insert the hook at, or even under the edge of the sclerotic, and as near as possible to the ciliary processes. The hook must recede gradually, the finger being kept steadily on, and moved slowly with the knob, regulating the spring in the silver tube. As the chance of tearing off a part of the iris is proportionate to the distance it has to be drawn out, the opening is to be made, as near as possible to the spot, where the separation is to be effected, taking care that the pupil shall be large enough, so that the prolapsed iris, and subsequent opacity of the cornea, cannot obstruct the entrance of the rays of light. The great advantage of this instrument in Langenbeck's opinion is, that the separation is effected by means of the spring, more gently and gradually, than by the finger alone; so that, if a commencement of the separation be effected, the completion of it is certain, without any risk of tearing the iris. As soon as the hook has receded to the golden tube, carrying with it the iris, the whole instrument is to be gently withdrawn, moving it slowly up and down, in order to loosen the upper and lower attachment of the iris, for this membrane may be torn, if there has been much previous inflammation, or, if direct force be employed in withdrawing it. The instrument always keeps it hold, as firmly as the best forceps, and with much more advantage, for it occupies less space, and enables the operator to make the incision in the cornea small, on which the correct strangulation of the iris depends. In all his operations, the capsule of the lens has never been injured by this instrument, which he considers another advantage, and, he conceives, that it may be used through the sclerotic, without rendering the lens opaque, as by the methods of Scarpa and Schmidt." (The latter author, however, as I have explained in this article, did not operate through the sclerotic, when the lens was transparent.) When the cornea is transparent it performs excision; but, when this membrane is opaque opposite the natural pupil, he opens the cornea, near the edge of the sclerotic, and, if the iris will not protrude, he takes hold of its pupillary edge with the hook, and draws it between the lips of the wound, where he leaves it strangulated.

(See *G. F. Guthrie on Artificial Pupil*, p. 63., &c. 8vo. Lond. 1819.; also *Langenbeck's Neue Bibl.* b. i. pp. 1. 454. and 676. 8vo. Hanover, 1817—19., and b. ii. pp. 13. and 106., where he answers some objections made to his instrument by *Schlagintweit*.) Doubtless, one cause of the failure of many operations for artificial pupil is one, to which Mr. Guthrie has adverted, viz. the omission to keep down the subsequent inflammation of the iris and adjacent textures by the timely employment of the lancet, and other antiphlogistic measures. On this subject, however, I need not here dwell, as the proper treatment is already described in that part of the article *OPHTHALMY*, which refers to *iritis*.

Consult *Cheesden*, in *Phil. Trans.* for 1735, p. 451. &c. *Sherrin's* Operations, chap. 29. *Janin*, Mém. sur l'Œil. *Richter*, von der Verschlussenen Pupille, in *Anfangsgründen der Wundarzn.* b. ii. Göt. 1795. *Scarpa*, Sulle Malattie degli Occhi, cap. 16.; or the English Transl. by Mr. *Briggs*. *Gibson's* Pract. Obs. on the Formation of an Artificial Pupil, &c. 8vo. Lond. 1811.: a work of considerable merit. *Wenzel*, On the Cataract. *Sir W. Adams*, Pract. Obs. on Ectropium, and on the Modes of Forming an Artificial Pupil, &c. 8vo. Lond. 1812.; also *On Artificial Pupil*, 8vo. Lond. 1819. *Houtz*, Parallele de la Chirurgie Angloise, &c. p. 283, &c. 8vo. Paris, 1815. *Mauvoisi* and *Scarpa*, in *Med. Chir. Trans.* vol. vii. p. 301, &c. *G. J. Beer*, Ansicht der Staphylomatösen Metamorphosen des Auges, und der künstlichen Pupillenbildung. Wien, 1815.; and *Lehre von den Augenkr.* b. ii. Wien, 1817. *P. Aspalini*, Ricerche sulle Pupille Artificiali; in Milano, 1811. This author practises the detachment of the iris from the ciliary ligament with a particular kind of forceps. He must have an early claim to the invention, as he began the method in 1786. *Jules Cloquet*, Mém. sur la Membrane Pupillaire. Paris, 1818. *Mauvoisi*, Sur l'Organisation de l'Iris, 8vo. Paris, 1812. *Benedict*, De Pupillæ Artificialis, Conformatione. Lips. 1810. *R. Muter*, Pract. Obs. on various Novel Modes of Operating on Cataract, and of forming an Artificial Pupil, 8vo. Wisbeach, 1811. *G. F. D. Evans*, Pract. Obs. on Cataract and Closed Pupil, &c. 8vo. Lond. 1815. *Ch. J. Hagen*, Das Coroneon, ein Beitrag zur Künstlichen Pupillenbildung. 12mo. Berlin, 1817. *G. Wagner*, Commentatio de Coromorphosi, sistens Brevem Method. ad Pupillæ Artific. Conformationem, novique ad Tridodialis Instrumenti Descriptionem, cum tab. æn. 8vo. Brunswick, 1818. *Schmalz* and *Himly*, Ophthal. Bibl. b. ii. and iii. *Fajani*, Collezione di Osservazioni, t. iv. 8vo. Roma, 1801. *Ligan*, in *Dublin Hospital Reports*, 1818. *Quadri* *Annottazioni Pratiche sulle Malattie degli Occhi*, 4to. in Neapoli, 1813. *Langenbeck*, Neue Bibl. für die Chir. b. i. and ii. 12mo. Göt. 1817—1819. *Reisinger*, Darstellung, &c. einer leichten, &c. Methode Künstliche Pupillen zu bilden, 12mo. Augsb. 1816. *Schlagintweit*, Ueber den gegenwärtigen Zustand der Künstlichen Pupillenbildung in Deutschland, 8vo. Munich, 1818. *Damergana*, Ragionamento sulla Pupille Artificiali; Milano, 1809.: this work suggests the method of opening the sclerotic, under certain circumstances, for the purpose of dividing the iris from behind forwards. *G. F. Guthrie*, On the Operations for the Formation of an Artificial Pupil, 8vo. Lond. 1819.; or, *Operative Surgery of the Eye*, 8vo. Lond. 1823. *B. Travers*, Synopsis of the Diseases of the Eye, p. 334, &c. 8vo. Lond. 1820. *C. H. Weller*, A Manual of the Diseases of the Human Eye, transl. by Dr. *Moulcath*, vol. ii. p. 55. &c. 8vo. Glasgow, 1821. The general Treatises on the Diseases of the Eye, by *Mackenzie*, *Lawrence*, *Middlemore*, and *Ammon*, may also be consulted with advantage.

PUS. (From πύον, matter.) The fluid, formed by the process of suppuration. (See *SUPPURATION*.)

QUININE, SULPHATE OF. This valuable preparation of bark, which is prescribed in a large number of surgical cases, may be exhibited in doses of from one to five grains, three or four times a day, according to circumstances. As its solubility in water is increased by an excess of acid, one drop of diluted sulphuric acid is frequently added for every grain of quinine. When, however, circumstances render it advisable to dispen-

with the acid, the sulphate of quinine may be prescribed without it, in the form of a draught, or mixture, with such other medicines as the case may need; or in the form of pills, either by itself, or combined with opium, blue pill, squills, extractum conii, &c. It may also be given to children, mixed with syrup.

RACHITIS. (From *ῥάχις*, the spine of the back, because the disease was once supposed to depend on disease of the spinal marrow.) The rickets. See this word.

RANULA. (Dim. of *rana*, a frog.) A tumour under the tongue, usually believed to arise from an accumulation of saliva in the duct of the submaxillary, and occasionally in that of the sublingual, gland. The term is derived, either from an imaginary resemblance of the swelling to a frog, or from the disease making the patient, as it were, croak when he attempts to articulate. Such writers as have treated of this disease, before it was known that the parts affected by it were destined for the secretion of the saliva, could have no accurate notions of its true nature. Celsus is supposed to have alluded to the ranula, in the fifth section of his seventh book, where, after treating of the diseases of the tongue, he introduces the following passage: *sub lingua quoque interdum aliquid abcedit, quod fere consistit in tunica, doloresque magnos movet.* The latter circumstance, however, renders it probable, that some other affection was signified, as a ranula is rather attended with a sense of restraint, than of pain. Fabricius ab Aquapendente and Dionis considered a ranula as an encysted tumour of the meliceris kind. Munick expressly says, that the affection originates from a thick saliva, which, not being able to pass out of the salivary ducts, accumulates under the tongue, so as to cause a swelling in that situation. De La Faye, in his notes on Dionis, adopted Munick's view: he says, "There are two sorts of ranulae; some, which are round, and situated beneath the tongue, seem only to be produced by a dilatation of the excretory duct of the sublingual gland; the others are longer than they are round, are situated at the side of the tongue, and are formed by a dilatation of the excretory duct of the inferior maxillary gland. The fluid, which fills such tumours, is the saliva, which gradually accumulates in them, in consequence of its viscosity and the atony of the duct." Now and then the contents are purulent, and very often calculi are met with. (Dupuytren, *Clin. Chir.* t. iii. p. 302.)

The excretory ducts of the submaxillary and sublingual glands appear to be the only ones liable to this change; for, the texture of the parotid duct is too dense to yield, and constitute a swelling of the above description. Baron Dupuytren, who has made the foregoing reflection, adds, that the sent of ranula has not yet been anatomically demonstrated, and that it is very desirable that there should be an elucidation of the questions by dissection, whether this disease is situated in the salivary ducts beneath the tongue? or whether it consists merely in a serous cyst? or else in one of a mucous, or sero-mucous texture, formed of the dilated follicles? The same distinguished surgeon then expresses his own suspicion, that tumours of different natures, belonging in turn to one of these three kinds, have been, on account of their situation, indiscriminately confounded together under

the name of ranulae. (*Clin. Chir.* t. iii. p. 297.) Malgaigne believes, that ranulae are most frequently only serous, or sero-mucous cysts, developed under the mucous membrane of the mouth. (*Man. de Méd. Opér.* p. 463, ed. 2.) Dupuytren notices the observation of certain writers, that children are sometimes born with ranulae; but suspects, that such tumours are only serous cysts situated under the tongue, and which occasionally become so large as to reach down to the sternum. M. Breschet dissected five of these pretended ranulae, and found them to be of the latter description. (*Répertoire d'Anatomie.*)

The closure of the orifice of the duct of the submaxillary gland may be the result of inflammation of the sublingual mucous membrane, or of the tongue itself. Aphthae and ulceration may obliterate the duct. Sometimes, when the frænum of the tongue is divided, some of the excretory ducts opening on each side of it are cut, and may become obliterated. (See Dupuytren, *Clin. Chir.* t. iii. p. 301.)

If the tumour acquire a certain size, it pushes the tongue backwards, displaces, or injures the teeth, affects the voice, obstructs speech, mastication, and deglutition, and in infants interferes with the action of sucking. Lastly, the tumour may project out of the mouth, or beneath the jaw.

Persons who move their tongues a great deal, and those who sing, have been set down as very liable to the present complaint; but this opinion, I believe, rests on no good foundation. The fluid in the tumour is precisely like white of egg; but it is thicker, after having remained a long while in the swelling; and it is occasionally of a calcareous, and even stony nature. Ranula does not proceed from an inspissation of the saliva, as De la Faye supposed, but from an obstruction of the duct, or orifices of this tube. The collection may produce a tumour of large size; but the swelling generally bursts when it has attained the dimensions of a walnut.

Mr. B. Bell met with a case, where an ulcerated opening had formed, and been treated in vain with various detergent and corrosive applications, and even a mercurial course. At length, the true cause of the disease having been ascertained, a cure was accomplished in a few days, by removing a piece of calcareous matter, which, by obstructing the duct, had first caused the swelling, and then ulceration.

An opening is frequently made with a lancet, but it closes up again, and the swelling reappears. J. L. Petit relates a case, in which the puncture was repeated ten times, and yet the cure was not accomplished. The ancients made the same remark; and hence, Paré preferred the actual cautery to the lancet. Dionis had also seen ranulae recur, after they had been simply opened with a lancet; and he recommends, for the prevention of this inconvenience, the application of a mixture of honey of roses and sulphuric acid to the inside of the cyst, so as to destroy it. By the introduction of a piece of lint into the cavity, or by freely opening it, and removing the edges of the incision, the chances of success are increased; but even these methods may fail, as I know from experience.

M. Louis having observed that the radical cure depended on a fistulous aperture, through which the saliva continued to flow, recommended such

an opening for the saliva to be made, as would not close.

Le Clerc recorded a case, in which the root of the swelling extended under the tongue; the tumour filled the whole mouth; the prominence which it formed outwardly was as large as a duck's egg; and the disease, in its progress, had made the teeth of both jaws project outward. At some parts of its surface, a fluctuation was perceptible; other places were exceedingly hard. The patient, who could scarcely breathe, demanded assistance; and a puncture was made in the softest part of the swelling below the chin. A thick yellowish fluid issued out of the ranula. The opening was enlarged with a knife, and about a pint of gritty inodorous matter was extracted. There was no hemorrhage from the cut; and no sooner had the contents of the swelling been let out, than the patient began to articulate, which he had not been able to do for a long while. The sides of the tumour being so prodigiously distended, Le Clerc thought proper to destroy the inside of the cavity with a tent, dipped in a mercurial solution. The cure was completed in a month, and the tongue gradually regained its original size, a part of which it had lost.

But, as M. Louis observes, fortunate as the termination of this case was, it must not be indiscriminately set down, that destroying the cyst, or even opening the tumour, is always requisite. A more simple method will sometimes succeed. In a particular case, which this gentleman has related, a sinusity, which divided the swelling into a right and left portion, made him suspect that it consisted of two sacs, in contact with each other. On each side, in front, and in the same line, there was a point, which was the orifice of the salivary duct, somewhat dilated, and blocked up with a viscid matter. Having very easily passed a small probe into the orifices, a matter similar to white of egg made its escape. A small leaden probe was passed into each opening, and, two days afterwards, the sacs were emptied again, and two pieces of lead, somewhat larger, introduced. The patient was advised to take out the pieces of lead every morning, empty the swelling, and then replace them. In a fortnight, the openings, having been kept continually dilated, had no tendency to close; the saliva did not accumulate, and the ranulae never appeared again. Sabatier also employed a tent, or piece of bougie, with success.

I attended a young lady who had a ranula, in which the plans of freely opening the cavity, of transfixing it with setons, of removing portions of the cyst, and of introducing into it lint wetted with a strong solution of nitrate of silver, all failed. The latter experiment caused a great deal of pain, and some swelling of the glands of the neck. I therefore decided to try the effect of making a small puncture in the tumour, and keeping in it a very small silver cannula, constructed with a little circular brim at its outer end, to prevent it from slipping into the sac. In about three weeks a cure was thus accomplished. The tube gave no inconvenience, and kept in its place remarkably well. Instead of a tube, Dupuytren preferred a little contrivance, termed *button of denture*, consisting of two thin elliptical metallic plates or buttons, one of which was broader in the greatest diameter, and joined together by a pedicle two or three lines

in length, and the external surface of which plates was convex, the internal concave. A puncture, two lines long, having been made in the tumour, about an inch from the point of the tongue, and its contents discharged, one button is introduced with the aid of a pair of forceps into the cyst, and the other remains in the mouth. This little instrument may be worn without inconvenience as long as necessary, the fluid of the cyst regularly escaping between the connecting pedicle of the instrument and the sides of the opening. (See *Clin. Chir.* t. iii. p. 316.)

Boinet related, to the French Academy, a case, in which the swelling not only filled the whole mouth, but one half of the tumour projected out, and a cure could only be accomplished by excision. The two upper incisor teeth, on the left side, were lodged in a depression observable there: and the canine tooth, of the same side, forced outward by the mass of the disease, had pierced the lip near its commissure. A fluid resembling mucus, flowed from a narrow aperture at the lower part of the swelling. The tongue could not be seen, so much was it pushed backward, and, for some time, the patient had only subsisted on liquid food, which he was first obliged to convey to the back of the throat with some mechanical contrivance. The four incisor teeth, two canine, and first grinders of the lower jaw, had been pushed out of their sockets, by the pressure of the swelling. The patient's aspect was alarming, and he was threatened with suffocation. Extirpation was deemed necessary, and performed with caution. The large cavity, thus occasioned, was filled with lint. The lower jaw being diseased, Boinet scraped some of its surface off, and covered the places with lint, either dry, or dipped in spirit of wine. Some exfoliations followed, and the fungous granulations which grew were repressed by proper applications. In three months the parts were healed in so regular a manner, that the motion of the tongue was not in the least obstructed, and no defect continued, except the alteration of the voice, occasioned by the loss of teeth.

Louis, in *Mém. de l'Acad. de Chir.* t. iii. *Sabatier*, *Méd. Opératoire*, t. ii. p. 19, &c. ed. 2. *Calliari*, *Systema Chirurgia Moderna*, vol. ii. p. 108, &c. *Ilafnia*, 1800. *Lassus*, *Pathologie Chir.* t. i. p. 402, &c. 8vo. Paris, 1809. *Richter*, *Anfanggr. der Wundarzn.* b. iv. cap. 1. Gütt. 1800. *J. J. Stahl et J. P. E. de Schoenber*, *De Ranula*, sub *Lingua*, speciali cum *Casu*, Erford. 1734. *Breschet*, in *Répertoire d'Anatomie* and in *Journ. Univ. des Sciences Méd.* Décembre, 1817. *J. P. Mithigaine*, *Man. de Méd. Opér.* p. 463. 12mo. Paris, 1837. ed. 2. *Baron Dupuytren*, in *Léçons Orales de Clin. Chir.* t. iii. 8vo. Paris, 1833, art. 11.

RECLINATION. A term employed in Germany to denote the operation of turning a cataract, so as to change the position of its anterior and posterior surfaces. (See CATARACT.)

RECTUM. Many cases, in which this bowel is more or less concerned, are treated of, in other parts of this Dictionary, and therefore it will only be necessary for me here to refer to them, and then notice some diseases of the same bowel, which are not considered in other articles. For an account of piles, hemorrhoidal excrecence, and other tumours of the rectum, see HEMORRHOIDS; and for that of prolapsus ani, fistula in ano, and imperforate anus, see ANUS. Under the head of *Intestinal Concretions*, I have noticed the dangerous obstruction of the rectum by masses of indurated

matter. In the article *Lithotomy*, the mode of cutting through the rectum into the bladder, for the purpose of extracting a calculus from the latter organ is explained; and if the reader refer to *Bladder*, he will there find a description of the method of tapping it from the rectum.

Foreign bodies introduced into the rectum by accident or design occasionally require to be extracted, as clyster pipes, bougies, portions of fish bone, or of the bones of chickens, rabbits, &c. This may generally be accomplished with forceps, or the lithotomy scoop guided on the finger. In the third volume of the *Mém. de l'Acad. de Chir.* M. Morand has given the particulars of many cases of this kind. In a case for which M. Maréchal was consulted, a pig's tail had been introduced with the thick end uppermost, into the rectum of a woman of the town by a medical student, whom she had offended. The tail had been prepared for the purpose, the bristles being cut short; the consequence was, that any attempt to remove it gave rise to most excruciating pain; the rectum became inflamed; and the bowels obstructed. Death must have been the result, had not the surgeon succeeded by a clever yet simple plan in extracting the foreign body. Having tied a piece of strong cord to the lower end of it, he introduced a tube over it, and without pain or difficulty removed both together. An anonymous writer extracted from a boy's rectum a wooden dragon with his horse; a toy which his playfellows had great trouble to introduce; and he had to dismount the dragon before extraction; that is, he broke it with a strong bent forceps for extracting polypi. The same author considers the introduction of the finger into the vagina of great use as a means of promoting the removal of some foreign bodies from the rectums of prostitutes, who are sometimes the victims of drunken brutality. (See *Edinb. Med. and Surg. Journ.* No. 134, p. 279.) Mr. Liston once extracted from the rectum half the jaw of a rabbit which had been swallowed. Fish bones, or small spiculæ of large ones, are apt to penetrate and pass into the cellular tissue in the vicinity of the bowel, where they may produce abscess and even a fistula in ano. (See *Liston on Practical Surgery*, p. 356.) Of such occurrences, Sir Benjamin Brodie has met with instances. (See *ANUS*, p. 214.)

An instance is mentioned by Mr. Mayo, in which the rectum was torn by an injection-pipe, and death occasioned by the passage of a pint of water-gruel through the laceration into the abdominal cavity.

With respect to *prolapsus ani*, Mr. Mayo refers to a preparation in the museum of King's College, showing that the muscular coat of the bowel may be inverted, as well as the mucous coat, and submucous cellular tissue; a point disagreeing with the statement of Dupuytren, that the prolapsus consists in extension of the mucous and submucous coats by the irregular action of the muscular coat. Mr. Mayo conceives that the use of the sphincter is to prevent protrusion of the rectum; and if this opinion be well founded, it follows, that no protrusion can take place, except in consequence of rupture, atrophy, or excessive relaxation of the sphincter. The atrophy of it in *prolapsus ani* of long standing has been ascertained and described by Cruveilhier; but here it may only be the effect, not the cause. Instead of Dupuytren's

plan of removing several marginal folds of integument close to the anus, for the cure of some examples of *prolapsus ani* (see *ANUS*), Mr. Mayo prefers the method of pinching up small folds of the protruded mucous and submucous coats with forceps, cutting their surface with scissors, and then including them in silk ligatures. In one case which he records, three such folds were tied on opposite sides of the bowel, and at different distances from the sphincter.

Ulcer of the Rectum may occur with or without a spasmodically contracted and hypertrophied sphincter. (See *ANUS*, p. 234.) It is situated on the posterior part of the rectum, opposite to the point of the os coccygis, and occurs chiefly in persons who are habitually constive, and whose fæces are of hard consistence, the mucous membrane being perhaps from such cause lacerated. As Sir Benjamin Brodie remarks, the ulcer, when once produced, is very difficult to heal, and frequently attains a considerable size. It is a superficial ulcer of exquisite sensibility, and great pain is always produced by the passage of the fæces over it, and, in some instances, considerable hæmorrhage takes place from it. The ulcer may always be cured by the division of the sphincter, but this is not invariably necessary, unless the muscle be actually contracted. When there is simply an ulcer, dividing the mucous membrane longitudinally so as to include the ulcer in the incision, has been found by Mr. Copeland to be sufficient. Many instances, in Sir Benjamin Brodie's practice, however, have yielded to the internal exhibition of confectio piperis comp., or Ward's paste, the bowels being at the same time kept gently open with lenitive electuary and sulphur. Ward's paste may also be applied locally twice a day, blended with soap. (Brodie, in *Lond. Med. Gaz.* vol. xvi. p. 27.)

Hoyer recommended the division of the sphincter, as essential for the cure of fissures (gerçures) on the verge of the anus, accompanied by spasmodic contraction of that muscle. (See *Traité des Mal. Chir.* vii. x. p. 125.) The fissures were regarded by him as the cause of the contraction. But Mr. Syme, in a considerable proportion of cases, has found the sphincter firmly contracted independently of any such cause. (On *Dis. of the Rectum*, p. 134.) a fact also noticed by Sir B. Brodie, and well known to every surgeon of experience. Dr. Bushe relates four cases. The first was healed by low diet, daily enemata, and the application of saturnine ointment; the second was touched with nitrate of silver, and the cure completed in a fortnight by the application of an ointment consisting of one part of extract of belladonna, and seven of spermaceti ointment. The other two cases required division of the sphincter. (G. D. *Bushe on the Malformations, Injuries, and Dis. of the Rectum*, 8vo. New York, 1837.)

Stricture of the Rectum.—Most of the ordinary unmalignant strictures treated by Mr. Salmon were situated between five and six inches from the anus. Their next most frequent situation, he says, is at the junction of the sigmoid flexure of the colon with the rectum; "the very reverse of which happens in the true carcinomatous affection of the rectum, which will most commonly be found near the orifice; the disease in all probability originating in the mucous glands of the intestine, which are most prevalent towards the inferior part of the bowel." (On *Stricture of the Rectum*,

p. 21.) In the various descriptions given of the complaint by writers, one great point of difference is remarkable, viz. that some of them represent the case as always of an incurable nature, while others consider it as admitting of relief, at least when it has not made considerable progress, and the parts are free from ulceration. "Many strictures of the rectum (as a judicious writer has remarked) are in their nature quite harmless, injurious only inasmuch as they present a mechanical obstruction, or disorder the functions of the alimentary canal, and fatal only from neglect. In many cases, also, great thickening and induration prevail, without the least tendency to cancer; at least, the latter disease has not supervened, even after an interval of many years." (*On Hemorrhoids, Strictures, &c. of the Rectum*, p. 120.)

There will be less confusion in the account of this subject, if the consideration of simple stricture, or contraction of the rectum, be separated entirely from that of cancerous, or malignant disease.

In dissecting a case of simple stricture of the rectum, Sir Benjamin Brodie found the mucous membrane thickened, of a harder structure than natural, and the muscular tunic also thickened. "The stricture sometimes occupies the whole length of the gut, for some way up above the anus, perhaps three or four inches; at other times, it is only of short extent. Frequently the gut is of its natural diameter close to the anus, and, about an inch and a half, or two inches above it, there is a circular contraction, and then above that the gut is of its natural diameter again. Although the contraction may occupy only a small portion of the length of the rectum, yet the disease of the tunics is generally more extensive." (*Sir B. Brodie, in Lond. Med. Gaz.* vol. xvi. p. 28.)

Besides a spasmodic form of stricture of the rectum, Mr. Calvert notices examples attended with change of structure. In some cases, he says, the contraction is chiefly owing to a thickened and indurated state of the mucous membrane, arising from inflammation, or some chronic alteration of texture; but, that when the disease has existed a considerable time, the mucous, cellular, and muscular coats become more or less affected; so that, on dissection, it is often impossible to determine in which the disease originally commenced. He describes other cases, in which the cavity of the rectum is nearly obliterated by the presence of hard, painful tubercles. "This disease (he observes) bears some resemblance to the first stage of malignant stricture, at least as it appears in some cases; but it is evidently quite of a different nature, as it is easily cured by compression." (P. 129.) He remarks, that a considerable obliteration of the cavity of the rectum may proceed from an inflammation, or ulceration, and subsequent adhesion of hemorrhoidal tumours, resembling, when the swellings are not of long standing, that form of stricture which arises from an infiltration of coagulable lymph in the relaxed folds of the mucous membrane of the bowel; but, in other instances, where such tumours are of older date and more solid, resembling the tubercular form of stricture. (P. 138.)

As the disease, at first, is not very painful, it is usually not much noticed till somewhat advanced. There is perhaps no disease in which the symp-

toms, arising from derangement of other parts, are so predominant over the local; and "there can be no doubt, that, in many cases of iliac passion, and obstinate constipation, arising from this source, death takes place without the slightest suspicion of the cause. In other cases, especially when the disease is of a malignant nature, it is not unfrequently confounded with scirrhus of the uterus." (*Calvert*, p. 123.) The same writer adverts to a case, in which a stricture of the rectum was mistaken for an intus-susception, by some practitioners "at the pinnacle of professional eminence." In one case, where Sir Charles Bell attempted to puncture the bladder, and in another where he was about to divide a fistula in ano, he felt his finger stopped by strictures of the rectum, of which the patients had no suspicion. The same thing happened to Mr. Syme. (*On Dis. of the Rectum*, p. 114.) The patient is at first habitually constive, or affected with what is called a torpid state of the bowels, and usually voids his stools with a little difficulty. In time, a good deal of pain is felt in the part affected, especially at stool, after which some relief is experienced. "As the gut continues to decrease in diameter (says Mr. Copeland), the efforts to expel the fæces become more violent, and the consequent progress of the disease more rapid. The stools, which have been long evacuated with difficulty, become contracted in size, appearing like earthworms in their form, or small pellets;" and, if the finger be introduced into the rectum, the gut will be found either obstructed with small tubercles, or intersected with membranous filaments: or else the introduction of the finger will be opposed by a hard ring of a cartilaginous feel, composed of the diseased inner membrane of the intestines." These states, as Mr. Copeland observes, are very different from the regular tumour on the anterior part of the rectum, occasioned by an enlargement of the prostate gland; a case apt to be suspected. "As the disease advances (says the same author), the fæces become more fluid, and there is a thin sanious discharge from the anus, accompanied with tenesmus." Mr. Calvert notices as the most characteristic symptoms, an unusual distension of the colon; the extension of pain, felt about the upper part of the sacrum, down to the feet, in the course of the large nervous trunks; the decrease of the tenesmus after a sufficient evacuation; and the scanty motions of irregular or figured appearances. The latter effect, however, he says, is not always present throughout the disease; for, if the contraction be at the upper part of the rectum, the motion may be of the usual size and appearance. (P. 147.) Pus and blood may be noticed with the excrement, particularly when the disease has advanced to the ulcerated state.

Sometimes a small fistulous orifice at the verge of the anus communicates with the inferior portion of the diseased part. Such a fistula, in a case recorded by Sir Everard Home, was half an inch in length. (*Obs. on Cancer*, p. 133.)

Professor Syme had a female patient, who was admitted into the Edinburgh Infirmary on account of a fistula in ano, but, in whom, as soon as he introduced his finger for the purpose of guiding the knife, he found a close stricture of the rectum; yet she had been unconscious of its presence. The cause of deception Mr. Syme refers to the effects of a confirmed stricture being "in general the

frequent, often almost incessant discharge of the feculent matters, owing to the copious secretion of mucus, which results from the irritation of the disease;" and to the "thin slimy stools, occasionally tinged with blood, attracting more notice, than the small indurated masses of feces passed along with them." Hence the disease is mistaken and treated as a diarrhoea.

The following is Sir Benjamin Brodie's description of stricture of the rectum in the ulcerated stage:—"As the disease advances, some parts of the mucous membrane ulcerate. This causes the pain to be much aggravated; there being then a discharge not only of mucus but of blood and pus from the anus. If the disease proceeds still further, inflammation takes place in the cellular membrane around the gut; putrid abscesses form, which burst in various situations at every side of the anus, into the urethra in men, and occasionally in women into the vagina. In some instances, the patient dies with symptoms of strangulated hernia; that is, a piece of hard feces is lodged above the stricture, and cannot pass through it. Thus, there is a mechanical obstruction to the passage of the feces; the belly becomes tympanitic; the tongue dry; there is sickness, vomiting, and the other symptoms indicating strangulation. He may have one of these attacks, and, by means of injections, and the use of a bougie, may recover: he may have a second, and recover from that; and then he may have a third, which may prove fatal. In the most advanced stage of the disease, independently of these attacks, the patient suffers much in his general health, loses flesh, perspires at night; his digestion is deranged; he is emaciated and hectic; and thus gradually becomes exhausted." The progress of the disease is tedious. The patient, where no remedies are employed, may linger ten or twelve years. In other cases, if not cured, the disease may be mitigated, and never prove fatal. (See *Sir B. Brodie*, in *Lond. Med. Gaz.* vol. xvi. p. 28.)

When the disease is not attended with ulceration, the contraction and thickening of the gut may be diminished by introducing bougies, keeping them for a certain time, every day, so introduced, and increasing their size gradually. The pressure of these instruments seems to lessen the disease, and stop its progress; a proof, at all events, that the nature of one form of indurated and contracted rectum differs from that of malignant scirrhus. Desault used long tents, made of linen, smeared with cerate, and passed into the bowel by means of a probe with a forked end. Their size was gradually increased, so as to keep up the compression, to which, it was conceived, all the good was owing. Their length was also augmented by degrees. At first, fresh ones were introduced twice a-day. When any hardiness were situated on the outside of the anus, Desault cured them on the same principle, viz. by making pressure on them with compresses and a bandage. In this manner, he is stated to have effected the cure of a scirrhus-contracted rectum. The patient was taught to pass occasionally the tents, without assistance, in order to prevent a relapse.

Instead of tents, modern surgeons employ bougies for the dilatation of strictures in the rectum. When from habitual costiveness, the altered figure of the stools, and other circumstances, there is reason to suspect organic obstruction to the passage of the feces, and this suspicion is confirmed by an

examination of the rectum with the finger, "the first object of the surgeon (says Mr. Copeland) should be an enlargement of the obstructed part, by the introduction of a bougie. This should be of such a size, as to pass, when well lubricated with oil, without much difficulty or pain. Sometimes, when the disease has been of long continuance, it will be necessary to begin even with large-sized urethra bougie, or one of the same size as those which are made for a stricture of the oesophagus, and of a length that is likely to pass beyond the end of the stricture, that is, about six, or seven, or eight inches. But, I think it of consequence to use a bougie at first, which is rather too small, than too large." (P. 29.) When it has remained for half an hour, or more, it is to be removed, and passed again the next day, the same sized bougie being continued for several days. In the introduction of the bougie, Mr. Copeland cautions the practitioner not to mistake the projection of the sacrum for a stricture of the gut; a mistake which, he says, has often been made, and, as I believe, too often wilfully, and from motives of imposition.

Mr. Syme relates a case in which some respectable practitioners were deceived. "In the feeble and unhealthy persons, who are usually suspected to labour under the disease, the coats of the rectum are so thin and relaxed, as readily to catch the point of the bougie employed for exploring the cavity, and thus impede its progress, which is also apt to be arrested by the promontory of the sacrum." The case of an elderly lady is then detailed, in which two medical gentlemen had spent three hundred hours in endeavours to dilate a supposed stricture with bougies. The patient died, and in the post mortem examination not the slightest trace of contraction could be discovered. A bougie was introduced by one of these gentlemen in the accustomed way, and on arriving at the depth it used to reach, its point was ascertained to be stopped by the promontory of the sacrum. (See *Syme*, *On Dis. of the Rectum*, p. 112.)

Pressure on the rectum by the retroverted uterus (*C. Bell*), an enlarged ovary, or other tumour, may also lead an inattentive surgeon to mistake the case for a stricture. Mr. Calvert has seen the bougie employed a long while in one example, where the real disorder arose from a biliary concretion imbedded in the parietes of the rectum. (*On Hemorrhoids, and other Diseases of the Rectum*, p. 167.) This gentleman conceives, that an ivory ball, affixed to the end of a silver wire, is a good instrument for ascertaining the exact situation and extent of strictures of the rectum. (P. 169.) When the stricture is just above the sphincter, some information of the state of the parts, he says, may be gained by employing the speculum ani; but, he adds, that whenever there is organic stricture near the anus, this instrument should be used with caution, as any sudden distension of the parts is always injurious. (P. 170.) Mr. Copeland advises the bowels to be kept constantly lax, by the use of castor oil, or electuary of senna, during the whole of the treatment. (P. 30.) Whatever be the nature of the stricture, whether it be that kind in which the rectum is obstructed by tubercles, by membranous filaments intersecting its canal (which two species Mr. Copeland says are the most easily relieved), or whether it be the indurated stricture, from a

thickening of the coats of the intestine, this local treatment is equally necessary. The plan is to be persisted in until a full-sized bougie will readily pass, and even after all symptoms have disappeared, it is recommended to introduce the bougie, and withdraw it again, once every two or three days, for some time, in order to prevent a relapse. The indurated, annular stricture, which long resists the bougie, Mr. Copeland sometimes divides with a probe-pointed curved bistoury on the side which is contiguous to the os sacrum; and he has frequently seen the late Mr. Ford perform the same operation. (P. 34.) This practice which originated with Wiseman, has also been followed by others with success. (See *Jameson's Case*, in *American Recorder*, April, 1822.) When the disease is either combined with venereal symptoms, or there is any reason for suspecting it to be itself "the solitary symptom" of lues, Mr. Copeland joins Desault in recommending a trial of the effect of mercury, in conjunction with bougies. (P. 44.) The formation of abscesses, he remarks, is very frequent in the advanced stages of the disease, and he has often seen the common operation for fistula done under such circumstances without success. (P. 35.) Sir Benjamin Brodie also joins in representing the inutilty, and even the mischief of laying open abscesses formed under these circumstances; for they will not heal till the stricture has been removed.

Besides tents and bougies, which latter Mr. Calvert thinks may be sometimes usefully made the vehicle of local applications, or be what is called medicated, this gentleman enumerates amongst the plans of dilating the stricture a prepared gut, introduced beyond the stricture, and then distended with water; in other words, Mr. Arnot's dilator. This method, he thinks, may be adopted where the bougie causes great irritation. (P. 173.)

If the stricture be not in a very irritable and tender state, Sir Benjamin Brodie is of opinion, that the patient may at once derive benefit from mechanical dilatation by the use of a bougie. The diameter of the stricture is to be ascertained, as nearly as possible, with the finger, and a bougie of proper size introduced through its orifice. He recommends the bougie to be kept in the stricture five or ten minutes, or in some cases, for a longer time; and the operation must be repeated every day, according to circumstances. In this manner, though the gut may not be restored to its full diameter, the stricture will be so much dilated, that the fæces will readily pass, and the patient suffer little inconvenience. Here, as in cases of stricture in the urethra, the use of the bougie must be continued. If it be neglected, the stricture will return. In some cases, where the stricture is situated about two inches above the anus, and occupies only a small portion of the length of the gut, forming a circular band, which embraces the finger, Sir Benjamin Brodie precedes the use of bougies by dividing the stricture in two or three places with a *bistouri caché*. The knife is introduced with the blade shut, and the screw so adjusted, that the blade may be opened about the sixth of an inch, but certainly not more than a quarter. The handle being pressed upon, the blade is opened, and being drawn out, the stricture is cut first in one point; then at a second; and again at a third. This having been completed, a

larger bougie may be introduced, than was previously applicable, and the cure is much expedited.

A bougie, made of a long piece of common sponge, dipped in a concentrated solution of gum arabic, is sometimes preferred. The whole length of it is tied up with a string, the circular turns of which must be close together. After being dried, the string is taken off, and the surface is made smooth with a knife, or file. As soon as the gum arabic is dissolved by the moisture of the part into which this bougie is introduced, the sponge gradually regains its natural elasticity, and extends the part without pressing or irritating it, as it assumes the shape of the gut. (See *Edinb. Med. and Surg. Journ.* No. 134. p. 290.)

Mr. Syme is not much in favour of dividing a stricture of the rectum with a knife; because, "in certain conditions of a constitutional and local kind, wounds of the rectum, even though of very small extent, are followed by serious, or fatal consequences; and as the bougie, though not so speedy in its operation as the knife, is equally effectual, and not exposed to the same objection, prudence seems to require that the practice of incision should be either entirely abandoned, or only used in particular cases with extreme caution." (*Syme, Op. cit.* p. 120.) In London, surgeons do not find cause for the apprehension here expressed, and as the division of the kind of stricture specified by Sir Benjamin Brodie promotes the cure materially, I believe it receives general approbation.

Instead of introducing the bougie daily, and allowing it to remain in the passage for hours, Mr. Syme employs it only every third or fourth day, and withdraws it immediately it has been passed through the stricture. Bougies, composed of iron or elastic gum, appear to him the most convenient. (P. 122.)

The late Dr. Bushe invented particular kinds of rectum bougies; a whalebone stalk, mounted with an ebony stalk three inches long; and also a silver instrument. (See Pl. VIII. *Bushe on Malformations &c. of the Rectum and Anus*); but a judicious critic expresses disapprobation of them. (See *Edinb. Med. and Surg. Journ.* No. 134. p. 290.)

In some cases, it is necessary previously to the use of a bougie, to lessen the irritable state of the bowel by the introduction of an opiate suppository every night, and the exhibition of a gentle aperient in the morning. The patient may take three times a day half a drachm of balsam of copaiva, fifteen minims of the liquor potassæ, three drachms of the mucilage of gum arabic, and nine drachms of carraway water. Sir Benjamin Brodie has also tried with advantage, a decoction of achillea millefolium (two ounces of it to a pint and a half of water, boiled down to one pint), a wine glass of it being given three times a day. (See *Lond. Med. Gaz.* vol. xvi. p. 29.)

When the fæces accumulate above the stricture, and distend the bowel into a large bag, attended with aggravation of the disease, Sir Benjamin Brodie recommends an elastic gum catheter to be introduced through the stricture into the feculent mass; and tepid water, or tepid soap and water, or a weak solution of caustic alkali to be injected. By repeating this operation every day, or every other day, the fæces will be dissolved, and their evacuation brought about. When this has been accomplished, the injection of warm water should

be frequently repeated, in order to prevent another accumulation.

Formerly it was a common practice to apply mercurial ointment to strictures of the rectum. Morgagni followed this plan on the supposition of the cases being connected with syphilis. Sir Benjamin Brodie states his belief, that this treatment has sometimes been beneficial. The bougie is covered with lint, smeared with mercurial ointment, and allowed to remain in the stricture a few minutes. Other practitioners have been content with smearing the bougie itself with the ointment. Mr. Ramsden (of St. Bartholomew's,) under whom I studied surgery, frequently resorted to this practice.

From what I have seen of strictures of the rectum, I incline to the opinion expressed by Sir Benjamin Brodie, that the degree of success of the treatment will depend upon the stage of the disease, in which the surgeon is consulted. If proper means be employed in good time, the stricture may be dilated, and, though the disposition to its return may yet continue, the patient may be kept from experiencing much inconvenience, and his life will not be shortened by the disease. But, in a more advanced stage of the complaint, when abscesses have formed, the symptoms will only admit of palliation.

When a stoppage of urine occurs in the advanced stage of the disease, Mr. Copeland advises surgeons not to use the catheter hastily. (P. 39.) And, in the event of great pain and irritation in the rectum, he has seen the greatest benefit derived from the local application of opium, either in a clyster, or by the introduction of one or two grains of the medicine within the anus. He also speaks favourably of the effects of the warm bath, and fomentations, in giving temporary relief; and he has exhibited in these cases the pil. extracti conii cum hydrarg. chlorido with considerable advantage.

Sometimes in the advanced state of this disease, the patient is seized with symptoms of peritoneal inflammation, which puts a speedy termination to his sufferings. In such cases on examination after death, it is discovered, that the process of ulceration has opened the intestine immediately above the stricture, and that, through this opening, a portion of fæces has passed into the cavity of the abdomen. (Colles in *Dublin Hospital Reports*, vol. v. p. 136.)

The following statements made by this gentleman deserve attention. "Among a considerable number of patients afflicted with this disease (he observes), I have had an opportunity in two instances only of meeting with it in its incipient state. In both of these the patients complained of different symptoms of irritation of the rectum, frequent stools, discharges mixed with mucus, and certain feelings of uneasiness. On examination with the finger, a thickening and slight projection of the gut was felt at a small spot on one side. This morbid alteration spread gradually round the entire of the canal, and extended along it only to a small distance; but until the morbid derangement of structure had almost entirely performed the circle of the intestine, the patient did not exhibit those symptoms which I consider as the common and inseparable attendants on stricture of the rectum. However constant in their attendance r unvarying in their course, may be the symp-

toms of this disease, yet will the surgeon desire to be confirmed in his opinion by manual examination. Proceeding to make this examination, we often observe at the orifice of the anus the following appearance, which is indeed almost always present when the disease is seated near the external sphincter; namely, at each side of the anus a small projection, which, on its external surface, appears as a mere elongation and thickening of the skin, but internally presents a moist appearance, not exactly like the lining membrane of the gut, nor yet can we say that it is ulcerated. These two projections lie close together below, and divaricate above, presenting a resemblance to the mouth of an ewer. Whenever this external appearance exists, I feel almost certain of finding a stricture of the rectum before the finger is pushed as far as the second joint into the gut. In some cases, however, this external mark has not been present."

"When the stricture is situated pretty high up, the portion of gut, interposed between it and the anus, is found to be in a perfectly healthy state; but, when the finger arrives at the stricture, it is arrested by the narrowness of the canal, which will barely admit the point of it. If now a slight degree of force, combined with a boring motion, be employed, the finger may be pushed through the thickened and indurated part, and will then find, that the gut just above the stricture is in a very healthy state." Sometimes the stricture is a mere ring; but, at other times, it extends along the canal as high as the finger can reach. Dr. Colles has not yet met with any instance, in which the intestine was strictured by means of bands thrown across its canal. Cases of this disease, examined after death, present all the coats of the intestine very much thickened, except the peritoneal tunic; the muscular, cellular, and mucous coats, are much thickened; and the latter one is hardened, and raised into irregular ridges, but not ulcerated. In the 4th Fasciculus of Dr. Baillie's *Morbid Anat.* p. 1—4. there is an excellent specimen of organic stricture of the rectum; and in the same plate, fig. 2, is a good representation of cancer of this bowel. (See *Colles's Dublin Hospital Reports*, vol. v. p. 137, &c.)

Dr. Colles believes that stricture of the rectum most frequently attacks persons who are about the meridian of life; sometimes, however, children, as early as the seventh, or eighth year of their age. He has not met with any instance, where it attacked an individual at or beyond the age of sixty. (See *Dublin Hospital Reports*, vol. v. p. 131.)

Strictures of the rectum are mostly situated in the lower part of it, within the reach of the finger. About four inches from the anus is specified by Mr. Liston as their general situation. (*On Practical Surgery*, p. 366.) In a few instances met with by Dr. Colles, the stricture could not be well reached with the finger, unless the patient forced it down. There are exceptions, however: in the museum of University College, London, may be seen a stricture situated between the rectum and the sigmoid flexure of the colon, not of a scirrhus nature. The parts were taken from the body of a woman, aged 55, who had had no evacuation from the bowels for a fortnight previous to her decease. The abdomen was much distended; and, around the ulcerated openings, just above the stricture, small abscesses had formed, communicating with

the bowel, but not with the cavity of the peritoneum. There is also to be seen in the same museum another stricture of the rectum, attended with fistulous sinuses, terminating in the vagina and perineum.

Sir Benjamin Brodie has seen one example where a stricture of the rectum was about six inches above the anus; and another case, where there was a stricture in the sigmoid flexure, manifestly the consequence of the contraction of a cicatrix. However, he deems strictures in these high situations very rare; yet he has known a great number of persons treated with long bougies on the supposition of their labouring under strictures so placed. "The only evidence of the existence of a stricture in these cases (he observes) has been *first*, that there was obstinate costiveness; *secondly*, that a bougie could not be made to pass beyond a certain number of inches above the anus. But, (he asks) what is the value of this evidence when compared with that which anatomy affords of the rarity of this kind of stricture? Are there not many causes of a costive state of the bowels besides mechanical obstruction? Will it be always easy, even in the most healthy rectum, to introduce a bougie more than a few inches into it? Although we call the lower bowel the *rectum*, it is any thing but a straight gut. Three or four inches above the anus, the rectum begins to make flexures, which increase as you trace it upwards, until they terminate in the sigmoid flexure of the colon. These flexures of the rectum differ in different individuals, and even in the same individual at different periods. When a bougie is introduced, be it small or large, it is certain, that it will be stopped somewhere or another, by one of these flexures; and nothing can be more unphilosophical than to conclude, because a bougie meets with an impediment at the distance of five, or six, or eight, or nine inches, that this is the result of an organic disease of the rectum, when the natural formation of the parts will account for it. But, let us suppose that you actually meet with one of those rare cases, in which there is a stricture in the upper part of the rectum; by what means are you to recognise the disease in the living person? Or, if you can recognise it, how can you know its exact situation? If the bougie can only be introduced to a certain distance, how are you to be sure that it is stopped by a stricture, and not by a fold of the bowel; or even by coming in contact with the sacrum? If you employ the force, which you would suppose to be necessary to make the bougie penetrate through the stricture, is there no danger of its penetrating the tunics of the intestine instead? I have been informed on good authority of seven or eight cases, in which this frightful accident occurred, and the patients died in consequence." Taking all these things into consideration, Sir Benjamin Brodie lays it down as a rule, that bougies should not be employed, except when the stricture is within reach of the finger. (See *Lond. Med. Gaz.* vol. xvi. p. 30.)

The distinguishing characters between stricture of the rectum and other affections are ably explained by Dr. Colles. 1. In cancer of the rectum, there is the same narrowing of the canal and hardness of its walls, the frequent straining stools and discharge of bloody purulent mucus; but the countenance presents a leaden sallow cast, and

lancinating pains dart through the hips and pelvis into the groins and down the thighs and legs. Although cancer of the rectum, in its early stage, presents to the finger a feel very similar to that of stricture, yet by repeating the examination, in a few weeks we discover that the cancerous ulceration has in the interval destroyed some portion of the hardened wall of the intestine. 2. Dr. Colles notices a rare form of scirrhus of the uterus and vagina, in which the latter passage is almost obliterated by a cancerous thickening of its walls. This gives rise to symptoms not unlike those of stricture of the rectum. Here manual examination will remove all doubt. 3. The same test will apply to enlarged prostate gland, if the symptoms should simulate those of stricture of the rectum. 4. An ulcer of the rectum, if low down, will become visible by expanding the anus, or by introducing a blunt polished gorget into the bowel, with its concavity towards the disease. The cavity of the ulcer may be felt with the finger, and more pain attends the evacuation of the bowels than in cases of stricture. 5. A tumour in the pelvis may compress the rectum: here the projection comes from one side only, and the coats of the intestine retain their healthy structure. (See *Colles, in Dublin Hospital Reports*, vol. v. p. 140.)

Sir Benjamin Brodie, has given the description of a disease of the rectum, in which there is generally, but not always, a contraction of the gut, which is not a malignant affection, and yet ought not to be confounded with ordinary stricture. He has observed it chiefly in women, and especially in those who have borne children. In the great majority of cases, it has begun some time after a difficult labour. The patient complains of pain referred to the rectum, pain in the lower part of the back, a discharge of mucus from the anus, and some difficulty in passing the evacuations. These symptoms gradually increase in severity; and the patient then complains of exceeding difficulty in passing the evacuations, and of constant pain, which, however, is greatly aggravated after the fæces have been voided. There is a discharge of mucus; and sometimes of blood, or of mucus tinged with blood. If the bowel at this period be examined with the finger, the inner surface of the mucous membrane is felt to be irregular, as if it were lined with a multitude of small flat excrescences, some of which may generally be observed, at the same time, on the margin of the anus, somewhat like shrunk, or collapsed external piles, but smaller. In some instances, the mucous membrane appears to be here and there in the intervals ulcerated. The examination gives extreme pain. Generally about an inch and a half, or two inches above the anus, a circular contraction, or stricture is perceived; but, in other instances, there is no contraction whatever in this situation, but a very contracted state of the anus itself. A contraction, however, is not an essential accompaniment. When the disease has advanced further, an abscess forms in the cellular tissue near the gut, and bursts near the anus, or on the nates, or in the perineum. These abscesses burst in other situations one after another, in the same manner as after common stricture of the rectum. Sometimes an abscess forms in front of the rectum, and bursts into the vagina, making a communication between them. Ultimately the fistulous openings are numerous, the abscesses

having no disposition to heal, though they sometimes get into a quiet state, and discharge but little matter; and then all at once inflammation takes place again; and a fresh collection of pus is produced, followed by copious discharge. The disease, if left to itself, always proves fatal in the end. Many years, however, may elapse, before it has run its course, the patient all the time suffering miserably. At last she has shiverings, nocturnal perspirations, a rapid pulse, and becomes hectic, and dies. (*Sir B. Brodie*, Vol. cit. p. 236.)

The following is the treatment recommended by this experienced surgeon. If the introduction of the finger does not occasion much pain, and a stricture is felt with it, an endeavour to dilate the stricture with a bougie may at once be made. In the first instance, a common bougie is to be passed into the stricture, and kept there for a few minutes daily, its diameter being gradually increased. After a time, the bougie is to be covered with lint, well smeared with mercurial ointment. This plan may be continued daily, or every other day, until the stricture has been considerably dilated; but if inflammation occur, the bougie must be omitted for a time. At first, also, if the parts are too irritable to bear the bougie, an opiate suppository may be used every night, and the bowels kept gently open with lenitive electuary and sulphur, or small doses of castor oil. The balsam of copruva with liquor potassæ will also be of service, or the decoction of achillea millefolium, in the forms already specified.

Sir Benjamin Brodie has seen some advanced cases, where much benefit was derived from the exhibition of four or five minims of liquor arsenicalis, three times a day. The effect was to lessen the discharge, diminish its irritability, improve the general health, and sometimes put an end to the rigors, to which the patient was liable.

Notwithstanding the alleviation derived from bougies, Dr. Colles is confident that a perfect cure of an organic stricture of the rectum has not yet been accomplished by any plan of treatment. He has not been contented with applying the bougie, but has often made it the means of conveying various applications to the seat of disease, employing for this purpose bougies with a deep groove running spirally their whole length, so that the ointment should not be rubbed off them by the tightness of the anus. Mercury, arsenic, cicuta, and preparations of iron, he has not found possess any power over this disease. Large quantities of mucilage appear to him to give most relief. Blue pill, however, combined with twice its quantity of compound powder of ipecacuanha, he notices as having sometimes afforded much temporary relief. (See *Dublin Hospital Reports*, vol. v. p. 143.)

Malignant Disease; Cancer of the Rectum; Scirrhus-Contracted Rectum.—According to Desault, scirrhus of the rectum is not uncommon at an advanced period of life, and afflicts women more frequently than men; as from a table, kept at the Hôtel Dieu, it appears that ten cases out of eleven occurred in females; a proportion far exceeding what has been noticed in this country. Indeed, Mr. Calvert sets down the greater frequency of the disease in one sex than the other, as a doubtful point. (*Op. cit.* p. 122.) If it were not for the fact, that Desault sometimes effected the cure of the disease in its early stage, I should venture

to conclude that his observations apply entirely to true scirrhus, or cancer of the rectum, which I believe rarely or never occurs in young patients, but, as Desault states, is not very unfrequent in elderly persons. My friend, Mr. Copeland, does not confine his remarks to really cancerous affections, but comprehends strictures of the rectum from a variety of causes; and this accounts for his statement that the disease "*attacks people of almost all ages*," but is most common about the middle age. However, he agrees with Desault, that women are more frequently the subjects of it than men. He believes that stricture of the rectum is not so often cancerous as is imagined; the mere induration not being an unequivocal proof of it. When the disease is truly cancer, it is usually attended with more severe pain, darting through the pelvis to the bladder and groin; the countenance is sallow (*On the Principal Dis. of the Rectum*, p. 15—17.); and the patient frequently labours under hepatic, or some other visceral affection. (*Sir B. Brodie*, *Lond. Med. Gaz.* vol. xvi. p. 237.) The disease is represented as most frequently beginning just above the internal sphincter. (*Calvert.*) Mr. Salmon believes that it originates in the mucous glands of the intestine, which are here most prevalent. (*On Stricture of the Rectum*, p. 21.) Mr. Calvert's investigations lead him, however, to admit the situation of the disease to be occasionally higher up, and especially in the sigmoid flexure. Cancer of the rectum rarely begins before the middle period of life, and the symptoms come on slowly and insidiously. The patient at first experiences slight uneasiness about the rectum, followed by some difficulty in passing his evacuations. This difficulty increases, and the uneasiness changes into pain; the stomach becomes disordered, and the health begins to fail. In the advanced stage, there is for the most part great difficulty in passing the evacuations; but this depends upon the degree of obstruction. At length, there is a constant discharge of bloody mucus, and incessant pain, aggravated after each evacuation from the bowels. The pain is especially referred to the lower part of the back, but there is also pain in the thighs, nates, and hips. "If at this period of the disease you institute an examination of the rectum, you find the morbid growth a little way up the bowel, within reach of the finger. But it varies in size, in figure, and in position in different cases. Sometimes there is a hard solid tumour, occupying only a portion of the circumference of the rectum, and usually situated at the back part, with elevated edges, and, as it were, excavated in the middle, the bowel not being contracted in size, but as capacious as ever. At other times, the morbid growth occupies the entire circumference of the bowel, which takes a winding course through its substance. Then, if you introduce your finger into the rectum, you meet with a large solid mass, and with some difficulty discover the orifice of the intestine in its centre. Sometimes the diseased structure extends down quite as low as the anus. More frequently it begins about two inches above it, the intestine below being in a healthy state. There is great variety also as to the extent of the disease upwards. The whole of it may be within reach of the finger, so that the healthy portion of the intestine may be perceived above it; or it may extend so high up, that you can in no way trace its upper border. In some instances, the disease

is complicated with the addition of several pedunculous excrescences, which come down through the anus when the patient passes his evacuations, and this very much aggravates his sufferings. In the advanced stage, there is sometimes, but not frequently, a large hemorrhage from the bowel. Abscesses form in the neighbourhood, and burst externally. In females they burst into the vagina, and the opening is increased by ulceration, so that a large quantity of feces may be passed by that canal. In the male sex, ulceration will frequently make a communication between the rectum and bladder, or the rectum and urethra, and then the patient voids, not only urine, but feces with his urine. Spasm may be induced in the urethra, and hence the patient is liable to a retention of urine." At length the patient dies worn out by great suffering. In some cases, the morbid growth completely obstructs the passage of the feces, which accumulate above it, and symptoms, somewhat resembling those of strangulated hernia, are produced, and with which the patient sinks; or the bowel may ulcerate above the obstruction, and the feces escape into the cavity of the peritoneum, and then death takes place from peritonitis. (Sir B. Brodie, in *Lond. Med. Gaz.* vol. xvi. p. 237.) Cruveilhier records the particulars of an interesting case, in which numerous cherry-stones were stopped by a circular medullary cancerous tumour of the colon, and death took place from peritonitis, in consequence of the passage of three of them by an ulcerated opening into the cavity of the peritoneum. (See *Anat. Pathol.* t. ii. pl. vi. livre 26.)

When stricture of the rectum is of a cancerous nature, every known remedy is inadequate to arrest its progress. A mitigation of sufferings is all that can be aimed at. "Diluent injections, combined with opium, conium, or similar remedies, may afford a temporary relief in the ulcerative stage;" but, according to Mr. Calvert, "the greatest advantage is derived from carefully introducing a hollow tube of elastic gum, through which the feces are drawn off by injecting tepid water." Dilating the passage, with any other view than that of maintaining an outlet for the forces, he considers quite useless. A soft tent composed of lint, smeared with some mild fresh ointment, will in general answer this purpose. If there be much pain and inflammation, fomentations may be used; and leeches applied in the vicinity of the anus, or over the sacrum. The bowels should be kept moderately open with castor oil, or some other mild laxative, which, if it is thought necessary, may be combined with the extract of hyoscyamus, cicuta, or opium; but the latter is in general less admissible, because it is more liable to counteract the effect of the laxative, and produce a torpid state of the bowels." (Calvert, p. 187.)

Mr. Salmon is of opinion that, in true carcinoma of the rectum, bougies dangerously aggravate the disease. The only palliative means recommended by him, are leeches to the anus, the introduction of a grain of two of opium into the rectum, and perseverance, night and morning, in injections containing from forty to sixty drops of laudanum. He particularly cautions the surgeon not to introduce the oyster-pipe more than an inch, or an inch and a half, within the sphincter, lest too much irritation be excited. (P. 65.)

According to Cruveilhier, cancer of the rectum may occur at any point of it, and the disease assume every possible form of cancerous degeneration. The diseased mass is sometimes quite indurated like scirrhus; and in other instances, softer, like medullary cancer. The two may be blended together, though for the most part a primary disease, it is in women often a mere extension of cancer of the uterus, or rather of the vagina. Cruveilhier has seen several women in the Salpêtrière, in whom, while the uterus was perfectly healthy, cancer was confined to those parts of the parietes of the rectum and vagina which rested against one another, and it was impossible to decide whether the disease had commenced in the one or the other of these passages. He never met but with one instance in a man where cancer, originated simultaneously in the rectum and bladder. He considers the obstacle to the evacuation of the feces as the most serious effect of cancer of the rectum, and he proves that obstruction may proceed so far as even to confine the gas completely within the bowels, and occasion from this cause the rupture of them. A cancerous disease of the rectum, beyond the reach of the finger in the early stage, may afterwards be forced lower down by the accumulation of feces above it, so as to admit of being touched. The same thing happens when the patient strains. Cruveilhier saw one case in which the disease could be touched with the finger, though it was five or six inches from the anus. Amongst other important remarks made by this eminent pathologist, I find a statement, that cancer of the rectum is mostly a local disease (*le plus habituellement exempt de toute infection cancéreuse*); an observation bearing upon the question, whether amputation of part of the rectum is ever an advisable proceeding.

Sir Benjamin Brodie recommends opiate injections, and injections of linseed oil, either in its pure state, or combined with limewater, as useful in allaying irritation; and he gives alkalies internally, either with balsam of copaiva, or otherwise combined. In the advanced stage, he deems the exhibition of opium indispensable to render life supportable, though he fully acknowledges the inconveniences of it in causing constipation, checking the secretion of the liver, disordering the stomach, injuring the general health, and rendering the patient nervous and irritable. (*Lond. Med. Gaz.* vol. xvi. p. 239.)

Mr. Syme deems opiate injections and the hip-bath useful palliatives. "The patient should be enjoined to abstain from every kind of stimulating food and drink, and also to avoid any exertion of body likely to aggravate the complaint, resting as much as possible in the horizontal posture. The introduction of bougies, and all other operations, not only can do no good, but must even produce an injurious effect." (*On Dis. of the Rectum*, p. 129.)

Great differences of opinion are entertained about the excision of cancer of the rectum. All parties admit the practicableness of the operation in a certain stage and form of the disease. Sir Benjamin Brodie objects to it on the ground of the probability of a relapse from the existence of the disease in parts above the tumour. If even the operation be justifiable, he thinks that it can only be so under some peculiar circumstances, as where the disease is very low down in the gut, and quite in its earliest stage.

Mr. Syme likewise condemns the operation: he

admits that a considerable portion of the rectum, even to the extent of a couple of inches, may be cut out, without immediately fatal, or very bad consequences at first; but he asserts, that the patient will derive no benefit from it, and an impulse will be given to the morbid action. "If (says he) there are any cases, in which this excision of the rectum has been followed by a permanent cure, the disease could not have been of a malignant nature. He makes an exception of cancer at the verge of the anus. (*Op. cit.* p. 129—131.) In one case, however, Mr. Mayo removed a portion of the entire cylinder of the rectum, and though it was followed by prolapsus, the patient's comfort is said to have been much increased by the operation: she died, however, in two years afterwards of abdominal inflammation.

I have already noticed Cruveilhier's belief, that cancer of the rectum is usually not joined with a disposition to relapse from what he terms cancerous infection; yet as the disease is often partly of the medullary character, there is difficulty in assenting completely to this proposition. We know, moreover, that relapses have actually taken place. Cancer of the rectum was universally regarded as incurable, until M. Lisfranc demonstrated that a considerable portion of the lower end of the rectum could be removed without danger. He commenced this practice under the idea that cancer was mostly restricted to the mucous coat; but having been emboldened by experience, and anatomical considerations, he afterwards ventured to attack cases in which all the coverings of the rectum were involved. Two conditions, however, are indispensable: 1. The finger must be capable of reaching above the limits of the disease. 2. The surrounding cellular tissue must be healthy, so that the bowel, free from adhesions, may admit of being brought down sufficiently low.

In the time of Morgagni, the operation was attempted by a surgeon, who was unable to complete it, and M. Bérard, who about the year 1822 or 1823 advocated its performance, never had the opportunity of practising it himself. It appears to have been first executed with success by M. Faget in 1739, who removed an inch and a half of the whole circumference of the bowel. The evacuation and retention of the feces were accomplished in this patient as well after the operation as before it, notwithstanding nearly all the external sphincter had been taken away; and Faget declared his own belief, that the removal of a much more considerable portion of the rectum might be effected. It remained for M. Lisfranc to furnish a proof of this: his first patient, operated upon in February 1826, was perfectly cured by the 13th of the following April. In January 1828, he operated on a woman; and in the following October on another female; both cases ending successfully. In a fourth patient, the result was doubtful. A fifth died in March 1829, four days after the operation, with abscesses in the pelvis and probably of phlebitis. The sixth patient, a man 72 years of age, died the day after the operation, and no *post mortem* examination was instituted. The seventh patient died on the 25th day, with suppuration in the pelvis and inflammation in the venis. In addition to these cases, M. Lisfranc had two other successful ones, so that the total result is, five cures, one case doubtful, and three deaths. (*See Velpeau, in Nouv. Élém. de Méd. Opér.* vol. iii. p. 1033.)

The patient being placed in the position usually chosen for lithotomy, two semilunar incisions are made, about an inch from the anus, on each side of it. These cuts, which are to extend through the skin and cellular tissue are to unite behind and in front of the rectum. The end of the bowel is then to be separated by careful dissection from all the surrounding parts. The forefinger, half bent, is then passed into it, for the purpose of drawing it downwards, and, by this means, the mucous coat, which may be the part alone, or principally, diseased, may be made to descend a good way; and a considerable portion of it may be easily removed with scissors curved sideways, or with a bistoury. Even if the cancerous affection should implicate the whole thickness of the parietes of the rectum, the advocates for the operation assert that the rectum may be turned inside out, and the whole of the disease brought into view, provided it does not extend more than an inch above the anus.

When all the coats of the bowel and some of the adjoining cellular tissue are involved, the surgeon, after making the semilunar incisions, and detaching the end of the bowel, at the whole of its circumference, is to pass his forefinger into the bowel in order to serve as a guide for a pair of strong straight scissors, with which the gut is to be divided parallel to its axis, through its entire thickness, and as far as the limits of the disease. This incision is to be inclined towards the posterior wall of the bowel, so as to be further from the vessels and the peritoneum. The latter cut enables the surgeon to unfold the gut, and expose the disease through its whole extent; but if it should be concealed by the hemorrhage, a sponge, full of cold water, must be held for a few minutes on the wound, for the purpose of stopping the flow of blood; and the lower portion of the rectum is to be kept downwards with hooks.

In operating on a female, the assistant's finger introduced into the vagina, will be of service. When the patient is a male, it is prudent to introduce a catheter into the bladder, which should be entrusted to an assistant. The surgeon then proceeds to dissect away the cancerous parts, which is difficult and tedious, especially near the vagina and urethra. Every vessel that bleeds copiously should be at once secured. Thus M. Lisfranc has removed portions of the rectum extending upward from one to three inches from the anus.

If the hemorrhage is not entirely commanded by ligatures, a sponge dipped in cold water is to be applied. M. Lisfranc, fearful of exciting inflammation, is never in a hurry to plug up the wound; and, whenever he is compelled to resort to this proceeding, he discontinues it in a few hours. He employs superficial dressings, and changes them thrice a day, so as to let the pus be discharged; but, as soon as all risk of inflammation is past, he introduces a thick roll of charpie into the rectum, and advises the patient to continue to wear it for some time after the cure. This usually takes place in the course of two or three months. "The functions of the rectum are preserved; a new mucous canal becomes a substitute for the portion removed; and a ring, in the form of a sphincter, capable of retaining the fecal matter, if it be not liquid, is produced from the muscular fibres of the rectum, and perhaps also from the insertion of the levator ani." (*See J. F. Malgaigne Manuel de Méd. Opér.* p. 591—592; ed. 2.) This

author represents the cul-de-sac of the peritoneum as being six inches from the extremity of the rectum in women, and four in men. The cellular tissue connecting the rectum to the prostate and bladder, he says, may be separated with the finger, and all risk of wounding the urethra avoided.

The rectum is sometimes the seat of polyp, which may either be tied, or snipped off with safety.

A fatal case of mortification of the rectum is detailed by Larrey. I found the rectum mortified in one case, where the patient died of the consequences of extravasation of urine in the pelvis.

Parissian Chirurgical Journal, vol. ii. p. 398, &c. See J. L. Petit, Œuvres Posthum. t. ii. Dr. Sherwin On the Scirrhus-contracted Rectum, in Mem. of the London Medical Society, vol. ii. Sir Everard Home, Obs. on Cancer, p. 129, &c. 8vo. Lond. 1805. L. F. J. Duchadot, De Proctostenia, seu de Morbosis Intestini Recti Angustia, Monsp. 1771. C. G. Siebold, De Morbis Intestini Recti, Hallii, Morbid Anatomy, p. 116. Œuvres Chir. de Desault, par Bichat, t. ii. p. 422. Obs. on the principal Diseases of the Rectum, &c., by T. Copeland, 1814. W. White, Obs. on the contracted Intestinum Rectum, 8vo. Bath, 1812. Also, his further Obs. on the same subject, Bath, 1822. Monro's Morbid Anat. of the Gullet, &c. p. 347. G. Calvert On Hemorrhoids, Strictures, and other Diseases of the Rectum, 8vo. Lond. 1824. W. Gibson, Institutes, &c. of Surgery, vol. i. p. 292. Philadelphia, 1824. F. Salmon, On Stricture of the Rectum, 8vo. Lond. 1821. Abraham Colles, in Dublin Hospital Reports, vol. v. p. 131. 8vo. 1830. John Houston, On the Mucous Membrane of the Rectum, Op. et. vol. ctt. p. 158. Herbert Mayo On Diseases of the Rectum, 8vo. Lond. 1833. Alt. Felpcau, Nouv. Elém. de Méd. Opér. t. iii. 8vo. Paris, 1832. Sir Benjamin C. Brodie, Lond. Med. Gaz. vols. xv. and xvi. 8vo. Lond. 1835. Cruveilhier, Anat. Pathologique, t. ii. livr. 21, 25, and 26. fol. Paris, 1836. George Bushe, On Malformations and Diseases of the Rectum, &c. 8vo. New York, 1837. J. F. Malgaigne, Man. de Méd. Opératoire, ed. 2. 12mo. Paris, 1837. James Syme, On Diseases of the Rectum 8vo. Edin. 1838.

RESOLUTION. The subsidence of inflammation without abscess, ulceration, mortification, &c. Also the dispersion of swellings, indurations, &c.

RETENTION OF URINE. See URINE, RETENTION OF.

RETROVERSIO UTERI. A turning backward of the womb. (See UTERUS, RETROVERSIO OF.)

RICKETS. (*Rachitis.*) The latter term was adopted by Glisson as a derivation from the Greek *ῥάχις* (spine), because the disease was once supposed to originate in the vertebral column. *Rickets* was a word, by which the complaint was commonly known in England even before his time. (See David Whistler, *Dissert. de Morbo. Puerili. Anglor. dicto. "The Rickets,"* Lugd. Bat. 1645.) This tract, which preceded Glisson's work, is stated by Dr. Cumin to be now exceedingly rare: a copy of it is preserved, however, in the Bodleian library. The disease is mostly met with in young children; seldom in adults. Morand, however, (*Acad. des Sciences*, 1753.) mentions an instance, in which an adult became affected. Dr. Cumin even divides the disease into two species; 1st, softening of the bones of children, or common rickets: 2d. that of adults, or mollities ossium; and to the disorder in this more extensive sense, he conceives that the term *osteomalakia* might be properly applied. (See *Cyclop. of Pract. Medicine*, art. *Rickets*.)

The disease may even take place in the foetus in utero; but the most common period of its commencement is in children between the ages of seven or eight months and two years, and it rarely begins before the child first attempts to walk. Mr. Wilson observes, that its origin has frequently been imputed to the effects of dentition; but he adds, that he has often known it make its appearance

after this time, and that it not unfrequently attacks the spine a little while before puberty, and may do so even later. (*On the Structure and Physiology of the Skeleton*, &c. p. 162.) Pinel has given a description of the skeleton of a rickety foetus, of which there is a good specimen in University College Museum. Further illustrations of the same fact may be found in the writings of Bordenave, Soemmerring, Otto, Sartorius, and Loder. (*Fourcroy's Journal*.) The disease seems to consist of a want of due firmness in the bones, in consequence of a deficiency in the phosphate of lime in their structure. The causes of the affection are involved in great obscurity.

Rickety subjects are often at the same time scrofulous; and this is, probably, the only reason for scrofula being accounted a cause of the other affection. Rickety children are usually of a bad, weak constitution, and their limbs and bones become bent in directions determined by the action of the muscles, and the weight and pressure which they have to sustain. When the affection is very general, the spine becomes shorter, and is curved in various directions; the breast becomes deformed, not only in consequence of the curvature of the spine, but by the depression of the ribs and projection of the sternum. The bones of the pelvis fall inwards, and the os pubis generally approaches the sacrum. The clavicles become more bent and prominent forward; the os humeri is distorted outward; the lower ends of the radius and ulna are twisted in the same direction; the thighs are curved forwards or outwards; the knees fall inwards; the spine and front surface of the tibia become convex; and the feet are thrown outwards.

But, as Mr. A. Shaw has explained, rickets, besides producing softening and distortion of the bones, has the effect of interrupting their growth. Notwithstanding the statement made by Mr. Wilson, we are not to regard the mere distortion of the spinal column, which sometimes takes place a little before puberty, as a certain indication of rickets. The late Mr. John Shaw examined an extensive series of specimens of morbid spine, and demonstrated the fact, that the spinal column may be incurved in a lateral direction, and may present a distortion of the same appearance in two different conditions of the system. "In one class of these specimens, he observed, that there was a lateral curvature of the spine, combined with distortion of the ribs, but this constituted the whole of the deformity; in none of the other bones of the skeleton, however weak, or exposed to pressure they might be, was there any trace of distortion to be discovered. In the other series of preparations, on the contrary, not only was there lateral distortion of the spine and ribs, but a universal deformity of the whole skeleton, including the cylindrical and solid, as well as the most delicate and pliant bones." And, with respect to the pelvis, Mr. John Shaw was led to conclude "that in whatever state of distortion the spine and ribs may be, the bones of the pelvis will not be found distorted, unless there be at the same time marks of rickets in some of the long and solid bones." Now, as neither the bones of the upper, nor those of the lower extremities, become incurved when the distortion commences near the age of puberty, it is argued, that a cause totally different from rickets, gives rise to it, and that the pelvis is in no danger of being implicated in such deformity.

(See *A. Shaw in Med. Chir. Trans.* vol. xvii. p. 437—439.)

Hence, with reference to deformity of the spine, this gentleman joins his brother in considering those skeletons only as true specimens of the effects of rickets, "in which the distortion is exhibited throughout all the osseous system together; in the skull, the cylindrical bones of the extremities, and the large bones of the pelvis, as well as in the spinal column and the thorax." (P. 441.) He very ably contrasts the configuration of the properly formed and the rickety skeleton. The human figure at maturity (he observes) is characterised by the lower extremities having a remarkable length, as well as breadth and solidity; while the superior parts are comparatively small and light in their structure. On the contrary, the rickety skeleton is distinguished by the head, the thorax, and the arms being preponderating and large, while the pelvis and lower extremities are in a relative degree diminutive and short. He notices the fact, that all the bones of the skeleton, deformed by rickets, are more or less deficient in size. But, this want of development is much more considerable in the pelvis and bones of the leg, than in the skull, spine, thorax, or bones of the upper extremity. Mr. A. Shaw finds, that the spine and bones of the arm scarcely lose one fifteenth of their natural length, while those of the leg lose somewhat more than a third. (See *Med. Chir. Trans.* vol. xvii. p. 443.)

M. Jules Cloquet has given an account of the aorta of a rickety child, ten years of age. The vertebral column is twisted to the left and backwards, and the aorta, adapting itself precisely to this curve, is doubled on itself in such a manner, that two inches of its outer coat are in contact and adherent to one another. The vessel gradually lessens as it descends, so that in the abdomen, it has not more than one third of the size which it has in the chest. The lower limbs are stated to be, as it were, in a state of atrophy; which M. Cloquet suspects might be in a great measure owing to the accidental bend of the aorta. (*Pathol. Chir.* p. 97.) Such want of development in the lower limbs, however, is usual in very rickety subjects.

The following observations with reference to midwifery, are highly deserving of recollection. "In women who have simply the lateral curvature of the spine, the pelvis is not only fully developed and capacious, but its brim does not suffer any encroachment, such as could prevent the descent of the child's head, from the falling down of the lumbar vertebrae. When, therefore, it becomes an anxious question of a mother, with regard to her marriageable daughter, how far the twist observable in her shoulder and back is likely to affect her life in the event of her pregnancy, the foregoing observations may furnish us with an answer, in addition to the marks which we find pointed out in books of midwifery, as indicative of a distorted pelvis: the more important signs will be discovered in the condition of the long bones. If the length of the extremities be natural, and there be no gibbosity of the tibia, we may be assured that the pelvis has not suffered. On the other hand, in the case of distortion from rickets, the pelvis is not only distorted, but it is preternaturally small; and, as a relation is established between the growth of the long bones and that of the pelvis, we may be able to estimate, from the proportionate

length of the limbs to the body, what is the degree of diminution of the pelvis, resulting from the stoppage of the growth." (*A. Shaw, in Lond. Med. Gaz.* vol. xvi. p. 49.)

When the tibia and fibula become curved, they sometimes "acquire increased breadth in the direction of the curve, losing a proportionate degree of thickness in the opposite direction. Hence the bones become, as it were, newly modelled, passing from the cylindrical into the flattened form. This would seem to be designed for the purpose of enabling them to support more efficiently the weight of the body, since by this alteration they acquire increased breadth and power of resistance in that direction, where the greatest strength is required. I have never noticed (says Mr. Stanley) any expansion in the articular ends of rickety bones, as is mentioned by some authors. I should therefore feel inclined to believe, that there has existed only the appearance of such a phenomenon, the ends of the bones having appeared swollen, in consequence of the enaciation of the surrounding soft parts. (See *Stanley, Med. Chir. Trans.* vol. vii. p. 402—405.)

Dr. Cumin states, however, that an attentive examination of rickety cases has convinced him of the correctness of the opinion respecting the enlargement of the extremities of the bones. "The extremities of the long bones, which are least encased by muscle (he observes) as those of the wrists and ankles, and the sternal ends of the ribs, particularly these last, are swelled out into knobs." That the ends of the bones may become thus expanded, seems to be proved by the case published by Mr. Thomas Brayne. (See *Trans. of Provincial Med. Association*, vol. iii.) In this instance, the enlargement of the articular ends of the larger joints is extreme, and the engraved representation of the patient very curious.

When the thoracic viscera are considerably oppressed by the alteration in the figure of the chest, produced by rickets, the disease may bring on fatal consequences.

Boyer has thus described the appearances of rickety bones:—They are lighter than natural, and of a red or brown colour. They are penetrated by many enlarged blood-vessels, being porous, and as it were spongy, soft, and compressible. They are moistened by a kind of sanies, which may be pressed out of their texture, as out of a sponge, or rather a macerated hide after it has been tanned. The walls of the medullary cylinder of the great bones of the extremities are very thin, while the bones of the skull are considerably increased in thickness, and become spongy, and reticular. All the affected bones, especially the long ones, acquire a remarkable suppleness; but, if they are bent beyond a certain point, they break, &c. Instead of being filled with medulla, the medullary cavity of the long bones contains only a reddish serum, totally devoid of the fat, oily nature of the other secretion in the natural state. (*Traité des Maladies Chir.* t. iii. p. 619.) The consistence of several rickety bones, examined by Mr. Stanley, was nearly that of common cartilage. They presented throughout an areolated texture, and the cells were in some parts large, and contained a brownish gelatinous substance. This gentleman did not find the periosteum thickened, as Bichat has described it. (*Anatomie Générale*, t. iii.) The investigations of Mr. Stanley also prove, that, in the process by

which rickety bones acquire strength and solidity, there is always an undeviating regularity in the situation, extent, and direction of the deposited earthy matter. "Thus it is obvious (says this gentleman) that, in the curved bone, the part where there is the greatest need of strength, to prevent its further yielding, is in the middle of its concavity, or, in other words, in the line of its interior curve; and it is just in this situation that strength and compactness will be first imparted to the bone by the deposition of phosphate of lime. It will be further found, that the greatest resistance being wanted at this part, the walls are accordingly rendered thicker here than elsewhere, and the degree to which this excess in thickness is carried, bears an exact ratio to the degree of curvature which the bone has undergone."

Mr. Stanley's observations also demonstrate, that the bony fibres are arranged obliquely across the axis of the bone, in a direction calculated to augment its strength. Lastly, if a long bone, like the tibia, be very much bent, while it has to support a great superincumbent weight, the deposition of the bony matter may not be confined to the thickening of the walls of the concave side, but may extend across the medullary cavity, rendering the bone here perfectly solid, and thereby greatly strengthened. (See *Medico-Chir. Trans.* vol. vii. p. 404, et seq.)

We learn from the late Mr. Wilson, that, for many years, he had also exhibited in his lectures preparations, illustrating the fact of the abundant deposition of osseous matter, "when the bones begin to recover from the disease, at the part where it is most wanted, viz. on the inner part of the concave surface of their curve." (*On the Skeleton*, &c. p. 167.)

Although the osseous system is principally affected in rickets, no doubt can be entertained of the dependence of the disorder upon constitutional causes. With regard to the bones, a deficiency in the secretion of the phosphate of lime is certainly not the only thing that marks the disturbance, or imperfection in them; for from what has been stated above, it appears that there is a disorganization of their minute textures. In the bones of the skull, as Mr. Shaw observes, there is commonly exhibited in a very remarkable manner, some parts of the calvarium acquiring an extraordinary degree of thickness, while other parts are reduced to the thinness of paper, and here the divisions of the tables are lost. Sir Charles Bell had in his possession the skull of a rickety subject, in which the parietal bones were seven eighths of an inch in thickness at their central parts. He had also the skeleton of a child, seven years of age, in which the parietal bones were five eighths of an inch in thickness. In both these specimens, the calvarium was remarkably thin in the situation of the sutures and fontanelles. Hunaud exhibited to the Academy of Sciences the skull of a child, between three and four years of age, the bones of the upper part of which were in some places seven or eight lines in thickness; and, when compressed, blood and serum oozed out of the interstices. (See *Shaw*, in *Med. Chir. Trans.* vol. xvii. p. 456.)

Many rickety and deformed infants improve as they grow up, and acquire strength. The deformity of their limbs spontaneously diminishes, and the bones gain a proper degree of firmness, a

due quantity of the phosphate of lime being deposited in their texture. Though the bones may never acquire their right shape, they become exceedingly firm; and some rickety subjects, after attaining the adult age, have been celebrated for the performance of great feats of strength.

It is a question, whether the restoration of the proper figure of the bones can be promoted by the constant pressure of bandages, and mechanical contrivances, sold in the shops. Some authors contend, that, in very young children, machines are useless, as the confinement and inactivity of the muscles, necessarily occasioned by such contrivances, must increase the general debility, and consequently the disease.

Notwithstanding the praises which have been bestowed on mechanical means by their inventors, and even by respectable authors, says Boyer, they are not now used by any enlightened judicious practitioners, it being generally agreed, that it is best to leave to nature alone, aided by good medical treatment, the duty of rectifying bones deformed by the rickets. (*Traité des Mal. Chir.* t. iii. p. 627.) Delpech expresses himself still more strongly against the employment of machinery. (See *Précis Élémentaire des Maladies Chir.* t. iii. p. 740, &c.) However, these opinions against mechanical contrivances for the improvement of rickety bones, are not meant to apply to machines for rectifying distortions of the foot. In such cases, the malformation does not depend on constitutional causes, and mechanical means will often do whatever is possible. Club-foot we know may frequently be cured by dividing the tendon Achilles.

With regard to this part of the subject, Dr. Cumin observes, that as soon as the constitution appears to be rallying, and the bones gaining strength and firmness, attempts should be made to restore them to their natural shape by well directed manipulations, and the employment of such mechanical contrivances as will give support without injurious confinement. Considerable success is known to have attended the treatment adopted by Dupuytren in deformity of the chest. (*Repertoire Gén. d'Anat. &c.* t. v. p. 198.) His plan was to place the child with its back against the knee or a wall, and to make moderate and gradually increasing pressure with the palm of the hand on the sternum, so as to diminish the diameter of the chest from before backwards, and to force out the ribs towards their natural convexity. This practice was repeated frequently every day, until the desired change had been brought about. (See *Cyclop. of Practical Med.* art. *Rickets*.) However, some of these deformities of growing youth would not be looked upon by Mr. A. Shaw, as examples of true rickets, and we know, that nature herself is often capable of removing them, without the tedious process resorted to by Dupuytren.

No medicine is known, that possesses any direct efficacy in rickets.—Tonics are indicated, and should be employed. Bark, especially the sulphate of quinine, may be tried, as well as steel medicines: to iron filings, a great deal of efficacy has been ascribed. (See *Med. Comment.* vol. ii. p. 48.) In particular, the functions of the bowels should be duly regulated by medicine. From the disease appearing to consist in a deficiency of lime in the bones, proposals have been made to exhibit internally the phosphate of lime; but this chemical

project has had no success. (See *Bonhomme's Memoir on Rachitis*, in *Duncan's Annals for 1797*.)

Several circumstances, considered by Mr. Wilson, tend to prove, that this scheme could present no chance of benefit, because there is no proof of a deficiency of lime in the system, though the arteries of the bones do not deposit it in the natural degree. (See *Wilson, On the Skeleton*, &c. p. 163, &c.)

More good is generally effected by keeping children in healthy situations, and in a salubrious air, than by any medicines whatever. Light, wholesome, nutritious, easily digestible food; cold bathing; good nursing; regular gentle exercise; or airings in a carriage; the use of the flesh-brush, &c. are also highly serviceable. The constitutional treatment of rickets belongs more properly to the physician than the surgeon; and it is not necessary to introduce more of the subject into a Dictionary expressly allotted to surgery. (See *MOLLITIE OSSIUM*.)

Das. Whistler, De Morbo Puerili Anglor. dicto "the Rickets." Lugd. Bat. 1645. *Glisson De Rachitide, sive Morbo Puerili.* Lugd. Batav. 1671. *Bonhomme, Mém. on Rachitis*, in *Duncan's Medical Annals for 1797*. *Riesherand, Nosographie Chir.* t. 3. p. 142, &c. ed. 4. *Leveillé, in Mém. de Physiologie et de Chirurgie*, par Scarpa, &c. *Boyer, Traité des Maladies Chir.* t. iii. p. 607, &c. *Stanley's Obs. in Med. Chir. Trans.* vol. vii. p. 404. *Delpech, Précis Élémentaire des Maladies Chir.* t. iii. p. 739, &c. *Tynka de Krzowitz, Historia Rachitidis*, 8vo. Vindob. 1787. *R. Hamillon, On Scrofulous Affections*, &c. 8vo. Lond. 1791. *A. Portal, Obs. sur la Nature et sur le Traitement du Rachitisme ou des Courbures de la Colonne Vertébrale et de celles des Extrémités*, 8vo. Paris, 1797. *J. Wilson, On the Structure and Physiology of the Skeleton, Diseases of Bones*, &c. p. 169, &c. 8vo. Lond. 1820. *A. Shaw, in Med. Chir. Trans.* vol. xvii. *J. Cloquet, Pathologie Chir.* p. 97. 4to. Paris, 1831. *Thomas Brayne, in Trans. of Provincial Medical and Surgical Association*, vol. iii. *W. Cullen, in Cyclop. of Practical Medicine*, art. Rickets, *Herbert Mayo, Outlines of Human Pathology*, p. 18. 8vo. Lond. 1835.

RINGWORM. (See *HERPES*.)

RUPTURE. A protrusion of the abdominal viscera. (See *HERNIA*.)

SABINA. *Savine*. The use of the leaves of this plant, in forming the active ingredient in the ointment, commonly preferred for keeping open blisters, has been explained in the article *Blisters*. The other chief surgical use of *savine*, is as a stimulating application for destroying warts and other excrescences. For the latter purpose, it is generally powdered, and mixed with an equal proportion of subacetate of copper. The same powder is also sometimes employed by surgeons for maintaining the hollows in which peas are inserted in issues. The best plan is, first to wet the peas, then roll them in the powder, and put them, in this state, on the issue. But, when the whole surface of the issue has risen high above the level of the skin, the powder must be sprinkled all over the sore, so as to produce an absorption of the high granulations.—Indeed, even in this manner, a good cavity often cannot be obtained; and it becomes necessary to destroy the surface of the issue, by rubbing it with caustic potassa, or potassa cum calce.

SALIVARY FISTULÆ. See *PAROTID DUCT*.

SANIES. The thin, serous, fetid matter discharged from fistulæ, unhealthy sores, &c., sometimes tinged with blood.

SAPO TEREBINTHINÆ. (*Starkey's Soap*.) *R. Potassæ Subcarbonatis calidi 3j.*

Olei Terebinth. 3 iij.—The turpentine is gradually blended with the hot subcarbonate of potassa in a heated mortar. Indolent swellings were formerly rubbed with this application, and, perhaps, some chronic affections of the joint might still be benefited by it.

SARCOCELE. (from *σάρξ*, flesh; and *κύημα*, a tumour.) A chronic enlargement of the testicle. (See *TESTICLE, DISEASES OF*.)

SARCO'MA, or SARCO'SIS. (from *σάρξ*, flesh.) A fleshy tumour. (See *TUMOURS, SARCOMATOUS*.)

SARSAPARILLA. The root of *sarsaparilla* was brought into Europe about 1530. It was at first reputed to possess singular efficacy in venereal cases; but afterwards lost all its fame. It was again brought into notice by Dr. W. Hunter, who advised Dr. Chapman to make trial of it in a bad case of phagedenic bubo; and the benefit obtained in this instance, led Dr. Hunter to extend the recommendation of the medicine. Sir W. Fordyce stated, that *sarsaparilla* would quickly relieve venereal headach, and nocturnal pains, and, if persisted in, cure them; that in emaciated, or consumptive habits, from venereal cause, it was the greatest restorer of appetite, flesh, colour, and strength, which he knew of; that when mercurial frictions had been previously employed, it would generally complete the cure of the disease of the throat, nose, palate, or spongy bones; and that it would promote the cure of blotches and ulcers, and sometimes accomplish it; *even without mercury*; though, in this circumstance, there was danger of a relapse. Sir W. Fordyce pronounced *sarsaparilla* to be of little use in chancres; but, that when these or buboes could not be healed by mercury, it would often cure, and always do good. He allows, however, that, in all venereal cases, *sarsaparilla* is not to be trusted, *unless preceded by, or combined with, the use of mercury*; and he thought *sarsaparilla* would, probably, always cure what resisted mercury. (*Medical Obs. and Inq.* vol. i.)

Cullen considered *sarsaparilla* as possessing no virtues of any kind; for, says he, "tried in every shape, I have never found it an effectual medicine in syphilis, or any other disease. (*Mat. Med.* vol. ii.)

Mr. Bromfield declares, that he never saw a single instance in which *sarsaparilla* cured the venereal disease without the aid of mercury, either given before, or in conjunction with it. (*Pract. Obs. on the Use of Corrosive Sublimate*, &c. p. 78.) Mr. Pearson also contends, that *sarsaparilla* has not the power of curing *any one form of the lues venerea*; but he allows, that it may suspend, for a time, the ravages of that contagion, the disease returning, if no mercury should have been used. This gentleman admits, also, that *sarsaparilla* will alleviate symptoms derived from the venereal virus. He maintains, that the exhibition of *sarsaparilla* does not diminish the necessity for giving less mercury. Nocturnal pains in the limbs, painful enlargements of the elbow and knee, membranous nodes, cutaneous ulcerations, and certain other symptoms, resembling venereal ones, are often experienced after a full course of mercury. Such complaints, Mr. Pearson allows, are greatly benefited by *sarsaparilla*, and exasperated by mercury; and, he observes, that it is from these complaints having been mistaken for venereal ones, that the idea has arisen, that *sarsaparilla* has cured syphilis,

when mercury had failed. Mercury and the venereal poison may jointly produce, in certain constitutions, symptoms which are not strictly venereal, and are sometimes more dreadful than the simple effects of syphilis. Some of the worst of these appearances are capable of being cured by sarsaparilla, while the venereal virus still remains in the system. When this latter disease has been eradicated by mercury, sarsaparilla will also cure the sequelæ of a course of the other medicine. (Pearson, *On the Effects of various Articles in the Cure of Lues Venerea*, 1807.)

The value of many of the foregoing opinions is much affected by the results of modern inquiries into the nature of the venereal disease, the general possibility of curing which, without the aid of mercury, seems well established, though the expediency of the method is another question.

SCALPEL. (from *scalpo*, to scrape.) Originally a raspatory, or instrument for scraping diseased bones, &c. The term now generally signifies any common surgical knife.

SCARIFICATION. (from *scarifico*, to scarify.) The operation of making little cuts, or punctures, in a part, for the purpose of taking away blood, letting out fluid in anasarca and crasypelatus cases, or the air of emphysema.

SCIRRHUS; SCIRRHOMA; SCIRRHOSIS. (from *σκιρῶω*, to harden.) The etymological import of these terms seems merely to be induration. The first is now generally restricted to the induration which attends scirrhus cancer.

SCROFULA, or SCROPHULA. (from *serofa*, a sow.) So named, as is commonly supposed, either on account of its often giving a thick appearance to the throat and neck, a character of the animal here mentioned; or, because swine were fancied to be subject to the disease; though the correctness of this last etymology is rendered questionable by the remarks of Dr. Henning; and the statement that pigs are really liable to scrofula he also pronounces to be erroneous. (See *Critical Inquiry into the Pathology of Scrofula*, &c. p. 1. 9.) Here, however, it is to be recollected, that this author does not admit tuberculous deposits to be any proof of scrofula; a point, on which the highest modern authorities would be against him. Now, according to Dupuy, all the domestic animals of France, not excepting the dog, as well as those imported from warmer countries, are subject to tuberculous deposits. (*De l'Affectio Tuberculeuse*, &c.)

Celsus clearly describes the disease, as it affects the absorbent glands under the name of struma. The other term applied to it, the *King's Evil*, commemorates the imaginary virtues of the royal touch, to which from the time of Edward the Confessor, till the reign of Queen Anne, multitudes of persons afflicted with scrofula were subjected. A similar custom prevailed in France; and miraculous powers for the cure of scrofula were likewise claimed for different Romish saints; for the heads of certain noble families; for the seventh son; and for many consecrated springs. One of the most frequent effects of the disease is a chronic swelling of the absorbent glands, in various parts of the body, which glands generally tend more or less slowly to suppuration. Our notions of scrofula, however, would be very imperfect, were we to describe the disorder to be a morbid state of the lym-

phatic glandular system. The first appearances, indeed, frequently consist of spots on different parts of the body, and of eruptions and ulcerations behind the ears. The system of absorbent glands, it is true, seldom or never fails to become affected in the progress of the disease; yet scrofula frequently appears, for the first time, in parts which are not of a glandular nature. There are, perhaps, but few, if any, of the textures of the human body, or of the organs, which these textures form, that are not liable to attacks of scrofula, and to scrofula as an original idiopathic affection. (See *Thomson on Inflammation*, p. 134.) These sentiments accurate as I believe them to be, are entirely at variance with those of Alibert and other moderns, who describe the disease as having its commencement in the conglobate glands, especially those of the neck (*Nosol. Naturelle*, t. i. p. 441. 4to. Paris, 1817.); and they are equally opposite to the doctrine of Dr. Henning, who argues, that the superficial absorbent glands alone are susceptible of the original action of the cause of this disease, and that if other parts become affected by it, such affection is consequential. (*On the Pathology of Scrofula*, chap. vi.)

The absorbent glands are far from being the only parts liable to the original attack of scrofula. Sometimes, as I have stated, the disease begins in the cutaneous texture; very often in the eyes, nostrils, or lips. In other cases, we find it fixing upon organs more deeply situated, as the bones and joints; or obstructing the organs for conveyance of the chyle; or giving rise in the lungs, the spleen, the kidneys, the peritoneum, and other parts, to those tubercular diseases, which, in this climate, are one of the greatest causes of mortality. The most frequent seats of scrofulous tubercles in adults are, first, the lungs and then the small intestines; but, in children, the bronchial glands, the mesenteric glands, the spleen, the kidneys, and the intestines, in the order here enumerated. When, therefore, tubercular phthisis is regarded as a scrofulous disease, it makes an important difference in the comparative estimate of the frequency of scrofula in children and grown up persons. The most certain evidence of the existence of scrofula seems to Dr. Cumin to be afforded by the production of a soft, brittle, unorganised matter, resembling curd, or new cheese, which is found mixed with the contents of scrofulous abscesses, or deposited in rounded masses of different degrees of firmness, varying in bulk from the size of a millet seed to that of a hen's egg. Sometimes it is contained within the natural cavities and canals of the body, sometimes it is enclosed in cysts, and occasionally it is diffused, as if by infiltration, through the natural texture of a part. To the rounded masses of this substance, the name of *tubercles* has been assigned, and the substance itself is called *tuberculous*, or tubercular matter. "We venture to assert, that the presence of tuberculous matter is a satisfactory proof of the existence of scrofula; but, we do not by any means maintain, that scrofula cannot exist without the deposition of this substance. The researches of pathological anatomy have shown, that scarcely any living texture of the human body is altogether exempted from tuberculous deposits. This morbid production has been observed on the free unbroken surfaces of mucous membranes, within mucous follicles, and forming the contents of lymphatic vessels, the

tunics of which were themselves sound. (*Andral. Anat. Pathol.* t. i. p. 419, and t. ii. p. 446.) Granules of tuberculous matter, sometimes insulated, sometimes clustered together, have also been detected within the clots of blood contained in the cells of the spleen." (*Andral. Op. cit.* t. ii. p. 431, and *Carswell's Illustrations of the Elem. Forms of Disease*, Fasc. i. p. 1. 3. *Cumin*, in *Cyclop. of Pract. Med.*, art. *Scrofula*.)

Professor Carswell remarks, that the prevailing opinion among pathologists is, that the seat of tuberculous matter is the cellular tissue of organs; that it may, however, be formed on secreting surfaces, as in the mucous follicles of the intestines; perhaps, in the air-cells and bronchi; the surface of the pleura and peritoneum; and likewise in false membranes, or other accidental and new products; and in the blood itself. According to the researches of this distinguished pathologist, the mucous system is the most frequent seat of tuberculous matter. "In whatever organ the formation of tuberculous matter takes place, the mucous system, if constituting a part of that organ, is, in general, either the exclusive seat of this morbid product, or is far more extensively affected with it than any of the other systems, or tissues of the same organ. Thus the mucous system of the respiratory, digestive, biliary, urinary, and generative organs, is much more frequently the seat of tuberculous matter, than any other system, or tissue, which enters into the composition of these organs. The coloured plates I. and II. furnish the clearest evidence of the formation of tuberculous matter in the mucous system of all these organs. I have shown it in the lungs, formed on the secreting surface, and collected within the air-cells and bronchi; the intestines, in the isolated and aggregated follicles; the liver, in the biliary ducts and their extremities; the kidneys, in the infundibula, pelvis, and ureters; the uterus, in the cavity of that organ, and Fallopian tubes; and the testicle, in the tubuli seminiferi, epididymis, and vas deferens.

"The formation and subsequent diffusion of tuberculous matter is also observed on the secreting surface of serous membranes, particularly the pleura and peritoneum; and in the numerous minute cavities of the cellular tissue. The accumulation in the lacteals and lymphatics, both before and after they unite to form their respective glands, is frequently very considerable." (See Pl. III. and IV.) In Pl. III. Dr. Carswell has also given representations of tuberculous matter in the substance of the brain and cerebellum, in accidental cellular tissue, and in the blood. (See *Illustrations of the Elem. Forms of Disease*, Fasc. i.)

Scrofula generally first shows itself during infancy, between the ages of three and seven; sometimes rather sooner; but frequently as late as puberty, and in some instances, not till a more advanced period of life. In the latter cases, the disease is said to be rarely so complete, or well marked, as it is in young subjects. Sir A. Cooper mentions the period of growth generally, as the time of life for scrofula; and its first commencement, afterwards, he agrees with most writers in pronouncing very uncommon. "Cette maladie (says Alibert) est communément le partage de la première enfance. Il est rare qu'elle se développe chez les adultes. Je l'ai pourtant observée chez des septuagénaires; mais presque toujours ce sont

les effets de la dentition, qui la font éclore, et ceux de la puberté, qui la font évanouir. (*Nosol. Naturelle*, p. 448.) These statements do not apply to tubercular forms of scrofula.

By some authors, it is stated, that the disease seldom attacks the glands in children under two years of age. Dr. Thomson, however, has seen the glands affected before this period, and Dr. Cullen used to mention a case, in which the disease broke out in an infant only three months old; which is uncommon. But, though glandular scrofula occurs most frequently in children, it is by no means confined to that period of life. Dr. Thomson has even found the mesenteric glands affected with scrofulous inflammation in persons of very advanced age. (*Lectures on Inflammation*, p. 136.) Probably, however, such patients had laboured under scrofulous complaints in their earlier days; and it merits notice, that some authors, like Dr. Henning (p. 110.), do not regard enlargements of the mesenteric glands as an unequivocal specimen of scrofula. But, how they can retain this opinion, when they see tubercular matter in those parts, I cannot understand. It is observed by Mr. Lloyd, that the susceptibility of different parts of the disease "is altered by age: thus, in children, the upper lip, eyes, glands of the neck, and those of the mesentery, are generally the parts first affected; the lungs, bones, and other parts, being subsequently attacked. It happens sometimes too in children, that small lumps form under the skin in various parts of the body, which suppurate, ulcerate, and pursue the same course with scrofulous abscesses in general." (*On Scrofula*, p. 5.) A species of warts, he says, also often forms about the face and neck of children of a scrofulous habit, but seldom in adults. "In more advanced age, the eyes, upper lip, and lymphatic glands are comparatively seldom affected; while the lungs, the other viscera, and the spongy parts of the bones are frequently attacked."

Scrofula is also as hereditary as any disease can be; that is to say, it is so inasmuch as any particular kind of temperament or constitution can descend, more or less completely, from parents to children. Mr. White, Dr. Henning, and others have strongly censured calling the disease hereditary; but their observations only lead to these conclusions, that children, born of scrofulous parents, are not invariably affected with scrofulous diseases; and that, sometimes, one child has some strumous affection, while the parents, and all the rest of the family, have no appearance of scrofulous habits. However, I still conceive, that neither Mr. White, nor any other writer, will maintain the opinion, that scrofula does not much more frequently afflict the children of scrofulous parents, than the offspring of persons, who have always been perfectly free from every tendency to any form of this affliction. Too numerous are the facts, which fall under my own notice, to allow me to entertain the smallest doubt, that scrofula prevails in certain families. In this sense, I think the term *hereditary* perfectly accurate and allowable. But, at the same time, I beg the reader to understand, that I have no intention of questioning what seem to be irrefragable truths, viz. that the children of scrofulous parents often continue, as long as they live, entirely free from the disease; and that one child is sometimes afflicted, while its father, mother, brothers, sisters, and all the rest of its relations, have

never had any tendency to stumous disorders. It should also be recollected, that the doctrine of a congenital tendency to the disease in particular families is one which interferes with some theories, which have been offered about the predisposing cause of the disease, as for instance with that of Dr. Henning, who declares that such cause is foreign to the body, and depends upon peculiarity of climate (*On the Pathology of Scrofula*, p. 69, &c.); an opinion, which is incorrect only in respect to its exclusion of the influence of other circumstances. Two specimens of tuberculated lungs in the fœtus, preserved in Mr. Langstaff's museum, have been adduced by Mr. Lloyd, as positive proofs of scrofula being hereditary. (*On Scrofula*, p. 23.) The facts and arguments on this point, I think, are decidedly in favour of the doctrine; and Dr. Alison, who has treated very ably of the pathology of scrofula, has remarked, that, "in most cases, in which scrofulous diseases are fatal, the diseased action is in internal parts, and the first symptoms are obscure and equivocal. The chief and certainly the most characteristic appearances on dissection are tubercles in different stages of their progress." (See *Edin. Med. Chir. Trans.* vol. i. p. 403.) The same writer everywhere treats of phthisis as decidedly a scrofulous disease.

In the individuals, possessing the disposition to scrofula, a peculiar softness and flaccidity of fibre are remarkable; their hair is more frequently light coloured than dark; and their eyes are oftener of a blue, than any other colour. The eyelashes are frequently long and the pupils large. Their skin is generally very fine, and even handsome, both in regard to its outward texture and complexion. When pinched, it feels (as Sir A. Cooper observes) thinner than that of a healthy child, and the vessels may often be seen meandering under it. Subjects with scrofulous constitutions frequently have a thickening of the upper lip; this swelling is sometimes very considerable, and occasionally extends to within the nostrils. The extremities of the fingers are broad and flat, or *clubbed*, as the phrase is, just like what is seen in phthisical persons; and the belly is large. Scrofula is sometimes complicated with rachitis, or follows the latter affection; but there is as little reason for supposing rickets to arise from scrofula, as this latter from rickets. In some subjects, however, the complexion is dark, and the skin coarse; but in these persons, at least when young, the face is generally tumid, and the look unhealthy. (*Burns on Inflammation*, vol. ii. p. 232.)

Mr. White denies that grey, or blue eyes, light hair, and a fair complexion, ought to be considered as marks of a scrofulous disposition; for the majority of children in this country have light hair and eyes while young, which become darker as they advance in life. Now, as the majority of scrofulous patients are children, and young subjects, and as most children in this country have naturally the kind of hair and eyes above described, Mr. White considers it inaccurate to lay any stress on persons affected with struma, or predisposed to this disease, having such appearances. (*On Struma or Scrofula*, p. 38. ed. 3.) However, it is to be recollected, that the greater frequency of scrofula in fair people is noticed in France, where the eyes are mostly dark. Thus, Alibert, in his description of a patient disposed to the disease, takes notice of his swelled nostrils and

upper lip; his florid complexion; his fair, delicate, and glossy skin; his cheeks of a lively red colour; circumscribed, however, by a pallid bloatedness of the rest of the face; his blue eyes; dilated pupils; light hair; short neck; large head and lower jaw; flabby flesh; large, protuberant belly; strong intellectual powers, &c. (*Nosol. Naturelle*, p. 442.; also *Dict. des Sciences Méd.* t. 1. p. 281.)

Dr. Thomson expressly declares, that some of the worst cases of scrofula, which he has seen, occurred in persons, whose complexion and hair were of a very dark colour. (*Lectures*, p. 134.) And every man of experience must be aware of one remarkable fact, namely, that many negroes are afflicted in this country with scrofula in its worst forms. Does not this fact indicate, at the same time, that it is climate, which is most powerfully concerned in the production of the disease? Since the African black, in his own country, is nearly exempt from scrofula. After all, however, as the disease is undoubtedly very frequent in persons of fair skin, light eyes, &c. the term *alike*, at least in the sense of *equally*, may not be altogether correct in the following inference, viz. "that persons of every variety of complexion are *alike* subject to this disease, and that it is only necessary to place them in circumstances, favourable to its development, to have it fully formed." (*Lloyd on Scrofula*, p. 7.) The truth, I believe, is, that though children of dark hair and complexion are often attacked by scrofula, those of light hair and fair complexion are still more frequently afflicted, and this even in France, where the fact cannot possibly be referred to the number of fair children exceeding that of such as naturally have dark hair and complexion.

Females are commonly believed to be rather more subject, than males, to scrofulous disease. (See *Alibert, Nosol. Naturelle*, p. 449.)

Struma prevails more extensively in temperate latitudes, than in very hot or very cold climates. It is also more frequent in some parts of Europe than others; and in this country, it has been alleged to be most prevalent in the counties of Suffolk and Lancashire. At all periods, it seems to have been a very common complaint in this island. From history, we learn, that it was denominated the king's evil in the time of Edward the Confessor, who is supposed to have been the first that attempted to cure it by the royal touch. From a register kept in the royal chapel, we find that Charles the Second touched 92,107 persons in a certain number of years; and this equally bigoted and useless practice was not discontinued till a recent period, when kings were found to be, as well as their poorest subjects, totally destitute of all supernatural power.

Scrofula is not communicable from one person to another; neither can it be conveyed into the system by inoculation. The opinion also, that scrofulous nurses may infect children, seems quite destitute of foundation. (See *White*, p. 26, &c.)

Pinel and Alibert purposely kept scrofulous and healthy children together in the same ward, without any of the latter receiving the complaint. Hébréard could not communicate the disease to dogs by inoculation. And G. T. Kortum, whose valuable work contains every thing known about scrofula at the period when it was written, tried

in vain to impart the distemper to a child, by rubbing its neck every day with the pus discharged from scrofulous ulcers. Lepelletier, desirous of ascertaining the correctness of such experiments, repeated them: he made guinea-pigs swallow scrofulous matter; and he injected it into the veins, and applied it to wounds; but, in no instance was there even a temporary appearance of the disease being communicated. The same author also mixed scrofulous with vaccine matter, and inoculated with it; yet, he never found the vaccine vesicle, thus produced, deviate in the least from its regular course. Lastly, Lepelletier inoculated himself with pus, discharged from scrofulous sores, as well as with the serum, collected under the cuticle of a strumous patient after the application of a blister; but remained perfectly free from every scrofulous ailment. (See *Dict. des Sciences Méd.* t. 50. p. 294.) Our countryman, Mr. Goodlad, inoculated himself several times with the discharge from scrofulous sores and abscesses, and the result was, that the disease could not be thus transmitted. (*On Diseases of the Absorbent System*, p. 113.)

The parts most frequently affected by scrofula, next to the lymphatic and mesenteric glands, and perhaps the skin, are the spongy heads of the bones, the joints, and the eyes. The three species of porrigo, named favosa, larvulus, and furfurans, together with eczema, impetiginodes and rubrum, in their chronic forms, are now frequently considered as strumous diseases. One variety of lupus, or noli mi tangere, is decidedly a scrofulous affection: I mean that which commences with small, red, button-like prominences, which usually remain indolent for some time, and then form eroding ulcers, with pale, shining, spongy granulations, and encrusted margins. Chronic enlargement of the tonsils is another scrofulous disease; and so is one example of the well-known ulceration of the pituitary membrane called *osœna*. The form, which the disease assumes in the bones, and serous membranes, is particularly described in the article *TUBERCLES*. The disorder of the spine, attended with a paralytic affection of the lower extremities, is frequently of scrofulous origin. (See *VITÆBRE.*) Spina bifida is a congenital disease, most frequently seen in children whose parents are scrofulous. (*Thomson's Lectures*, p. 133.) The chronic abscess, which forms in the cellular texture, between the peritoneum and psoas muscle, is often regarded as a strumous disease; and when its contents are found to contain flakes of a curd-like matter, a substance peculiar to scrofulous abscesses, no one can doubt, that the complaint is connected with this constitutional affection. (See *LUMBAR ABSCESS*.) I may here take the opportunity of remarking, that scrofula always produces in the system a predisposition to the formation of chronic abscesses, a kind of *suppurative diathesis*, as it has been called by Andral; and this, not only in the absorbent glands, and in the cellular tissue of the loins, but in this latter texture generally. The chronic enlargement of the thyroid gland is sometimes considered as scrofulous; but, though patients with this affection, very often have at the same time other complaints, which are unequivocally strumous, though the enlargement of the thyroid gland most frequently commences at an early period of life, like scrofulous diseases, and, though, like them, it is sometimes

benefited by the carbonate of soda, burnt sponge, and iodine, the opinion of its being scrofulous, I think, is rather on the decline. (See *BRONCHOCYST.*) Scrofula also frequently makes its appearance in the form of imperfect suppurations, in various parts of the body; the contents of such abscesses being a curd-like matter, and the skin covering them having an unhealthy red appearance, and a thickened doughy feel. The mesenteric glands are often found universally diseased, and enlarged in scrofulous subjects; and, as all nutriment has to pass through these parts, before it can arrive in the circulation, we cannot be surprised at the many ill effects which must be produced on the system when such glands are thus diseased. Scrofula frequently makes its attack on the testicle. (See *TESTICLE, DISEASES OF.*) The female breast is also subject to scrofulous tumours and abscesses.

According to Sir A. Cooper, scrofulous persons frequently have follicles on different parts of the body, incrustated with inspissated matter. He agrees with most other writers in considering the absorbent glands and joints as the parts most frequently attacked, especially the glands of the neck and mesentery. Various other parts of the body he enumerates as liable to it—the lungs, the brain, the eyes; but, the heart, he believes, is never affected. The secreting glands, he also says, are rarely the seat of scrofula, at least, the liver and kidneys; for the breast and testicle are exceptions. However, if we take into the account tubercles and tuberculous deposits, as proofs of scrofulous disease, scrofula is common in or upon most of the viscera; yet, as puberty approaches, the disposition to most of the forms of scrofula, except those of pulmonary tubercles in the lungs, or intestines, and of lumbar abscess, diminishes.

Dr. Thomson believes, that more or less local inflammation occurs in every form and stage of scrofulous diseases. He observes, that the swellings are very often from the first attended with a sensible increase of heat and redness; and that the pain, though seldom acute, is always present in a greater or less degree. Pressure on scrofulous swellings never fails to create pain; and the temperature of the skin covering them, is usually two or three degrees higher than that of the contiguous parts. (*Lectures*, &c. p. 131.)

Scrofulous inflammation is marked by a soft swelling of the affected part, which is frequently one of the lymphatic glands. The covering, or coat of the gland, becomes slightly thickened, and its substance more porous and doughy. The swelling increases, and the doughy feel changes by degrees into that of elasticity, or fluctuation, and a firm, circumscribed, hardened margin, can be felt round the base of the tumour. The skin is slightly red. If, at this time, an incision or puncture be made, either no matter, or very little, is evacuated; the lips of the wound inflame and open, displaying a sloughy-looking substance within; and, between this and the skin, a probe can often be introduced for some way all round. If, however, the disease should have advanced further, then there is very little elasticity in the tumour; it is quite soft, rather flaccid, and fluctuates freely; the skin becomes of a light-purple colour, and small veins may be seen ramifying on its surface. Some time after these appearances, the skin becomes thickened at one particular part, and here it is sometimes rendered of a darker colour. It afterwards bursts

and discharges thin fluid, like whey, mixed with a curdy matter, or thick white flocculi. The redness of the skin still continues; but the aperture enlarges as the tumour subsides, and thus a scrofulous ulcer is produced. The margins of this kind of sore are generally smooth, obtuse, and overlap the ulcer; they are of a purple colour, and rather hard and tumid. The surface of the sore is of a light-red colour; the granulations are flabby and indistinct; and the aspect is of a peculiar kind, which, as Mr. Burns states, cannot be described. The discharge is thin, slightly ropy, and copious, with curdy flakes. The pain is inconsiderable. When this ulcer has continued for some time, it either begins slowly to cicatrise, or, as more frequently happens, the discharge diminishes and becomes thicker. An elevated scab is next formed, of a dirty white, or yellowish colour. This continues on the part a good while; and, when it falls off, leaves the place covered with a small purple cicatrix. Mr. Burns adds, that the preceding description corresponds to the mild scrofula, or the *struma mansueta* of the old writers. Sometimes, especially if a bone be diseased below the ulcer, the sore has a more fiery appearance; the surface is dark-coloured, the margins soft, elevated, and inflamed, and sometimes retorted. The discharge is watery, the pain very considerable, and the surrounding skin inflamed. This has been called the *struma maligna*. Such overacting scrofulous sores are most frequently met with over the smaller joints, particularly those of the toes. Sometimes a scrofulous abscess, after it has burst, forms a sinus; the mouth of which ulcerates, and assumes the specific scrofulous appearance, while the track of the sinus still continues to emit a discharge. Scrofulous swellings are often disposed to subside in winter, and recur on the approach of summer; but this is not an invariable law. Glandular enlargements are very apt to become smaller, in a short time, in one place, while other glandular swellings originate with equal suddenness, somewhere in the vicinity of the former ones. Ulcers, also, very often heal, upon the appearance of the disease in other parts. (*Burns on Inflammation*, vol. ii. 1800.)

Professor Carswell notices the opinion sometimes entertained, that scrofulous swellings are only simple chronic inflammatory enlargements of the lymphatic glands. This view, he conceives, is incorrect, "for (says he), among the great number of cases, which I have examined, I have never found these glands, when generally affected, exempt from the presence of tuberculous matter; and even when the cutis is pale (if they are situated under this tissue), I have sometimes found them almost completely filled with this morbid product. When therefore enlarged glands in a scrofulous patient ultimately disappear, we may conclude, almost with certainty, that we have witnessed the cure of a tubercular disease." (See *Illustrations of the Elementary Forms of Disease*, fasc. 1.)

According to Dr. Carswell, tabes mesenterica has been known to terminate favourably. In one case of this kind, he had an opportunity of examining the mesenteric glands, and thereby of determining the certainty of the cure. The patient, when a child, had been affected with this disease, and also with swellings of the cervical glands, some of which ulcerated; died at the age of six months, the seventh day after delivery.

Several of the mesenteric glands contained a dry, cheesy matter, mixed with a chalky-looking substance; others were composed of a firm cretaceous substance; and a tumour, as large as a hen's egg, included within the folds of the peritoneum, and which appeared to be the remains of a large agglomerated mass of glands, was filled with a substance resembling a mixture of putty and dried mortar, with a small quantity of turbid serosity. In the neck, and immediately beneath an old cicatrix, there were two glands, which contained in several points of their substance, which was healthy, small masses of hard cretaceous matter. Dr. Carswell has also been able to trace the same steps of the curative process in the bronchial glands. (*Op. cit. fasc. 1.*)

The glandular swellings which occur in syphilis, are of a more acute character than those which proceed from scrofula; and they arise from the absorption of a specific poison. Chronic swellings of the absorbent glands occur also in carcinoma; but these manifest little or no disposition to suppuration: they succeed most frequently to carcinomatous indurations, or ulcers existing in the neighbourhood of the glands affected; and they are accompanied in their progress and growth by a peculiar lancinating pain. (See *Thomson on Inflammation*, p. 135.)

With regard to the proximate cause of scrofula, medical men may be said to remain, even at the present day, in entire ignorance of it. After the ridiculous theory, referring scrofula to certain humours in the constitution, or chemical changes in the blood, had been exploded, the opinion gradually arose, that it was a disease of the lymphatic system; and, indeed, that the absorbent glands are often visibly the seat of its attack, when no changes are distinguishable in other textures, is a fact that admits of no dispute. I believe, at the same time, that whoever supposes scrofula to be exclusively confined to the lymphatic system, must have a very imperfect conception of what is really the case. On the contrary, I fully participate in the sentiments of Professor Thomson, already adduced upon this point, and in the belief of another modern writer, that strumous complaints "are not to be considered as dependent on disease of any particular system, as the lymphatic." (*Lloyd*, p. 10.) Such writers as have fixed upon the absorbent vessels, as the particular seat of scrofula, can throw no useful light upon its origin, by following up the theory, whether they imagine the cause to be obstruction of the vessels and glands; or take up the wild speculation of Cabani, that, in scrofula, the mouths of the lymphatics are in a state of increased activity, while the vessels themselves are in a state of atony; or the doctrine of Soemmering, that scrofula depends upon a passive relaxation and dilatation of the absorbents; or the hypothesis of Girtanner, that these vessels are in a state of increased irritability. The idea of obstruction being the cause has, of late years, been much on the decline; and that the convolutions of lymphatic vessels, forming the glands, are quite pervious, and may readily be injected, even when diseased, a fact, first demonstrated by Soemmering, is one that must weigh heavily against this opinion. Sir A. Cooper describes the disease as proceeding from congenital debility, which attends its whole course, and imparts to it a peculiar character, rendering the various processes of inflam-

mation in it slow and imperfect. With respect to the exciting causes, Mr. John Hunter remarks that, "in this country, the tendency to scrofula arises from the climate, which is in many a predisposing cause, and only requires some derangement to become an immediate cause, and produce the whole disease. (*On the Venereal Disease*, p. 26.) The disease is remarked to be most common in females; in cold, damp, marshy countries, and in all places, near high mountains, where the temperature is subject to great vicissitude. "Nous voyons presque toujours (says Alibert), que les tumeurs et les ulcères se rouvrent au printemps pour se fermer ensuite vers la canicule." (*Nosol. Naturelle*, p. 449.)

Mr. Hunter notices slight fevers, colds, small-pox, and measles, as exciting scrofulous diseases. He observes, that in particular countries, and in young people, there will sometimes be a predisposition to scrofula; and that, in such subjects, buboes will more readily become scrofulous. (P. 37.) In short, it was one of Mr. Hunter's opinions, that the venereal disease is capable of calling into action such susceptibilities as are remarkably strong, and peculiar to certain constitutions and countries; and that, as scrofula is predominant in this country, some effects of other diseases may partake of a scrofulous nature. (P. 96.) Mr. Hunter, in speaking of venereal buboes, mentions his having long suspected a mixed case, and adds, "I am now certain that such exists. I have seen cases where the venereal matter, like a cold, or fever, has only irritated the glands to disease, producing in them scrofula, to which they were predisposed. In such cases the swellings commonly arise slowly, give but little pain, and seem to be rather hastened in their progress, if mercury is given to destroy the venereal disposition. Some come to suppuration while under this resolving course; and others, which probably had a venereal taint at first, become so indolent that mercury has no effect upon them; and, in the end, they get well of themselves, or by other means." (P. 269.) For such buboes, Mr. Hunter used to recommend sea-bathing; and, in case of suppuration, poultices made of sea-water.

Sir A. Cooper observes, that the predisposing cause of scrofula is congenital, or original fault of constitution. The exciting causes, he says, are whatever tends to produce or increase debility, such as fever from diseases of a specific kind, like measles, scarlet fever, and small-pox. He notices the greater frequency on this account of scrofulous cases some years ago, when the advantages of vaccination were not known; and the importance of this practice to society, if it had no other recommendation.

In the words of a well-informed Professor, scrofula readily forms an alliance with almost every morbid affection, occurring either from external injury or from internal disease: it modifies the appearance of other diseases, and seems to convert them gradually into its own nature. Indeed, there are few of the local inflammatory affections which occur in this country, in which the symptoms and effects of these affections, and the operation of the food and remedies employed for their cure, are not more or less modified by the degree of scrofulous diathesis, which prevails in the constitution of those who are affected by them. The scrofulous diathesis, wherever it exists, usually gives more or less of a chronic character to local inflammatory affections. (*Thomson's Lectures*, p. 131.)

Sentiments, corresponding to some of those already quoted, are delivered by Dr. Alison: "The facts," says he, "which seem most decisive, as to the connection of the scrofulous habit with general debilitating causes, may be recapitulated as follows:—1. The differences in the symptoms and progress of inflammation, when scrofulous, and when healthy, appear manifestly to indicate in the former case a languid state of the circulation, particularly in the capillary vessels of the diseased part. 2. The hereditary disposition to scrofula is chiefly transmitted from parents, and is mostly observed in children, who show evident marks of constitutional debility in other respects. 3. There is no state of the body, as every practitioner knows, in which scrofulous action is so easily excited, as the state of great and often permanent debility which remains after severe febrile disease, continued fever, small-pox, measles, scarlatina, or which follows the long-continued use of mercury, or accompanies amenorrhœa. 4. The season, at which scrofulous diseases have been observed to prevail most in this climate, is not that when cold weather has recently set in, and is most productive of disease in general, but the end of the winter and the spring; and they are then chiefly observed in those young persons, who have manifestly lost strength during the continuance of the cold weather." (*Alison*, in *Edin. Med. Chir. Trans.* vol. i. p. 381.)

It has been the fashion of late years to ascribe the origin of a vast number of diseases to disorder of the digestive organs, little trouble being generally taken to consider, with any impartiality, whether the derangement of those organs may not be rather the common effect, than the common cause, of so many various diseases. Numerous circumstances tend to perpetuate the delusion, into which young practitioners are falling upon this topic. They see various diseases, attended with dyspepsia, flatulence, loss of appetite, costiveness, and a torpid state of the bowels; they observe that such diseases and the latter complaints of the alimentary canal generally diminish together; that, when the functions of the stomach and bowels are deranged, any other diseases, which the patient may be labouring under, either grow worse, or are retarded in their amendment; and, lastly, the treatment, to which the theory leads, improves the health, by rectifying the state of the alimentary canal, and the sore, tumour, or other complaint, in the end, with the additional aid of time, nature, and other favourable circumstances, gets well. But, however simple, safe, and beneficial the practice may be, and plain as the facts are, which lead to it, there is no proof, that the other disease was truly a consequence of the disorder of the digestive organs. The latter symptom, I believe, is very frequently an effect mistaken for a cause, and perhaps, always so, in relation to scrofula. Besides, if it were to be assumed (as indeed it actually is), that, in scrofula, "there always is more or less disorder of the digestive organs, and primarily of no other important function," I do not see that we advance one step nearer the truth; because, as the same cause is generally assigned, by gentlemen attached to this theory, for a vast number of other cases, we still remain in the dark, as to the circumstances, which make so many complaints of different kinds spring from one and the same cause. These circumstances, though buried in silence, are still the mystery—still the

secret, which is desired; and, if it be answered, that the effect will only happen in particular constitutions, then we are brought back at once to the point, from which we first started, viz. that scrofula is a disease depending upon some unknown peculiarity of constitution, congenital or acquired, and capable of being excited into action by various causes, as climate, mode of living, &c. However, lest I may not have attached sufficient importance to the doctrine of gastric disorder being the cause of scrofula, I feel pleasure in referring for the arguments in its support, to the writings of Mr. Abernethy, Dr. Carmichael, and Mr. Lloyd, whose sentiments appear highly commendable, so far as they tend to teach surgeons, rather to place confidence in means calculated to improve the health in general, as the most likely mode of benefiting scrofulous patients, than to encourage foolish dreams about new specifics for the disorder. Thus far, I can follow these gentlemen safely; but no farther. However, perhaps, none of the believers in the effect of disorder of the digestive organs mean to say, that such disorder is any thing more than one of the many exciting causes of scrofula; and, with this qualification, their theory may, or may not be correct. It is the doctrine of Alibert; and indeed of nearly all writers: "*ce sont les vices de la puissance digestive, qui préparent de loin les scrofules. Rien n'influe davantage sur leur développement que la mauvaise qualité des alimens,*" &c. (*Nosol. Naturelle*, p. 449.)—"Ajoutez à cet cause le séjour dans les habitations malsaines." But, every explanation, even of exciting causes, remains unsatisfactory, so long as we find children living in the same air, under the same roof, and feeding and sleeping together, and clothed also exactly alike, yet only one or two of them become scrofulous, while all the rest continue perfectly free of the disease. Here, then, we are again compelled to return to predisposition, constitution, diathesis, and a congenital tendency to the complaint, as a solution of the difficulty. In short, then, respecting the etiology of scrofula, little is known, except that certain constitutions probably have a congenital disposition to the disease; that such disposition may be increased, or diminished, by the operation of climate, mode of life, age, &c.; and that irritations of a thousand kinds may excite the disease into action, when the system is predisposed to it, by inexplicable causes. That climate has great influence cannot be doubted, when it is reflected, that the inhabitants of certain countries, in which the temperature is invariably warm, never suffer from scrofula. It is noticed by Sir A. Cooper, that the occurrence of scrofula is much promoted by climates, in which the change from cold to heat, and from heat to moisture, is particularly frequent, as is the case in this island. But though cold and moist climates have this effect, he remarks, that persons living in the extremes of heat, or cold, are not affected. The disease, he says, is even arrested by cold and heat, uncombined with a damp atmosphere. On the other hand, numerous children who come from the East or West Indies to this country, fall a prey to scrofula. He has also known some individuals from the South-Sea Islands die here of the same disease. The fact of the great influence of climate on scrofula is generally proved by the effect of the weather and seasons. For, it is a common and a true remark,

that in a mild dry atmosphere, and in summer-time, the health of scrofulous persons generally improves, and, whatever local complaints they may have, get better, while on the contrary their disorder in winter is more difficult of relief, and either continues stationary, or becomes worse again. Hence, as Sir A. Cooper has justly remarked, the exact value of any proposed remedy for scrofula cannot be estimated, without reference to the time of year when it is tried. There can also be no doubt, that, with age, the disposition to scrofula diminishes; for, children, much afflicted while young, frequently get quite well when they approach the adult state; and, if a person remain perfectly free from every mark of a scrofulous constitution, till the age of twenty-five, he may be considered as nearly out of all danger of the disease.

According to the calculations of Dr. Alison, scrofulous diseases are much more frequent in the inhabitants of great towns, than in the agricultural population of any climate. This seems to him an unquestionable fact, and one that confirms the truth of the connection of scrofula with debilitating causes. (See *Edinb. Med. Chir. Trans.* vol. i. p. 383.)

It seems to M. Lepelletier, that the privation of solar light creates a tendency to scrofula; but, though it occasions a pale complexion, a flaccidity of fibre, and a bloated look, these states may not exactly constitute the conditions implied by the term scrofula. Independently of the redundancy of white tissues and colourless fluids, conjectured by Stokes, Jolly, and others, to form one of the chief characters of a scrofulous constitution, and at the same time one of the chief anatomical circumstances of scrofula, there is no doubt, that the composition of the fluids of scrofulous individuals is more or less a deviation from what it ought to be; and especially that some of them contain an extraordinary proportion of the phosphate and carbonate of lime, and chloruret of soda; and that these same principles frequently enter copiously into the matter of scrofulous tubercles. M. Labillardiere ascertained that the milk of a cow, affected with tubercles, contains seven times as much phosphate of lime as the milk of a healthy cow.

TREATMENT OF SCROFULA.

As the nature and treatment of particular forms of scrofulous disease are described in other articles of this work, I shall here limit my observations to the general treatment of the disorder.

From the remarks delivered in the foregoing columns, it is evident, that many children are born with a constitution and organisation predisposing to the attack of scrofula; nay, that some pass into the world with tubercles, or the germs of them already formed; but all children are liable to become scrofulous under the influence of various conditions detrimental to the general health. The following is Dr. Cumin's advice respecting the mode of rearing a child, in which circumstances justify the opinion of a tendency to the disease:—"When the child of a scrofulous father is born, the infant, unless the mother is free from all traces of the disease, ought to be consigned to a wet-nurse, of sound and robust constitution, having an abundant supply of milk. This alone ought, for some months, to be sufficient for the nourishment of the child; but, after a time, should it appear delicate, a littleisinglass jelly may be allowed in addition,

or liquid yolk of egg, or beef-tea, together, with some preparation of wheaten meal, or flour, or pure starch. Daily immersion in cold water, and gentle friction of the whole body, will be found of great utility. The child ought to be warmly clothed; to be carried about in the open air as much as possible; and the apartment in which it sleeps ought to be kept at a steady moderate temperature, and perfectly well ventilated. All rooms, occupied as nurseries for children, ought to be spacious and lofty, never situated in a sunk floor, nor in an attic, and, if possible, considerably above the level of the ground." (*Cumin, in Cyclop. of Pract. Med.*; art. *Scrofula*.)

To all individuals, in whom a scrofulous diathesis is manifest, or even probable, and whose circumstances enable them to remove to a mild climate, and to localities judiciously selected, such change affords one of the best chances of preventing or checking the disease. (See *Sir James Clark on the Influence of Climate*.) The facts of scrofula being so prevalent in cold damp countries, noted for extremely variable temperature, like this kingdom, and of its comparative rarity in, or total absence from, some other parts of the world, prove sufficiently, that climate is of all the exciting causes of scrofula the most powerful one. Climate and local circumstances also determine very much what form of scrofula predominates in any particular country where the disease exists; for, in some places, we find the tubercular varieties of it are particularly common, though the disease in its other shapes is infinitely less frequent.

"For the cure of scrofula (says Cullen), we have not yet learned any practice that is certainly, or even generally, successful." With respect to mineral waters, he was not satisfied that they shortened the duration of the disease, whether they were chalybeate, sulphureous, or saline. Neither did he think more favourably of sea-water. (*First Lines of Physic*, vol. iv.) On the subject of mineral waters, Dr. Thomson remarks, that they are now usually employed as purgative and tonic remedies, and not as specifics. In employing them, it is often difficult to distinguish between the effects which they in reality produce, and those which are to be attributed to the slow operation of time, the season of the year, change of situation, alteration in the mode of life, or exercise in the open air. (*Lectures on Inflammation*, &c. p. 195.)

In scrofulous diseases, Dr. Fordyce had a high opinion of bark; and he endeavoured to prove, that, in cases of tumefied glands, attended with a feeble habit, and a weak circulation, it is a most efficacious medicine, and acts as a resolvent and discutient. He also brings forward a case, in support of bark being a means of cure for ophthalmia strumosa. (See *Med. Obs. and Inq.* vol. i. p. 184.) Dr. Fothergill, in the same work (p. 303.), writes in favour of the good effects of bark in similar cases; small doses of calomel being sometimes given with it. On the other hand, Cullen pronounces the efficacy of bark in scrofula to be dubious and trivial. (*First Lines*, &c. vol. iv.)

According to Mr. Burns, bark has been frequently found useful in the cure of scrofulous inflammation, but more often of ulceration than tumefaction of the glands. But, it does not appear to him to possess, by any means, that certain power of curing scrofulous affections, which is attributed to it by Dr. Fothergill and several other

authors. He observes, that we are not to suppose it will infallibly cure scrofulous inflammation, or ulceration of parts, which, even when affected with simple inflammation, are very difficult of cure. If it be difficult to cure a simple inflammation, or ulceration, of a tendon, cartilage, or bone, we must not be disappointed if even a specific remedy for scrofula (were such ever discovered) should prove ineffectual in procuring a speedy restoration to health. Mr. Burns contends, that bark is often ineffectual, because improperly administered. Given in small quantities, once or twice a day, it may prove a stomachic, and increase, like other tonic bitters, the power of the stomach, or the function dependent on it; but, in order to obtain the benefits of the specific action of bark, he maintains, that it should be given in large quantities, for several weeks, with a good diet, air, and proper exercise. (*On Inflammation*, vol. ii. p. 371.) Dr. Thomson does not believe that bark, or iron, has any specific virtue in curing scrofula; but, he admits that either of these medicines may sometimes prove useful in amending the tone of the digestive organs, when given after, or occasionally along with, a course of purgative mineral waters. (*Lectures*, p. 197.) When bark is prescribed, the sulphate of quinine is one of the best formulæ, as least likely to disagree with the stomach.

So far as I can judge, Mr. White has with much reason recommended paying attention to such circumstances as may have effect in preventing the disease, viz. airy cleanliness, exercise, and diet. He mentions cold-bathing among the preventives of struma, and speaks of sea-bathing as being the best. He advises attention also to be paid to the manner of clothing children, keeping them more covered in winter than summer. He thought a great deal of sleep prejudicial; but this seems only conjecture.

In noticing the treatment of the disease, Mr. White states, that "The general idea of struma is, that it is a disease of debility (a doctrine also inculcated by Sir A. Cooper) and therefore the great object is, to invigorate the habit by every possible means; the chief of which are tonic medicines, and sea-bathing. Some are of opinion, that, in the case of young patients, this should be continued, during the summer months, every year, to the age of fourteen or sixteen. Many recommend it, not only in the summer, but throughout the year; whilst others are for administering alteratives, principally the alkaline salts, with or without antimonials, and the different tonics, during the winter; and the sea-water, and sea-bathing, or cold-bathing, during the summer, for a continuance of two or three years from the commencement of the disease; with this general observation, that they will outgrow the complaint." Mr. White mentions, as the chief external means, fomentations and poultices of sea-water. With respect to regimen, some recommend a milk and vegetable diet; others animal food and fermented liquors. Sir A. Cooper, in particular, who regards the disease as connected with congenital debility, strongly recommends a nutritious diet of animal food, in preference to one of vegetables.

Mr. White maintains, that the preceding plans of treatment are not, in general, efficacious, though, in some instances, they may prove useful. "In early affections of the lymphatic glands, and from the want of a pure air, and proper exercise, where

children are delicate and irritable, a change of situation to the sea-side, together with bathing, when they have acquired some strength, must be exceedingly proper; and, in gross plethoric subjects, who have diseased lymphatics, from improper feeding, and want of necessary exercise, a journey to the sea-coast may be very useful, particularly if the salt-water is drank often, and in a sufficient quantity to become purgative. This, with the novelty of their situation, which may naturally produce an increase of exercise, might answer every expectation; but these are the kind of cases that, with a very little attention, are easily cured." (*White on the Struma*, ed. 3. p. 104.)

The conclusion, to which Mr. White's remarks upon this part of the subject tend, is, that sea-bathing only deserves praise, as a preventive, and in the early stages of the disease. He particularly condemns cold-bathing, for poor, weakly, debilitated children, whose thin visages, enlarged bellies, and frequent tickling cough, sufficiently indicate diseased viscera: such do not recover their natural warmth, after cold-bathing, for hours; and their subsequent head-ach, livid lips, and pale countenance, are sufficient marks of its impropriety. (P. 107.)

Dr. Cullen entertained a very favourable opinion of cold-bathing, since he affirms, that he had seen scrofulous diseases more benefited by it, than any other remedy. (*First Lines of Physic*, vol. iv.)

"Cold-bathing, especially cold sea-bathing, (says Mr. Russell) is a remedy universally employed in scrofula, and I believe with great advantage in many cases; for it not only appears to improve the patient's general health and strength, but likewise to promote the detumescence of enlarged glands, and the resolution of indolent swellings in the joints, even after they have attained a considerable size, and have existed for a great length of time. But, in order that cold-bathing may be practised with safety and advantage, the constitution must have vigour to sustain the shock of immersion without inconvenience. If the immersion be succeeded by a general glow over the surface of the body, and the patient feels cheerful, and has a keen appetite, we may conclude that the cold-bath agrees with him; but if he shivers on coming out of the water, continues chill, and becomes drowsy, we may be assured that the practice of cold-bathing does no good, and had better be omitted.

"In estimating the comparative merit of cold-bathing and warm-bathing, in the cure of scrofulous complaints, my own experience, together with the result of different conversations on the subject with some of the most judicious practitioners of my acquaintance, would lead me to bestow much more commendation on the effects of warm-bathing. I should not even be inclined to circumscribe the practice to cases of emaciation and debility, since, from observation, I am fully satisfied with regard to the beneficial effects of the warm-bath to patients of plethoric constitutions, who were much affected with swelled scrofulous glands. Several of these instances occurred in young women, about the prime of life, who were in all respects healthy and vigorous, abating the swellings of the glands, and these symptoms of disease, which were connected with fulness of blood. The action of the warm-bath is exceedingly

grateful to most patients, and the practice is universally safe. It may be employed at all seasons of the year, and in all weather, without danger or inconvenience; the risk of suffering from exposure to cold, immediately after immersion in the warm-bath, having been much magnified by prejudice. There is not even any good reason to believe in the existence of such a risk. The precautions, however, which are employed to avert it, are perfectly innocent; and provided they do not impose any unnecessary and incommoding restraints upon the practice, may be encouraged, so far as to relieve the patient's mind from uneasiness and groundless apprehensions.

"It requires many weeks, and sometimes several months, to ascertain the full effects of warm-bathing in relieving scrofulous complaints; but, as the practice is not attended with any inconvenience, nor followed by any bad consequence, there can be no reason to intermit the course, till the trial is completely satisfactory; and I am convinced, that the practice of warm-bathing, in cases of scrofula will be more universally adopted, after the knowledge of its beneficial effects is more widely diffused." (See *Russell on Scrofula*.)

Nothing can be more satisfactory (says Professor Thomson), than the evidence, which is on record, of the efficacy of the muriate of soda, as it exists in sea-water. In reading this, one only wonders how so efficacious a remedy should ever have fallen into neglect. (P. 196.) In a subsequent passage, however, the same gentleman evinces only a limited confidence in this means of relief. "Local sea-bathing, both cold and warm, has often appeared to be of use in procuring the resolution of scrofulous swellings. The temperature of the bath must always be varied according to circumstances, according to the season of the year, the strength and habits of the patient, and the particular effect which the bath seems to produce. It is at all times difficult to distinguish between the effects immediately arising from the application of salt-water to the body, and those which arise from the increased warmth of temperature in the bathing seasons of the year; from the exercise which patients going to sea-bathing generally take in the open air; from the change of situation and amusements; and, among the poorer classes, from the more nourishing diet and exemption from labour, in which they are usually permitted to indulge, during their residing at sea-bathing quarters. It is not improbable, that those living on the sea-coast; who become affected with scrofula, would, for similar reasons, derive equal benefit by going from the sea-coast to reside for a time in the interior of the country." (See *Thomson's Lectures*, &c. p. 203, 204.) A still later writer declares his belief, that cold sea-bathing has no specific power over the disease. (*Lloyd on Scrofula*, p. 43.) Yet the plain surgeon, in search of practical truths, will not care whether any plan has a specific power or not over a complaint, if that disorder is sometimes relieved by it. And, that this is the fact, is admitted by Mr. Lloyd, when he says, "cold sea-bathing, however, is certainly useful when judiciously applied," &c. &c. (P. 44.)

Mr. White, after enjoining attention to air, exercise, and diet, as promotive of a recovery, as well as a preventive of the disease, proceeds to explain his own practice. The first external symptoms,

such as swellings of the lips, side of the face, and of glands under the chin, and round the neck; also other symptoms, usually considered as strumous, viz. roughness of the skin, eruptions on the back of the hand, and different parts of the body, redness, and swelling of the eyelids and eyes; are accompanied, according to Mr. White's conceptions, with an inflammatory diathesis, though seldom such as to require bleeding. Calomel is the medicine which this gentleman recommends for the removal of the foregoing complaints. It is not to be given in such quantities, as to render it a powerful evacuant, either by the intestines, or any other way; but, in small doses, at bedtime. Thus, says Mr. White, "it remains longer in the intestinal canal, a greater quantity is taken into the habit, and the patient is less susceptible of cold, than when taken in the daytime. The first, and, perhaps, the second dose may prove purgative, which has in general a salutary effect; but, afterwards, the same quantity will seldom do more, than is sufficient to keep the body open; and should it fail of answering that purpose, I have usually recommended some gentle purgative, every third or fourth morning, according to circumstances. If there should be a prevailing acidity, a few grains of the carbonate of soda, magnesia, or some testaceous powder, may be added to the medicine. By this simple method (continues Mr. White) most of the symptoms before mentioned will, in a short time, disappear; but if the tumours should continue hard, and retain their figure, without dividing into smaller ones, we may derive some benefit from external applications, particularly the steam of warm water. I have used a variety of medicinal herbs with success; but am inclined to believe that the advantage was particularly derived from warm water, &c. At other times, I have stimulated the part affected with electricity, insulating the patient, and drawing sparks from the tumour, until a slight degree of inflammation was excited. After the application of the steam, or the use of the electrical machine, I have sometimes rubbed a little of the unguentum mercuriale into the tumour, and neighbouring parts, or applied the emplastrum saponaceum, or mercuriale cum ammoniaco, over the swelling, or a liniment with camphor, ol. olivarium, and sp. teberinth." Mr. White adds, that in such cases, if the tumours should suppurate, and burst, the parts will, in most instances, heal without much trouble. For eruptions on the head, he recommends applying the ung. saturn. album camphoratum, or the cerat. alb. cum hydrarg. præcip. alb. For the roughness of the skin, which is generally followed by eruptions, he also advises the liquor plumbi acetatis dilutus, aqua calcis, solutions of sal. tartar. or of the hydrarg. mur., as outward applications. "This last (says Mr. White) will seldom fail to check the progress of the complaint, and dry the sores; and in the quantity of ten or twelve grains to a quart of warm water, the use of it will not be productive of any pain. If the eruption should ulcerate, and require any unctuous application, to prevent the adhesion of the linen, the ointment before mentioned may be applied; the best remedy will be warm-bathing, and when practicable the sea-water claims a preference." (P. 114.) The author next mentions his having occasionally recommended the vinum antimoniale, tartarum emeticum, decoctum Lusitanicum, decoctum lig-

norum or sarsaparillæ; and that he sometimes found advantage derived from artificial drains.

For the cure of indurations in the breast, remaining after mammary abscesses, Mr. White speaks very highly of the effects of the steam of warm water; and cautions us against indiscriminately employing calomel, which will often affect the mother little, but the child violently. Mr. White mentions his employing a small tin machine, large enough to hold a pint and a half, or two pints of boiling water. From the top proceeded a narrow tube, ten or twelve inches long, through which the steam passed. Near its end, which was moveable and curved, was a joint for the greater convenience of directing the steam to the diseased parts. The water was easily kept boiling by means of a lamp under the machine. Mr. White says, that the steam should be employed twice, or thrice a day, and a piece of flannel, or skin, afterwards applied. The body should also be kept open. In obstinate, neglected cases, mercurial preparations, according to Mr. White, must likewise be given, and, if they affect the child much, suckling should be suspended. (P. 117, 118.) For chronic swellings of the breast, suspected to be scrofulous, I would here particularly recommend a trial of iodine, which should be used both externally and internally. (See IODINE and MAMMA.)

When the glands of the neck, or other parts of the body, tend to a state of suppuration, it is very slowly, the skin appearing uniformly thin, and of a deep red-colour, and the tumour seeming flaccid. In such cases, Mr. White recommends the use of the lancet or caustic; for if no artificial opening is made, it will be a long time before the skin gives way; and, when it does, the aperture will not only be very small, but often unfavourable in its situation. Mr. White adds, that the contents will often be more like mucus, than pus, or like a mixture of both; and the discharge will continue for a great length of time, if no remedy is applied. He found a solution of gum, myrrhæ in aqua calcis, used as a lotion, and the ceratum saponaceum, or some similar outward application, the best method of treating this symptom.

We need not describe Mr. White's practice in the treatment of scrofulous joints, as the subject is fully considered in the article JOINTS. It appears, however, that he confirms the efficacy of stimulating applications, and pressure with bandages, when the fingers and toes are affected with strumous disease. (P. 143.)

Whoever compares the practice of Mr. White in administering calomel, occasional purgatives, the decoctum Lusitanicum, sarsaparilla, &c. with the blue pill, sarsaparilla, and laxative treatment of the present day, will perceive no very material difference between them, especially when the stress which Mr. White laid upon attention to diet, clothing, &c. is taken into the account. Mr. Lloyd, who has detailed Mr. Abernethy's practice in scrofula, lays it down as an axiom, that "the disease is only to be cured by avoiding all sources of irritation, and restoring the natural and healthy functions of the digestive organs." (P. 48.) By sources of irritation, Mr. Lloyd means exciting causes; the advice is therefore excellent, so far as it can be followed, or such causes are decidedly known. The restoration of the functions of the digestive organs is also a thing worth aiming at;

and the only difference in my views from those of Mr. Lloyd is, that, as I look upon the disorder of the digestive organs to be in general only a complication, or effect of the scrofulous disease, ulcer, abscess, diseased joint, &c., and not the exciting cause, the treatment, when beneficial, becomes so only on the principle of improving the general health, by the removal or diminution of one of the most hurtful consequences of the original disease. The treatment, described by Mr. Lloyd, in addition to the usual advice about diet, clothing, the avoidance of damp and cold, and the utility of good air, exercise, &c. consists in giving the patient five grains of the pil. hydrarg. every night, and half a pint of decoct. sarsap. c. twice a day. And, if, at a certain hour of the day, there has been no motion, recourse is had to opening medicines. This plan is pursued till the bowels become regular; and then, with the view of preventing a relapse of the bowels into their former state, Mr. Lloyd continues the exhibition of alterative doses of mercury for an indefinite time, the preference being given to the compound calomel pill, in doses of five grains every night. In children, the practice is exactly like that of Mr. White, viz. small doses of calomel with purgatives. When acidity prevails in the stomach, small doses of soda are recommended; and when the stomach is weak, with loss of appetite, cinchona, steel, and mineral acids. A full diet, with porter and wine, is disapproved of, and, as already stated, not much confidence is placed in sea-bathing. (*Lloyd on Scrofula*, p. 38.)

Crawford, Pinel, and others tried the muriate of barytes in scrofulous cases (*Med. Communications*, vol. ii.; *Nougr. Philosophique*, vol. ii. p. 239.); and it had the recommendation of the celebrated Hufeland. Mr. Burns says, that the muriate of barytes has no effect on diseased glands; but, that it is occasionally serviceable in scrofulous ulceration, though, he adds, that it deserves little dependence. (*Diss. on Inflamm.* vol. ii. p. 372.) This gentleman recommends the following formula: R. Terræ Ponder. Salit. Chryst. gr. x. Aq. Font. Aq. Caesæ, utriusque, ʒ ij. Syrup. Aurant. ʒ ij. Half an ounce may be given at first, twice or three times a day, and gradually increased to such quantity as the stomach can bear without sickness. At present, few practitioners have any faith in the antiscrofulous virtues of the muriate of barytes; and, as Dr. Thomson remarks, it has had a much shorter lived reputation than sea-water, or its successor the muriate of lime. (See *Lectures on Inflammation*, p. 196.)

Fourcroy proposed the muriate of lime; but its efficacy is very doubtful, and inconsiderable. "Professor Thomson (says Mr. Russell) has favoured me with the following observations on the effects of muriate of lime: he employed muriate of lime in various cases of scrofula, without having derived benefit from it in a single instance. Some patients, indeed, he admits, got well, while under a course of muriate of lime; but then he had no reason to ascribe the cure to the effect of the medicine. In other cases, on the contrary, the muriate of lime produced severe sickness and oppression at the stomach, and the patients got daily worse, till the muriate of lime was intermitted, and other medicines employed. The relief experienced upon the intermission of the muriate of lime, is no doubt, with regard to the injurious

effects which the use of it had produced; and from extensive experience and accurate observation on the subject, Professor Thomson is satisfied that muriate of lime is attended with prejudicial effects in many cases of scrofula." (See *Russell on Scrofula*.) Since the publication of the earlier editions of this DICTIONARY, I have seen the muriate of lime given in several cases of scrofula; but, without any beneficial effect on the disease. How long the muriate of lime will be permitted to enjoy its present fame, Dr. Thomson will not venture to say; but from what he has seen of its use, he imagines its reputation will only last, till some other new remedy is proposed by those who are still sanguine in their hopes of discovering a specific for scrofula. (*Lectures*, &c. p. 196.) Iron, given either alone, or joined with carbonate of soda, or potash, or with ammonia, has also been extensively tried; but the reports of its utility are so various, that we may infer that it is only useful in a limited number of cases. Burnt sponge, millipedes, and sulphate of potassa, have all been extensively tried: the first of these contains, as is now well known, a proportion of iodine, which is unquestionably a medicine of high value in the treatment of scrofula. (See IODINE.)

The Marischal de Rougeres employed a remedy, composed of iron filings, muriate of ammonia, subcarbonate of potassa, &c. (*Journ. de Méd.* tom. xi. p. 219.)

Several narcotics have been tried, such as opium, hyoscyamus, the solanum duleamara, &c.; but, though their virtues against scrofula have been sometimes cried up very highly, the moderns have lost all faith in them. The attention of the public to the effects of cicuta, in cancer and scrofula, was first particularly excited by the accounts of its virtues published by Baron Stork.

Fothergill also praises cicuta, and perhaps, next to iodine, and soda, joined with rhubarb and columba, it is as good an internal medicine as can be tried; but it is far from being generally efficacious. It is highly deserving of recommendation for irritable scrofulous ulcers. There is now not the least doubt, that the statements of Baron Stork were greatly exaggerated. He considered cicuta indicated, whenever obstructions and tumours existed; and, under this treatment, he says that he found the swellings melt away like ice. What is extraordinary, every sort of tumour yielded to cicuta. But (as Dr. Thomson judiciously remarks), universal success is always one of the most suspicious circumstances which can be mentioned in the history of the effects produced by any new remedy. (*Lectures*, &c. p. 199.) Dr. Cullen frequently employed hemlock, and sometimes found it useful in discussing obstinate swellings; but, he says, it also frequently disappointed him, and he never saw it dispose scrofulous ulcers to heal.

With regard to mercury, we have already noticed, that calomel was much employed by Mr. White. Some have exhibited the bichloride, some the chloride, others the acetate of mercury. All these preparations have been at times conjoined with cicuta, antimony, &c. Calomel or the chloride is, perhaps, the best mercurial preparation in scrofulous cases; but mercury, given internally with any view of exciting salivation, is justly deemed hurtful. As an alterative, and an occasional purgative, it is undoubtedly a good medicine for strumous patients. Mercury was disapproved of by Cullen, as a me-

dicine for scrofula. As a distinguished Professor observes, "From the great apparent similarity of the symptoms, progress, and seats of scrofula, to those of syphilis, and from the well-known effects of mercury in curing syphilis, it need not seem strange, that medical men should have been a little obstinate in their attempts to obtain benefit from the use of mercury in scrofula. These expectations are in general abandoned, and mercury is now given for the cure of scrofula as a purgative only. A long-continued, or improperly administered course of this medicine, has often been known to aggravate all the symptoms of scrofula; and, in many instances, to excite these symptoms in persons, in whom they did not previously exist." (See *Thomson on Inflammation*, p. 194, 195.)

Mr. Burns thinks the nitrous acid has some effect in promoting the suppuration of scrofulous glands, and tumours, and disposing ulcers to heal. He says, two or three drams may be given every day, for a fortnight; but if, in this time, it should do no good, its employment ought to be discontinued. The mineral acids, diluted with water (says Professor Thomson), are often used with views similar to those which guide us in the employment of tonic remedies. Their medicinal powers appear to be nearly the same; but the nitric acid has of late been preferred, particularly in the scrofulous affections, which are sometimes induced by the action of mercury. (*Lectures*, &c. p. 197.)

The carbonate of soda and potassa are useful in the treatment of scrofula, but not to be regarded as specifics. They may be given with rhubarb, and, if the alvine discharges be of bad colour, with a few grains of hydrargyrum cum creta.

A spirituous infusion of gentian, into six ounces of which are put thirty-six grains of the carbonate of soda, or the same quantity of the carbonate of ammonia, is a medicine highly spoken of by Richerand for scrofulous cases. (*Nouv. Chir.* t. i. p. 184, ed. 4.)

Potassa, in large doses, with mercurial frictions, is the practice extolled by Mr. Farr. (See *Farr on Scrofula*, 8vo. Lond. 1820.)

According to Mr. Burns, eight or ten drops of hydrosulphuret of ammonia, given thrice a day, are useful, in irritable strumous ulcers. The breathing of oxygen gas has been proposed; but, of this plan I know nothing from experience; and as it now makes less noise in the world than formerly, I conclude that either its usefulness has been exaggerated, or the difficulty of the practice is too great to permit its extensive adoption.

The sentiments of Dr. Cullen are decidedly against antimony. As a modern writer observes, no great dependence seems ever to have been placed in the use of diaphoretic medicines for the cure of scrofula. The different preparations of antimony, indeed, have been occasionally administered; but, chiefly in cutaneous affections, supposed to be of a scrofulous nature. Guaiacum, sarsaparilla, sassafras, and mezereon, singly, and in combination, have all been supposed to be useful in the cure of scrofula; but they are now seldom given with this view, except in cases of scrofula combined with syphilis, or excited by the too free and injurious use of mercury. (*Thomson's Lectures*, &c. p. 199.)

With respect to Alibert's practice, amongst the vegetable bitters, he prefers the hop, burdock, gentian, and bark. He seems to have no confi-

dence in specifics, like hemlock, belladonna, acetonitum, &c. Neither does he express himself favourably of alkaline medicines, or the murates of ammonia and barytes. However, he praises the good effects of steel medicines on enlarged glands. He affirms, that he has seen most good derived from external means; aromatic fumigations in an apparatus prepared by the chemist Darcey. What he calls scrofulous eruptions, he covers with a strong solution of the nitrate of silver. Swelled glands he rubs with the antimonial ointment. He commends also change of air, and the avoidance of low damp places; and speaks favourably of sea-bathing, sea-voyages, sulphureous mineral waters, and particularly of the good effects derived from the solar warmth. (See *Nosol. Nat.* p. 449.)

Sir A. Cooper, in his account of the treatment of scrofula, dwells more upon the good effects of air, exercise, and nourishment, than upon the virtues of physic. He asserts, that there is no specific for the disease. Medicines, occasionally given for the improvement of the digestive organs, and regulation of the secretions, he admits, are useful; but attention to air, exercise, and diet, he considers far more important. Sometimes, he prescribes, once a week, or every ten days, two grains of calomel, and eight of rhubarb, in order to restore the visceral secretions. A good tonic medicine, for a short time, he observes, is two grains of rhubarb, and from three to five of the carbonate of iron. Another, he says, is two of rhubarb, six of dried subcarbonate of soda, and ten of columba, taken mixed with sugar. He recommends also a few grains of hydrargyrum cum creta, to be taken in the infusion of camomile flowers, at bedtime; or the bichloride of mercury, in the proportion of a grain to two ounces of tincture of bark, of which a tea-spoonful may be taken twice a day in a glass of camomile infusion; or, when costiveness prevails, the tincture of rhubarb may be substituted for that of bark. The liquor potassæ is also enumerated. But the medicines preferred by him are steel, with rhubarb and calomel, or the subcarbonate of soda, with rhubarb and columba.

The local treatment, preferred by Mr. White, has been already described. I have only a few words to add, concerning this part of the subject. Dr. Cullen states, that, in his practice, he had very little success in discussing incipient scrofulous tumours by topical applications; and that a solution of acetate of lead, though sometimes useful, more frequently failed. Dr. Cullen found the liquor ammoniæ acet. not more successful. "Fomentations of every kind (says he) have been frequently found to do harm; and poultices seem only to hurry on a suppuration. I am doubtful, if this last be ever practised with advantage; for scrofulous tumours sometimes spontaneously disappear, but never after any degree of inflammation has come upon them; and, therefore, poultices, which commonly induce inflammation, prevent that discussion of tumours, which might otherwise have happened." Even when scrofulous tumours had advanced towards suppuration, Dr. Cullen thought, that hastening the spontaneous opening, or making one with a lancet, was hurtful.

Formerly, the extirpation of scrofulous tumours was advised; but this method is now considered as being for the most part injudicious, and unnecessary, with the exception of diseased joints, and a few other parts, which frequently require being

amputated, for the sake of saving the patient's life. Certainly, no particular danger (generally speaking) would attend cutting out scrofulous glands, and tumours: the objections to the plan are founded on the pain of the operation; on the number of such glands frequently diseased; on their often subsiding, either spontaneously, or by surgical treatment; on the operation doing no good to the general affection of the system, &c. Wiseman relates, that he was in the habit of cutting out scrofulous glands, and tumours, with great success; but, for reasons already alleged, most of the moderns think such operations in general inadvisable.

Cauties have been employed for the same purpose, instead of the knife; but as they effect the object in view less certainly, more painfully and tediously, and cause extensive ulcers, they are disused by all the best surgeons of the present day.

Some authors advise making issues, and keeping them open, in order to prevent any ill effects from the healing of scrofulous ulcers: issues may, perhaps, be unnecessary for any purpose of this kind; but they are eminently useful as a part of the local treatment of scrofulous joints and abscesses, as we have more particularly explained in the articles JOINTS, LUMBAR ABSCESS, and VERTEBRE.

Mr. Burns notices, that issues have hitherto been chiefly used in diseases of the bones and joints; but, he adds, that it is reasonable to suppose, that they ought likewise to be useful in the cure of enlargements of the glands, and other scrofulous tumours, if inserted in the immediate vicinity of the part. The only objection to their use is the scar which they leave, and which, in certain situations, one would particularly wish to avoid. When the tumour is thickly covered with the integuments, the issue may be made directly over it, and kept open with the savine ointment. In other cases, a small pea issue, or seton, may be inserted by the side of the tumour. This method would be objectionable, for scrofulous glands in the neck, in consequence of the scar; but it might be employed, when the mamma is diseased. (*Dissertations on Inflammation*, vol. ii.) The late Mr. Crowthey used to apply blisters to scrofulous swellings, and maintain a discharge from the part. And a more modern practice is that of producing irritation of the integuments, covering tumours and abscesses, by means of nitrate of silver, or tartar emetic ointment (*Alibert, Nosol. Naturelle*, p. 449; *Goodlad on Diseases of the Absorbents*, p. 162, &c.) The good effects of iodine upon scrofulous tumours and ulcers, both as an internal medicine and local application, seem to be exciting considerable attention. Certain indolent swellings of the testicle and breast, in particular, yield to this powerful medicine.

Iodine, as prescribed by Lugol, is at present in considerable repute. He recommends it to be given in small doses, varying from half a grain to two grains in the 24 hours, dissolved in distilled water, with double its proportion of hydriodate of potash. Lugol also employs iodine in baths and lotions to a much greater extent, than is done in this country. His baths contain about two grains of iodine in each pint of water, and his lotions for scrofulous ulcers, &c. about one grain and a half, dissolved with hydriodate of potash. Hydriodate of potash, with sarsaparilla, is frequently given by Europeans to scrofulous patients, and with mercury. From three to five grains of the

hydriodate, is from two to four ounces of the decoction twice or thrice a day, may be safely tried in a variety of cases. (See IODINE.)

Preparations of lead; cold water; sea-water; weak vegetable acids; æther; linimentum camphoræ; a mixture of æther and laudanum; and hemlock poultices; the unguent. potasse hydriodatis; form a long list of applications, which have been employed for scrofulous tumours.

According to Mr. Burns, moderate pressure, by means of adhesive plaster, conjoined with the application of cold water, is one of the best plans of treating mild scrofulous ulcers, when their situation admits of it. In other cases, he recommends applying a powder, five parts of which consist of cerussa acetata, and the sixth of burnt alum. A piece of dry lint is next to be applied, and a compress, with such pressure as can be borne. Benefit occasionally results from dipping the compress in cold water. Water dressing, or ung. zinci, is an eligible application, when it is wished not to interfere much with the progress of the ulcer. Ung. hydrarg. nitrat. rub. and the ung. hydrarg. nitrat. are amongst the best stimulating ointments. Poultices of bread and sea-water; lotions of alum, sulphate of copper, and the bichloride of mercury; solutions of the nitrates of copper, bismuth, and silver; the recent leaves of the wood-sorrel bruised; lint dipped in lemon-juice, or vinegar and water; a mixture of mercurial ointment and ceratum saponis (*Scott on Chronic Inflammation*, &c.), are among the applications to common scrofulous ulcers.

For irritable sores, diluted hydrosulphuret of ammonia; ointments containing opium; carrot and hemlock poultices; a solution of opium; and carbonic acid gas; have all been recommended.

The following are Mr. Russell's sentiments respecting the treatment of scrofulous ulcers: "Scrofulous complaints in general do not agree well with stimulant applications. In the treatment of scrofulous ulcers under the ordinary circumstances of complaint, the simplest and mildest dressings answer best. When the patients are using a course of sea-bathing, it is usual to wash the sores with sea-water over and above the momentary application of the sea-water during the immersion of the whole body. Cold spring-water is likewise a favourite application with many practitioners; and, from much observation, it appears that the operation of cold is well suited to counteract the state of inflammation, which accompanies scrofulous sores. Preparations of lead are, upon the whole, very convenient and useful applications, provided the solutions be used in a state of sufficient dilution to prevent irritation. Liquid applications are applied by means of wet linen, which is renewed whenever it dries, so that the surface of the sore may be kept constantly moist, when under this course of management. Upon the same principle, simple ointment and Goulard's cerate furnish the best dressing in ordinary cases.

"Scrofulous congestions, of a solid nature, in the more external parts of the body, are little adapted to the practice of local bleeding, unless they be attended with symptoms of inflammation; but as some degree of inflammation is, in general, present during the incipient stage, it may be prudent to employ local bleeding in moderation at the commencement of the attack, although there may be no indication to persist in the practice, after

the complaint has advanced farther in its progress. If, however, these congestions are more of an indolent nature, unaccompanied with heat or pain, there is no benefit to be expected from the local detraction of blood; warm fomentations, together with the use of stimulants, and a repetition of blisters, are the most serviceable class of remedies: such cases, too, are the best adapted to the use of friction as a discutient. Friction, indeed, has long been employed for this purpose; but of late years, it has been introduced to an extent, and with an effect, far beyond the experience of all former practice. As yet, it has been circumscribed to the practice of a few individuals, with whom it is said to have performed very great cures; and if, upon the test of more extensive experience, it is found to answer its present high character, I shall consider the use of repeated frictions to be one of the most valuable improvements which have been introduced into practice in modern times. The safety and simplicity of the practice recommend it strongly to favour, though I am afraid they are the very circumstances which retard its adoption by the public in general. I only regret that I do not feel myself entitled to give a decided opinion upon the subject from my own experience, though I have known some instances of successful cures; but the reports of success are so numerous and so well supported, that I am inclined to think very favourably of the practice.

"There is no substance, interposed between the surface of the swelling and the hand of the person who administers the friction, excepting a little flour, to prevent the abrasion of the skin. The friction is applied regularly two or three hours every day, with great celerity, the hand being made to move to and fro one hundred and twenty times in a minute, and the course may require to be continued, without interruption, for some months." (See *Russell on Scrofula*.) Here I would again recommend to the notice of surgeons, the external use of iodine, as perhaps possessing more efficacy than simple friction. (See *IODINE*.)

Scrofulous affections of the joints are elsewhere explained. (See *JOINTS*.) *Bronchocoele*, *Iodine*, *Lumbar Abscess*, *Noli me tangere*, and *Verrucae*, are other articles, containing matter connected with the preceding observations.

The reader may consult *Wiseman's* Chirurgical Treatises, fol. 1676. *J. Brown*, Adenochirodologia, or an Anatomick-Chirurgical Treatise of Glandules and Strumula, or King's Evil Swellings, together with the Royal Gift of Healing, or Cure thereof by Contact, or Imposition of Hands, &c. 8vo. Lond. 1684. *Wm. Clowes*, A right frutefull and approved Treatise, for the Artificial Cure of the Struma, or Evil, cured by Kings and Queens of England, 4to. Lond. 1602. *Th. Fern*, On the King's Evil. *Cheyne*, On the King's Evil, 8vo. 1709. *R. Russell*, On the Use of Sea-Water in the Diseases of the Glands, &c. 8vo. Lond. 1769. *B. Bell's* Surgery, vol. v. *B. Bell*, On Ulceri Tumor Strumous Colli post vomitorium immixtus, 8vo. (Weikard, Collect. 88.) *Kirkland's* Medical Surgery, vol. ii. Lond. 1783. *J. Morley*, Essay on the Nature and Cure of Scrofulous Disorders, &c. ed. 37. 8vo. Lond. 1790. *White*, On Stuma, ed. ii. 1794. *P. Lalouette*, Traité des Scrofules, &c. Paris, 1780. *A. G. Kortum*, Comment. de Vitio Scrofuloso, in 2 vols. 4to. Lemgovie, 1789. *R. Hamilton*, On Scrofulous Affections, &c. 8vo. Lond. 1791. *S. T. Soemmering*, De Morbis Vasorum Absorbentium Corporis Humani, 8vo. Traj. 1795. *C. W. Hufeland*, Ueber die Natur, &c. der Skrophelkrankheit, 8vo. Jena, 1795. *John Burns*, On Inflammation, vol. ii. *M. Underwood*, On Ulcers, &c. with Hints on Scrofulous Tumours, &c. 8vo. Lond. 1788. *Crother's* Obs. on the Disease of the Joints, commonly called White Swelling; with Remarks on Caries, Necrosis, and Scrofulous Abscesses, &c. ed. 2. 1808. *James Russell*, On Scrofula, 8vo. Edinburgh, 1808. *J. Thomson*, On Inflammation, p. 180, et seq. p. 155-191. &c.

Edinb. 1813. *W. Goodlad*, Essay on the Dis. of the Vessels and Glands of the Absorbent System, 8vo. Lond. 1814. *G. Henning*, A Critical Inquiry into the Pathology of Scrofula, 8vo. Lond. 1815. *Richerand*, Nosographie Chir. t. i. p. 165, et seq. edit. 4. *Bayer*, Traité des Maladies. Chir. t. ii. p. 414, &c. Paris, 1814. *Ch. Bypm*, On Scrofulous Diseases, showing the good Effects of facitious Airs, 8vo. Lond. 1798. *J. Brandish*, Obs. on the Use of Caustic Alkali in Scrofula, and other Chronic Diseases, 8vo. Lond. 1811. *C. Armstrong*, On Scrofula, in which an Account of the Effects of the Carbonas Ammoniacæ is submitted to the Profession, 8vo. Lond. 1812. *W. Lambie*, Inquiry into the Origin, &c. of Constitutional Disorders, particularly Scrofula, Consumption, Cancer, &c. 8vo. Lond. 1805: also Additional Reports on the Effects of a peculiar Regimen in Cases of Cancer, Scrofula, &c. 8vo. Lond. 1815. *R. Carmichael*, Essay on the Nature and Cure of Scrofula, and a Demonstration of its Origin from Disorder of the Digestive Organs, 8vo. Dub. 1810. *J. Rabben*, De præcipuis Causis Mali Scrofulosæ ejusque Remediis efficacissimis Commentatio, 12mo. Gott. 1817. *Albert*, Nosologie Naturelle, p. 448, fol. Paris, 1820. Dict. des Sciences Méd. t. i. art. Scrofules, 8vo. Paris, 1821. *E. A. Lloyd*, On the Nature and Treatment of Scrofula, 8vo. Lond. 1821. *Dr. Cotnudet's* Letter on the Administration of Iodine in Scrofula, in Journ. of Science, &c. vol. xii. Jan. 1822: also his Obs. on the Remarkable Effects of Iodine in Bronchocoele and Scrofula; transl. by *J. B. Johnson*, M. D. Lond. 1821. *Brera*, Saggio Clinico sull' Iodio, &c. 8vo. Padua, 1822. *W. Gibson*, Institutes, &c. of Surgery, vol. i. p. 249, &c. 8vo. Philadelphia, 1824. By the kindness of the author, I have just received a fifth edition of this work. *W. P. Alison*, in Edinb. Med. Chir. Trans. vol. i. Edinb. 1824. *A. Manson*, On the Effects of Iodine, 8vo. Lond. 1825. *J. Scott*, On Chronic Inflammation, 8vo. Lond. 1853. *T. Buchanan*, On a new mode of Treatment for Diseased Glands, 8vo. Lond. 1828. *J. G. A. Lugol*, Trois Mém. sur l'Emploi de l'Iode dans les Maladies Scrofuleuses, 8vo. Paris, 1829, 1830, 1832. *Camin*, in Cyclop. of Pract. Med.; art. Scrophula. *Lepelletier*, Sur la Maladie scrophuleuse, 8vo. Paris, 1830. *A. C. Baudouin*, Etudes sur la Maladie Scrophuleuse, 8vo. Paris, 1834. *Robert Carswell*, M. D. Illustrations of the Elementary Forms of Disease, 4to. Lond. fasc. 1.

SCROTOCELE. (From *scrotum*, and *κῆλη*, a tumour.) A rupture, or hernia in the scrotum. **SCROTUM CANCER OF.** (*Chimney-sweeper's Cancer. The Soot-wart.*) This peculiar disorder, which commences as a wart-like excrescence, is described by Mr. Pott, as always making its first attack on, and its first appearance in, the inferior part of the scrotum; where it produces a superficial, painful, ragged, ill-looking sore, with hard and rising edges. He never saw it in persons under the age of puberty. According to Mr. Earle's observations, it very rarely attacks persons under the age of thirty. Most of the cases, seen by him, were in individuals between the ages of thirty and forty. He has seen three instances in subjects between twenty and thirty; but only one at the age of puberty. A single case is mentioned by Sir J. Earle, which happened in a child under eight years of age. I have seen one case in a boy not more than sixteen. (*Med. Chir. Trans.* vol. xii. p. 299.) Sir Astley Cooper has known the disease occur at various ages from twenty to eighty.

In no great length of time, the disease pervades the skin and membranes of the scrotum, and seizes the testicle, which it enlarges, hardens, and renders truly and thoroughly distempered; from whence it makes its way up the spermatic chord into the abdomen, where it affects some of the viscera, or glands, and then soon becomes painfully destructive. (*Pott*.) Not only is the discharge from the sore very fetid, but the perspiration from the whole body has a peculiar and an ammoniacal smell. (*Earle*, in *Med. Chir. Trans.* vol. xii. p. 298.)

"Other people, besides chimney-sweepers, (says Pott) have cancers of the same part; and so have others, besides lead-workers, the Poitoun colic, and the consequent paralysis: but it is nevertheless a

disease to which they are peculiarly liable; and so are chimney-sweepers to the cancer of the scrotum and testicles."

Workmen, exposed to the fumes of arsenic, are said to be liable to a cancerous disease of the scrotum, resembling that which infests chimney-sweepers. This is particularly the case with the smelters in Cornwall. (See *Paris's Pharmacologia*, p. 89. vol. ii. ed. 5.) If the two diseases are precisely similar, the fact is particularly interesting with regard to the cause of the complaint, which has been referred to the irritation of soot, and this alope, in a supposed peculiar condition of constitution, not defined, nor indeed at all understood.

From the great number of persons who pursue the occupation of sweeping chimneys, and the comparatively few affected by the application of soot, "it would appear, that there is something either in the constitution, or the parts of some individuals, which disposes to its production. I am inclined to believe (Sir Astley Cooper adds), that it depends more upon local circumstances, than upon the constitution, because the subjects of it appear to be very healthy at the dawn of the disease, although they lose that health in the progress of the complaint." (*On Dis. of the Testis*, p. 229.)

Mr. Pott describes the disease as always beginning at the lower part of the scrotum; but there are exceptions. Sir James Earle has recorded an instance of its occurrence on the wrist of a gardener, who had been employed in distributing soot for the destruction of slugs; and some cases have taken place on the face. (*H. Earle, in Med. Chir. Trans.* vol. xii. p. 297.) Sir Astley Cooper has seen it on the face of an old person, whose cheeks were full of wrinkles, calculated to afford a lodgment for soot. Mr. Keate met with a similar case. One circumstance is noticed by Mr. Earle, which, if it prove generally correct, materially influences the prognosis and treatment: he says, "The inguinal glands are often enlarged, but they will generally subside on the removal of the diseased scrotum; clearly proving that the disease is not commonly communicated in the course of the absorbents." (P. 298.) He knows only one exception to this statement; a case, where a bubo formed, suppurated, and assumed the same characters, as the primary affection in the scrotum. According to Mr. Travers, the lymphatic glands are seldom specifically affected. (*Med. Chir. Trans.* vol. xvii. p. 345.)

If there be any chance of putting a stop to, or preventing this mischief, says Mr. Pott, it must be by the immediate removal of the part affected; namely, that part of the scrotum where the sore is; for, if it be suffered to remain until the testicle is affected, it is generally too late even for castration. "I have many times made the experiment; but though the sores, after such operation, have, in some instances, healed kindly, and the patients have gone from the hospital seemingly well, yet, in the space of a few months, it has generally happened, that they have returned either with the same disease in the other testicle, or in the glands of the groin, or with such wan complexions, such pale leaden countenances, such a total loss of strength, and such frequent and acute intermitting pains, as have sufficiently proved a diseased state of some of the viscera; and which have sometimes followed by a painful death." (Pott.)

Mr. Travers's prognosis is less encouraging, for, says he, "The disease returns after extensive re-

moval." That it does so sometimes is unquestionable; but that it does so always, is not what my experience teaches me. Some of Mr. Travers's patients appear to have fallen victims, not to a return of the disease itself, but to scrofulous tubercles of the lungs, or peritoneum. (See *Med. Chir. Trans.* vol. xvii. p. 345, 346.)

Mr. Earle concurs with Sir Astley Cooper, that no topical applications, nor internal medicines, have the slightest influence over the disease. The scalpel, he says, is the only resource; and it may be employed with confidence, provided the whole of the diseased mass can be removed. Even when the inguinal glands are enlarged, he inculcates the same practice. Also, when the testicle is affected, provided the spermatic chord is sound, he conceives, that it is right to give the patient the chance of recovering; and, notwithstanding the discouraging results of Mr. Pott's operations in this stage of the disease, he has known the attempt succeed in two cases, in which no relapse had happened several years afterwards.

Sir Astley Cooper does not consider enlarged glands in the groin a positive prohibition of the operation, "as they are sometimes increased from simple irritation only; and, as the removal of a portion of the scrotum is little painful, soon performed, and unattended with danger, the patient should have this chance of recovery given him. If the tunica vaginalis participate in the disease, it will require great care in its removal to prevent injuring of the testis." (*Op. cit.* p. 230.)

The following case, which was under my care in University College Hospital, is replete with instruction. Frederick Leith, admitted September 26, 1837; a married chimney-sweeper, aged twenty-three, and of very intemperate habits. About five years prior to this date, he noticed a small pimple, or wart, on the anterior part of the scrotum, accompanied by intense itching, which obliged him frequently to scratch the part. The little wart-like induration increased considerably in size, and in two years ulcerated. The ulceration proceeded slowly, till about nine months before his admission into the hospital, when, happening to place himself under the care of a practitioner, who suspected the disease to be syphilitic, he was severely salivated, and the ulcer then began to enlarge, and continued to do so down to the time of his coming under my notice. At this period, the following circumstances were remarked. A large irregular ulcer was seen at the lower and anterior part of the scrotum, with elevated, hard, and red margins, which were in some parts very thick. The centre of it was occupied by a foul adherent greenish slough. The ulcer discharged copiously a thin, purulent, offensive fluid. The rest of the scrotum was hot, red, and somewhat swollen, and at several points little fleshy excrescences were seen, which the patient said resembled that which had changed into this foul, ill-conditioned ulcer. There was much itching and burning felt, and occasionally an acute lancinating pain was experienced, which however did not extend to the groin. The spermatic cords were free from induration, and the testes were sound; and, though some enlargement of one or two of the inguinal glands might be perceived, they were not at all painful, and, according to the patient's account, they sometimes entirely subsided. The general health was moderately good—the pulse 104—the tongue

clean—appetite good, and the bowels were regular. The diluted solution of the chloride of soda was applied, and aperient medicine prescribed.

Oct. 3. Hoping that the disease had not yet seriously implicated the inguinal glands, and that the swelling of them was merely from irritation, and a manual examination of the abdomen, joined with a consideration of the man's general health, having convinced me that the lumbar glands were sound, I decided to remove the ulcerated part of the scrotum, and indeed the greater portion of it; for there were several warty indurations at various points of it, more or less distant from the ulcer. The testes having been held up by Mr. Quain, and a catheter introduced to inform us of the precise situation of the urethra in the performance of the deeper incisions, two semilunar incisions were made, which joining together circumscribed the disease, which was then carefully dissected out. Owing to an adhesion and induration of the left tunica vaginalis, a part of it was necessarily removed, and the testes exposed. No vessels required ligature. As the loss of substance was too great to admit of the edges of the wound being brought together, the part was simply covered with the water dressing, and the patient conveyed back to his bed, with directions that he should take an anodyne, if he suffered much pain.

Oct. 22. Went on without any untoward event till this day, when some tenderness was experienced in the right groin, followed by an erysipelatous blush of the skin, which, however, subsided under the beneficial influence of purgatives and cold applications. The case then advanced favourably for three or four days; at the end of which I found that the patient had suffered great pain in the right groin, where the skin had become reddened, and the glands swollen and indurated; whether from mere irritation, or a commencement of the disease, seemed now doubtful. By means of the repeated applications of leeches, and the use of calomel aperients, and other antiphlogistic means, however, the inflammation was soon reduced, and an abscess which formed healed up without difficulty, and the patient left the hospital cured. This case exemplifies several well ascertained facts, relative to chimney-sweeper's cancer, or cancer scroti.

1. The usual commencement of the disease, about or a little before puberty; its occurrence in younger subjects being so rare, that Pott never noticed it but in one instance shown to him by the late Sir James Earle.

2. The usual beginning of the disease at the anterior, or inferior part of the scrotum, in the form of a small lump, or induration.

3. The painful, ragged, ill-looking nature of the ulcer, surrounded by hard rising edges.

4. The occasional presence of one or more indurations, fleshy growths, or soot warts, on other points of the scrotum. When these are very small and superficial, with a narrow base, I believe that they are sometimes picked off, and that the parts may then heal. In other instances, they reach more deeply, and advance to cancerous ulceration.

5. The absolute locality of the disease, until it has so implicated the spermatic cord, the inguinal, or lumbar glands, or viscera, that the same kind of disease has been extended to them. That is to say, it is not dependant upon, or originally connected with, that unfavourable kind of constitution which attends ordinary cancer; and therefore if the

whole of the disease admits of being cut away, the patient will not suffer a relapse. This is so true, that patients have recovered permanently, although it has been necessary to remove a part of, or the whole of the testes. Sir Astley Cooper informed me, that he has in some instances taken away a portion of the testicle together with the diseased part of the scrotum. In my case, a portion of the tunica vaginalis was removed.

See Pott's Works, vol. iii. edit. by Earle. Also W. Simmons's Obs. on Lithotomy, to which are added Obs. on Chimney-sweepers' Cancer. 8vo. Manchester, 1808. H. Earle, On Chimney-sweepers' Cancer, in Med. Chir. Trans. vol. xii. p. 206. &c. Benj. Travers, Op. cit. vol. xii. p. 344. Sir Astley Cooper, On the Structure and Diseases of the Testis, 4to. Lond. 1830.

SCROTUM, *Sarcomatous Thickening and Enlargement of*. The investigations of Baron Larrey lead him to believe, that cases of enormous growth of the scrotum are endemial in warm countries, or, at least, that they are seldom observed in cold climates; since most of the examples, which have been seen in Europe, came from Asia and Africa. With the exception of the case, on which Mr. Liston operated, the scrotal tumour of Delacroix, formerly minister of external relations, is considered by Larrey as perhaps the only well authenticated instance of the origin of such a disease in our own climate; and it was also much smaller than the instances related in the *Ephemerides German.* for the year 1692, in the surgical writings of Dionis, in the 9th vol. of the *Bibliothèque de Médecine*, and those which Larrey met with in Egypt. The smallest of these latter, after they had attained their full size, weighed more than 25 kilograms (between 60 and 70 pounds). Many instances of this curious disease are recorded, particularly by Dr. Cheston, Dr. Titley, and the celebrated Sandifort. I remember in Mr. Abernethy's museum a considerable fleshy substance, which was a portion of hypertrophied scrotum.

The tumour, removed by Mr. Liston, is believed by him to be the only case, which ever occurred in a resident native of these islands. (See *Liston's Practical Surgery*, p. 289.)

In the cases, which Larrey had an opportunity of seeing in Egypt, the fleshy mass, into which the scrotum was converted, was broad below, and suspended from the pubes by a sort of pedicle. "Externally the tumour presents rugosities of different sizes, separated by particular lines, or sinuses, to which the mucous cryptæ and roots of the hairs correspond. Upon a large portion of its surface, especially when the case is of long standing, yellowish scaly crusts are always seen, the detachment of which constantly leaves so many small herpetic ulcers, emitting an ichorous discharge. The tumour is indolent, and hard at some points, but softish at others. It may be handled and pressed in different directions, without the least pain. The patient is only incommoded by its weight, and the impediment which it causes to his walking well. Hence he is necessitated to employ a suspensory bandage. In consequence of the situation of the urethra, the urine dribbles over the swelling; but without causing any excoriation." In most of the cases, seen by Larrey, the spermatic chord and testicles were in the natural state, situated at the sides and at the root of the swelling. The spermatic vessels, however, were somewhat enlarged and elongated. All the

patients were likewise more or less affected with elephantiasis.

Baron Larrey attempts to explain the causes of the complaint in Egypt, but, as I think, without any degree of success. As the affection is seldom seen in cold countries, climate has certainly a chief effect. Employments which keep persons a good deal in a sitting posture; the loose breeches worn by the Egyptians, and the consequently pendulous state of the scrotum; diseases of the humours, and particularly itchy pustules on the part, an ordinary consequence of syphilis in that country; bad regimen; abuse of venery; and the immoderate use of the warm bath; are merely conjectures, which will not bear the test of reasoning.

The enormous magnitude, which this sort of disease may attain, is almost incredible. The case, recorded in the *Ephemerides German.* weighed about a hundred kilograms, or more than two hundred weight. Another, described by Larrey, was calculated to weigh about one hundred and twenty pounds; and this surgeon likewise saw in Egypt ten or twelve more instances, nearly as large, and all of the same character.

A curious example, in which a similar disease affected the labia pudendi in a surprising degree, is also detailed by Larrey. The woman was a native of Cairo.

In the early stage of the disorder, we may try preparations of antimony combined with sudorifics; drinks acidulated with sulphuric acid; lotions containing the same acid, or the bichloride of mercury, the oxide of copper, or the chloride of ammonia. These means are to be assisted by a gradual, uniform compression of the whole tumour. In one case, incisions, and the application of caustic, proved of no service, and Larrey very properly condemns all such experiments.

When the disease resists every plan tried for its relief, and its increase renders the patient's life irksome and wretched, the extirpation of the tumour with a knife becomes proper. In this proceeding, the chief skill consists in doing no injury to the spermatic chords and testicles, which are in general perfectly sound. As the substance of the swelling is not furnished with very large vessels, the hemorrhage need not be feared. Care must also be taken not to injure the corpora cavernosa penis, and the urethra. After the operation, the skin is to be brought over the exposed testicles, as much as possible, with adhesive plaster and a bandage. If they could not be covered, we know, that a new kind of scrotum may be formed by the granulating process; so that this consideration alone is not a valid reason for cutting away the healthy testes.

M. Delonnes successfully removed the diseased mass in the celebrated case of the French minister Delacroix, and Larrey performed the same operation with success when he was in Egypt. Dr. Titley, of the island of St. Christopher, also cut away such a tumour, which weighed seventy lbs., and the patient, who was a negro, and also affected with elephantiasis, speedily recovered. (See *Med. Chir. Trans.* vol. vi. p. 73, &c.) The case of the Chinese operated upon by Mr. Aston Key, in Guy's Hospital, had a quickly fatal result, the patient not having had stamina sufficient to endure the requisite proceeding.

In Mr. Liston's example, the tumour had been growing for twelve years, in a patient about twenty-two or twenty-three years of age. The

operation was performed many years ago, and the patient now enjoys perfect health. "It was impossible (Mr. Liston observes) to say where the organs of generation were placed in the mass; if they could have been found and saved, I should not have been able to cover them; they would thus have been totally unserviceable." I think, however, that nature would soon have formed a new investment for them, as she often does where the scrotum sloughs away from effusion of urine. The mass was detached from the perineum and pubes, together with the testes, and two inches of the penis. About sixteen arteries were tied. The tumour weighed nearly fifty pounds, and is preserved in Mr. Liston's collection. (*Op. cit.* p. 290.)

Probably some of the cases, which occur in warm countries, are analogous to elephantiasis; one weighing one hundred and ten pounds, and successfully removed by Clot-Bey, is stated to have been of this nature (see *Travaux de l'Ecole de Méd. d'Abou Zabel, Egypte*, p. 131. 8vo. Paris, 1833); but I do not believe that the scaly incrustations, which are represented by this distinguished individual, and also by Baron Larrey, as having occurred in the cases which they saw in Egypt, have always been noticed in the instances which have taken place in colder countries. Nor, indeed, did they take place in the instance recorded by Dr. Titley.

Delpéch gives an account of a patient, aged thirty-five, a native of Perpignan, whose scrotum was converted into an enormous mass, weighing sixty French pounds, in which the penis, the spermatic chords, and the testicles were completely buried. The swelling was nearly pyriform, flattened transversely, divided at its lower front part into three principal lobes, and reached downwards below the calf of the leg. Behind, it formed a vast projection; and it was attached to the perineum and hypogastric region by a neck, or pedicle, that occupied the whole space comprised between the pubes, the two groins, and the anus. The circumference of the pedicle, at its narrowest part, was eighteen French inches. The patient could neither walk nor stand, without much difficulty. Although the organs of generation were buried in the manner thus specified, erections and seminal emissions occasionally took place. Some parts of the integuments were tuberculated; and in the interior lobe of the swelling, which was like a cauliflower excrescence, there was a transverse fissure, at the bottom of which was a deep sinus, running upwards and rather to the left: such was the state of the prepuce and passage, through which the urine was discharged. For the particulars of the operation, by which this enormous mass was removed, so as to leave two lateral flaps of sound skin for covering the testicles, I must refer to *Chir. Clinique de Montpellier*, t. ii. 4to. 1828. The extent of the wound may be conceived, when it is stated, that the external pudendal artery, the artery of the septum scroti, the dorsal arteries of the penis, the transverse artery of the perineum, the right and left arteries of the bulb, and several branches of the inferior hemorrhoidal, required ligatures, the ends of which M. Delpéch cut off, in order that the extraneous matter in the wound might be lessened. Owing to the prodigious elongation of the spermatic chords, it was necessary to arrange them after the operation in a tortuous form, and some difficulty was experienced in fixing the testicles in their proper situation. The wound was

completely cured in about two months; and the patient returned to Perpignan; where, in the course of a few weeks, he became indisposed, and died. On opening the body, a very large abscess was detected in the liver. Must this be regarded as a consequence of the extensive wound, inflicted in the operation, or, as the result of the patient's excesses after the wound had healed? If the former view be adopted, it is another confirmation of the frequency of visceral inflammations and suppurations after severe local injuries, or great operations; a subject, on which much interesting matter may be collected from the Memoirs of the Royal Academy of Surgery; the papers of Messrs. Rose and Arnott in the *Medico-Chir. Trans.* of London; and the great work of Cruveilhier, on *Pathological Anatomy*.

With regard to the nature of the tumour, Delpech contends, that it presented an example of true elephantiasis of the scrotum; a point on which many practitioners will disagree with him. The following circumstance relative to the structure and composition of the swelling, are noticed: The skin of its anterior part was not less than three inches thick; and the inequalities, observable upon every portion of it, were here greatest. Notwithstanding the discolorations, which the skin exhibited in places, where it was most deeply affected, the incisions in it bled very little; few vessels of considerable size were met with, and not a single varicose vein. The cellular tissue was manifestly every where distended; its lamellæ were lengthened, and included very large cells; most of them were semi-opaque, and of a white pearl-colour, which change is ascribed to an inflammatory process that had thickened them. The areolæ of this tissue, besides being very dense, contained a serosity, a part of which flowed out in the operation, while the rest, in consequence of its greater consistence, did not escape from the cells, though they were opened. Both contained a large proportion of albumen, and were coagulated by heat or acids. Blood-vessels were seen ramifying in this tissue; but they were not numerous, and only of small size. The lymphatics were plainly discernible in great numbers, and of considerable diameter. In front of the spermatic chord, some fat was found, the only situation in which it presented itself; and here its accumulation made Delpech suspect, for a little while, that there was an omental hernia, with a very thin transparent sac. The cremaster seemed to have preserved the spermatic chord completely from the disease.

To the preceding history, Professor Delpech has annexed the case of, what he terms, an elephantiasis of the female sexual organs, removed by Dr. Talrich, of Perpignan. The disease, which originated just below the mons veneris, hung down as low as three inches above her knees, and unless it was pushed towards the naval, rendered the evacuation of the urine difficult. It involved the labia, especially the right one; and the clitoris, which was considerably elongated by the weight of the swelling, was concealed under its roof. I do not adopt the view taken by Delpech of this swelling, which he contends was that of elephantiasis. Whoever will compare the description of the disease with the history of elephantiasis (see *Good's Study of Medicine*, vol. ii. p. 326, ed. 4.) will see few points of resemblance between them.

Larrey, Mém. de Chir. Militaire, t. ii. p. 110, et seq. *Richerand, Nosographie Chir.* t. ii. p. 314, &c. ed. 4. *Delonnes' Mém. &c. Cheston's Case, &c. Med. Chir. Trans.* vol. vi. *Delpech, Chirurgie Clinique*, t. ii. 4to. 1838; p. 239. *R. Liston's Practical Surgery*, 8vo. Lond. 1837.

SEARCHING. The operation of introducing a metallic instrument, through the urethra, into the bladder, for the purpose of ascertaining whether the patient has a stone or not. (See **SOUNDING**.)

SETON. A kind of issue, usually made by means of a flat needle, from half an inch to nearly an inch in breadth. The needle is commonly a little curved. From the point, to its broadest part, it is double-edged, and, behind, it has a transverse eye, through which a skein of thread or silk is placed. A fold of skin is pinched up, at the part where the seton is designed to be made, and the needle is pushed through it, together with the skein of thread, which is first dipped in sweet oil. The instrument is not to be introduced too low into the base of the fold, nor too high, near its edge. In the first case, the muscles, and parts, which ought to be avoided, might be wounded; in the second, the interspace between the two wounds would be narrow, and the seton soon make its way through it.

When no seton-needle is at hand, the fold of the skin may be punctured with a lancet, and the skein of thread introduced by means of an eye-probe. A seton may be applied almost to any part of the surface of the body, when circumstances require it; but, one of its openings should always be made lower than the other, that the matter may readily flow out. The skein of thread is to remain untouched, for a few days after the operation, until the suppuration loosens it. Afterwards, the part of the thread, nearest the wound, is to be smeared with oil, white cerate, or any common ointment, and drawn under the interspace between the two wounds, and what was there before is to be cut off. The seton is to be drawn in this manner once or twice a day, according as the quantity of matter may require. A new skein of silk, or thread, is to be attached to the preceding one, as often as necessary. Care is to be taken to keep the thread on the outside of the wound well covered, and free from the discharge, which would make it stiff and hard, and apt to occasion pain and bleeding on being drawn into the wound. If the discharge should be deficient in quantity, powdered cantharides or savine may be mixed with the ointment. A neater, and less troublesome kind of seton, is that in which a thin, smooth slip of elastic gum is employed, instead of silk. The elastic gum tape is generally about four inches long, and half an inch wide; the needle for conveying it through the integuments has no eye, but takes hold of it in the manner of a pair of forceps. This kind of seton has the recommendation of being less painful than the common one, more cleanly, and does not require the repetition of the disagreeable operation of changing the silk. When it is wished to render it more irritating, the elastic gum slip may be drawn a little out of either opening, and smeared with savine ointment.

SHINGLES. See **HERPES**.

SIGHT, DEFECTS OF. There are persons, who, from their infancy, are incapable of distinguishing one colour from another. A man who was affected with this infirmity, could not distinguish green at all. Green and red appeared to him the

same. Yellow and blue he could discern very well. With regard to dark red and dark blue, he frequently made mistakes. In other respects, his vision was sound and acute. The father of this patient was afflicted with the same infirmity. The mother and one sister were free from it. Another sister and two of her children had it. The patient himself had two children, who did not labour under the disorder. (See *Phil. Trans.* vol. lxviii. part 2.) Another subject, whose eyes were in other respects healthy, and whose eye-sight was sharp, could not distinguish a dark green from a dark red.

An interesting example of this curious imperfection of vision has been published by Dr. Nicholl, of Cowbridge. (See *Med. Chir. Trans.* vol. vii. p. 477, &c.) The subject was a healthy boy, eleven years of age, whose eyes were grey, with a yellow tinge surrounding the pupil. He never called any colour green. Dark bottle-green he called brown. He could distinguish light yellow; but darker yellows and light browns he confounded with red. Dark brown he mistook for black. Pale green he called light red; common green he termed red. Light red and pink he called light blue. Red he called by its proper name. He could distinguish blue, both dark and light. On the mother's side, the boy had some relations whose sight was similarly affected.—An interesting chapter on what is termed *coloured vision* will be found in *Wardrop's Essays on the Morbid Anatomy of the Human Eye*, vol. ii. p. 196. 8vo. Lond. 1818.

Sometimes, objects appear to the eye to be of a different colour from what they really are, not because there is any thing wrong in the eye itself, but in consequence of the unclear and coloured light by which the object is illuminated. Thus, for instance, a bad tallow candle, which emits a yellow flame, makes every thing appear yellow. When brandy is burning, all objects appear blue. In short, it is only by the light of the sun, that any object can be seen in its clear natural hue. In certain cases, the infirmity is owing to the transparent parts and humours of the eye, which do not happen to be of a proper colour. Thus, persons having the jaundice in a high degree see all things yellow, because the transparent parts of the eye are of that colour. When, in consequence of external violence applied to the eye, blood is effused, and the aqueous humour rendered red by this fluid, all objects seem to the patient to be red; and white, when the aqueous humour has been made of this colour by the couching of a milky cataract. Sometimes this defect in vision is ascribable to the duration of an impression. When one has surveyed a bright-coloured object a long while—as for example a bright red or yellow wall, on which the sun shines, that colour will often remain a good while before the eyes, although one may not be looking any more at an object of this hue. There are some eyes, which seem much disposed to retain the impression of objects, which are not very bright-coloured; but such a disposition always betrays great weakness and irritability of those organs. The most frequent cause of this defect in vision, is an irritation operating upon the optic nerves, so as to produce the irritability in them, which alone makes objects appear of one colour. The seat of such irritation, according to Richter, is also most commonly in the abdominal

viscera, and the case demands evacuations, tonics, and anodyne medicines. But the disorder may also originate from other causes. The operation of bright-coloured or shining objects upon the eye, sometimes has, for a certain time afterwards, the effect of making objects of diverse colours appear to be moving before the eyes. In extreme terror, or fright, things may also seem to have a different colour from their real one. The same often happens in fevers attended with delirium. In one instance a sudden exposure of the head to cold, at a period when it was perspiring much, caused many coloured appearances before the eyes; but the disorder subsided in a couple of days. (*Richter, Anfangsgr. der Wundarsn.* b. iii. p. 523.)

Also a healthy eye sees a distant object with uncertainty and error, in a room, or space, the extent, length, and breadth of which are unknown, when the size of the object itself is unascertained, and when there are few or no other objects intervening at a smaller distance between the eye and the thing looked at. The more numerous the objects are between the eye and the principal thing looked at, the more distant it is made to appear; the fewer they are, the nearer it seems to be. In a country covered with snow, and upon the sea, very distant objects appear to be close. The smaller an object is to the eye, in relation to its known magnitude, the further off it seems. The errors which the eye makes, in regard to the distance of objects, also tend to deceive. But, there are certain cases, in which the eye is almost entirely incapable of judging of the distance of objects. The first is, when the object, of which we wish to ascertain the distance, is looked at with only one eye. Hence, all one-eyed persons, and persons affected with strabismus, are unable to judge well of the real distance of objects. However, they are only so for a certain time; and by practice, they gradually acquire the faculty. Even when two eyes are employed, it requires some exercise, in order to enable them to judge of the right distance of objects. Persons, born blind, but who have their sight restored in both eyes by the operation for the cataract, are a long while incapable of judging of distances, and only obtain this power very gradually. Lastly, this infirmity is sometimes owing to an irritation affecting the optic nerves, whereby their sensibility is so altered, that distant objects make the impression upon them of near ones. In this circumstance, all objects appear to the patient closer than they really are. This is the only case which admits of being treated as a disease. The irritation producing the disorder, is often supposed to be seated in the abdominal viscera, and requires evacuations, and such medicines as invigorate the nerves. A suppression of perspiration is alleged to be sometimes a cause. (*Richter, Op. cit.* b. iii. p. 525.)

A sound eye likewise does not always judge with accuracy and uniformity of the magnitude of objects. This may arise from three causes. In order to judge rightly of the size of any thing, its precise distance must be known; for, the more remote it is, the smaller will it seem to the eye. Hence, any conjecture respecting the magnitude of an object, is constantly erroneous, unless the distance be ascertained. Size is invariably something relative. A single large object, surrounded by many small ones, always appears to be larger than it really is; et vice versa. An object whose

magnitude is known seems smaller than it actually is, when one has been a little previously looking at another that is still larger. Lastly, the refraction of the rays of light in the eye, by which operation an object is made to appear large or small, is not always accomplished in the same degree, as the eye is not at all times equally full and distended with its humours. Hence, at one time, the same object will appear to the same eye, and at the same distance larger; at another time smaller. Sometimes, however, the eye judges so erroneously of the magnitude of objects, that there is reason for regarding the case as an infirmity, or disease. It is for the most part owing to a defective sensibility in the nerves, caused by some species of irritation acting upon the eye, and generally seated in the gastric organs. A man to whom every thing seemed one-half smaller and nearer than it really was, was cured by means of an emetic, bark, an issue, and valerian. (*Leutin, Obs. Fascic.*)

Sometimes to the eye, under circumstances of disease, straight lines appear serpentine; perpendicular objects, sloping; things standing upright, to be inverted, &c. The son of a distinguished artist began, when seven years old, to learn drawing under his father, who was much surprised to find all the objects, which the young pupil represented, drawn upside down. It was at first supposed, that the child might be practising this inversion of objects in joke; but, he affirmed, that the things were drawn exactly as they appeared to him, and there was no reason to doubt his word. Whenever an object was turned before he took a sketch of it, he represented it in the natural position, showing that the sensation received by the eye corresponded perfectly with the inversion formed on the retina. This state of vision ceased at the end of a year. (*Sec Journ. Univers. des Sciences Méd. Fév. 1828.*) All the preceding cases are set down by Richter as depending upon a wrong sensibility of the nerves, occasioned by the effect of some irritation. The irritation, he says, may be of many kinds; but experience proves, that it is mostly seated in the gastric organs. These defects of sight may generally be cured by first exhibiting emetics and purgatives, and afterwards having recourse to remedies for strengthening the nerves—bark, ammonia, valerian, issues, &c. One mark of a very weak and irritable eye, is when objects, after being looked at a good while, and presenting a right appearance, begin to move, swim about, mix together, and, at length become quite undistinguishable. This principally happens when the objects regarded are small and strongly illuminated. Here such remedies, both general and topical, as have the effect of invigorating the nerves, are indicated. However, sometimes the infirmity is partly owing to the operation of some species of irritation, which will require removal, ere the tonic medicines and applications can avail. Indeed, in particular cases, the dispersion of such irritation is alone sufficient to accomplish a cure.

Sometimes, all objects appear to the eye, as if they were in a more or less dense mist. This defect in vision is always owing either to some slight opacity of one of the humours of the eye, or to excessive debility of the optic nerves. (*See Richter, Anfanggr. der Wundarz. b. 3. p. 251., &c.*)

SINUS. A long, narrow passage, or canal,

discharging from time to time purulent matter, and leading from some abscess, diseased bone, &c.

SILVER, NITRATE OF. (*Lunar Caustic.*) One of the best of the milder caustics. Its utility in stimulating indolent ulcers, and keeping granulations from rising too much, is well known to every surgeon. Mr. Hunter sanctions its application in the early stage of a chancre, while absorption of the syphilitic virus may not yet have taken place. He directs the caustic to be scraped to a point, like a black-lead pencil; every part of the chancre to be touched with it, and the repetition of this process till the last slough thrown off leaves the sore florid and healthy. The plan has been advocated by many other surgeons, in the hope that it may lessen the chance of the constitution becoming affected; and it is occasionally resorted to by those who use mercury, as well as by others who trust to other means for the cure of the venereal disease.

The important use of the nitrate of silver in the cure of numerous diseases, which fall under the care of surgeons, I have noticed in various articles of this work. The late professor Delpsch believed that it had greater power than any other escharotic or stimulant in expediting the process of cicatrisation. I entertain the same belief. Its efficacy in the relief and cure of many diseases of the eye, may be learned from the explanations given in the articles CORNEA, IRIS, OPHTHALMY, &c. As an application to this organ, it is used either in substance, or in the form of a lotion, or of the black ointment, containing from ten to twenty grains of the nitrate to each drachm of lard. Some examples of lupus, or *noli me tangere*, are benefited by the nitrate of silver, and a strong solution of it agrees well with certain obstinate ulcerations, which occur round the roots of the nails of the fingers and toes. The lotion is sometimes applied by means of a camel-hair brush; sometimes by means of lint; sometimes with a syringe; and occasionally by dropping it on the part, as for instance the eye.

In an interesting "*Essay on the Use of Nitrate of Silver*, ed. 2, 8vo., London, 1829," Mr. Higginbottom notices its influence in subduing inflammatory action. That it "should subdue the inflammation of phlegmon, or of a line of inflamed absorbents, arrest the spreading of erysipelas, prevent and modify the formation of pus (says he) are facts I believe totally new." In some cases of external inflammation, he finds it sufficient merely to blacken the cuticle; in others, it is necessary to produce a degree of vesication. In some instances, the application has appeared to prevent suppuration; in others, a plainly fluctuating fluid has been absorbed. Mr. Higginbottom throws out a suggestion, that the application may prove useful also in internal inflammation, by inducing prompt vesication over the inflamed part, or even without it. But, for a particular account of its use in phlegmonous inflammation, whitlow, erysipelas, inflammation of the absorbents, wounds, ulcers, burns, and cases of hard painful cicatrix from the latter injuries, I must refer to this gentleman's publication, in which will also be found observations on its employment, in examples of diseased joints, inflammation of the urethra, neuralgia, contracted rectum, ulceration of the tongue, eye, and navel of infants, and corns. In University College Hospital, I often employ it as a means

of checking the extension of erysipelas, which sometimes will not pass beyond a black line made with it. Its use in strictures, and many of the cases here specified, are further explained in other parts of this DICTIONARY.

SOUND. An instrument, which surgeons introduce through the urethra into the bladder, in order to discover, whether there is a stone in this viscus or not. The sound is made of highly polished steel, in order that it may convey to the surgeon's fingers the sensation of any thing against which its end may strike. It is also generally rather less curved than a catheter, so that its extremity may be more easily inclined to the lower part of the bladder, where the stone is most frequently situated. However, some practitioners occasionally employ a sound, which is straight, except a small portion of it near the back, which, after the introduction of the instrument, is turned down to either side, so as to touch any calculus lodged just behind the prostate gland.

SOUNDING. The operation of introducing the foregoing instrument. Sounds are generally introduced much in the same way as catheters, either with the concavity towards the abdomen, or the convexity; in which last method it is necessary, as soon as the beak of the sound has arrived in the perineum, to bring the handle of the instrument downward by a semicircular movement to the right, while the other end is kept as much fixed as possible. This is what the French term the *coup or tour de maître*; a plan less often followed at the present day than formerly, because, except in very corpulent subjects, it has no particular recommendation; and, even in such individuals the inconvenience of the protuberant hypogastric region may be avoided, by inclining the handle in the first stage of the operation towards the patient's left groin.

When a patient is to be sounded, he is usually put in a posture very similar to that adopted in the lateral operation for the stone, with the exception that he is not bound in this position, as there is sometimes an advantage in making the patient stand up, in order that the stone may come into contact with the end of the sound. The instrument having been introduced, its extremity is to be turned, and moved in every direction, when, if there be a calculus, its presence will usually be indicated by the collision against the beak of the sound. When the symptoms afford strong evidence of the presence of a stone, which cannot be detected in these ways, the patient should be sounded, while his pelvis is raised up, and his chest depressed. He should also be sounded both in the full and empty state of the bladder; and both in the erect and recumbent positions; with sounds and catheters of different shapes.

Stones have sometimes been found in the bladder after death, although they could never be discovered with a sound while the patient was alive, suffering all the symptoms of the complaint. The celebrated French surgeon La Peyronie was thus circumstanced: he was so fully convinced of there being a stone in his bladder, notwithstanding neither he, nor any of his friends, could feel it with a sound, that, on his death-bed, he gave directions for examining the fact. Hence, when the usual means of detecting a stone in the bladder continue, patients should be sounded several times, before a decision is given respecting the nature

of the disease. When, during the operation of sounding, all the urine has escaped from the bladder, the inner surface of this viscus comes into contact with the end of the sound, and such a sensation may be communicated to the surgeon's fingers, as leads him to suspect that a fungus, or some other hardish extraneous substance, is contained in the bladder. In such cases, patients have actually been out for the stone, when no foreign body whatever was present. (See LITHOTOMY and SEARCHING.)

SPECULUM. An instrument to facilitate the examination of parts, and also the performance of operations on them: thus we have specula ani, oculi, auris, vaginae, uteri, &c. "The use of the speculum vaginae (says Mr. Crosse) must be regarded as a great practical improvement, enabling us to detect, by ocular inspection, the different morbid alterations of the os uteri; and to treat inflammation of this part by the direct application of the most powerful antiphlogistic means. Not only can we observe, but distinguish, and effectually cure ulceration of the os uteri, and even (as Drs. Emery and Ricord show in their daily practice) make applications to ulcers within the cavity of the uterus itself; thus attacking, in the stage in which they are quite remediable, many diseases, which, until a very modern period, were allowed to progress towards such a bad condition, as to be only manageable by excision of the part; or, as more commonly happened, proceeded uncontrolled to the patient's destruction." (See *Provincial Med. and Surgical Trans.* vol. 5.)

SPHACELUS. (from σφάζω, to destroy.) Complete mortification, as contrasted with that stage of it, in which the parts are not yet totally deprived of life, and sometimes termed *gangrene*. See MORTIFICATION.

SPICA. (from σπάχω, an ear of corn.) A name given to a bandage, in consequence of its turns being thought to resemble the rows of an ear of corn. In order to apply the spica bandage to the shoulder, the margins of the axillæ must first be protected from the effects of the pressure, by means of soft compresses, and the end of a common roller is then to be placed under the armpit, on the sound side. After conveying the bandage backward, obliquely over the scapulae, the surgeon is to bring it forward over the injured shoulder. The roller is next to descend under the armpit, then be carried upward again, and made to cross on the deltoid muscle. It is now to be carried obliquely over the front of the chest, and under the opposite armpit, where the end of it is to be pinned, or stitched. The bandage is next to pass across the back, over the part of the roller previously applied in this situation, and is to be conveyed round the head of the os brachii, so as to form a turn, or *doloire*, with the first circle of the roller. Three or four *doloires*, or turns, each of which covers about one-third of the preceding one, are to be made, and then the upper part of the arm is to be once surrounded with a plain circle of the bandage. This last circular application leaves between it, and the cross previously made, a triangular, equilateral, space, technically named by writers *geranis*. The roller is now to be carried upward in a spiral manner; its head is to be brought to the opposite armpit, and the application of the whole concludes with a few turns round the body. The bandage is to be fastened with pins at the place where it commenced.

In applying the *epios inguinis*, the end of the roller is to be placed on the spine of the os ilium of the affected side. The bandage is then to be carried obliquely over the groin, and under the perineum. Then it is to pass over the back of the thigh, and next forward, so as to cross the part previously applied on the front of the groin. The application is continued by carrying the roller over the pubes, over the opposite os ilium, and next round the body above the buttocks. The bandage thus returns to the place where it began. Its application is completed by making a few turns, like the preceding ones, and, lastly, a few circles round the body.

SPINA BIFIDA. (i. e. the Cloven Spine.)

Hydro-Rachitis. A disease attended with an incomplete state of some of the vertebræ and a fluid swelling, which is most commonly situated over the lower lumbar vertebræ, sometimes over the dorsal and cervical ones, and, in some instances, over the os sacrum. An analogous tumour sometimes occurs on children's heads, attended with imperfect ossification of the cranium. The malformation of the spine seems to consist in a deficiency of one or more of the spinous processes and arches of the vertebræ. Sometimes, indeed, these processes are wanting, through the whole length of the vertebral column, as was seen in the case reported by Kieliz. (See *Richter's Chir. Bibl.* b. 9. p. 185.) Sometimes the tumour is composed of two distinct cysts, as happened in the case recorded by Mr. Brewerton (*Edin. Med. and Surg. Journ.* vol. xvii.): but this is uncommon.

The Arabians, who first treated of this disease, erroneously imputed the deficiency of one or more of the spinous processes to the tumour, while it is now well known, that the incomplete state of the affected vertebræ is a congenital malformation, and that the swelling is only an effect. In fact, the tumour generally becomes larger and larger, the longer it continues. Spina bifida is seldom met with but in children: few, very few, living to the adult age with this mostly incurable affection. Warner, however, has related a case, in which the patient lived till he was twenty. (*Cases in Surgery*, p. 134. 4 edit.) I have also seen, under the care of Mr. C. Hutchison, a young woman, 19 years of age, who had a spina bifida, which was of astonishing size, and situated at the lower part of the vertebral column. One curious circumstance in the case was, that the patient used to menstruate through a sore in the thigh. I conclude this is the same case as is described by Mr. Jukes (see *Med. and Phys. Journ.* for Feb. 1822), and who states the measurement of the swelling to have been 30 inches in its vertical line. The urine and feces used to pass involuntarily.

The swelling is most frequently situated towards the lower part of the spinal canal, particularly at the place, where the lumbar vertebræ join the sacrum. The fluid which it contains resembles serum, being somewhat more liquid, than the white-of-egg, and, like the latter, coagulable. It is in general limpid and colourless; but, occasionally, turbid, and tinged with blood. On pressing the tumour, a fluctuation is very perceptible, and a preternatural space may also be felt existing between some of the spinous processes. The fluid is contained in a kind of cyst, which is composed of the continuation of the dura mater, investing the spinal canal, and is for the most part closely adherent to the integuments.

Spina bifida is frequently attended with hydrocephalus, and the enlargement of the head has been known to undergo a considerable diminution, after the casual rupture of the tumour of the spine. (*Morgagni, de Sed. et Caus. Morb.* epist. 7. art. 9. *Ephem. Cur. Nat.* decad. 3. art. 1., decad. 2. art. 2.) The fluid, which was lodged in the lateral ventricles, and third ventricle, passed into the fourth, through the aquæductus Sylvii, ruptured the calamus scriptorius, and thus passed into the spinal canal.

Spinæ bifidæ usually occur on the lower part of the spine; but they occasionally take place on the cervical vertebræ, where the tumours have the same characteristic marks as those near the sacrum. Many facts, recorded by Ruysch, confirm the preceding account. (*Obs. Anat. Chir. Centuria*, 4to. Amst. 1691.)

The present affliction generally has a fatal termination; for, with the exception of one case mentioned by Morgagni (*De Sed. et Caus. Morb.* epist. 12. art. 9.), a second, recorded by Keilmann (*Prodrom. Act. Havn.* p. 136.), and two or three others published by Sir Astley Cooper, there is not, I believe, in all the records of medicine, or surgery, any case, which either got well of itself, or was benefited by any mode of treatment. Opening the tumour, either with caustic, or cutting instruments, has generally only tended to hasten the fatal event of the disease. Death soon follows an operation of this kind, and sometimes instantly. Tulpius observes on this subject: *Quam calamitatem si quidem reformides, chirurgæ, cave sis improvide aperias, quod tam facile occidit hominem.* (*Obs. Med.* ed. 5. Ludg. Bat. 1716.)

But, whether the tumour be opened, or not, still the disease is one of the most fatal, to which children are exposed. When afflicted with it, they seldom reach the age of three years; but, after lingering several months from their birth, suddenly die. It has been said, that children, with spina bifida, always have their legs in a paralytic state. However, this is not true; for one of the largest spinæ bifidæ I ever saw was under my friend Mr. Maul, of Southampton, and was unattended with any weakness of the legs. Indeed, the child was, to all appearance, as stout, healthy, and full of play, as possible. The fatal event, however, took place after a time, as usual; and, a little before death, a remarkable subsidence of the swelling occurred, which however never burst externally. Still it is a fact, that many infants, with spina bifida, have paralytic legs, and can neither retain their feces, nor urine.

If we draw our inferences from the cases and remarks, offered by almost every writer on spina bifida, we must regard all attempts to cure the disorder, by making any kind of opening, as exceedingly perilous, and generally fatal. It is to be observed, at the same time, that some practitioners have not altogether abandoned the idea of devising a mode of accomplishing a cure, at least in a few instances. Mr. B. Bell, says, that if the tumour proceed from disease of the spinal marrow, or its membranes, no means of cure will probably ever be discovered. But, if the deficiency in the spinous processes of the vertebræ, with which the disease is always accompanied, be not an effect of the complaint, as was commonly imagined, and if the collection of fluid take place, from the want of resistance in the dura mater, in consequence of the

imperfection of the bones, Mr. B. Bell questions, whether it would not be proper to tie the base of the tumour with a ligature, not merely with the view of removing the swelling, but in order to resist the propulsion of the cyst further outward. Mr. Bell acknowledges, that the event of this practice must be considered as dubious; but expresses his wish to devise any plan that would afford even the least chance of success, in a case which must otherwise terminate in an unfavourable manner. Mr. Bell mentioned the design of putting the method to a trial on the first opportunity, and after the detachment of the swelling on the outside of the ligature, he intended to keep a soft compress on the part with a proper bandage. I do not know whether this gentleman ever put the above scheme in practice; but suppose not. It is objected to by the author of the article *Spina Bifida* in the *Encyclopédie Méthodique Part. Chir.* because the disease is often attended with other mischief of the spinal marrow and brain, and the base of the swelling is almost always too large to admit of being tied at all, or not without hazard of dangerous consequences.

Richter proposed the trial of two caustic issues at a little distance from the swelling; but, I am not acquainted with any facts in favour of this practice.

Mr. Abernethy first suggested the trial of a gentle degree of pressure on the tumour from its commencement, with the view of producing absorption of the fluid, and preventing the distention of the unsupported dura mater. Were the fluid to continue to increase, notwithstanding such pressure, Mr. Abernethy thinks, that as death would be inevitable on the tumour bursting, it might be vindicable to let out the fluid, by means of a puncture, made with a finely-cutting instrument. The wound is to be immediately afterwards closed with sticking-plaster, and, if possible, healed. Another accumulation is then to be prevented, if practicable, with bandages and topical applications. Mr. Abernethy actually made the experiment of a puncture in one hopeless instance, in which, indeed, the swelling had previously just begun to burst. The puncture was repeated, every fourth day, for six weeks, during which time the child's health continued unaffected. The wounds were regularly healed; but the plaster having been rubbed off one of the punctures, the part ulcerated, the opening could not be healed, the discharge, from having been of an aqueous quality, became purulent, and death ensued. This case was also unfavourable for the trial of the method, as the integuments covering the tumour were diseased, and had no disposition to contract.

The annexed case, published by Sir Astley Cooper, shows the benefit, which may be derived from pressure.

"James Applebee, Baldwin-Street, Old-Street, was born on the 19th of May, 1807, and his mother, immediately after his birth, observed a round and transparent tumour on the loins, of the size of a large walnut. On the 22d of June, 1807, the child was brought to my house, and I found, that although it had spina bifida, the head was not unusually large; and the motions of its perfect; and its stools and urine were naturally. I applied a roller round the child's trunk, so as to compress the tumour, being induced to do so from considering it as a spe-

cies of hernia, and that the deficiency of the spin might be compensated for by external pressure. The pressure, made by the roller, had no unpleasant influence on its voluntary powers; its stools and urine continued to be properly discharged; but the mother thought, that the child was occasionally convulsed. At the end of a week, a piece of plaster of Paris, somewhat hollowed, and that hollow partly filled with a piece of loose lint, was placed upon the surface of the tumour; a strap of adhesive plaister was applied to prevent its changing its situation; and a roller was carried around the waist, to bind the plaster of Paris firmly upon the back, and to compress the tumour as much as the child could bear. This treatment was continued until the month of October, during which time the tumour was examined about three times a week, and the mother reported, that the child was occasionally convulsed. When the child was five months old, a truss was applied, similar in form to that which I sometimes use for umbilical hernia in children, and this has been continued ever since. At the age of fifteen months, it began to make use of its limbs; it could crawl along a passage and up two pair of stairs. At eighteen months, by some accident, the truss slipped from the tumour, which had become of the size of a small orange, and the mother observed, when it was reduced, that the child appeared in some degree dull; and this was always the case, if the truss was left off for a few minutes, and then re-applied. At fifteen months he began to talk; and, at two years of age, he could walk alone. He now goes to school, runs, jumps, and plays about, as other children. His powers of mind do not appear to differ from those of other children. His memory is retentive, and he learns with facility. He had the measles and small-pox in the first year, and the whooping-cough at three years. His head, previously and subsequently to the bones closing, has preserved a due proportion to other parts of the body. The tumour is kept by the truss entirely within the channel of the spine: but when the truss is removed, it soon becomes of the size of half a small orange. It is therefore necessary, that the use of the truss should be continued. When the truss is removed, the finger can be readily pressed through the tumour into the channel of the spine." (*Méd. Chir. Trans.* vol. ii. p. 323, &c.)

The next case, also published by Sir Astley Cooper, will prove, that spina bifida may sometimes be treated on another plan, so as to accomplish a permanent cure.

"January 21st, 1809, Mrs. Little, of No. 27, Limehouse Causeway, brought to my house her son, aged ten weeks, who was the subject of spina bifida. The tumour was situated on the loins; it was soft, elastic, and transparent, and its size about as large as a billiard ball when cut in half; his legs were perfectly sensible, and his urine and feces were under the power of the will, &c. Having endeavoured to push the water, contained in the tumour, into the channel of the spine, and finding that, if the whole was returned, the pressure would be too great upon the brain; I thought it a fair opportunity of trying what would be the effect of evacuating the swelling by means of a very fine-pointed instrument, and by subsequent pressure to bring it into the state of the spina bifida in Applebee's child. I there-

fore immediately punctured the tumour with a needle, and drew off about two ounces of water. On the 25th January, finding the tumour as large as before it had been punctured, I opened it again, and in the same manner, and discharged about four ounces of fluid. The child cried when the fluid was evacuated, but not whilst it was passing off. On January 28th, the tumour was as large as at first. I opened it again, and discharged the fluid. A roller was applied over the tumour and around the abdomen. February 1st, it was again pricked, and two ounces of fluid discharged. On the 4th, three ounces of fluid were discharged. On the 9th, the same quantity of fluid was evacuated as on the 4th; but instead of its being perfectly clear, as at first, it was now sanious, and it had been gradually becoming so in the three former operations. On the 13th, the same quantity of fluid was taken away; a flannel roller was applied over the tumour and around the abdomen; a piece of pasteboard was placed upon the flannel roller over the tumour, and another roller over the pasteboard to confine it. On the 17th, three ounces of fluid, of a more limpid kind, were discharged; the pasteboard was again applied. On the 27th, the surface of the tumour inflamed: the fluid, not more than half its former quantity, was mixed with coagulable lymph, and the child suffering considerable constitutional irritation, was ordered calomel and scammony, and the rollers were discontinued. On the 26th, the tumour was not more than a quarter of its former size; it felt solid; the integuments were thickened, and it had all the appearance of having undergone the adhesive inflammation. On the 28th it was still more reduced in size, and felt solid. March 8th, the swelling was very much lessened; the skin over it thickened and wrinkled; a roller was again had recourse to; a card was put over the tumour, and a second roller was applied. March 11th, the tumour was much reduced; the skin covering it was a little ulcerated. On the 15th, it was flat, but still a little ulcerated. On the 27th, the effused coagulable lymph was considerably reduced in quantity, and of a very firm consistence. On the 2d of May, nothing more than a loose pendulous bag of skin remained, and the child appearing to be perfectly well, the bandage was soon left off. On December 18th, the child was attacked with the small-pox, and went well through the disease. The skin now hangs laccid from the basis of the sacrum; its centre is drawn to the spine, to which it is united, and thus the appearance of a navel is produced in the tumour by retraction of the skin. The pricks of the needles are very obvious, forming slight indentations." (See *Med. Chir. Trans.* vol. ii. p. 326—329.)

At the time when Sir A. Cooper transmitted his case to the Royal Medical and Chirurgical Society, it had been under his observation two years and a half. But he lately had an opportunity of meeting with the subject of it, whom he was so obliging as to send to my house, with the following note:

22d January, 1838.

MY DEAR SIR,

I have sent you Mr. Little, whose spina bifida was cured by adhesion, 28 years ago. (See *Medico-Chir. Trans.* vol. ii.) You will see a sort

of navel going into his spine. I will send you another case of spina bifida of 29 years, treated differently.

Yours always most truly,

ASTLEY COOPER.

The last case I have also examined, and is an instance of a spina bifida being successfully treated with a truss. Both patients are active, and in perfect health.

The first of the preceding observations exemplifies the palliative treatment, adopted by the latter gentleman, and consisting of the application of pressure in the manner of a truss for hernia; the second shows the radical mode of cure by puncturing the swelling from time to time with a needle, and exciting the adhesive inflammation, which, with the assistance of pressure, stops the disease altogether, that is to say, in such examples as admit of cure.

Children are sometimes born with tumours analogous to spinae bifidae, but situated on the head. There is a deficiency of bone at some part of the skull, and through the opening a sac, composed of the dura mater, protrudes, covered only by the integuments. Mr. Earle met with such a swelling, situated upon the occiput of a female infant. The plan of repeatedly making small punctures with a common needle, discharging the fluid, healing up the punctures, and applying pressure, was tried, and followed up for some time, without the occurrence of any unpleasant symptoms. Even punctures were sometimes made with an ordinary lancet; yet the child suffered no harm from the operation, and some hopes of a cure were indulged. At length, however, ulceration of the swelling took place, the child became indisposed and rapidly sunk. (See *Med. Chir. Trans.* vol. vii. p. 427.)

Mr. Dawson has recorded the particulars of a spina bifida in a lady, 38 years of age, which, occasioned a tumour at the upper and back part of the thigh, and was supposed to be a swelling of a different kind. When an operation for the removal of it was about to be performed, a puncture was made in the thinnest part of the skin, covering its apex, and 12 ounces of clear fluid were discharged, leaving the sac collapsed, which, was found to have a narrow neck passing to the lower part of the sacrum, in which there was an aperture capable of admitting the little finger. The patient sunk on the nineteenth day after the operation. Amongst the curious facts, adverted to by Mr. Dawson, "In this instance, there was not more functional disturbance present than is often met with in cases of hysteria; while the (post mortem) examination unfolded an extent of actual disorganisation of the nervous centre, of a most appalling character: to such an extent, indeed, as might have been believed to be, not only incompatible with the exercise of voluntary power, but with life. There was no paralysis of the lower extremities, nor of the sphincters. The inability to empty the bladder indicated some want of consent of parts; but not more than is frequently met with in hysterical females, or after a tedious labour. (See *Trans. of Prov. Med. and Surg. Association*, vol. i. p. 219.)

Ruyschii, Obs. Anat. Warner's Cases in Surgery. B. Bell's System of Surgery, vol. v. Acrel, in Schwed. Abhandl. b. x. p. 291, &c. Murray, Opusc. II. No. 5. et Med. Pract. Bibl. III. p. 612. Portal, Cours. d'Anat. Méd. t. iv. p. 66. Lassar, Pathologie Chir. t. i. p. 250. et seq. edit. 1809. Abernethy's Surgical and Physiol.

part I. and III. T. P. Oker, An Account of Spina Bifida, with Remarks on the Method of Treatment, proposed by Mr. Abernethy, 8vo. Cambridge, 1810. Richter, Anfanggr. der Wundlern. b. v. kap. 17. Sir A. Cooper, in Med. Chir. Trans. vol. II. p. 352, &c. H. Earle, in the same Work, vol. VII. p. 327, &c. Edinb. Med. and Surgical Journal, No. 67. J. A. Murray, De Spina Bifida ex mala Ostitum Conformatione Initio. Göt. 1779. Fleischmann, De Vitio Congenitis circa Thoracem et Abdomen. Erlang. 1810. Otto, in Seltenen Beobacht. Breslau, 1816. P. Hayes, in New England Journal, 1817. vol. I. No. 3. Neurndorff, De Spina Bifida Curatione Radicali. Lips. 1820. W. Law, in Edinb. Med. and Surgical Journ. No. 100. (A case in which punctures, followed up by pressure, were tried; but though the child went on favourably for a time, suppuration afterwards occurred, and death took place rather suddenly.)

SPINA VENTOSA. The Arabian writers first employed this term to express a disease, in which matter formed in the interior of a bone, and afterwards made its way outward beneath the skin. Until the matter had escaped from within the bone, these authors describe the pain as being incessant and intolerable; but that, after the pus had made its way outward by fistulous openings, the patient's suffering underwent a considerable diminution. The matter sometimes insinuated itself, from the interior of the bone, into the cellular substance, so as to render it soft and flabby, though not always attended with any change of colour in the skin. The swelling had some of the appearance of emphysema. To express this state, the Arabians added the term *ventosa* to that of *spina*; which was employed, before their time, to express the nature of the pain attendant on the disease. (See an account of this subject in the *Encyclopédie Méthodique*, Part. Chir. art. *Spina Ventosa*.)

The term *spina ventosa* has, since the time of the Arabian writers, been used by many to signify the disease named *white-swelling*, and the former might also mean by it a similar affection, though the contrary may be inferred from their account of the matter passing from the interior of the bone under the integuments, a thing which, I believe, never yet happened in any case of *white-swelling*. Another, and perhaps a decisive argument, against the original signification of the word being the same as that of *white-swelling*, is, that it was not restricted to diseases of the joints and heads of the bones; but was also applied to abscesses, which commenced in the cavities of the middle portions of the long bones, where, I need hardly observe, *white-swellings* never make their attack.

For these reasons, many respectable authors have implied, by the term *spina ventosa*, an abscess in the interior of the bone. (See Latta's *System of Surgery*, vol. i. p. 165.) Cases of this latter kind, I know are rare, compared with that common disorder, *white-swelling*; and I am also certain, from the descriptions given by some authors, that their cases of *spina ventosa* were in reality instances of necrosis. But, that abscesses do occur, and begin in the interior of the bones, more particularly of those of young persons, cannot be doubted by any surgeon of experience.

Dr. Camin, however, saw a case in which, though matter had formed within one of the bones of a dis-
cussed finger, which bone was in a state of decay, certainly not affected with necrosis; "for at absorption seemed to be going on in it, and no line of separation could be de-

tested between the diseased parts, and the healthy articulating extremities." (See Edin. Med. and Surgical Journ. No. 82.) In University College Hospital, I amputated a man's thumb, the phalanges of which were thinned, softened, and full of pus, though the soft parts covering them were free from disease.

J. L. Petit refers to a man, with a tumour on the middle of the tibia, who had been treated by him as a venereal patient, but a fortnight afterwards, the pains which had never ceased now began to grow more violent. The patient was feverish, his legs became red, and even painful, externally. An incision was made in the situation of the tumour, with the view of letting out the matter, which was suspected to be the occasion of the bad symptoms, and to have insinuated itself under the periosteum. The incision was of no service, and, two days afterwards, the trepan was applied, by which means a large quantity of matter was let out. The medullary part of the bone seemed quite annihilated, and the cavity almost empty. Petit made three other perforations with the trepan, and cut away the intervening pieces of bone. The actual cautery was also used several times to destroy the caries, and the patient at length got well. (*Traité des Maladies des Os*, de J. J. Petit.) If any one doubt, that abscesses form in the middle of the long bones, he should consult Hey's *Practical Obs. in Surgery*, p. 22., where he may peruse two very interesting cases, illustrative of what Mr. Hey calls *Abscess in the Tibia with Caries*. It must be confessed, however, that these were only cases of necrosis, for which affection the term caries is too often inaccurately used. Indeed, it would appear, from the observations of Dr. Macartney, that a very small suppuration in the medulla is accompanied with the beginning of those changes of the periosteum which attend necrosis. (See Necrosis.) Yet, Sir Benjamin Brodie has recorded some instances of small abscesses in bones, which kept up lameness and annoyance for a very considerable time, unaccompanied by necrosis. The cure was accomplished by perforating the part. (See Med. Chir. Trans.)

J. Pandolphinus, De Ventositatis Spinae gravissimo Morbo, 12mo. Norib. 1674. A. J. van der Meer, De Spina Ventosa. Dulsb. 1729. F. L. Augustin, De Spina Ventosa Ossium, Icon. iv. 4to. Hale, 1797. F. H. Schenck, Annotata quaedam de Spina Ventosa, cum annexa singulari hujus Morbi Observatione, 12mo. Marburg. 1817. Sir B. Brodie, in Med. Chir. Trans. Hey's Surgery, p. 22.

SPIRITUS AMMONIÆ AROMATICUS. Besides the well-known uses of this medicine internally exhibited, its vapours are occasionally applied to the eye in some cases of chronic ophthalmia. Scarpa recommends a remedy of a similar nature.

SPLINTS. Long thin pieces of wood, or tin, or strong pasteboard, employed for preventing the ends of broken bones from moving so as to interrupt the process by which fractures unite. They are sometimes used in other cases, for the purpose of keeping the joints motionless, particularly in certain dislocations, wounds, &c.

In simple fractures of the arm, forearm, or even of the thigh, or leg, in young infants, it matters not whether the splints be made of wood, pasteboard, or tin. In this country, many surgeons keep sets of splints made expressly for the leg, which are of

different sizes, excavated and shaped to the part, and furnished below with apertures or excavations for the projecting malleoli. When the limb is laid upon its outside, the foot is also usually supported and kept steady by the under splint extending towards the toes. Excellent splints for the legs of young children may be made of strong pasteboard accommodated in shape to the contour of the limb. Splints for the thigh, arm, and forearm, whether made of tin, or wood, should always be slightly concave on the side, which is to be applied to the broken limb. They should likewise be made as thin and light, as is consistent with the degree of strength necessary for preventing the broken bone from bending. The sets of splints, which are used for fractured legs and thighs by such practitioners as still follow Pott's plan of treatment, are frequently furnished with straps, which have a great many small perforations in them at stated distances, and can thus be easily fastened by means of little pegs for the purpose. With the same view, a roller and tapes are also sometimes employed. Pasteboard, as a material for splints, has one advantage, viz., when wet, it becomes soft, and admits of being accurately applied to every point of the surface of the limb: consequently, as soon as it dries and recovers its firmness again, it retains the exact shape of the part, and makes everywhere equal pressure on it, without incommoding the patient. Pasteboard, however, is hardly strong and durable enough for many fractures: nor will it answer when there is a discharge, nor when the surgeon wishes to employ fluid applications. But it is generally allowed, that no substance is better calculated for fractures in children, and the broken lower jaw in adults. It admits also of being cut and adapted to cases, for which we have not the exact apparatus at hand. Thus it is convenient for fractures of the lower part of the humerus, requiring angular splints, for which it may be converted into an excellent substitute. If wet before being applied, it forms, when dry, a solid covering, most accurately corresponding to the shape of the parts.

Whatever may be the substance of which splints are made; they ought always to be at least as long as the fractured bone; and if the situation of the limb will allow, they ought, says Boyer, to extend its whole length. "For instance (says he), for simple fractures of the thighs of very young children, the pasteboard splints, which I employ, reach from the upper part of the thigh, to the lower part of the leg. Generally speaking, the longer splints are, the better they fix the limb, and keep the fracture steady." (*Mal. Chir.* t. iii. p. 50.)

The number of splints must depend upon their breadth; and the thickness of the limb. For the forearm, two are sufficient; for the upper arm and thigh, four are often used; and for the leg, two, and sometimes three.

In cases of fractured thighs, when the straight position is preferred, the external splint should extend from the crista of the ilium to some little distance beyond the sole of the foot; while the inner one, if it be employed, should reach from the upper and internal part of the thigh also beyond the sole of the foot. With respect to an anterior splint, this is now less frequently used than formerly, and it need only reach from the groin to the knee.

The lateral splints for a broken leg ought to be

sufficiently long to embrace the knees and confine the motions of the foot and ankle. When the straight posture is adopted, a splint is sometimes laid along the front of the leg, from the patella to the lower part of the tibia; but if the other splints be of good construction, this plan is seldom of any real use.

In University College Hospital, fractures of the leg are generally placed on McIntyre's apparatus, or the modification of it, suggested by Mr. Liston; while fractures of the thigh are mostly kept in the extended posture, with a single very long splint reaching from the lower part of the chest to some way beyond the outer edge of the foot, and applied according to the principles explained in the article FRACTURE. The use of these kinds of apparatus has here superseded common splints, and the eighteen-tailed bandage in the treatment of such accidents.

As splints are generally composed of hard materials, the bad effects of their pressure upon the skin must always be counteracted by placing a sufficient quantity of tow, wool, oaten chaff, bran, or other soft substance, between them and the limb.

In order to understand, however, the principles which guide the surgeon in the choice and application of splints, many remarks, offered in the article FRACTURE, may be consulted.

SPONGIA PRÆPARATA. (*Prepared Sponge: Sponge-tent.*) Formed by dipping pieces of sponge in hot melted emplastrum ceræ compositum, and pressing them between two iron plates. As soon as cold, the substance thus formed may be cut into pieces of any shape. It was formerly much used for dilating small openings, for which it was well adapted, as, when the wax melted, the elasticity of the sponge made it expand and distend the opening. However, the best modern surgeons seldom employ it.

SPONGIA USTA. (*Burnt Sponge.*) This medicine, which the preparations of iodine have nearly superseded, was at one period often given for the cure of bronchocoele, in which case much efficacy was imputed to allowing lozenges, containing burnt sponge, to dissolve gradually under the tongue. Burnt sponge has also been exhibited in scrofulous diseases, and in chronic enlargement of the prostate gland. The dose is from a scruple to a drachm.

STAFF. An instrument of considerable importance in lithotomy, being in fact the director for the gorget or knife. It is made of steel, and its handle is generally rough, in order that it may be more securely held. As it is intended to be introduced through the urethra, its shape ought to be principally determined by the natural course of that passage. English surgeons generally employ a staff, the curvature of which forms the segment of a larger circle than that formed by the curvature of a staff used by French practitioners. (*Sec Roux, Voyage fait à Londres en 1814, ou Parallèle de la Chirurgie Anglaise, &c.* p. 319.) In other words, the French staff turns more upward than ours, as it approaches and enters the bladder. There may be some advantage in this construction, inasmuch as it tends to make the gorget enter in the direction of the long axis of the bladder; yet, a great deal more seems to me to depend upon the position in which the staff is held than upon its shape. Lithotomists should always

employ as large a staff as can be easily introduced, because the operation will thereby be facilitated. The groove, the most important part of the staff, is of course situated upon the convexity of the curved part of the instrument, or upon that portion, which, when introduced, lies in the membranous part of the urethra, prostate gland, and the bladder. It should always be made very broad and deep, as recommended by Langenbeck, Martineau, and others. (See LITHOTOMY.) The termination of the groove, at the end of the instrument, should be closed, so as to stop the further entrance of the gorget, and prevent the beak of the latter instrument from doing mischief. Some former surgeons, who neglected this precaution, have been censured by Desault and Sabatier, for certainly the most fatal injury may be caused by the gorget slipping beyond the end of the staff. (See LITHOTOMY.)

STAPHYLOMA (from *σταφυλή*, a grape, from its being thought to resemble a grape) is that disease of the eyeball, in which the cornea loses its natural transparency, rises above the level of the eye, and even projects beyond the eyelids, in the form of an elongated, whitish, or pearl-coloured tumour, which is sometimes smooth, sometimes uneven. Staphyloma is either *partial* or *total*: that is to say, it affects only a part, or the whole of the cornea; and, in the first case, if there be not too much additional injury of the eye, a degree of vision may yet be left, and even admit of further improvement. The circumstance of Scarpa's observations applying only to cases in which the eye sight is already destroyed, accounts for some important differences between him and other writers, who, in the practice which they advise, refer to the *partial* staphyloma, and cases in which the sight is not quite annihilated. Scarpa does not mention adhesion of the iris to the diseased cornea, as a part of the definition of staphyloma; a point in which he differs both from Richter and Beer. (*Lehre von den Augenkr.* h. ii. p. 69.) However, Scarpa may be correct; for though, as Mr. Wardrop remarks, "the internal surface of the cornea adheres to the iris in almost every case of staphyloma." (*On the Morbid Anat. of the Eye*, vol. i. p. 101.) Yet as it does not invariably do so, the circumstance forms no essential part of the nature of the disease. In some instances, Mr. Wardrop has seen the opacity confined to one half of the cornea, generally the lower one. (*Vol. cit.* p. 100.) And another experienced writer also remarks, that partial staphyloma of the cornea and iris, being generally the result of an onyx, is situated, in nine cases out of ten, upon the lower part of the cornea. (See *Muckersie, On Dis. of the Eye*, p. 603. ed. 2.)

In a great number of subjects, when staphyloma has attained a certain elevation, it becomes stationary, or only increases in due proportion to the rest of the eye. In other instances, the small tumour of the cornea enlarges in all its dimensions, and, in such a disproportion to the rest of the eye, that at length it protrudes considerably between the eyelids.

This disease is justly considered as one of the most serious to which the eyeball is subject; for to the total and irremediable loss of sight that it occasions, are added all the evils which necessarily result from the bulk and protuberance of the staphyloma. In such circumstances, the contact of the cornea with the eyelids, and the contact of

the air, and particles of matter suspended in it; the friction of the eyelashes; the incessant flux of tears down the subjacent cheek; render the eye painful and inflamed; the sound one is affected by sympathy; and the diseased one at length ulcerates, together with the lower eyelid and cheek, on which it presses.

According to Richter (*Obs. Chir. fasc. ii.*), staphyloma is generally formed, without the swelling of the cornea being preceded by any of those dispositions which are usually considered capable of weakening the texture and elasticity of the cornea: which seemed to him to acquire a much greater thickness, than what it has in its natural state. If this were the case, staphyloma, far from being concave within, must be every where compact and solid; though it ought to be quite the contrary, if the tumour were occasioned, as Beer yet appears to believe, by an immoderate distention, operating on the cornea from within outward, with absorption of its natural texture.

Richter's view is not, however, generally adopted. "In order that the state of staphyloma should be produced, there must be severe inflammation of the eye; involving the entire cornea, and rendering its texture opaque; that inflammation must also have extended to the iris, and caused it to adhere to the cornea; and there must be increased secretion of the aqueous humour, to push these unnaturally connected structures forwards." (See *Lawrence, On Dis. of the Eye*, p. 373.) Purulent and variolous ophthalmies, are a common cause of staphyloma in infancy; and, "it arises (says the latter writer) more particularly from severe external inflammations, attended with sloughing, suppuration, or considerable ulceration of the cornea. The texture of the latter, weakened by these processes, gives way to distending causes, acting from within," &c.

Scarpa thinks, that Richter has generalised his doctrine too much, by not drawing any line of distinction between the staphyloma of recent occurrence in infants, and that of adult subjects, in whom the disease has acquired so large a volume, as to protrude considerably beyond the eyelids. He agrees with Richter, that the recent staphyloma in infants is quite compact and solid, on account of the augmented thickness of the cornea; but he is convinced, by repeated observation, that, in this very same staphyloma, originally quite solid and compact, the cornea becomes thinner, or, at all events, is not thicker than natural, after the disease has existed a series of years in adult subjects, and in whom the swelling of the cornea has attained such a size as to protrude between the eyelids. The tumour, he observes, is not solid throughout, except in regard to its containing, in its amplified state, the iris, the lens, and very often, also, a portion of the vitreous humour.

The cornea of infants, in its natural state, is, at least twice as thick and pulpy as that of adults, and consequently, the anterior chamber of the aqueous humour, in the former, is comparatively so contracted, to what it is in the latter, that, in infants at the breast, the cornea may be considered as in contact with the iris.

To such qualities of the cornea in children of tender years, and to the natural narrowness of the anterior chamber of the aqueous humour, Scarpa imputes the cause, why ophthalmies in infants so often produce opacity and thickening of this membrane. The cornea swells, becomes preternaturally

thickened, and is soon converted into a pointed, whitish, or pearl-coloured tumour, without any cavity internally, and either in perfect contact with, or adherent to, the iris. In the course of years, however, this disease undergoes new modifications. For, as the whole eye enlarges with age, the iris, and crystalline lens, from causes not sufficiently understood, abandon their natural situation, and are propelled forward, nearer and nearer to the cornea, which they in time distend in all its dimensions, so as to make it project beyond the eyelids, at the same time rendering it thinner in a ratio to its bulk and magnitude. Scarpa never met with a voluminous staphyloma projecting beyond the eyelids in adult persons, which had not originally made its first appearance in infancy; and he invariably found, that the thickness and density of the cornea, both in the living and dead bodies of those who had been affected with this disease, were in an inverse ratio to the eye. In inveterate cases of staphyloma, forming a large protuberance beyond the eyelids, the iris may here and there be clearly discerned through the diseased cornea, and, if it be not equally manifest at all points of the tumour, it is because the conjunctiva, externally spread over the cornea, forms, in conjunction with its varicose vessels, on the surface of the tumour, a stratum of matter, not everywhere equally dense and opaque. In staphyloma, Mr. Wardrop observes, "The pupil is hid according to the situation and degree of the opacity of the cornea; but in most cases, it is altogether obliterated, and even in those, where a transparent portion of the cornea is opposite to it, vision is much impaired; for, as the eye has lost its form as an optical instrument, the change in its refractive power must render objects very indistinct." (*Morbid Anat. of the Eye*, vol. i. p. 101.)

In one form of total staphyloma, the tumour is spherical; in another, it is conical. In the spherical, according to Dr. Mackenzie, the anterior chamber is abolished, the posterior continues to exist; in the conical, both chambers are obliterated. "In the spherical, the lens is generally transparent; in the conical opaque, or wanting. In the spherical, the vitreous humour is generally healthy; in the conical, it is very often dissolved."

As, by the abolition of both chambers, the secretion of the aqueous humour must be entirely prevented, we can easily explain, in the first place, why the conical staphyloma never reaches that great size which is frequently attained by the spherical. In the latter, the posterior chamber remaining entire, that portion of the secreting organ of the aqueous humour, which is lodged in that cavity, continues its functions, and, by its overbalancing supply of aqueous humour, forces the united iris and pseudo-cornea to expand into a spherical and constantly more and more attenuated tumour, &c." (See *Mackenzie, Op.* p. 605, ed. 2.)

The sclerótica is also subject to staphyloma, that is, to a partial distention, and prominence of its anterior hemisphere in the white of the eye. Scarpa never met with any tumour or prominence on the front surface of the sclerótica, corresponding to the white of the eye; but in the dead subject he found two examples of staphyloma, in the posterior hemisphere of the sclerótica. According to Mr. Travers, in the spheroidal staphyloma of the cornea, the sclerótica sometimes yields so much as greatly to increase the deformity,

"This happens in hydropic and other degenerations of the humours. It also frequently becomes attenuated, or bulged near its junction with the cornea in the amaurosis, which follows inflammation of the choroid. This protrusion, larger or smaller, is sometimes circumscribed, and, in other instances, diffused over a large portion of the ball. It is often seen encircling the cornea, and presenting a sacculated or pouched appearance. It has a bluish grey tint," &c. (*Synopsis of the Dis. of the Eye*, p. 130.)

The palliative treatment of corneal staphyloma consists in removing the inflammation, which may be present, by antiphlogistic means; or in lessening the tumour by puncturing it with a cataract needle, and discharging the aqueous humour. If the patient suffer repeatedly from return of inflammation, the radical treatment is proper.

In cases of recent staphyloma, Richter used to make at the bottom of the tumour of the cornea an artificial ulcer, by repeatedly applying the argenti nitratum, or the oxygenated muriate of antimony (butter of antimony), and to keep the little sore open by the continued use of the same caustic, with the view of effecting a diminution of the swelling of the cornea. In this way he frequently succeeded in lessening staphyloma, and, in one particular case, he even restored the transparency of the cornea. *Ter repetitâ operatione, quarto scilicet, septimo, et decimo die, ne vestigium quidem morbi die decimo-quarto superabat.* (*Obs. Chir. fasciculus 2.*) In this plan, Mr. Guthrie conceives, that Richter evidently meant that the small ulcer made with the caustic, should penetrate the cornea; and that, from not comprehending this particular, Scarpa's trials of the method were unsuccessful. (*Operative Surgery of the Eye*, p. 175.) It appears, however, that Richter himself never intended, nor attempted any thing more than what Scarpa did afterwards; for, he expressly cautions the surgeon not to let the caustic penetrate through the cornea. This meaning, indeed, admits of no doubt: in his chapter on staphyloma, he refers for the description of the method to his observations on leucoma (*Anfangsgr. &c.* b. iii. p. 138, 139), where it is distinctly stated "*Immer muss man wohl darauf merken dass das Geschwür nicht zu tief in die hornhaut eindringt, und dieselbe ganz und gar durchfriert.*" Richter does not claim the proposal, as one originally made by himself, but mentions it as a suggestion made by Günz. (*Diss. de Staphylomate.*)

Though Scarpa frequently attempted to cure the recent staphyloma of infants, by the above method, he never met with such success as could be at all compared with Richter's, either in restoring the transparency of the cornea, or accomplishing a diminution of the volume of the staphyloma. Having formed with the nitrate of silver a small ulcer, at the bottom of the cornea, and kept the sore open thirty days and more, he failed in obtaining any benefit, in respect to the diminution, much less the opacity of the cornea, in three infants, one a year and a half old, and the two others somewhat more than three, all which subjects had been recently attacked by staphyloma in one eye, in consequence of the small pox. A violent chemosis, in a very short time, produced a staphyloma in the eye of a child five years old. Scarpa made an ulcer at the bottom of the cornea, into the unorganised swollen substance of which he introduced,

for a little depth, the flat part of a lancet. The sore was kept open for five weeks, with a solution of nitrate of silver, and the staphyloma became somewhat flatter, so as to lose the acute prominence in its centre; but the cornea continued, as before, everywhere opaque. Though Scarpa employed the same method in two other subjects, of about the same age, and in the same circumstances; though he kept the ulcer open fifty days; he was never able to effect any depression or diminution of the staphyloma; and consequently, the pointed, pearl-coloured, projecting part of the tumour continued in the same state as it was before. The conical shape, which the cornea assumes in this disease, he observes, is a characteristic symptom, by which a staphyloma may be distinguished from a leucoma, with total opacity of the cornea.

Celsus describes two modes of cure; viz. that with a ligature, and the removal of a portion of the conical most-projecting part of the diseased cornea. (*Lib. 9. cap. vii.*) Though, says Scarpa, the first is at present abandoned, the majority of surgeons still persevere in passing a needle and ligature through the lower part of the staphyloma; not for the purpose of tying or constricting the tumour, it is true, but of making a noose, in order to fix the eye conveniently, when the staphyloma is to be cut off in a circular manner. This use of a needle and ligature, which I observe is sanctioned by Mr. Travers and Dr. Mackenzie. (*Synopsis, &c. p. 285. On Dis. of the Eye, p. 608.*) is strongly disapproved of by Scarpa.

With regard to the second method, or that of excision, Scarpa thinks, that sufficient attention has not been paid to the directions of Celsus, that this operation should be done in the centre, or conical point of the tumour, and that as much of this part of the staphyloma ought to be cut away as will equal a lentil in size: *In summa parte ejus ad lenticulæ magnitudinem excindere.* Scarpa remarks, that the great importance of this precept can be duly appreciated only by those, who have often had occasion to compare the advantages of Celsus's doctrine, with the serious inconveniences, which result from the practice of cutting away the staphyloma circularly at its base.

The patient being seated, Scarpa directs an assistant to support his head properly; then taking in his hand a knife, similar to what is used in the extraction of the cataract, he passes the instrument completely across the staphyloma, at the distance of one line and a half, or two lines, from the centre or apex of the tumour, from the external towards the internal angle of the eye; and, by passing the knife forward in the same direction, just as is done in the extraction of the cataract, he makes a semi-circular incision downwards, in the most prominent part of the tumour. Having done this, he takes hold of the segment of the staphyloma with the forceps, and turning the edge of the knife upward, he completes the circular resection of the apex of the tumour, in such a way that the detached portion is one, two, three, or four lines in diameter, according to the size of the staphyloma. As a portion of the iris adhering to the cornea, from the very commencement of the disease, is commonly included in this section of the pointed part of the tumour, no sooner is the circular division of the apex of the staphyloma made, than the crystalline lens issues from the eye, followed by a portion of the aqueous humour. In consequence of this eva-

cuation, the eyeball is often so diminished that it can be covered by the eyelids.

Notwithstanding the advice delivered by Scarpa, the generality of modern practitioners still adhere to the plan of removing the staphylomatous cornea by taking hold of the tumour with a tenaculum, and carrying the incisions through its base. After the operation, the eyelids are to be covered with a compress or pledget, lightly supported with a roller. If great inflammation follow, antiphlogistic treatment and poultices and fomentations will be requisite.

When the eyesight is not totally lost, and the projection of the diseased cornea produces no serious annoyance, the foregoing operations are not demanded. Amongst others, Dr. Vetch particularly objects to the removal of the apex of the tumour, as destructive of all chance of the recovery of a degree of vision; a consideration, however, which would not exist in the hopeless cases spoken of by Scarpa. Dr. Vetch also disapproves of letting out the aqueous humour in cases of staphyloma as an endless operation, from which no permanent effect takes place, the humour collecting again in a few hours; an opinion which is likewise expressed by Mr. Travers. (See *Vetch, On the Diseases of the Eye, p. 63*; and *B. Travers, Synopsis, &c. p. 286.*) For the purpose of accomplishing the gradual diminution of the tumour, and bringing the eye into a state in which an artificial pupil may be made, Dr. Vetch employed caustic (the method commended both by Richter and Beer), and the introduction of a seton through the tumour. Beer confirms the statement of Scarpa, concerning the impossibility of restoring the transparency of any part of the cornea affected with staphyloma. For the relief of a partial staphyloma, he prefers the cautious application of oxygenated muriate of antimony, by means of the point of a camel-hair brush, while the eyelids are held asunder. The diseased part of the cornea is to be smeared with it until a small whitish superficial slough is formed, when every particle of the caustic must be immediately washed out of the eye with another larger camel-hair brush, dipped in water, or milk. The application is not to be repeated until the subsequent inflammation has quite subsided, and the slough been thrown off. Beer condemns all escharotic salves, because their action extends to parts, which should be left unirritated. (*Lehre von den Augenkr. b. ii. p. 74.*) Mr. Guthrie regards the treatment with caustic as only applicable to cases in adult subjects, where the diseased cornea is thin, and the sclerótica nearly, or quite healthy. The knife, he says, is requisite in young, or old individuals, where the staphyloma is evidently thick and hard, and the front of the eye more or less varicose. (*Operative Surgery of the Eye, p. 174.*) In this last condition indicated by the bluish, leaden appearance of the sclerótica, which seems to be penetrated, close to the cornea, by many tortuous dark-red vessels, and accompanied in a more advanced stage by a bulging out of particular parts in the same situation, he says, "The anterior portion of the eye ought to be removed, and, with it, the vessels which are in a varicose state." (*P. 178.*)

Wenzel, and numerous other writers, imply, by staphyloma, a protrusion of a piece of the iris, through a wound or ulcer of the eye. (See *LAZARUS, PROLAPUS OF,*)

Scarpa sulle Malattie degli Occhi, ed. 5. G. J. Beer's Ansicht der Staphylomatösen Metamorphosen des Auges.

de. Wien, 1806. *Lehre von den Augenkr.* b. ii. p. 69. 8vo. Wien, 1817. *Richter Anfangsgründe der Wundarzneikunst*, b. iii. p. 153, &c. Göt. 1795. *James Wardrop, Essays on the Morbid Anatomy of the Human Eye*, vol. i. p. 99. 8vo. Edinb. 1808. *B. Traverser's Synopsis of the Diseases of the Eye*, 8vo. Lond. 1820. *J. Vetch, On Dis. of the Eye*, 8vo. Lond. 1821. *G. J. Guthrie, Operative Surgery of the Eye*, 8vo. Lond. 1823. *G. Frick, On Diseases of the Eye*, ed. ii. by *Welbank*, p. 101. 8vo. Lond. 1826. *W. Lawrence, On Dis. of the Eye*, p. 373, &c. 8vo. Lond. 1833. *W. Mackenzie, On Dis. of the Eye*, p. 602, &c. ed. ii. 8vo. Lond. 1835. *R. Middlemore, On Dis. of the Eye*, vol. i. p. 124, 502, &c. 8vo. Lond. 1835.

STEATOMA. (from *στῖς*, fat.) A wen, or encysted tumour, containing fat. See **TUMOURS, ENCYSTED**.

STELLA, or STELLATED BANDAGE. A bandage so named because it makes a cross, or star, on the back. It is a roller, applied in the form of the figure 8, so as to keep back the shoulders, and often employed in cases of fracture of the clavicle.

STETHOSCOPE. (from *σθῆθος*, pectus, and *exploro*, explore.) An instrument consisting of a cylinder, originally employed by Laennec, to elucidate the diagnosis of certain diseases of the chest, but now indeed used to throw light on the nature of many other cases. See *Auscultation*. "A very few words suffice to state (as Dr. Forbes observes) in what way the stethoscope becomes, in the hands of an expert auscultator, the means of an accurate diagnosis. By it we learn, that the motions of the lungs and heart, in a state of health, produce certain determinate sounds in certain parts of the chest; and that these sounds are modified in certain determinate ways, and certain other determinate sounds superadded in states of disease. By the study of the symptoms during life, by dissection after death, and by considering the principles of the generation of sound, we are able to connect, as cause and effect, particular forms of disease with particular sounds: hence, the indications of the stethoscope, in certain diseases, become positive physical signs of these diseases." (*Cyclopædia of Pract. Med. art Auscultation*).

STRAMONIUM. A series of interesting experiments were detailed, in illustration of the properties of stramonium, in a Dissertation, which was read to the Medical Faculty of the University of Pennsylvania, on the 12th of May, 1797, by Dr. Samuel Cooper. The experiments, No. 15 and 16, merit particular notice in this Dictionary, as being, perhaps, the earliest discovery of the effect of the local application of powerful narcotics in dilating the pupil. A drop of an infusion of the powder of stramonium was let fall into the left eye. In half an hour the pupil began to enlarge, and attained its greatest dimensions about twelve hours after the experiment, at which time it was viewed in a considerable light, and seemed thrice as large as the other. It continued dilated two days. In a strong light, objects were seen more distinctly with the right eye; but, in a weak light, with the left. Some other gentlemen, however, on whom the experiment was tried, experienced no increased power of seeing in the dark. A drop of the expressed juice, dropped into the eye of a cat, soon converted the whole of the coloured part of the eye into pupil. (See *Caldwell's Medical Theses*, p. 173, 8vo. Philadelphia, 1805.) Stramonium then resembles belladonna and hyoscyamus in its action upon the iris. It has been exhibited internally, in epilepsy, tic douloureux, and severe chronic pains, and used in poultices for discharging indurations of the breast, and in ointments,

for allaying the pain of piles. The doses should at first be only gr. ss. of the extract, twice a day, but they may be gradually increased to five grains.

STRICTURE. (from *stringo*, to bind.) A contracted state of some part of a tube, or duct. (See **URETHRA, STRICTURES OF; ESOPHAGUS, &c. RECTUM, &c.**) Stricture also means, in cases of strangulated hernia, the narrowest part of the opening or passage through which the bowels protrude. (See **HERNIA**.)

STRUMA. (from *struo*, to heap up.) Scrofula, or Scrophula. The King's Evil. (See **SCROFULA**.)

STRYCHNIA. Its salts, and the extract of nux vomica, have been found useful in paraplegia, amaurosis, some forms of deafness, and a few other paralytic affections, from disease or external injury. The endermic use of strychnia is noticed in the article **AMAUROISIS**. "Strychnia in all its forms, pure or combined (says Dr. A. T. Thomson), is a powerful excitant, displaying its influence, first by an increasing energy of the whole system; and next chiefly on those tracts of the medulla spinalis, which give origin to the motor nerves. The nerves of sensation, however, are also involved in this action; for, along with the muscular contractions and convulsions which supervene, the surface of the body is so morbidly sensitive, as to be sensible of the slightest impressions; even the motion of the air becomes a source of uneasiness, nearly as considerable as in hydrophobic cases." (See *Elem. of Materia Medica*, &c., p. 186, edit. 2.)

STUMPS. P. G. Van Hoorne, in 1803, published a valuable work giving an account of the changes which occur in the texture of stumps after amputation, and particularly in the bone *De Iis, quæ in partibus membri præsertim ossis amputatione vulneratis, notanda sunt.* (Lugd. Bat. 1803, 4to.) In the 16th, vol. of the *Med. Chir. Trans.*, Mr. Langstaff has published many interesting remarks on the healthy and morbid condition of stumps. According to his investigations, after the effusion and organisation of lymph in the healing process, "the absorbents remove such superfluous parts of the muscles, as are likely to retard the progress of cicatrization of the integuments. After this period, the nutrient arteries of the periosteal covering of the divided bone, or bones, and the medullary parts, deposit lymph; a medium of cellular tissue is produced, which unites to the organised integumental surface, and these together form a cushion, as a protection to the end of the stump." The absorbents remove the asperities occasioned by the division of the bone; a deposit of osseous matter takes place round its edges, forming a junction with the new bony substance thrown out by the vessels of the medullary texture; and the absorbents, if not interrupted by a diseased state of the stump, produce a regular rounded appearance of the extremity of the bone, in which merely apertures are left for the communication of the nutrient arteries, veins, and nerves of the shaft of the bone, with its coverings.

"Should the surfaces of the amputated part not regularly unite by the first intention, nor by the second, and there be inflammation affecting the divided nerves, then a morbid action is established, which occasions the face of the stump to ulcerate or mortify; frequently causing a portion of the extremity of the bone to project, which occasionally becomes carious, and should be taken off." In other

instances, osseous deposit takes place round the edges of the sawn bones in a degree amounting to exostosis; and "sometimes a spiculum of bone projects horizontally, generally taking the direction of the artery, vein, and nerves of the limb, which thus become implicated with the bony deposit; and sometimes (adds Mr. Langstaff) I have found a large spiculum of bone, with a very sharp point, taking an oblique direction, and connected with a muscle, occasioning morbid changes in its fibres, and being a source of great suffering to the patient. In all such stumps, I have invariably found the nerves greatly enlarged at their extremities, giving them a ganglionic appearance, and generally firmly adherent to the surface of the stump, and frequently in union with spicula of bone." On cutting through these bulbous extremities of the nerves, Mr. Langstaff did not notice any marks of enlargement of their natural structure, the thickening appearing to have been occasioned wholly by the deposition of lymph, the effect of inflammation in the cellular tissue covering the neurilema. Mr. Langstaff gives the particulars of numerous preparations and cases in confirmation of his statements. In amputation, he prefers the flap operation to the circular, cutting obliquely through the integuments, muscles, vessels, and nerves, and taking especial care to preserve a sufficient quantity of skin to cover the end of the bone. He notices the bad consequences of leaving too much muscle in the circular operation, in impeding the adhesive process. "If (says he), in performing the flap operation, a sufficient quantity of skin be not preserved to cover the stump, and the ends of the nerves are likely to be included, while cicatrization is going on, I should have no hesitation in shortening them by cutting off a portion of each."

The frequent necessity, however, for cutting the large nerves twice, is considered by many surgeons—in which number I wish to be included—as one of the principal objections to flap amputations, more especially of the arm. Thus, Sir Charles Bell observes, "Of all the conditions to which man is subject, there is no state of suffering more severe than that produced by the engagement of a nerve in a stump; and therefore I say, that it is most important that the nerve should be directly divided across, and not obliquely torn out. You cannot secure this effect, unless you make a free and decided division of the muscles. When you pierce the limb with a great cutting knife, and put it close on the bone, and draw it out obliquely, to make the flap, you cut the nerve longer than the other parts. The nerve is firm, but very elastic, it is not so easily cut through as muscles. Being elastic, it goes before the edge of the knife; and, if you look carefully to an amputation performed in this way, you will find that the nerve hangs out, that it becomes necessary to draw it out, and cut it again. What do you do when the nerve is cut a second time, by way of this operation is attended with less pain?"

d. Med. Gaz. vol. xv. p. 96.) In post mortem

examinations, Molinelli and Morgagni long ago found the ends of nerves, which had been cut through, enlarged. Lower and Arsenmann noticed the same occurrence in animals, and Proschaska gave an instructive description of such a case.

In Van Hoorne's work are excellent engravings of the condition of the nerves, as well as of the osseous deposition at the end of the bones of stumps, and of the changes in various degrees and stages.

In Froriep's *Chir.-Kupfertafeln*, pl. 118, the same things are represented, accompanied by an account of two preparations of stumps, preserved in the Museum of the University of Bonn by Professor Mayer, the particulars of which merit the attention of all who are investigating the present subject. Cruveilhier has published a representation of a shoulder-stump, after an amputation, performed many years previously by Larrey. The changes in the muscles, and ends of the vessels, are carefully drawn and explained, as well as the ganglionic enlargement of the nerves. (*Anat. Pathol.* t. i. livr. vi. pl. 5.—Paris, 1829. 35 Fol.)

In University College Museum is preserved a stump, which, in consequence of bleeding, had been opened on the first night succeeding amputation. Locked jaw ensued; the bone protruded to the extent of an inch; and in six weeks, the case ended fatally. The extremity of the sciatic nerve is seen enlarged, and connected to the cicatrix.

When the severe neuralgic affection of a stump, sometimes attended with convulsive twitches, is dependent upon the bulbous enlargement of the end of a nerve, it may sometimes be cured by the repetition of amputation, or even by the mere excision of the extremity of the nerve. The latter operation, I think, with Mr. Mayo, is to be preferred if the symptoms are clearly attributable to an affection of one nerve. (*Human Pathology*, p. 139.) In support of this advice, Mr. Mayo gives an interesting example of the success of the practice. He likewise adds the particulars of a case, in which the source of the painful affection of the stump was not confined to the cut extremity of the nerve. A second amputation had been performed. "On examining the amputated part, the sciatic nerve and the saphenous nerve were found to terminate in large callous bulbs. In the second operation, care was taken to draw out and remove a considerable portion of the sciatic nerve, which retracting lay well covered among the muscles. Nevertheless, when the stump had nearly healed, the old pain again commenced;" but was more circumscribed. Mr. Mayo now cut down to the sciatic nerve, where, covered by the lower fibres of the *glutæus maximus*, and divided it. A portion of it was then removed. The benefit was only temporary. Mr. Mayo suspects, that amputation at the hip might cure this patient, though loth to recommend this formidable proceeding; and refers to a case, in which a neuralgia, which had followed an amputation above the wrist, had returned after a second amputation, but been permanently cured by amputation of the shoulder. Sometimes the relief, afforded by excision of the bulb of the nerve, is not complete, as we find exemplified in the case under Mr. Palmer, who removed from a stump a portion of the fibular nerve. "The stump is still occasionally agitated by slight spasms, and the nerve, for above two inches above the cicatrix (as may be perceived by feeling through the integuments), is still enlarged and very sensitive. Unquestionably the relief afforded has been immense; but I now regret, that I did not in the first place remove a greater length of the nerve, so as completely to obviate the possibility of its being again involved in the new cicatrix." (*Palmer, in Lond. Med. Gaz.* vol. xvii. p. 220.)

When the soft parts are deficient, and the bone prominent on the face of the stump, forcible attempts are often made to bring the integuments

together by adhesive straps. These endeavours (as Mr. James correctly observes) commonly fail, and are indeed mischievous; for, if the straps are brought over the surface of the bone, then they bind down this thin and irritable covering upon a broad surface, which is sure to indispose them to unite; and, if applied at the sides, although they may bring the edges together, yet they will force the soft parts still more back than the bone. The only remedy for such stumps, according to Mr. James, is, to be found in the skilful application of a bandage, and a proper position; and these failing, in sawing off the bone higher up. (See *Provincial Med. and Surgical Trans.* vol. iii. p. 228.)

Mr. Benjamin Phillips has written some good remarks on inflammation of the medullary membrane succeeding to amputation; one of the most serious, and, as it appears to this gentleman, not the least frequent of the accidents, which follow its operation. It is from this cause that necrosis of the whole thickness of the sawn bone mostly arises. The several stages of the case are well described by Mr. Phillips, as that of simple congestion of the medullary membrane; another, leading to osseous deposit; a third, attended with the formation of pus; and a fourth, with gangrene of the texture in question. Mr. Phillips ascribes the disorder to the violence inflicted upon it by the saw. An anxiety, he observes, is felt to prevent such action of the saw upon the periosteum; "but the action of the instrument upon this membrane would not bring about those formidable consequences, with which such injuries to the medullary membrane are pregnant." He notices the custom, followed in many parts of the continent, of applying a very tight bandage round the stump, for the purpose of preventing the retraction of the muscles. This system, he states, exists at La Charité in Paris, where the proportion of unfortunate terminations in cases of amputation is very great. Dr. Carswell thinks it probable, that the tight bandages there used, produce congestion, and a tendency to inflammation of the medullary texture of the sawn bones. (*B. Phillips, in Lond. Med. Gaz.* vol. xiii. p. 189, &c.)

When the end of the femur, tibia, or other bone of a stump, is affected with necrosis of its whole thickness, and this for some extent, the excision and removal of the sequestrum is the most expeditious means of cure.

STYE. A little inflammatory tumour on the eyelid. (See *HORDEOLUM.*)

SULPHURIC ACID. The strong sulphuric acid is used as a means of extricating from the nitrate of potash, or muriate of soda, certain gases for the purpose of purifying the air of sick rooms, or infected places. A few practitioners have also sometimes employed it, blended with sixteen times its weight of lard, as a local application for the cure of scabies. One drachm of it, mixed with an ounce of lard, is sometimes rubbed upon diseased joints, and with considerable effect, when the right cases are selected. (See *JOINTS.*) As a caustic, this acid is not generally eligible, because it is difficult to limit its operation exactly to the parts which are intended to be destroyed. A few years ago, a proposal was made to apply it along the outside of the eyelid, in cases of trichiasis, so as to produce a slough and subsequent ulcer, the cicatrization of which would draw out the inverted tarsus. In this way, an instantaneous amendment in the position of the eyelid is some-

times produced. I have seen cases, in which the experiment was tried; but, whether it was owing to the acid not having been sufficiently applied, or other causes, the method did not answer so well as the usual plan of removing a part of the integuments with a cutting instrument. Sulphuric acid has also been employed in the cure of ectropium.

Diluted sulphuric acid is frequently employed as an ingredient in gargles. It is also commonly exhibited with the view of checking passive hemorrhages, and profuse nocturnal sweats in hectic fever. The dose is from ten to thirty drops.

This acid, in the diluted form, has been tried in venereal cases. According to Mr. Pearson, when a bad state of health prohibits the introduction of mercury, the case has not yet put on an unequivocal appearance, or dyspeptic symptoms, attended with profuse perspirations, harass the patient, it is a useful remedy, capable of giving a temporary check to the progress of the disease. He says, that he has often seen it arrest the progress of venereal ulcers of the tonsils, and make venereal eruptions fade and nearly disappear; but that these beneficial effects were never permanent. At the same time, he acknowledges that the medicine will confer actual and durable benefit in certain examples of ulcers of the penis, groin, and throat, remaining stationary after a mercurial course. He has likewise found this acid very efficient, when mercury acts too violently upon the mouth. (See *Pearson's Obs. on the Effects of various Articles in the Cure of Lues Venerea*, p. 189 — 191. ed. 2.)

In cases of poison, by sulphuric acid, the most successful treatment consists in making the patient drink large quantities of water, in which calcined magnesia is suspended. Should this last medicine, however, not be at hand, soap, blended with water, is the best substitute. While these remedies are preparing, copious draughts of some mucilaginous beverage, milk, or even of common water, should be administered without delay; for the practitioner should ever be mindful, that so rapidly does sulphuric acid operate upon the texture of the parts with which it comes into contact, that all chance of saving the patient must depend upon the quickness with which the means to counteract the poison are applied. After the acid has been diluted and neutralised, local and general bleeding, emollient clysters, and mucilaginous drinks, constitute the best remedies. (*Orfila, Traité des Poisons*, &c. vol. i. p. 434. ed. 2.)

SUPPRESSION OF URINE. A stoppage of the secretion of urine. (See *URINE, RETENTION OF.*)

SUPPURATION. A process by which a peculiar fluid, termed *pus*, is formed in the substance, or from the surface, of parts of the body.

When purulent matter accumulates in the part affected, it is termed an *abscess*, which is distinguished into several kinds — *acute, chronic, venereal, scrofulous*, &c.

The texture, in which suppuration seems to be most readily produced, by a certain degree of inflammation, is mucous membrane, whether this lines excretory ducts, or canals, or covers the inner surfaces of the respiratory, or urinary organs. In a few hours after an irritating cause has been applied to these surfaces, the physical and chemical qualities of the fluid, which they secrete in their natural state, are changed. From being a tough viscid substance, not easily miscible with water, the mucus of the nose and bronchi becomes, du-

ring an attack of inflammation, very readily miscible with water, of a yellowish, white colour, and fluid consistence. If, in this state, the secretion from these membranes be examined with the microscope, it will be found to contain small globules, similar to those which are seen in the blood; and these globules are found to increase in number in proportion to the degree and continuance of the inflammation. We have examples of the production of this pus, or, at least, of a puriform fluid, in the respiratory organs of persons affected with catarrh, and in the urinary organs, of those who labour under gonorrhoea. In the progress of these diseases, we can generally trace the changes which take place by slow, but sensible degrees, in the nature of the secretion, from mucus to pus, and from pus back again to the state of mucus. This puriform discharge from mucous membranes, in a state of inflammation, may be kept up for months without these membranes appearing to undergo any other morbid changes, than a slight degree of redness and swelling. A loss of substance, or ulceration, is found not to happen oftener, than in one case, out of ten examples of suppuration from mucous membranes. (See Thomson, *On Inflammation*, p. 305, 306.)

Suppuration may be readily produced in the skin, by whatever excites inflammation in that texture, or causes a separation of the cuticle. We have examples of this fact, in blisters from cantharides, and in vesications from superficial burns. If the cuticle, covering a recent blister, or burn, be removed, and the cutis exposed to the irritation of stimulating substances, pus will soon be discharged from the abraded surface. Suppuration can be kept up in the skin for an indefinite length of time, as we see done every day in the management of perpetual blisters. Here ulceration is seldom observed, and, consequently in the skin, loss of substance is by no means necessary for the production of pus.

If the cutis be divided, as in a wound, or a portion of it removed, as in the extirpation of tumours, and either the air or any other external body be permitted to remain in contact with the divided surfaces, the process of suppuration is speedily induced in the subjacent cellular texture. After the hemorrhage, which takes place from the small vessels, has ceased, an oozing of a fluid, at first resembling serum, occurs, which is gradually changed into pus. But in this case, as Dr. Thomson has correctly observed, the surface of the wound is previously covered with a layer of coagulable lymph, which is penetrated with blood-vessels, and gradually raised into the little red eminences, termed granulations.

Appearances similar, though slighter in degree, says Dr. Thomson, are observed in cutaneous suppuration; giving probability to the opinion of Sir E. Home, that, in inflammation, a vascular surface is produced previously to the formation of pus in a cellular tissue, and perhaps also in cutaneous texture. However, no new vascular surface is generated in the inflammation of mucous membrane. Thus, we see, that, in the formation of pus in mucous membrane, cutaneous texture, and exposed cellular substance, no ulceration, no breaking substance is essential; but that, on the contrary, in two of these textures, the cutaneous and cellular, there is an addition made to the parts of coagulable lymph, which be-
(Thomson, p. 305—306.)
of an inflamed serous membrane

soon becomes covered with a very thin layer of an albuminous and gelatinous substance, and when this is removed, the membrane is found to have lost its smooth polish. This deposit gradually becomes thicker and more adherent, and forms the rudiment of a false membrane. It is almost constantly accompanied with a serous or sero-purulent effusion. This organisable matter has been proved by the experiments of Dowler and Laënnec to consist of two parts; one concremental and adhesive, formed of fibrine; the other fluid, and contained in cells of the former, consisting of albumen. It constitutes what is usually termed, coagulable, or coagulating lymph, and, by undergoing certain modifications, it appears to several pathologists of the present day to be converted into pus. Thus Laënnec states, that when adventitious membranes do not become organised, they are generally softened down into pus.

Although, with the exception of the epidermis, nails, and hair, there is no structure in the human body exempt from the attack of inflammation, yet abscess does not form in every texture. Thus it never takes place in a dense, fibrous, or cartilaginous texture, nor in that of a serous membrane. It would appear that only those organs are liable to abscess, which have cellular tissue as one of their constituents. Certain it is also, that of all tissues this is most frequently the seat of suppuration and abscess. John Hunter noticed the fact, that suppuration takes place oftener in superficial than deep-seated cellular tissue; a fact, perhaps correctly attributed to the cellular tissue near the surface of the body, being more exposed to the exciting causes of inflammation, than that which is deep-seated. Yet, the difference in the effects of foreign bodies deeply placed, from those which arise when such bodies approach the skin, as referred to by Mr. Hunter, cannot fail to attract the notice of every experienced surgeon.

Pus is sometimes formed within a muscle; and here it seems to be deposited in the intermuscular cellular tissue; the muscular fibre itself being apparently incapable of suppuration.

Purulent matter is met with in all the parenchymatous tissues, either in the form of abscess or of purulent infiltration; as, for instance, in the lungs, liver, spleen, pancreas, and kidneys. A circumscribed, or encysted abscess is more common in the liver; a purulent infiltration in other organs. With respect to suppuration in nerves, M. Andral considers it an undecided point, whether the nervous tissue itself, or the cellular membrane, which enters into its composition, is the real source of the purulent matter.

Mucous membranes are more prone to suppuration than the serous, in which last there is a far greater tendency to the adhesive inflammation. (See INFLAMMATION.)

Pus is also sometimes met with within the blood-vessels and lymphatics, and even in the centre of clots of blood in the vessels, or heart itself. It has been detected in veins which return the blood from parts in which pus has been collected; as well as in lymphatics, originating in textures in the state of suppuration. In phlebitis, its presence in the veins, and its mixture with the circulating blood, without any preparatory action of the absorbents upon it, are believed to be the principal causes of the frequently fatal termination of this dangerous affection.

SYMPTOMS OF SUPPURATION.

When matter is fully formed in a tumour, there is a change, or even a remission of some of the symptoms. The throbbing pain, which was experienced so severely on the approach of suppuration, from acute phlegmonous inflammation, now subsides, and the patient complains of a more dull, constant, and heavy pain in the part. A conical eminence, or *pointing*, as it is termed, mostly takes place at some part of the tumour, generally near its middle. In this situation, a whitish, or yellowish appearance is observable, instead of a deep red, which was previously apparent; and a fluctuation under it may be discovered, on a careful examination with the fingers. Sometimes, indeed, when an abscess is thickly covered with muscles and other parts, the fluctuation cannot be easily distinguished, though from other concurring circumstances, hardly a doubt can be entertained of there being even a very considerable collection of matter. An oedematous swelling, over the situation of deeply situated abscesses, is a symptom which sometimes throws light on cases of this description.

Skill in detecting the existence of deep abscesses is a circumstance of the highest importance in practice, and one, which greatly contributes to the practitioner's reputation. In no part of surgery is experience of greater use to him, than in the present; and however simple this part of his duty may appear, yet nothing, it is certain, more readily distinguishes a man of observation and extensive practice, than his being able easily to detect collections of deep-seated matter. On the contrary, nothing so materially injures the character and professional credit of a surgeon, as his having in such cases given an inaccurate prognosis; for their nature is at last clearly demonstrated to all concerned.

Together with the several local symptoms of the presence of pus already enumerated, may be mentioned the frequent shiverings to which patients are liable, especially on the first formation of acute abscesses. However, these rigors seldom occur so as to be distinctly observed, unless the collection of matter be considerable, suddenly produced, or deeply situated in some of the viscera. "In the progress of the fever, accompanying acute inflammation (says Professor Thomson), rigors, or cold shiverings, not unfrequently take place, which recur at irregular intervals, and are in general followed by a hot fit, and slight increase of the febrile symptoms. These rigors, or cold shiverings, in general indicate, when they occur in the progress of inflammatory diseases, that pus either is formed, or is about to be so. In inflammation, succeeding to injuries of the head, these rigors are often the first constitutional symptoms which give alarm to the well-informed practitioner; for they are generally, though not always, an indication, that inflammation has already made a dangerous, if not fatal progress. These rigors also accompany the formation of pus in the viscera, contained within the cavities of the chest and belly; and are often the first symptoms which inform the practitioner, that his endeavours to procure resolution have not been successful." (See INFLAMMATION.)

Rigors, as Mr. Hunter remarked, are more common at the commencement of spontaneous inflammations, than of inflammations from external injury. They seldom precede the suppuration which follows operations.

When matter is formed upon the natural surfaces of the body, which are connected with vital organs, much irritation and disturbance take place; but, when matter is produced upon the surface of a wound, or upon parts of little vital importance, then its formation is often unpreceded by irritative fever. (See *Sir Astley Cooper's Lectures*, &c. vol. i. p. 113.) Pus may continue to be produced from the mucous membrane of the urethra, or from a chronic ulcer, for an indefinite period, without any perceptible disturbance of the constitution.

The constitutional symptoms, which attend the formation of pus in the progress of chronic suppurations, are generally comprehended under the name of hectic fever. (See FEVERS.)

The pain, attending what Mr. Hunter termed *suppurative inflammation*, is increased at the time when the arteries are dilated, and this gives the sensation called throbbing, in which every one can count his own pulse, by merely paying attention to the inflamed part. Perhaps this last symptom is one of the best characteristics of this species of inflammation. When the inflammation is moving from the adhesive state to the suppurative, the pain is considerably increased; but when suppuration has taken place, the pain in some degree subsides. The redness that took place in the adhesive stage is now increased, and is of a pale scarlet colour. The part, which was firm, hard, and swelled in the previous stage of the inflammation, now becomes still more swelled, in consequence of the greater dilatation of the vessels, and the greater quantity of coagulating lymph thrown out. (Hunter.)

THEORY OF SUPPURATION.

The dissolution of the living solids of an animal body into pus, as an essential part of the process of suppuration, and the power of this fluid to continue the dissolution, are opinions which are no longer entertained; and the phrase "*pus corrodes*," is at present rarely heard. If these notions were true, no sore, which discharges matter, could be exempted from a continual dissolution. Such ideas probably arose from the circumstance of an abscess being a hollow cavity in the solids, and from the supposition, that the whole of the original substance of that cavity was now the matter, which was found in it. This was a natural way of accounting for the formation of pus by one entirely ignorant of the circulation, the powers of the arteries, and what takes place in an abscess after it is opened. The knowledge of these three subjects, abstracted from the knowledge of the abscess previously to its being opened, Mr. Hunter thinks, should have led surgeons to account for the formation of pus from the blood by the powers of the arteries alone. According to the above erroneous principle, abscesses would continue to increase after being opened as fast as before. Upon the principle of the solids being dissolved into pus, was founded the practice of bringing all indurated parts to suppuration, if possible, and not making an early opening. This was done for the purpose of giving time for the solids to melt down into pus; but it was apparently forgotten, that abscesses formed matter after they were opened, and, therefore, the parts stood the same chance of dissolution into pus as before. Blinded with the idea that the solids entered into the composition of pus,

the partisans of this doctrine could never see pus flowing from any internal canal, as from the urethra, in gonorrhoea, without supposing the existence of an ulcer in the passage. Such sentiments might be forgiven, while it was not known, that these surfaces could, and generally did, form pus, without a breach in the solids; but, the continuance of this way of thinking now, Mr. Hunter pronounces to be, not mere ignorance, but stupidity. The formation of pints of matter in the cavities of the chest and abdomen, without any breach in the solids, could not have been overlooked by the most zealous advocates for the doctrine of dissolution.

The moderns (he observes) have been still more ridiculous; for, knowing that it was denied that the solids were ever dissolved into pus, and that there was not a single proof of it, they have been busy in producing what to them seemed a proof. They have been putting dead animal matter into abscesses, and, finding that it was either wholly, or in part dissolved, they, therefore, attributed the loss to its being turned into pus. This, however, was putting living and dead animal matter upon the same footing, which is a contradiction in itself; for, if the result of this experiment were really what they supposed it to be, the idea of living parts being dissolved into pus must be abandoned, because living and dead animal matter can never be considered in the same light. It might have been remarked, that even extraneous animal matter would lie in abscesses for a considerable time, without being dissolved; and, that in abscesses arising either from violence, or from a species of erysipelatous inflammation, there were often sloughs of the cellular membrane, which sloughs would come away, like wet tow, and, therefore, were not dissolved into pus.

Mr. Hunter noticed, that in abscesses of tendinous parts, as about the ankle, a tendon often mortified, and sloughed away, and that the sores would not heal till such sloughs were detached; but, though this separation was sometimes not completed for several months, yet the sloughs were at last thrown off, and not converted into pus. Pieces of dead bone often lie soaking in matter for many months, without being changed into pus; and although bones, so circumstanced, may lose a considerable deal of their substance; a loss, which some might impute to the dissolution of the bone into pus; yet such waste can be accounted for on the principle of absorption. The loss is always upon that surface, where the continuity is broken off, and it is a part of the process by which the exfoliation of a dead piece of bone is accomplished.

The formation of pus has been attributed to a kind of fermentation, in which both the solids and fluids are fancied to be concerned. This doctrine is easily refuted by stating what happens in internal canals, which naturally secrete mucus, but frequently form pus, without any loss of substance, or any previous fermenting process. Were we to suppose a fermentation of the solids and fluids the immediate cause of the production of pus, whence could the solids come, which enter into the composition of discharges from the urethra? for the whole penis could not afford matter enough to form the pus, which is discharged in gonorrhoea. How also could the fermentation of the solids ever cease? for there is the fermentation continuing in them, whenever the

formation of pus is discontinued. It may be asked, likewise, by what power the first particles of pus in an abscess, or on a sore, is formed, before there is any particle existing which is capable of dissolving the solids? An abscess may be stationary for months, and at last be absorbed; what becomes of the fermentation all the while the collection of matter continues stationary?

Extravasated blood has been supposed to be capable of being converted into pus. We find, however, that blood, when extravasated, either from violence, or the rupture of a vessel, as in aneurism, never of itself becomes pus; nor was pus ever formed in these cases, without being preceded by inflammation. Both the blood and matter are also found together in the same cavity, under such circumstances. If the blood had coagulated, which it seldom does in cases of violence, it would be found still coagulated; and if it had not coagulated, the pus would be bloody. (Hunter.)

The theory of suppuration now most extensively adopted, is, that pus is separated from the blood by the secreting power of the vessels of the inflamed part, which acquire a new mode of action.

That pus is formed in the vessels from which it exudes, by an action of these vessels analogous to secretion (according to Professor John Thomson), was first distinctly suggested by Dr. Simpson of St. Andrew's, in his "*Dissertationes de Re Medica*," published in the year 1722. An opinion similar to that of Dr. Simpson's, suggested itself about the year 1756, to De Haen, from the consideration of what takes place in some cases of phthisis pulmonalis. This author observed, that pus was often expectorated, for a great length of time, by patients affected with phthisis, in whom, after death, no mark of ulceration could be perceived, not even the place in which the pus had been formed. The hypothesis of pus being a secretion was afterwards more fully considered by Dr. Morgan of Philadelphia, in his inaugural thesis, printed at Edinburgh in 1763, entitled "*Puopioises, sive Tentamen Medicum de Puris Confectione*." The belief that pus is a secretion, or formed at least by an action of the vessels analogous to secretion, was adopted by Mr. Hunter. Indeed, the merit of the original suggestion of this hypothesis has been ascribed to him, though improperly. Bruggman, at Leyden, maintained the same doctrine in an excellent thesis "*De Puogenia*," published in 1785; and it is that which is now very generally taught all over Europe. (See Thomson, *On Inflammation*, p. 316, 317.) With respect to suppuration from exposed surfaces, however, it is more proper to say, that the vessels secrete a fluid, which becomes pus; for Sir Everard Home has proved, that this fluid has not the purulent appearance, when first secreted, but acquires it while it remains on the inflamed surface, and does not acquire it the less readily, when removed from that surface in a colourless state, provided its proper temperature be preserved, and it be kept exposed to the air, which promotes the change.

The opinion, that suppuration is a process analogous to glandular secretion, was at first hastily rejected by many, who were swayed by the belief that pus is never found blended with the blood in the circulating system. By this mode of reasoning, however, such thinkers must be led to deny the universally received and, undoubted doctrine,

that the bile is a secretion; and, yet, it is well known, that nothing like this fluid can be detected in an analysis of the blood; and, indeed, a very small quantity would be sufficient to tinge the whole mass of circulating blood with a yellow colour, the same as we see in cases of jaundice. No one would wish to defend the idea of there being either pus, or bile, actually in the circulation; but, only the matter, or modifications of the matter, which, by the combinations, or whatever changes we may choose to term them, produced by the action of the secreting vessels, are converted into one of the particular fluids in question. According to Mr. Hunter, in the commencement of what he terms the *suppurative disposition*, the vessels of the cellular membrane, and circumscribed cavities, are but little changed from the state in which they are in the adhesive stage of inflammation; but, afterwards, their condition is altered, and the discharge is also every instant "varying and changing from a species of extravasation, to a new-formed matter peculiar to suppuration. This matter is a remove further from the nature of the blood, and becomes more and more of the nature of pus. It becomes whiter and whiter, losing more and more of the yellow and green" and becoming also more viscid and creamy. He adds, "Pus is not to be found in the blood, similar to that which was produced in the first stage; but is formed from some change, decomposition, or separation of the blood, which it undergoes in its passage out of the vessels; and for effecting which, the vessels of the part have been formed." He further states, "We must look upon it as a new combination of the blood itself, and must be convinced, that, in order to carry on the decompositions and combinations necessary for producing this effect, either a new or peculiar structure of vessels must be formed, or a new disposition, and, of course, a new mode of action of the old, must take place. This new structure, or disposition of vessels, I shall call *glandular*, and the effect, or pus, a *secretion*." However, as Professor Carswell justly observes, this glandular structure to which the French pathologists give the name of *tissu pyogénique*, is by no means necessary for the production of pus. (See *Illustrations of the Elem. Forms of Disease*, fasc. 8.)

Although, as the latter eminent pathologist remarks, Mr. Hunter does not appear to have ascertained the particular changes which take place in the blood of the capillaries of an inflamed part, during the suppurative stage, "it is clear that he considered pus as essentially composed of the constituent elements of the former fluid; for, when speaking of the discharge which accompanies the suppurative stage, he thus emphatically expresses himself: 'This matter is a remove further from the nature of the blood, and becomes more and more of the nature of pus'; that is to say, it is only a remove further from the nature of the blood, than the matter formed by the adhesive inflammation; an opinion, the accuracy of which has received the fullest possible confirmation from the recent experiments of Gendrin, who expresses himself on this point in nearly the same language: 'Il n'y a entre le fluide purulent des tissus enflammés et le fluide coagulable organisable qu'un degré de plus.'" (See *Carswell's Illustrations of the Elem. Forms of Disease*, fasc. 8.)

Gendrin has entered into a minute account of the process of suppuration. He excited inflam-

mation in the web of the frog's foot, and in the mesentery, by means of boiling water, the actual cautery, and the seton, and followed with the microscope the gradual development of pus from the globules of the blood. He affirms, that he distinctly saw the globules of the blood, after they had become stagnant in the capillaries, lose their colouring envelope, become opaque, and assume a yellowish grey colour, approaching to that of pus. He traced them moving slowly in the capillaries, or in new formed vessels; and, as they advanced towards the edge of the ulcer, or eschar, occasioned by the violence of the inflammation, gradually acquiring all the physical characters of perfect pus. Previously to the investigations of M. Gendrin, Kaltenbrunner arrived at nearly the same results. "The microscopical researches of this author, however, would seem to show, that not only is the blood, which is carried into the inflamed tissue, but likewise a *portion of the solids*, converted into pus; for he states, that small granular bodies are seen to separate from the parenchyma, to pass into canals which are formed for their reception, and to mingle with others of a similar kind coming from the blood, both of which are converted into true granules of pus." The facts elicited, appear to Dr. Carswell to leave no doubt, "that the formation of pus is a consequence of a modification of the blood, manifested more especially by a change taking place in the colour, transparency, and bulk of the globules of this fluid, after its circulation has been arrested in the capillaries by inflammation; that this change in the globules takes place in the capillary vessels; and that these vessels conduct the globules in this state to the exterior, where they appear to be combined with the serum of the blood, under a peculiar liquid form, or that which we call pus." (R. Carswell, *Op. cit.*)

Dupuytren's views of suppuration concur with those of Kaltenbrunner, in respect to its consisting in part of a dissolution of the solids. "If," says he, "the inflammatory action is not stopped, or diminished, the tissues affected soften, and, being destroyed, mix with the blood, which penetrates them; forming a pulpy substance, which, by further elaborations, is gradually converted into pus. This fluid is originally formed both of the wrecks of the solids of the inflamed organs and of the elements of the blood, which have entered into new combinations. These two kinds of materials are readily distinguishable in the commencement of suppuration, which is at first bloody, and, in certain organs, the texture of which presents very marked qualities, difficult to annihilate, carries along with it manifest vestiges of portions of their parenchyma. For example, suppuration of the liver is almost always of a brownish red colour, and contains particles of the substance of that organ, imparting to the pus the consistence and appearance of the lees of wine." It is only, however, in the early stage of suppuration, that the colouring matter of the blood, and the wreck of textures, are represented by Dupuytren to be discernible. (See *Dict. de Méd. et de Chir. t. i. p. 5.*)

Whatever may be thought of this doctrine, with regard to suppuration in some situations, it does not appear to me at all applicable to suppurations from inflamed mucous membranes, or even to those common cases where abscesses are furnished with a distinct membranous cyst, resembling

bling a mucous membrane. Here certainly we cannot suppose that the solids are softened, or any particles of the inflamed texture commixed with the pus. The same observation may be extended to a serous, or any other free surface, in a state of suppuration, but not attended with ulceration, or loss of substance.

Besides the formation of pus by a process compared to that of secretion, some pathologists admit another mode, whereby pus appears as if it were produced in the blood, "under circumstances in which the influence of the capillary system, as exercising a function of secretion, can have no part." This mode of formation, Dr. Carswell proposes to call *extravascular*, some evidence of which, he remarks, is manifest in the observations delivered by him in the notice of the microscopical observations made by Gendrin and Kaltenbrunner. "Thus we have seen that, besides the conversion of the globules of the blood, contained in the capillaries, into pus, there was also observed a similar change in those of the blood, effused into the cellular tissue around these vessels. In fact, the whole of the blood, *intra and extravascular* was seen to undergo the same gradual change of colour from red to yellowish grey; the globules in both situations became opaque, acquired an increase of bulk, and passed slowly towards the surface of the part, either in the original, or new-formed capillary vessels in the form of pus." Dr. Carswell has, on several occasions, been able to satisfy himself, that this mode of formation of pus often takes place to a considerable extent in blood effused into the cellular tissue from external violence, and followed by acute inflammation; but he has most frequently observed it in the blood which has ceased to circulate in inflamed (See VENS.) He considers Gendrin's experiments a complete proof of this fact. "If," observes this last author, "after having injected a great quantity of blood into the subcutaneous cellular tissue, a seton is passed through the same tissue, in order to excite a certain degree of inflammation, the blood is rapidly converted into pus, as if it had escaped from the vessels themselves of the part." (See *Carswell's Illustrations of the Elementary Forms of Disease; Gendrin, Hist. Anat. des Inflammations, &c.*)

The doctrine of the conversion of the blood into pus in inflamed vessels of large dimensions, seems to be confirmed, not only by what happens in phlebitis, but by the following experiment performed by Gendrin. "If (says he) after the circulation in an artery, or vein, has been interrupted for an instant, a solution of nitrate of silver, or caustic potash be injected, and soon withdrawn, and the blood again admitted and retained in the vessel by means of two ligatures, suppuration ensues; the blood, at first coagulated, afterwards becomes discoloured, and is progressively converted into pus."

In the experiments and observations here referred to, Dr. Carswell notices three striking circumstances, which, from their constancy, and the uniformity of their results, must be regarded as having a common origin, and as consequences the one of the other. "These are the cessation of the circulation, the coagulation of the blood, and the conversion of the fibrine or globular structure of a fluid into pus." But these changes were preceded by inflammation of the tissue in which they were contained, and the pus that

was immediately derived from this fluid. "That inflammation was the common origin of these changes cannot, therefore, admit of a doubt; and as it has been proved that they constitute the process of suppuration, the legitimate conclusion at which we arrive is, that this morbid process is essentially dependent upon inflammation as its efficient cause."

Dr. Carswell makes a distinction between the process of suppuration, considered as a vital act, and the mere presence of pus as a product of that process. "If," says he, "pus is found in an organ, in which neither the physical nor physiological characters of inflammation are to be detected, either during life, or after death, the necessity of establishing a distinction between the mere presence of pus, and suppuration, must be obvious." That pus is formed under such circumstances, he endeavours to prove; first, from this fluid being found in the blood, where inflammation could have exercised no direct influence in its production; and secondly, from its being found in organs where no traces of inflammation are perceptible during life, or after death. He adverts to examples, in which pus was found in coagula, contained in the cavities of the heart, and, as the particulars demonstrate, without any inflammation of that organ. After alluding to facts of this kind, recorded by Andral, Reynaud, and others, he observes: "But, there is another most important fact, which requires to be established, before we can understand how pus can be formed in coagula in the cavities of the heart, and that is the coexistence of suppuration in some other organ. I have never met with a case of anomalous formation of pus, either in the cavities of the heart, in the cellular or parenchymatous structure of organs, or in the cavities of serous membranes, without finding, at the same time inflammation and suppuration to a greater or less extent in some remote organ. It may indeed be asserted that this is also the almost uniform result of the researches of other pathologists; although Andral, Maréchal, and some others have rather vaguely stated, that they have met with puriform matter in fibrinous concretions of the heart, without the presence of pus being detected in any other organ of the body." But, so far as Dr. Carswell's observations extend, the fluid matter of these concretions never resembles pure pus, but is a thin grumous grey, or reddish coloured fluid; and probably puriform in its nature, as it resembles the contents of those concretions which are formed during life in the cavities of the heart in some cases of inflammation of the internal membrane of this organ, succeeding to rheumatism of the joints. "If such be the origin of puriform collections of this kind, they of course come under the head of suppuration, and do not form an exception to the law, that the formation of pus in the blood, and in other parts of the body, under circumstances which disprove its connexion with inflammation, as cause and effect, has never been shown to take place, without being preceded by suppuration in a remote organ." This important fact being admitted, Dr. Carswell considers the principal circumstances under which suppuration has been observed to precede those anomalous formations of pus; for instance, external suppurating sores, wounds, amputation, lithotomy, operation for fistula in ano, the excision of portions of diseased bone, fractures, phlebitis after external in-

juries, and parturition, &c. Then the situation of the pus in these cases appears to Dr. Carswell to deserve particular notice. "In the great majority of cases, this morbid product is found in the veins of the affected part. In idiopathic phlebitis; in phlebitis of the uterus following delivery; and even in phlebitis after blood-letting; it is sometimes found only in the veins; whereas, in phlebitis succeeding to external injuries, or operations, it exists often extensively, at the same time, in the intermuscular cellular tissue, in the canals, and the cancelli of the bones: it is found in the smallest veins that can be traced by dissection, in the largest trunks of the extremities, and pelvic viscera, and even in the vena cava. In some cases, the quantity of pus does not amount to a drachm; in others, it measures several ounces. The number of veins in which it is found, varies from a very few, small or large, to the whole of those of the arm, or forearm, or of the uterus. The arteries, in such cases, never contain any pus; nor have I met with it to any extent in the lymphatics, except in uterine phlebitis, in some cases of which these vessels were distended with it, the veins being in a similar state, or containing only a very small quantity."

With all these facts presenting themselves, Dr. Carswell joins Dance, Blandin, and Cruveilhier, in attributing the formation of anomalous collections of matter in remote parts of the body to the transmission of the pus from the veins in which it is formed, directly into the circulation, and not through the medium of the lymphatics. He believes also, with Velpeau, Marchal, and Rouchoux, that purulent deposits may be formed as a consequence of the separation of pus from the blood, and its subsequent accumulation in the capillaries, or cellular texture. (See *Carswell's Illustrations of the Elem. Forms of Disease*, fasc. 8.) For other remarks connected with this subject, see VEINS.

Violence done to parts, is one of the great exciting causes of suppuration; but simply violence does not always occasion it. The violence must be followed by something that prevents the cure in a more simple way, something that prevents the restoration of the structure, and the continuance of the animal functions of the part. The parts must be kept long enough in that state into which they were put by the violence; or, what is somewhat similar to this, the violence must be attended with death in a part, as in many bruises, all mortifications, and all sloughs, in consequence of the application of caustic, which, when the dead parts separate, leave internal surfaces exposed. (Hunter.)

As every injury, or effect of outward violence, under the above circumstances, is more or less exposed to the surrounding air, the application of air to internal surfaces has been assigned as a cause of suppuration; but, certainly, the air has not the least effect on parts circumstanced as above, for a stimulus would arise from a wound, were it even contained in a vacuum. In circumscribed abscesses, the air cannot possibly get to the parts, so as to have any share in making them suppurate.

In emphysema, when air is diffused over the whole body, no suppuration is the consequence, unless an exposure, or imperfection of some internal surface, should be made, for the purpose of

allowing the air to escape. A stronger proof, that it is not the admission of air, which makes parts inflame, is, that the cells in the soft parts of birds, and many of the cells and canals of their bones, communicating with the lungs, and always containing air, never inflame; but if these cells are exposed in an unnatural way, the stimulus of imperfection is given, these cavities then inflame, and their surfaces either form adhesions together, or produce pus. (Hunter.)

When the interior of an abscess is examined, the cavity, which contained the matter, is observed to be lined with a smooth, membrane-like substance, which is of a whitish ash colour, and, in a recent case, has a strong resemblance to coagulating lymph. In examples of longer standing, and in old fistulæ, it assumes an appearance very much like that of mucous membrane, from which it differs, however, in containing no follicles; though, as Andral remarks, there are some mucous membranes in which the presence of follicles has not yet been demonstrated. (*Anat. Pathol.* t. i. p. 257.) Nor, as this distinguished pathologist has explained, are these cysts, resembling mucous membranes, only met with in abscesses of the loose cellular tissue. He has met with similar productions in the parenchyma of different organs, as that of the liver (see *Clin. Méd.* t. iv.), and once in the hemispheres of the brain, two cavities which were filled with pus, and united by a fistulous track, the cavities and the latter passage being all invested by a thin, greyish red smooth membrane, readily separable from the subjacent texture. (See *Andral, Anat. Pathol.* t. i. p. 263.)

The membrane-like investment of an abscess has been termed its *sac* or *cyst*. It seems in general to adhere by a vascular union to the surrounding cellular membrane, which is itself likewise denser in texture, and more vascular, than in the natural state (*Thomson's Lectures*, p. 310.), its cells being closed by coagulating lymph, effused, in consequence of that species of inflammation which Mr. Hunter termed the adhesive. Thus, by the formation of a cyst, and the effusion of coagulating lymph in the cellular tissue around the abscess, the collection of matter is bounded, and cannot become diffused, as it otherwise would do, in the communicating cavities of the cellular texture, like the water in œdema.

Something like this diffusion of pus seems to occur in phlegmonous erysipelas. "But, in this case (says Professor Thomson), the vitality of greater or less portions of the cellular substance is destroyed; the deadened portions are converted into dirty, whitish, ash-coloured sloughs; and it becomes extremely difficult to say, whether any part of the pus, contained in the deadened cellular membrane, has been formed in the cells in which it is contained, or has been absorbed into these cells, after being separated from the parietes of the cavities containing the sloughs themselves." (*Lectures*, &c. p. 310.)

There can be no doubt, that, after an abscess has received a membranous lining, or cyst, the secretion of pus is continued from the surface of the latter part entirely, as well as whatever degree of absorption of the same fluid happens to be going on. In fact, the cysts must be both secreting and absorbing surfaces. The circumstances which leave no doubt of this point, are the frequent,

sudden, or gradual removal of very large manifest collections of matter; the continual changes occurring in the quantity and consistence of the pus, and the speedy filling of the cavity with purulent matter again, after the first contents of the abscess have been discharged.

The facts and opinions adduced by Dr. Carswell, in relation to the long disputed question, whether suppuration ever happens unpreceded by inflammation, I have already noticed. Professor John Thomson believes, that the affirmative on this point was first suggested by De Haen, of Vienna; but he thinks that much of the difference of sentiment in this matter has proceeded from the vague "notions entertained with regard to the symptoms which necessarily characterise the state of inflammation, and also with regard to the properties, by which pus is to be distinguished from other animal fluids. Accordingly, in almost all the examples which De Haen has adduced to prove the formation of pus, without the previous existence of inflammation, he has himself occasion to remark the exudation of coagulating lymph, and the existence of preternatural adhesions; phenomena which we now know are produced by that state which Mr. Hunter has denominated adhesive inflammation." But De Haen uses the term inflammation to express that state which we denominate ulceration, or ulcerative absorption; for, in speaking of the cases of suppuration which he has adduced, he observes, that "in many of them no previous loss or consumption of substance could be perceived." An observation, similar to this, was made about the same time, or perhaps a little earlier, by Dr. W. Hunter, and an account given of it in the second vol. of the *London Medical observations and Inquiries*.

"Mr. Hunter, though he endeavours to establish it as an invariable fact, that no suppuration takes place, which is not preceded by inflammation, is of opinion, that collections of what he terms extraneous matter, something like pus, may form in various parts of the body, without the previous existence of inflammation in the parts in which it is formed; and accordingly you will find, at page 300. of his *Treatise on Inflammation*, a chapter entitled 'Of Collections of Matter without Inflammation.'"

Professor Thomson doubts, however, "whether these collections of matter, said to be formed without inflammation, would not have been more properly denominated serofulous abscesses, or chronic suppurations. I am disposed to believe (says he) that, in whatever texture, or organ of the body, scrofula manifests itself, there inflammation will be found to exist. The phenomena, it is true, of inflammation, both local and constitutional, are modified by the existence of the serofulous diathesis; but they are, I believe, always present in such a degree as to justify us in giving to them the name of inflammation, and in classing most, if not all local serofulous affections, among inflammatory diseases. When the indolent swellings, of which Mr. Hunter speaks, occur near to the surface of the body, that part feels warmer than usual, as may be felt in white swellings of the joints. The swelling also is either preceded or accompanied with some degree of pain, though, when the affection is internal, the patient may not always be very accurate with regard to the precise state of this pain. When cut

into, the parts affected with serofulous swellings are always found more vascular than usual; in short, all the symptoms occur, by which the state of inflammation is characterised." (*On Inflammation*, p. 313, 314.) In another place Dr. Thomson admits, that the matter, which is formed in chronic suppurations, does not always accurately resemble that which is formed in acute abscesses; yet he contends, that it is so analogous both in its physical and chemical characters, as well as in the circumstances in which it is produced, that he can see no reason why it should not be called pus, or a puriform fluid. (P. 315.) Sir A. Cooper also inculcates the common doctrine, that the formation of matter is preceded by inflammation, which, he says, in healthy persons is active, while, in the debilitated and serofulous, it is often very slight, and the pus produced generally less perfect. Sometimes there is even such a change of action, that the products entirely differ, being in serofulous abscesses serous and curdlike, or even chalky. (*Lectures, &c.* vol. i. p. 120.) The doctrine of Dupuytren likewise was, that abscesses never constitute primary diseases, but are constantly the effect, or termination, of previous inflammation of greater or less intensity, depth, and extent in the living textures. (See *Dict. de Méd. et de Chir.* t. i. p. 3.)

QUALITIES OF PUS.

True pus has certain properties, which, when taken singly, may belong to other secretions, but which, conjointly, form the peculiar character of this fluid; viz. globules swimming in a fluid, which is coagulable by a solution of the muriate (hydrochlorate) of ammonia, which no other animal secretion is, and, at the same time, a consequence of inflammation. This fluid, like serum, is coagulable by heat. "Pus also contains abundance of fibrin: if water be poured upon pus, until the solid part, which remains at the bottom of the vessel, be entirely deprived of its serum and globules, numerous portions of fibrin are found remaining, and although not exactly of the same size, yet they have a great uniformity of appearance. Thus pus is composed of serum, fibrin, and globules; and (says Sir A. Cooper), if I were to hazard a theory upon this subject, I should say that pus was composed of the constituent parts of the blood, slightly changed in their character by inflammation." (*Lectures*, vol. i. p. 121.)

The colour and the consistence of pus are the two qualities which first attract the notice of every, the most superficial, observer. The colour arises from the largest portion of this fluid being composed of very small round bodies, much resembling the globules of cream. The fluid, in which the globules of pus swim, might at first be supposed to be the serum of the blood, for it coagulates with heat, like the latter fluid. Pus is also probably mixed with a small quantity of coagulating lymph; as it partly coagulates, after it is secreted. However, the fluid part of pus is found to have properties which serum has not. There being a similarity between pus and milk, experiments have been made to ascertain whether the fluid of pus could be coagulated with the gastric juice of animals: but, no coagulation could be effected in this manner; a solution of muriate of ammonia made the fluid part of pus coagulate; but, not any other secretion, or natural fluid; and,

hence, it was concluded, that whenever globules were found swimming in a fluid, coagulable by muriate of ammonia, the matter was to be considered as pus.

It was announced by M. Dumas, in 1828, that, amongst the component parts of pus, there is one exactly similar to caseum, which must therefore not be regarded as a product peculiar to the mammary secretion. (See *Andral, Précis d'Anat. Pathol.* t. i. p. 351.)

"Formed by a process similar to that of secretion, the chemical composition of pus must vary, not only with the nature of the tissue from which it is derived, but likewise under the influence of various morbid conditions, which are known to modify the products of secretion in general. It is on this principle, that we explain the difference, which exists, particularly at the commencement and termination of suppuration, between the pus furnished by serous and mucous membranes; the quantity of albuminous matter being much greater in the former, than in the latter case, and, as has been observed by Gendrin, the pus furnished by the granulations in caries contains a greater quantity of the phosphate and muriate of lime; the puriform discharge of serofulous ulcers a larger proportion of soda and the muriate of soda; and that which is found in the tissues surrounding the joints in gout, an excess of the carbonates, phosphates, and perhaps the urate, of lime." (See *Carswell's Illustrations of the Elementary Forms of Disease*, fasc. 8.)

The proportion, which the white or yellowish opaque globules bear to the other parts of pus, depends on the health of the parts producing the discharge. When the globules are very abundant, the matter is thicker and whiter, and is called *healthy pus*; the meaning of which, according to Hunter, is, that the solids which produced it, are in good health; for these appearances in the matter are no more than the result of certain salutary processes going on in the solids, the effect of which processes is to produce the disposition on which both suppuration and granulation depend. The globules are pronounced by microscopical observers to be larger than those of the blood.

Pus is specifically heavier than water, and is probably about as heavy as blood.

Besides the above properties, pus has a sweetish, mawkish taste, very different from that of most other secretions; and this, whether it be pus from a sore, or from an inflamed surface. It has likewise a smell in some degree peculiar to itself; but different in different cases. Some diseases, it is said, may be known by the smell of the discharge, as, for instance, gonorrhœa and ulcerated cancer.

Pus sinks in water; but mucus generally floats; not always, however; for the mucus secreted by the lining of the bladder, as is well known, always sinks to the bottom of the vessel in which the urine is received. The elastic viscous quality of mucus, a quality which never belongs to pus, seemed to Dupuytren a much better criterion. (See *Dict. de Méd. et de Chir.* t. xi. p. 6.)

Pus communicates to water an uniformly troubled white colour; mucus gives the appearance of stringy portions floating in it. Mucus is said to be more readily dissolved by sulphuric acid, than pus is. It has also been asserted, that, if water be added to such solutions, the pus is precipitated

to the bottom of the vessel; while the mucus, instead of being completely precipitated forms swimming flakes. These and other distinctions, between pus and mucus, are not however deemed of much importance at the present day, when pus is no longer regarded as a sure proof of the existence of ulceration.

Pus does not irritate the particular surface which secretes it, though it may be very irritating to any other. Hence no suppurating surface of any specific kind can be kept up by its own matter: if this had not been the case, no sore of a specific quality, or producing matter of an irritating kind, could ever have been healed. This is similar to every other secretion of stimulating fluids, as the bile, tears, &c., which fluids do not stimulate their own glands, or ducts, but are capable of stimulating any other part of the body. (Hunter.)

Whenever disease attacks either the suppurating surface, or the constitution, the production of true pus ceases, and the fluid becomes changed. In general, it becomes fetid, thinner, and more transparent, and partakes more of the nature of the blood, as is the case with most other secretions under similar circumstances.—*Sanies* is the term usually applied by surgeons to pus, in this degenerated state. This unhealthy sort of matter has more of the serum, and frequently more of the coagulating lymph in it, and less of the combination, which renders it coagulable by a solution of muriate of ammonia. It has also a greater proportion of the extraneous parts of the blood, which are soluble in water, such as salts; and it has a greater tendency than true pus to become putrid.

The secretion of pus is often suspended in fevers; while the constitution is thus disturbed, a sore will frequently appear almost dried up; but, on the subsidence of the fever, its surface will again secrete pus in abundance. This is a fact, which every young dresser must have noticed. A similar check to the secretion of pus is also produced, when a sore, or the parts immediately around it, are attacked by fresh inflammation. At the same time the pus is changed in its qualities, for it becomes a thin ichor, or a red fluid, composed of serum and red particles. (See *A. Cooper's Lectures*, vol. i. p. 123.) The qualities of pus, in fact, vary with every change in the state of the health and constitution, and, like other secretions, this fluid is altered by every thing which excites, depresses, or deranges the system. The properties of pus in specific and infectious diseases, are not indicated by any particularity in its appearance, nor has chemical analysis thrown any light upon this part of the subject. The pus of small-pox and of a venereal ulcer differs in no respect in its physical and chemical properties from that of a phlegmonous abscess. The nature of such pus can only be known by its action on the living body.

The discharge, when of an irritating sort, is more stimulating to the adjoining parts with which it comes in contact, than to its own secreting surface. In this manner, it frequently produces excoriation of the skin, and ulceration. Thus the tears excoriate the skin of the cheek, in consequence of the quantity of salts, which they contain. From this effect, matter has been called corrosive, a quality which it has not; the only property which it possesses being that of irritating

the parts, which it touches, so as to cause their absorption. (*Hunter*.)

When the vessels thus lose the power of producing good pus, they also lose more or less the power of forming granulations. This may depend on some deviation from the due structure and action, which such vessels should possess, in order to be qualified for the performance of these two operations.

Pus has been suspected to have a great tendency to putrefaction; but, this is not the case with pure pus, which, when first discharged from an abscess, is perfectly sweet. But, if the abscess has any communication with the air, while the matter is confined in it; or if the collection has been so near the colon, or rectum, as to have been infected by the feces, then the matter will quickly become putrid. When blood is blended with pus; when sloughs are mixed with it; when the parts forming the seat of the abscess are in a gangrenous state from an erysipelatous affection; the matter has a greater tendency to putrefy, than the pure pus discharged from sound abscesses, or healing sores. Pure matter, though easily rendered susceptible of change, by extraneous additions, is in its own nature tolerably uniform and immutable. It appears so unchangeable, that we find it retained in an abscess for weeks, without having undergone any alteration. These qualities, however, only belong to perfect pus. If a healthy sore inflames, the matter now produced from it, though unminged with extravasated blood, or dead solids, becomes much sooner putrid, and more irritating, than the discharge formed before this alteration of the ulcer. (*Hunter*.)

In the preceding paragraph, it is stated, that matter frequently remains unchanged in abscesses for weeks. This expression is not strictly correct; for, inasmuch as the cysts of abscesses are absorbing, as well as secreting surfaces, there must be a continual mutation going on in the contained matter.

In the words of one of the most eminent surgeons of modern times; "the functions of the proper membrane of an abscess are not restricted to containing the pus and forming a boundary for it in the midst of the adjacent textures. By means of the very active absorption and exhalation, which take place upon its surface, its contents are incessantly undergoing renewal, and its qualities modified, according to the different degrees of stimulation, which it receives. An abscess is not altogether removed from the influence of life; on the contrary, it participates in it, though feebly and obscurely, like all other fluids collected in organic receptacles. It is through the medium of the living cyst, that, in consequence of excitements of all kinds, the fluid of abscesses is seen to augment, or diminish in quantity, to become thicker or thinner, and often to be reached by substances introduced by the regular action of the absorbents, or by direct injection into the sanguiferous system. It is because the cysts of abscesses are connected by close sympathies with the principal centres of our organisation, that they rapidly feel the effects of the least stimulation of the viscera, and that medicines, internally exhibited, are sometimes so efficacious in bringing about the absorption of pus. The cyst of an abscess is its most important part. It is a special organ, of new formation, which takes rank, as it were, in the living economy,

and is to be classed with those parts of it, whose relations are the most conspicuous and the most active." (See *Dupuytren*, in *Dict. de Méd. et de Chir.* t. i. p. 7.)

When dead bone, or other extraneous bodies, are present, and keep up irritation, or when blood becomes mixed with the purulent matter, the discharge is always fetid and offensive. This state of it is one mark of the presence of carious or dead bone.

The discharge of an unhealthy sore blackens silver probes, and preparations of lead. This effect is imputed by Dr. Crawford to the sulphuretted hydrogen gas, generated in such matter. (*Phil. Trans.* vol. lxxx. year 1790, p. 385.) Further observations on pus may be found in an *Essay on the Differences between Pus and Mucus*, by Dr. Darwin, junior; and also in Dr. G. Pearson's Paper in *Philos. Trans.* 1811.

USE OF PUS.

Suppuration is sometimes regarded as a constitutional disease, changed into a local one, the former being supposed to be discharged, or thrown out of the body, either in the form of pus, or together with this fluid. Critical abscesses have been thought to be an example of this use of suppuration. It has also been imagined to carry off local complaints from other parts of the body, on the old principle of derivation, or revulsion. For this reason, sores or issues are sometimes made, before an attempt to heal up an ulcer of long continuance. Suppuration is sometimes excited with the view of making parts, such as indurated swellings, dissolve into pus; but it is by no means certain that it ever operates on this principle.

The secretion of pus has been looked upon as a general prevention of many, or of all the causes of disease. Hence, issues have been made to keep off universal, as well as local, diseases. However, the use of pus is perhaps unknown; for it is formed most perfectly from healthy sores, and in healthy constitutions; and large discharges from parts not very essential to life, produce very little change in the constitution, and as little upon being healed up, whatever some may suppose to the contrary. (*Hunter*.) This is certainly the case with many old ulcers, the suppuration from which seems to have little, or no effect, in impairing the health.

When the surface of a sore is left uncovered, the thin part of the matter evaporates, and the thick part dries and forms a scab. Nature, therefore, seems to have designed, that one use of pus should be to make a cover, or protection, for ulcerated surfaces. But I cannot agree with what has been asserted (*Hunter*), that the natural healing of a sore under a scab usually takes place more quickly, than when surgical dressings are employed.

On ulcers, as would appear from certain microscopical observations, "the coagulated pus is rendered tubular by the extrication of its carbonic acid gas, and these tubes, or canals, are immediately filled with red blood, and thus connected with the circulation." If this point were established, Sir Everard Home conceives, that there would then be little difficulty in making out the succeeding changes, by means of which the coagulated pus afterwards becomes organised. (*On the Conversion of Pus into Granulations or new Flesh*, in *Phil. Trans.* vol. cix. p. 109. Lond. 1819.)

These statements may be curious ; but I do not imagine that nature will let us trace much further the secrets here referred to.

Among the secondary uses of suppuration, may be mentioned, that of opening a communication between a disease and the external surface of the body ; and that of leading to the formation of a passage for the exit of extraneous bodies, &c.

Though an abscess is sometimes dispersed by its contents being absorbed, this is not the usual course of the case ; and, the tumour, instead of diminishing, generally continues to increase, instead of subsiding, or remaining stationary. Under such circumstances the pus commonly advances either to the skin, or a mucous surface, in which an outlet for it is produced by an ulcerative process. Here we find, that pus is subject to the general law of the animal economy, which tends to expel from the body all extraneous substances, capable of irritating and disturbing its textures. It is scarcely necessary to observe, that when pus makes its way into a cavity, passage, or organ lined by a mucous membrane, it finds almost as ready an outlet from the body as if the abscess had taken its still more frequent course to the cutaneous surface. If an abscess be near a mucous texture, then, nature will often make the pus take this direction to discharge itself, instead of conducting it to the skin, which may be more remote. But, we do not remark a similar tendency of abscesses to make their way into cavities invested by a serous membrane, because as this always constitutes a close sac, the advantage of an outlet for the purulent matter would not thereby be obtained. Illustrations of this disposition are afforded in abscesses in the vicinity of bones, or in the parietes of the abdomen, or chest, or situated near fibrous, or synovial membranes, where, instead of weakening the textures, abscesses frequently have the contrary effect, by thickening the periosteum, the pleura, the peritoneum, and the fibrous and synovial structures.

Notwithstanding the fact, that abscesses generally tend to the surface, and not to the great cavities, and internal organs, which seem even to be frequently protected by a thickening of the textures interposed between them and the collection of matter, exceptions are sometimes noticed. If an abscess, situated in the parenchyma of the lungs, may occasion an adhesion of the pulmonary to the costal pleura, followed by ulceration of the intercostal muscles, and the formation of an outlet for the matter through the parietes of the chest, it is not less certain, that purulent collections situated on the outside of the chest, in contact with the ribs, may insinuate themselves between these bones, press back the pleura, and be effused within that cavity. The son of J. L. Petit is said to have died from such a cause. Analogous occurrences have been observed in abscesses, situated on the outside of the peritoneum, and especially in those which so commonly form in the inguinal region in women who have been recently delivered. The extension of an abscess into an adjoining cavity is also possible, where the matter is originally formed near a joint.

In a previous page of this article, I have explained, that deep-seated abscesses are not always rendered obvious by local symptoms, the diagnosis sometimes depending exclusively upon changes observable in the general state of the patient, and upon disturbance in the functions of the or-

gans affected. Under these circumstances, as Dupuytren remarks, the surgeon should attend to the slightest alteration in the frequency of the pulse ; the heat of the skin ; the degree of thirst ; and in the freedom of the intellectual, respiratory, digestive, urinary, and other functions. The nicest exercise of the *tactus eruditus* will also be frequently required.

With respect to the prognosis, this is partly in relation to the seat of the abscess, a deep one being more dangerous than another, which is superficial, and this in proportion as the parts implicated are of high importance. Collections of purulent matter in the lungs, the pleura, the liver, or the kidneys, bring life into more immediate danger, than an abscess in a joint, or in the substance of a limb.

It is scarcely necessary to state also, that the severity and danger of abscesses are in proportion to their size ; those whose interior surface is of great extent being evidently the most serious.

Abscesses, arising from acute inflammation, are in general more easily cured, than others of a chronic character, the cysts of which are hard, fibrous, and less readily capable of contributing to the healing process.

Abscesses which tend to the surface, are attended with less danger, than others which take an opposite direction, and are likely to make their way into internal cavities. But, as Dupuytren has noticed, there are important exceptions to this observation, resulting from the situation of the abscess in the substance of certain organs, which have what may be termed natural outlets. Then it is always more desirable that the collection of pus should empty itself into these organs, than discharge itself through the parietes of the great splanchnic cavities. For instance, an abscess of the lungs may discharge itself with less inconvenience by bursting into the bronchi, than by making its way through the side of the chest ; and those of the kidney by taking the course of the urine, than by extending to the lumbar region. The same observation may be made with respect to all abscesses situated near the bladder, or any portion of the alimentary canal.

The connexion of an abscess with scrofula, syphilis, or with dead, or carious bone, makes also great difference in the treatment, and prospect of a cure.

TREATMENT OF ABSCESSES.

In cases of inflammation arising from external violence, but so circumstanced that suppuration cannot be prevented, the indication is to moderate the inflammation, which, if the injury be considerable, will probably be violent. Here, if the patient is young, and not already much debilitated, and reduced in health from other causes, the surgeon should not be afraid to employ antiphlogistic means, and this even with some degree of freedom, especially local and general bleeding, calomel, and antimonial saline medicines. These are the measures calculated to lessen the inflammation and constitutional disturbance, and thus diminish the extent of the approaching suppuration. On account of the severity of pain, the various preparations of opium, and including those of morphia, are also frequently and urgently required in that stage of acute inflammation, which is immediately antecedent to the formation of an abscess, or the occurrence of suppuration.

To free the part from the purulent matter; and to promote the approximation, and afterwards the reciprocal agglutination of the opposite surfaces of the cavity which contained the matter; are the general indications in the treatment of abscesses. The surgeon fulfils these objects, either by bringing about the absorption and dispersion of the matter, or by discharging it, and healing the part with the aid of methodical dressings and suitable medicines.

Instances of the rapid absorption of abscesses in consequence of a sudden attack of profuse diarrhoea, or copious increase of urine, or perspiration, are not unfrequent; and this is unquestionably the least painful mode of cure. What nature thus occasionally brings about, art has likewise attempted to accomplish by means of active purgatives, diuretics, sudorifics, and stimulating applications. But, abscesses resulting from acute inflammation seldom admit of absorption: they are almost sure to burst, and the continuance of a degree of suppuration seems afterwards to be essential to bring the cavity into a healing state. Nor are the thick cysts of certain chronic abscesses more favourable to this mode of cure, because, before their opposite sides will enter into the adhesive process, fresh inflammation is requisite to modify their texture. The greater number of abscesses, which have been known to be removed by absorption, were formed with rapidity, unpreceded by much inflammation, and in individuals weakened by long suffering and previous severe disease. If, in such cases, any great increase of secretion take place from the kidneys, the mucous membrane of the bowels, or of the bronchi, or from the skin itself, there may be a cessation of the secretion of pus in an abscess, the contents of which may be absorbed. It is, however, only abscesses formed under the foregoing conditions, or else abscesses situated in lymphatic glands, which present any chance of being dispersed by absorption. The application of nitrate of silver to the integuments, covering a suppurated lymphatic gland in the neck, will sometimes lead to the dispersion of the abscess. From the effects of mercury, and antiphlogistic means combined, what experienced surgeon has not witnessed the gradual subsidence of a venereal bubo, after matter could be plainly felt in it, and this entirely by the process of absorption?

With regard to stimulating applications, they are more particularly adapted to certain chronic abscesses. Iodine, mercurial frictions, and repeated blisters, are in such cases often tried. But, the nitrate of silver, applied so as to blacken the skin, has sometimes been employed even for the dispersion of phlegmonous abscesses and whitlows with success. (See *Higginbottom on the Use of Nitrate of Silver in the Cure of Inflammation, Wounds, and Ulcers*, ed. 2. p. 20—26.)

In consequence of the general ill success, however, which attends the plan of endeavouring to disperse abscesses by absorption, surgeons do not usually make the attempt; they try, indeed, to prevent acute inflammations from advancing to suppuration at all; and when this cannot be completely accomplished, they aim at lessening the extent of the abscess by antiphlogistic means in the early stages; but, as soon as purulent matter has been unequivocally formed, they more commonly direct their plans to the discharge of the pus, than to the absorption of it.

In every example of abscess from acute inflammation, the suppurative process does not immediately put a stop to the surrounding inflammation, which often continues in a severe form. Hence, antiphlogistic means which were indicated in the previous stage of the case are still called for; and local measures of this description, as Dupuytren observes, may be resorted to with great advantage, even when the fluctuation of pus can be distinctly felt. Emollient applications and topical bleeding, (if it has not yet been carried to a sufficient extent, and the patient is not too much debilitated,) are to be employed so long as pain, redness, tension, and heat, exist around the collection of matter. "These means promote the resolution of the parts, which have not yet suppurated, consequently lessen the mass of textures involved in the abscess, and accelerate the period when the abscess, being completely formed, may be opened, unless it be judged more proper to let it burst of itself." The soothing effect of emollient applications and topical bleeding, will also sometimes bring about the absorption of the pus, which would in vain be attempted by other means. (*Dupuytren, Dict. de Méd. et de Chir. t. i. p. 32.*)

The common applications to inflammations, which are to suppurate and form an abscess, are poultices and fomentations. These are useful, when inflammation attacks the skin, either in the first instance, or after an abscess has approached so near the skin, that this becomes secondarily affected. This benefit appears to arise from the skin being kept soft and moist. Such is the use of a poultice in inflammation, either before or after suppuration, until the abscess is opened. But, when poultices and fomentations are applied to inflamed parts, in which we wish to avoid suppuration, reason and principle will not justify the practice, though such applications may be proclaimed by experience to be proper. (*Hunter.*) When, however, suppuration cannot be avoided, the most approved plan is not to persist in the use of cold applications, but to have recourse at once to emollient applications. In many cases, in which the parts are indolent, and hardly admit of true inflammation, in consequence of which a perfect suppuration cannot take place, stimulating the skin brings on a more salutary, and of course a quicker inflammation. On this principle antimonial ointment, or blistering the skin, over chronic abscesses, may sometimes be proper.

Emollient poultices are commonly applied to inflamed parts, in which suppuration is known to have taken place. These can have no effect upon suppuration, except that of lessening the inflammation, or making the skin more easy. The inflammation must have reached the skin before poultices can have much effect, for they can only affect that part. The ease of the patient, however, should be considered, and we find, that fomentations and poultices are on this principle often beneficial. By keeping the cuticle moist and warm, the sensitive operations of the nerves of the parts are soothed. On the contrary, if the inflamed skin is allowed to dry, the inflammation is increased, and the patient's suffering is unnecessarily lengthened. As warmth excites action, the fomentation should be as warm as the patient can bear, without inconvenience. (*Hunter.*) Warm emollient applications, are also useful in accelerating the progress of the matter to the surface of the body;

that is, in promoting the ulcerative process in those textures which lie between the collection of matter and the cuticle.

"The local treatment in phlegmonous abscesses (as Professor Thomson observes) is still more simple, than that by which we endeavour to procure resolution. It consists almost solely in the application of a moderate degree of warmth and moisture to the inflamed part, either by means of fomentations or poultices. The manner in which these means act in promoting suppuration, is unknown. Independently of their temperature, it seems very doubtful, whether fomentations and poultices have any power of promoting suppuration in the parts to which they are applied. They keep the cuticle moist and warm, they promote perspiration, they soothe, and allay pain in many inflammations, and these are probably the only immediate effects which they produce. The rest is the work of nature. In suppurations, attended by very severe pain, the use of warm fomentations is often found to afford singular relief; not only by their effect in easing pain, but also by their seeming to shorten the duration of the suppurative stage. In the cases of suppuration, in which they give relief, they should be repeated every four or six hours. The most common way of employing them is by wringing linen, or wollen cloths, out of warm water, and applying these to the inflamed part, of as high a temperature as the feelings of the patient can bear. Decoctions of herbs were formerly much employed in the way of embrocation, and were then, and are still by many practitioners, supposed to possess peculiar virtues in promoting suppuration. Whether embrocations with the narcotic herbs might not in some cases be beneficial, by producing a sedative effect in allaying pain, I am unable to say, though I am inclined to believe, that even they act chiefly by their warmth and moisture. In cases where you find it necessary to use an embrocation with herbs, the flowers of camomile may in general be substituted in place of the leaves or flowers of almost every other plant. These flowers readily imbibe and retain moisture. They are, when moist, of a soft consistence, and can be easily moulded to the figure of the parts, to which they are applied." (*On Inflammation*, p. 333.) Oatmeal, crum of bread, and especially linseed meal, are the ingredients mostly preferred in this country for emollient poultices. (See CATAPLASMA and INFLAMMATION.)

OF THE TIME WHEN ABSCESSSES SHOULD BE OPENED.

The following are generally regarded as cases in which an opening should be made, as soon as the slightest degree of fluctuation is perceptible, or sometimes even sooner.

1. Abscesses arising from extravasation or effusion of irritating fluids or matters in the cellular tissue. To this class especially belong urinary and fecal abscesses. Here the incision is necessary, not only for the discharge of pus, but of the effused matter, or fluid, which is the cause of irritation and suppuration. I may add, that, under such circumstances, a very free incision is required to fulfil these two important indications.

2. Abscesses preceded by intense inflammation, and situated in parts abounding in adipous

cellular tissue; as, for instance, the verge of the anus, the neighbourhood of the rectum, the sides of the neck, and the axillary, inguinal, and popliteal regions. In such cases, if an early opening be not made, the purulent matter spreads to a great extent in the cellular tissue, and an enormous denudation of parts, or separation of them from one another, is apt to ensue.

3. Daily experience teaches the surgeon, that abscesses are seriously retarded in their progress to the surface of the body by the intervention of a fascia, or an aponeurosis. These are cases, therefore, requiring an early opening to be made, in order to prevent the matter from spreading widely in the interstices of the muscles, from detaching the vessels and nerves from their connexions, and from forming numerous and extensive sinuses in various directions. Abscesses under the fascia: of the thigh, arm, forearm, and leg, come under the rule here specified, as well as collections of matter under the palmar and plantar fasciæ, and in the sheaths of tendons. Here, as Dupuytren observes, the practice of an incision is warranted as soon as the practitioner perceives œdema of the parts, a broad and undefined swelling of them, the phenomena attending the progress of internal abscesses, and a deep obscure fluctuation, following the ordinary symptoms of inflammation.

4. Abscesses in the parietes of the chest, or abdomen, in the vicinity of a serous membrane, should be opened without delay, in order to prevent with certainty the effusion of pus inwardly, an occurrence which, though rare, has sometimes happened. Certain abscesses of the neck, formed under the sterno-cleido mastoid muscle, call for an early opening; because they not only cause a considerable and very painful swelling, but the matter may easily descend towards the clavicle and chest, in the course of the vessels and nerves.

5. Abscesses in parts abundantly supplied with nerves and capillary blood-vessels, and which when inflamed, are accompanied by excessive pain or close confinement or strangulation of the textures, as whitlows, large painful boils, carbuncles, &c.

6. All abscesses producing serious disturbance, or interruption of the functions of very important organs, and thereby endangering life; as abscesses of the throat, or near the larynx, or pharynx; abscesses compressing the jugular veins, and threatening the patient with apoplexy or suffocation, &c. In such cases, if the practitioner were to defer making an opening until the swelling had softened, and the abscess had been perfectly formed, the patient would be in great danger of perishing ere such changes had taken place.

7. The generality of chronic abscesses should be opened early, more especially if the means usually resorted to for promoting the absorption of the matter, present no prospect of success. By omitting to make an outlet for the matter, we allow the accumulation of it to increase, and sometimes the abscess then becomes dangerous from its mere size, the inner surface of it, or the cyst, acquiring vast magnitude. With respect to chronic abscesses, connected with diseased bone or diseased joints, and collections of purulent fluid in the synovial membranes, some directions will be found other parts of this work. (See JOINTS; LUMBAR ABSCESS; VERTEBRÆ.)

"Those abscesses ought to be opened early (says Professor Thomson), that are situated in

parts through which the matter is liable to become widely diffused. This is particularly the case with abscesses that are situated on the fore part of the neck, or in the cavity of the axilla, or by the side of the rectum. When matter is formed in the cavity of the axilla, if it does not speedily obtain an external outlet, it is very liable to pass up towards the clavicle in the course of the axillary plexus of nerves and vessels, or forwards under the pectoral muscle. I have repeatedly seen axillary abscess take both of these directions at the same time, forming one of the most painful and difficult cases to treat, which occurs in the management of abscesses." Dr. Thomson also considers an early opening proper and necessary, when the matter is lodged, as in some cases of whitlow, in the sheaths of the tendons; when matter is formed under the periosteum; when it collects under fascia; or in the vicinity of large arteries, joints, or the greater cavities of the body; and also when the abscess is deep-seated. (See *On Inflammation*, p. 336—338.)

With respect to making an early opening into abscesses situated near large arteries, I am not aware that any danger of the artery ulcerating in consequence of the nearness of the pus, really exists. Therefore, some doubts may reasonably be entertained of the soundness of Professor Thomson's advice in this particular case, as the general rule of opening abscesses near large blood-vessels, in an early stage of the disease, would be objectionable on the ground of the practice exposing the vessels themselves to injury. Indeed, this well-informed writer distinctly mentions, in considering the subject in question, that the arteries are not very susceptible of ulcerative absorption. (P. 337.)

The making of an opening in certain abscesses should be deferred longer than in common instances. Such are collections of purulent matter, situated in internal organs, as the liver, spleen, kidney, and lungs, and producing an outward swelling. Dupuytren deems it most prudent not to open such tumour until the skin is inflamed, the only circumstance which can be depended upon as denoting the formation of those adhesions, by which alone the insinuation of the pus into the great serous cavities will be prevented.

OF THE PLACE WHERE THE OPENING SHOULD BE MADE.

If a free opening be not required, or making such free opening not practicable, it is at least proper to make whatever outlet for the matter can be made in a depending situation. By this means, the pus will more readily escape, and all pressure arising from its confinement or lodgment will be prevented.

When circumstances forbid an opening to be made at the most depending part of an abscess, the surgeon should make a freer opening than would otherwise be required, press out the matter as often as necessary, and keep the sides of the abscess together with a compress and bandage. In some instances, the opening may be converted into one sufficiently depending, by keeping the patient in a desirable posture.

But abscesses are not always to be opened at the most depending part. The distance between the matter and the skin at this part, is the com-

mon reason against the method. If an abscess is rather deeply situated, and points in a place which is higher than that where the main collection lies, it is proper to make the opening where the conical eminence, or, as it is termed, the *pointing*, appears. Thus, if an abscess should form in the centre of the breast, and point at the uppermost part, which is often the case, it would be improper to cut through the lower half of the mamma, in order to make a passage for the matter in that direction. If an abscess should form on the upper part of the foot, it would be wrong to make an opening through the sole of the foot to get at the most depending part of the abscess; for, besides cutting such a depth of sound parts, a great many useful ones would be destroyed.

When the abscess did not point in a depending situation, Mr. Hunter preferred leaving the collection of matter first to burst of itself, and then dilating the opening as freely as necessary. By allowing abscesses to burst spontaneously, the opening is not so apt to heal as if made by art, and therefore, Mr. Hunter conceived, better, in such situation.

In most cases, however, it is decidedly better even to cut through a certain thickness of parts, for the sake of obtaining a depending opening, than to make the opening where the pointing appears; that is, where the parts are thinnest, and the matter is nearest the surface. This advice is worthy of remembrance, when there is no doubt of the existence of matter at the depending place, and when the parts to be divided are not important. Collections of matter beneath the fascia of the forearm and thigh particularly demand attention to this direction, as they commonly point where those fibrous expansions are thinnest, not where the matter can most readily escape. Abscesses in the sheath of the rectus abdominis should also be opened in a low situation.

DIFFERENT METHODS OF OPENING ABSCESSES.

All abscesses will sooner or later naturally burst of themselves, unless the matter be absorbed; and sometimes they ought to be allowed to take this course. There are, however, as I have already explained, particular circumstances which urgently require an early opening; but, when the skin over the abscess is very thin, it is not of much consequence, whether the case be permitted to burst of itself, or it be opened by the surgeon.

When abscesses are large, it is generally necessary to open them by art, whether they have burst of themselves or not; for the natural opening will seldom be sufficient for the completion of a cure; and, although it may be sufficient for the free discharge of the matter, yet these abscesses will heal much more readily when a free opening is made; for the thin skin over the cavity granulates but indifferently, and therefore unites but slowly with the parts underneath. (Hunter.)

Abscesses may be opened either with a lancet or knife, or occasionally by making an eschar with caustic. Against the latter plan, however, strong objections generally lie: the use of caustic is not usually attended with any advantage which may not be obtained by a simple puncture or incision; upon a tender inflamed part it gives much more pain; it is more slow in its effects; and the surgeon can never direct its action so nicely as to

destroy exactly the parts which he wishes, and no more. If the eschar be not made deep enough, the lancet must, after all, be used. Caustic also leaves a disagreeable scar, a consideration of much importance in the female neck or face. To these numerous objections I may add, that the eschar is frequently ten or twelve days in becoming detached. It is seldom, except when there is a redundancy of skin, or when there is a good deal of it thinned and undermined, that caustic should be preferred. It may sometimes be advantageously resorted to when there is a good deal of indolent hardness around a small abscess.

For this purpose, the *potassa cum calce*, or the *potassa* alone, is the best caustic. The part is first to be covered with a piece of adhesive plaster, which has a portion cut out exactly of the same figure and size as the opening intended to be made in the abscess. The end of the caustic is then to be dipped in water, and to be rubbed on the part till the skin becomes brown. The surface is now to be immediately washed with some wet tow, the plaster is to be removed, and an emollient poultice applied.

In almost all cases, it is better to use the lancet, double-edged bistoury, or sharp-pointed narrow knife. Either of these instruments opens the abscess at once, and with less pain than results from caustic; it occasions no loss of substance, consequently a smaller cicatrix; and, by using it, the opening may be made in the most advantageous direction, and of the exact size required.

DRESSINGS FOR ABSCESSES.

When an abscess has burst of itself, the surrounding skin is to be kept clean, and the emollient applications are to be continued until the discharge has considerably diminished, and the accompanying inflammation has subsided.

Should such opening be too small in relation to the size of the abscess, it is to be enlarged with a director and curved bistoury. Should it not be depending, it may sometimes be rendered so by altering the patient's position. If this cannot be accomplished, and the lodgment of matter is considerable, a new or counter opening must be formed in an advantageous place for the exit of the pus.

An abscess, opened with a cutting instrument, is both a wound and a sore, and partakes more of the nature of a fresh wound in proportion to the thickness of the parts cut. Hence it is sometimes necessary, that something should be put into the opening to keep it from healing by the first intention. If it is lint, it may be dipped in sweet oil, or smeared with spermaceti ointment, which will prevent it from adhering, and allow it to be removed sooner, without causing pain and irritation, than would otherwise be practicable. This is advantageous, because the ulcerated opening should be dressed the next day, or, at latest, on the second day, in order that the pus may be discharged again. As soon as the cut edges of the opening have suppurated, the dressings cannot be too simple, and may consist of the common poultice, or the water dressing, and afterwards of such other applications as the state of the sore may require.

Openings, spontaneously formed in abscesses, have less disposition to close, than those made

with a cutting instrument; and seldom, therefore, require any lint to be introduced into them for the purpose of maintaining them. The previously thinned state of the integuments, and their ulcerated condition, are considerable impediments to any prompt closure of the openings by adhesion. But the edges of an incision, which extends through some thickness of textures, if allowed to be in contact with one another are also disposed to unite.

If the abscess has been opened with caustic, and the slough has separated, the case is to be regarded altogether as a suppurating sore, and dressed accordingly.

Dry lint, a bread and water poultice, a linseed meal one, or the water dressing, is as good an application as any, till the nature of the sore is known. If it should be of a good kind, the same dressings may be continued; but, if not, then it must be dressed accordingly. Parts, which at first appear to be sound, sometimes assume every species of disease, whether from indolence, from irritability, or from scrofulous or other dispositions. In some instances, this tendency to disease arises from the nature of the parts affected, as, for instance, bone, ligament, &c. (*Hunter.*)

John Hunter, On the Blood, Inflammation, and Gun-shot Wounds; a work in which more interesting knowledge, respecting Abscesses and Suppuration, is contained, than in any other ever published. *F. Quercus*, Traité de la Suppuration, 1749. *J. Grahnke*, A Disc. on Suppuration, 8vo. Lond. 1752. *John Burns*, On Inflammation, 1809. *Sir R. Home*, On the Properties of Pus, 1788. *Tract. Obs. on Ulcers*, 2d ed. 1801. *C. Darwin*, Experiments, establishing a Criterion between Mucilaginous and Purulent Matter, &c. Lichfield, 1780. Several parts of *Pott's* Chirurgical Works, but especially his Treatise on Fistula in Ano. *T. Brand*, Strictures in Vindication of some of the Doctrines misrepresnted by Mr. Foot, in his two Pamphlets entitled, "Observations upon the new Opinions of J. Hunter, in his Treatise on the Venereal, including *Pott's* Plagiarisms, and Misinformation on Pus," &c. 4to. Lond. 1787. *Dr. J. Thomson's* Lectures on Inflammation, p. 303, &c. Edin. 1813; a work, in which a profound knowledge of Medical Science, and of the Pathology to Surgery, is everywhere conspicuous. *Pearson's* Principles of Surgery, p. 34, &c. edit. 2. *Lassus*, Pathologic Chir. t. i. p. 21, &c. &c. ed. of 1809. *Seb. J. Brugmanns*, De Puogonia, sive Medis quibus Natura utitur in creando Pure, 8vo. Groningæ, 1785. *Dr. G. Pearson's* Obs. and Experiments on Pus, in Phil. Trans. for 1811. *C. J. M. Langenbeck*, Von der Behandlung der Fistelgänge, der Schisscanale, und grosser Riter absondernder Höhlen, in Neue Bibl für die Chirurgie, 12mo. Hannover, 1817. Also Nosologie der Chirurg. Krankheiten, 2ter b. Götting. 1823. *Gibson's* Institutes, &c. of Surgery, vol. i. Philadelph. 1824; or the 5th ed. of which, by the kindness of the author, I have just received a copy. *Baron Dupuytren*, in Diet. de Méd. et de Chirurgie Pratique, t. i. art. Abscès, 8vo. Paris. 1829. *Bauer and Faraday*, in Home's Paper on the Conversion of Pus into Granulations, in Phil. Trans. 1819, pt. 2. *M. J. Chelius*, Handbuch der Chirurgie, band 1. p. 7. 8vo. Heidelberg, 1826. *G. Andral*, Précis d'Anatomie Pathologique, tom. III. 8vo. 1829. *Kollenbrunner*, in Répertoire d'Anat. &c. A. N. *Gendrin*, Hist. Anatomique des Inflammations, tom. II. 8vo. Paris, 1822. *Robert Carswell*, M. D., Illustrations of the Elementary Forms of Disease, fasc. 8. 4to. Lond. 1836. *J. W. Earle*, in Lon. Med. Gaz. vol. xvi.

SURGERY, or CHIRURGERY (from *χρῆσις*, the hand, and *ἔργον*, work), has been sometimes represented to be that branch of medicine which principally effects the cure of diseases by the application of the hand alone, the employment of instruments, or the use of topical remedies. Such definition, however, conveys but a very imperfect idea of the nature of this most useful profession, and, as applied to the present state of practice, cannot be said to be correct. It might, indeed, be applicable to that short unfavoured period of surgery, some centuries ago, when its practice

was denounced by the Council of Tours, as unfit for the hands of priests and men of literature, and when the surgeon became little better than a sort of professional servant to the physician, the latter alone not only having the sole privilege of prescribing internal medicines, but even that of judging and directing when surgical operations should be performed. Then the subordinate surgeon was only called upon to execute, with his knife or his hand, duties which the more exalted physician did not choose to undertake; and, in fact, he visited the patient, did what was required to be done, and took leave of the case, altogether under the orders of his master. In modern times, however, the good sense of mankind has discovered, that surgery is deserving of an eminent rank amongst those arts and sciences which ought to be cultivated for the benefit of society at large; that the man who is not himself accustomed to the performance of operations, cannot be the best judge of their safety and necessity; and that, in every point of view, the surgical practitioner merits as much favour and independence in the exercise of his profession, as he whose avocation is confined to physic. Hence, the surgeon is now exclusively consulted about many of the most important diseases to which the human body is liable. Being no longer under the yoke of the physician, he follows the dictates of his own judgment and knowledge; he prescribes whatever medicines the case may demand, internal, as well as external; and under the encouragement of an enlightened age, he sees his profession daily becoming more scientific, more respected, and more extensively useful.

Surgery, as Mr. Lawrence has stated, is a branch of that science and that art which have diseases for their object. This science, considered generally, embraces the physical history of man. It investigates the construction of the human body, and its living actions; it inquires into the purposes executed by each part, and into the general results of their combined exertions; it observes the human organisation under all the various modifications impressed on it by surrounding influences of all kinds; and it draws from these sources the rules for preserving health, and removing disease. The practical application of these rules constitutes the *art of healing*, or rather of *treating disease* (for, in many cases, we are unable to *heal*, and do not even attempt it); while the assemblage of facts and reasonings, on which these practical proceedings are grounded, make up the *science of medicine*.

By some writers, physic is said to have for its object the treatment of internal, surgery that of external, diseases. This definition, however plausible it may at first appear, can only be received with numerous exceptions in regard to modern practice: for instance, necroses of the shafts of bones; psosæ abscess; stone in the bladder; polypi and scirrhus of the uterus; strictures of the œsophagus, urethra, and rectum; an extravasation of blood within the skull, in consequence of accidental violence; are universally allowed to be strictly surgical cases; yet, no man in his senses would call these disorders external.

As Mr. Lawrence has pertinently observed, "Nature has connected the outside and inside so closely, that we can hardly say, where one ends, and the other begins. She has decreed, that both

shall obey the same pathological laws; and has subjected them to such powerful mutual influences, that we cannot stir a step in investigating the diseases of either, without reference to the other. How deep would the domain of surgery extend, according to this view? Half an inch, or an inch? The entrance of the various mucous membranes presents a series of puzzling cases; and the distribution of diseases in these situations, between the two branches of the profession, is quite capricious. How far is the surgeon to be trusted? He is allowed to take care of the mouth. Where is he to stop? At the entrance of the fauces—in the pharynx—or in the œsophagus? Inflammation and ulceration of the throat from syphilis belong to the surgeon; catarrhal affection of the same membrane to the physician. Polypus and ulceration of the nasal membrane are surgical; coryza is medical. The affections of the bones and joints have been given to the surgeon; yet they can hardly be called external parts. In hernia and aneurism, there is external tumor: but it is produced by displacement or disease of organs that are quite internal.

"When we look to the nature and causes of disease, the absurdity of the distinctions now under consideration, is still more apparent, and the inseparable connexion between the interior and exterior of our frame more obvious. Internal causes produce external disease, as we see in erysipelas, carbuncle, nettle rash, gout, œdema; while external agencies affect inward parts, as in catarrhal rheumatic affections, in various inflammations of the chest and abdomen."

Others have defined surgery to be the mechanical part of physic, "*quod in therapia mechanicali*," but, although this has obtained the assent of so eminent a surgeon as M. Richerand (*Dict. des Sciences Méd.* t. v. p. 85.), I believe few on this side of the water will be of his opinion. The late Mr. J. Pearson observed, "Many people have imagined that, when a man has learnt the art of dressing sores, of applying bandages, and performing operations with a little dexterity, he must necessarily be an accomplished surgeon. If a conclusion so gross and fallacious had been confined to the vulgar and illiterate, the progress of scientific surgery would have suffered little interruption: but, if young minds are directed to these objects, as the only important matters, upon which their faculties are to be exercised; if the gross informations of sense constitute the sum of their knowledge; little more can be expected from such a mode of study, than servile imitation, or daring empiricism. Indeed, some people have affected to oppose surgery as an *art*, to medicine as a *science*; and if their pretensions were justly founded, the former would certainly be degraded to a mere mechanical occupation. But it is not very easy to comprehend the grounds of such a distinction. The internal and external parts of the body are governed by the same general laws during a state of health; and if an internal part be attacked with inflammation, the appearances and effects will bear a great similarity to the same disease situated externally; nor are the indications of cure, in general, materially different. If by science, therefore, he meant 'a knowledge of the laws of nature,' he who knows what is known of the order and method of nature, in the production, progress, and termination of surgical diseases,

merits as justly the title of a scientific practitioner as the well-educated physician. The practical parts of physic and surgery are very frequently disunited; but their theory and principles are indivisible, since they truly constitute one and the same science." (*Principles of Surgery*, Preface.)

As a learned Professor notices, the limits between physic and surgery are not very precisely marked, and the respective functions of the physician and surgeon, long as those names have existed, are still but very inaccurately defined. "The most superficial acquaintance with the symptoms, progress, and termination of the various morbid affections, to which the human body is liable, must be sufficient to convince every unprejudiced inquirer, that there is but a slight foundation, if indeed there be any, for this distinction in the nature of the diseases which these practitioners are required to treat, or in the modes of treatment, by which the diseases themselves may be cured, or relieved. Experience has long shown, that the use of internal remedies is not only required in a large proportion of the diseases, which are regarded as strictly chirological, but also, that there are few diseases, which come under the care of the physician, in which morbid affections, requiring the manual aid, or practical skill of the surgeon, do not frequently occur.

"The treatment of febrile and internal inflammatory diseases, it will be allowed, belongs exclusively to the province of the physician wherever the distinction between physician and surgeon has been introduced, and is rigidly observed; yet, in some species of fevers, and in all internal inflammatory diseases, blood-letting is often the principal, if not the only, remedy that is required. But this is an operation, however urgent the necessity for it be, which from engagement the physician cannot, and, from the fear of degrading his province of the profession, will not perform. Retention of urine not unfrequently takes place in symptomatic febrile diseases, and this is an affection, which does not always yield to the use of internal remedies; but it is an affection also, from the painful uneasiness which it immediately excites, as well as from the danger which it threatens, that will not admit of delay. When internal remedies, therefore, fail in relieving the patient, the urine must be speedily drawn off by means of a chirological operation; otherwise inflammation, mortification, and rupture of the bladder, must necessarily ensue. Febrile and internal inflammatory affections terminate not unfrequently in the formation of fluids, which it is necessary to let out by a chirological operation; and abscesses, fistulous openings, and ulcers are formed, which require the aid of the surgeon. In patients, also, affected with severe febrile diseases, from being long fixed down to their beds in one position, some of the parts of the body, upon which they rest, occasionally acquire a disposition to mortify; larger or smaller portions of the skin and subjacent cellular membrane becoming dead, separate from the living parts, and sores are formed, which are but too often the subject of unavailing chirological practice. To employ, in the different stages of this species of mortification, from its first commencement to the complete separation of the dead parts, and the formation of a new skin, the appropriate external and internal remedies, re-

quires a greater share of chirological skill than can reasonably be expected in those who make a profession solely of physic. Unhappy, therefore, must be the lot of that patient, who, in circumstances similar to those which I have described, has the misfortune to have for his sole medical attendant a physician ignorant of surgery.

"But (continues Professor Thomson), if a knowledge of surgery be necessary to the student who intends to practise physic, the knowledge of physic, on the other hand, is no less necessary to him who intends to devote his attention exclusively to the profession of surgery; for, indeed, there are few chirological diseases which are not, in some period or another of their existence, accompanied by morbid affections of the same nature with those which fall properly, and most frequently, under the care of the physician. It will only be necessary to mention, as examples of these affections, the symptomatic fever, which attends inflammation, whether this affection has been induced by external injury, or has occurred spontaneously in the body from internal disease; the hectic fever supervening to long-continued processes of suppuration; the febrile state, and other morbid affections, which are sometimes brought on by the too sudden and injudicious use of mercury; bilious fevers, and the various derangements of the digestive organs, which are sometimes the cause, and at other times the consequence, of local diseases; the nervous affections, such as apoplexy, convulsions, paralysis, and nunnia, which arise not unfrequently from injuries of the head; and locked jaw, or tetanus, which, in warm climates particularly, is so very liable to be induced by punctured wounds. These are morbid affections, the proper study and treatment of which, when they occur without local injury, are supposed to belong to the physician, rather than the surgeon: but occurring very frequently as they do in chirological diseases, and always modifying, or aggravating the effects of these diseases, ignorance of their nature, relations, and modes of cure, is not only inexcusable, but highly criminal in the practitioner, who ventures to undertake their treatment." (*Thomson's Lectures on Inflammation*, Introduction. Also *J. R. C. Bollman Tentamen, ostendens Chirurgiam a Medicina hand impune separari*, 12mo. Rintel. 1803.)

From what has been stated, I think it very certain, that there never can be a complete and scientific division of the healing art into physic and surgery; and that all attempts to distinguish the numerous diseases and injuries of the human body into medical and surgical cases, must, in a great measure, be decided by custom, and the mutual agreement of practitioners, rather than by any rules, or principles, which are at all consistent.

Mr. Lawrence joins in the opinion, that the line of demarcation between surgery and physic cannot be easily traced; and he considers the distinction between them to be a mere matter of arbitrary usage. He employs the word *surgery* in its common acceptance; understanding it to include, 1st, Injuries of all kinds; 2dly, The greater part of external and local complaints; 3dly, Such internal affections as produce changes recognisable externally; for example, alterations of figure, colour, or consistence; 4thly, All cases requiring external topical treatment, operations, or manual proceedings of any kind. This view coincides

very much with 'the catalogue of diseases treated of in the present work ; yet such is the difficulty of separating surgery from physic by any general definitions, that every man of experience will immediately recollect various exceptions to some of the foregoing principles of classification. Thus, ascites or dropsy, which is an internal disease productive of change of figure, and often requiring an operation, is usually regarded as a medical case. I should say, that it is an instance in which the skill both of the physician and surgeon is plainly necessary.

In the earliest periods, the same men cultivated the whole field of medicine. The writings of Hippocrates, Galen, Celsus, Paulus Ægineta, Albucasis, &c., prove, that the Greeks, Romans, and Arabians never had an idea of the human body being susceptible of only two classes of diseases, one of which formed the province of physic, while the other constituted a separate and distinct science, called surgery. They had no conception of two systems of pathology ; one applicable to the exterior, the other to the interior parts of the body. They knew as well as the best-informed practitioners of the present day, that, though each organ has its particular function to perform, its office is not independent of, but closely connected with, the use and perfect state of other organs. Hence, as Mr. Lawrence has noticed, the expression of Hippocrates is perfectly correct : "*Labor unus ; consentientia omnia.*"

The numerous individual organs, which make up the human body, although various in structure and office, are all intimately connected and mutually dependent. They are merely subordinate parts of one great machine ; and they all concur, each in its own way, in producing one general result, the life of the individual. All the leading arrangements are calculated to give a character of unity to the organisation, and living actions of our frame. There is a common source of nutrition for the whole body ; a single centre of circulation ; a common place of union for all sensations and volitions, for nervous energy of whatever kind. The various organs are not only intimately connected by the share, which they severally take in executing associated and mutually dependant functions, they act and react on each other, often very powerfully, by those mysterious, or, at least, hitherto unknown influences, which we call sympathies. As the animal machine, although complicated in structure, is single ; and as its living motions, although numerous and intricate, form one indivisible series, so a similar connexion runs through those changes of structure and functions, which constitute disease. Hence, there is *one anatomy and physiology* ; and there can be *only one pathology*. (*Richerand, Lawrence, J. Cloquet, &c.*)

Hippocrates, Galen, Celsus, and other writers of high antiquity treat successively of fevers, fractures, wounds, and nervous diseases ; and none of them appear to have supposed, that there could be any disorders which really deserved to be called *external*, and others *internal*. Nor was it until the middle of the 12th century, when the clergy were restrained by the council of Tours from undertaking any bloody operation, that surgery was rejected from the universities, under the empty pretext, "*Ecclesia non est sanguinis*," often expressed in its decrees,

as Professor Thomson well observes, but never acted upon, except in this instance, by the church of Rome. It is to this epoch that we must refer the artificial separation of physic from surgery ; the latter being abandoned to the laity, who in those ages of barbarism, were totally illiterate.

It is an observation made by the celebrated Bichat, that two things are essentially necessary to form a great surgeon ; viz. genius and experience. One traces for him the way ; the other rectifies it : both reciprocally assist in forming him. Without experience, genius would be unprofitably fertile ; without genius, experience would only be a barren advantage to him. (*Œuvres Chir. de Desault, par Bichat, t. i. Discours Prélim.*) Out of the large number of hospital surgeons, who are to be met with in every country of Europe, and who enjoy ample opportunities of profiting by the lessons of experience, how few distinguish themselves, or ever contribute a mite to the improvement of their profession ! Opportunity, without talents and an aptness to take advantage of it, is not of more use than light to a blind man. On the other hand, splendid abilities, without experience, can never make a consummate surgeon, any more than a man with the greatest genius for painting can excel in his particular art, without having examined and studied the real objects which he wishes to delineate. In short, as a sensible writer has remarked, "*Les grands chirurgiens sont aussi rares, que le génie, le savoir, et les talens.*" (*Mém. de l'Acad. de Chir. t. i. Pref. p. 41. edit. 12mo.*)

The description of the qualities which a surgeon ought to possess, as given by Celsus, is excellent so far as it goes. A surgeon, says he, should be young, or, at any rate, not very old ; his hand should be firm and steady, and never shake ; he should be able to use his left hand with as much dexterity as his right ; his sight should be acute and clear ; his mind intrepid and pitiless, so that when he is engaged in doing any thing to a patient, he may not hurry, nor cut less than he ought, but finish the operation, just as if the cries of the patient made no impression upon him. (*A. C. Celsi Med. Pref. ad lib. vii.*) By the word "*immisericus*," as Richerand has observed (*Nosogr. Chir. tom. i. p. 42. edit. 2.*), Celsus did not mean, that a surgeon ought to be quite insensible to pity ; but that, during the performance of an operation, this passion should not influence him, as all emotion would then be mere weakness. This undisturbed coolness, which is still more rare than skill, is a most valuable quality in the practice of surgery. Dexterity may be acquired by exercise ; but firmness of mind is a gift of nature. Haller, to whom nature was so bountiful in other respects, was denied this quality, as he candidly confesses. "Although (says he) I have taught surgery seventeen years, and exhibited the most difficult operations upon the dead body, I have never ventured to apply a cutting instrument to a living subject, through a fear of giving too much pain." (*Bibl. Chir. 1775, vol. ii.*)

Surgery may boast of having had an origin that well deserves to be called noble ; for the earliest practice of it arose from the most generous sentiment which nature has implanted in the heart of man, viz. from that sympathetic bene-

volence which leads us to pity the misfortunes and sufferings of others, and inspires us with an anxious desire to alleviate them. He who first saw his fellow-creatures suffer, could not fail to participate in their pain, and endeavour to find out the means of affording relief. Opportunities of exercising this useful inclination were never wanting. In the first ages of the world, man in his destitute state was under the necessity of earning, by force or stratagem, a subsistence which was always uncertain; and in the combats to which this sort of life exposed him, he frequently met with wounds and other injuries. Wherever the chase was followed as a means of livelihood, or amusement; wherever broils and contests occasionally arose; wherever man was the same animal which he now is, liable to various diseases and accidental hurts; there must have existed a necessity for surgery.

Among the ancients, the profession of medicine and surgery constituted a sacred kind of occupation, and the practice of it belonged only to privileged persons. *Æsculapius* was the son of *Apollo*. In the armies, the highest princes gloried in dressing the wounds of those, who had fought the battles of their country. Amongst the Grecians, *Podalirius*, *Chiron*, and *Machaon*, were not only distinguished for their valour, but also for their skill in surgery, as we learn from the poem of the immortal *Homer*. The value which was placed upon the services of *Machaon* by the Grecian army, may well be conceived from the anxiety which it evinced to have him properly taken care of when he was wounded in the shoulder with a dart. "O *Nestor*, pride of Greece (cries *Idomeneus*), mount, mount upon thy chariot! and let *Machaon* mount with thee! Hasten with him to our ships: for a warrior, who knows as he does, how to relieve pain, and cure wounds, is himself worth a thousand other heroes." (See *Iliad*, lib. xi.) *Hippocrates* was one of the first citizens of Greece: he nobly refused all the rich offers of several kings, enemies of his country, to entice him into their service; and, in particular, he disdained to accept those of *Xerxes*, whom he regarded as a barbarian.

It is in the immortal poems of the *Iliad* and *Odyssey*, that we find the only certain traditions respecting the state of the art, before the establishment of the republics of Greece, and even until the time of the Peloponnesian war. There it appears, that surgery was almost entirely confined to the treatment of wounds, and that the imaginary power of enchantment was joined with the use of topical applications. In the infancy of the art, in every nation, the intervention of a supernatural power is always believed to be combined with what is within the scope of human possibility. The priests of India, the physicians of China and Japan, and the jugglers of the savage and half-civilised tribes of the old and new continents, constantly associate with drugs and manual operations certain mysterious practices, upon which they especially rely for the cure of their patients. Such was also, no doubt, the character of the medicine and surgery of the Egyptians, in the remote times, previous to the invention of the alphabet, and upon which so little light is now thrown.

From some observations made by the men of science who accompanied the French expedition to Egypt, in 1798; it appears that, amongst the

ruins of ancient Thebes, there are documents, fully proving that surgery, in the early time of the Egyptians, had made a degree of progress, of which few of the moderns have any conception. It is noticed by *Larrey*, that, when the celebrated French General *Desaix* had driven the *Mamelukes* beyond the *Cataracts* of the Nile, the Commission of Arts had an opportunity of visiting the monuments of the famous Thebes, and the renowned temples of *Tentyra*, *Karnac*, *Medinet-Abu*, and *Luxor*, the remains of which still display their ancient magnificence. It is upon the ceilings and walls of these temples that basso-relievos are seen, representing limbs that had been cut off with instruments very analogous to those which are employed at the present day for amputations. The same instruments are again observed in the hieroglyphics, and vestiges of other surgical operations may be traced, proving that, in these remote periods, surgery had made more progress than is often supposed. (*Larrey*, *Mém. de Chir. Militaire*, t. i. p. 233; t. ii. p. 223.)

The mention of Egypt will not permit me to pass on, without offering a tribute of praise to one of the most enterprising surgeons, whose services were ever exerted for the benefit of mankind: need I say, that it is here my wish to express admiration of the public services of *Clot-Bey*, that extraordinary individual, by whose meritorious exertions in Egypt, medical science is returning to a land, once her cradle, but from which she had been an exile more than a thousand years. (See *Compte rendu des Travaux de l'Ecole de Médecine d'Abou-Zabel (Egypte)*, &c., par *Clot-Bey*, 8vo. Paris, 1833.)

We next come to the epoch when, by the union and arrangement of scattered facts, the science truly arose. *Hippocrates*, born in the island of *Cos*, four hundred and sixty years before the common era, collected the observations of his predecessors, added the results of his own experience, and composed his first treatises. In the hands of this great genius, medicine and surgery did not make equal progress. The former reached a high degree of glory. *Hippocrates* drew up the history of acute diseases in so masterly a style, that twenty past centuries have added scarcely anything to the performance. But surgery was far from making the same approach to perfection. The religious veneration for the asylums of the dead, and the impossibility of dissecting the human body, formed an insurmountable obstacle to the study of anatomy. An imperfect acquaintance with the structure of animals, reputed to bear the greatest resemblance to man, could only furnish venturesome conjectures, or false inferences. These circumscribed notions sufficed for the study of acute diseases. In these cases, the attentive observation of strongly marked symptoms, and the idea of the operation of a salutary principle, derived from remarking the regular succession of such symptoms, and their frequently beneficial termination, enlightened the physician in the employment of curative means; while surgery, deprived of the assistance of anatomy, was too long kept back in an infant state. Whatever praises may have been bestowed on those parts of the works of *Hippocrates* particularly relating to surgery, and which amount to six in number (*de officina medici; de fracturis; de capitis vulneribus; de articulis vel luxatis; de ulceribus; de fistulis*), when compared with his

other acknowledged legitimate writings, they appear only as rough sketches by a great master.

Excepting the fragments collected or cited by Galen, we possess no work written by any of the successors of Hippocrates until the period of Celsus; which leaves a barren interval of almost four centuries. In this space lived Erasistratus, as well as Hierophilus, celebrated for the sects which they established, and particularly for having been the first who studied anatomy upon the human body.

Celsus lived at Rome in the reigns of Augustus, Tiberius, and Caligula. He appears never to have practised the healing art, on which, however he has written with much precision, elegance, and perspicuity. His work is the more precious, inasmuch as it is the only one, which gives us information, with regard to the progress of surgery in the long interval between Hippocrates and himself. The four last books, and especially the seventh and eighth, are exclusively allotted to surgical matter. The style of Celsus is so elegant, that he is regarded quite as the Cicero of medical writers. Notwithstanding he wrote at Rome, his surgery was entirely that of the Greeks; for, in that capital of the world, physic was then professed only by persons who had either come from Greece, or had received instruction in the celebrated schools of this native soil of all the arts and sciences.

Passing over the interval between Celsus and Galen, I shall not dwell long on the latter, who was born at Pergamus, in Asia Minor, and came to Rome in the reign of the Emperor Marcus Aurelius, where he practised surgery and physic about the year 165 of the Christian era. (*Galen's Opera omnia*: 1521, ed. Aldi, 5 vols. in fol.) These two sciences were at that time still united, or rather the possibility of completely dividing them had never been conceived; and, though some writers of much earlier date speak of the division of physic into dietetical, chirurgical, and pharmaceutical, no such distinction had been followed in practice. As Galen had been a surgeon, or, more probably a general practitioner, at Pergamus, he continued the same profession at Rome; but, being soon attracted, by the predominating taste of the age in which he lived, to studies which more easily accommodated themselves to the systems and dazzling speculations of philosophical sects, he afterwards neglected surgery, which strictly rejects them. His writings prove, however, that he did not abandon it entirely. His commentaries on the treatise of Hippocrates, *De Officina Medici*, and his essay on bandages, and the manner of applying them, show, that he was well versed even in the minor details of the art. Besides, it is known, that he paid great attention to pharmacy; and in his work upon antidotes, chap. 13., he tells us himself, that he had a drug shop in the Via Sacra, which fell a sacrifice to the flames, which destroyed the Temple of Peace, and several other public edifices, in the reign of Commodus.

To Galen succeeded the compiler Oribasius, Flavius of Amida, who lived towards the close of the fifth century, Alexander of Tralles, and Paulus Aegineta, so called from the place of his birth, though he practised at Rome and Alexandria. Paulus collected into r t, still justly had been

made in surgery down to his own time. He concludes the series of Greek and Roman physicians, and may be looked upon as the last of the ancients, unless it be wished to let the Arabians have a share in the honours of antiquity. "He appears," says Portal, "to be one of those unfortunate writers, to whom posterity has not done justice. It seems as if he had been decieved without having been read; for if pains had been taken to examine his works, he would neither have been regarded as a mere copyist, nor been called the 'ape of Galen,' with whom he does not always coincide. Nay, in some places, he ventures to oppose the doctrines of Hippocrates. He was perfectly acquainted with the practice of the ancients; and when he agrees with, or differs from them, it is not from a spirit of contradiction, but because the reasons, which led him to take one side, or the other, appear to him well founded." (*Portal, Hist. de l'Anat. &c. t. i. p. 123.*) Ali now agree, that surgery is much indebted to him. (See *R. A. Vogel, De Pauli Aeginetæ Meritis in Medicinam imprimisque Chirurgiam*, 4to. Götting. 1768.)

Afterwards the downfall of surgery followed that of all the other sciences, and from the capture of Alexandria by the Saracens under Amrou, Viceroy of Egypt, in 641, until the end of the tenth century, nothing prevailed but the dark clouds of ignorance and barbarism. The Arabians, who became masters of a great part of the Roman empire, dug up the Greek manuscripts, which lay buried under the ruins of the libraries; translated them; appropriated to themselves the doctrines which they contained; impoverished them by additions; and transmitted to posterity only enormous compilations. In a word, such are the treatises of Rhazes, Hali-Abbas, Avicenna, Averrhoes, and Albucasis, the most celebrated of the Arabian authors. Inventors of a prodigious number of instruments and machines, they appear to have calculated the efficacy of surgery by the richness of its arsenals, and to have been more anxious to inspire terror, than confidence. As an instance of the cruelty of their methods, I shall merely notice, that, in order to stop the bleeding after amputation, they plunged the stump in boiling pitch.

The fate of medicine was not more fortunate. In vain the school of Salerno, founded about the middle of the seventh century, made some attempts to revive its splendour. As a modern writer observes, medical science, seated on the same benches, where the doctrine of Aristotle, accommodated to religious opinions, was the subject of endless controversies, imbibed, as it were by contagion, the argumentative and sophistical mania, and became enveloped in the dark hypotheses of scholastic absurdity. (*Richerand, Nosogr. t. i. ed. 2.*)

The universal ignorance (continues this author); the pretended horror of blood—the dogma of a religion, which shed it in torrents for useless quarrels; an exclusive relish for the subtleties of the schools, and speculative theories; are circumstances, further explaining the profound darkness, which followed these empty labours. About the middle of the twelfth century (1163), the Council of Tours prohibited the clergy, who then shared with the Jews the practice of medicine and surgery in Christian Europe, from undertaking any bloody operation. It is to this epoch that the true separation of medicine from surgery must be

referred. The latter was abandoned to the laity, the generality of whom, in those ages of barbarism, were entirely destitute of education. The priests, however, still retained that portion of the art, which abstained from the effusion of blood. Roger Rolandus, Bruno, Gulielmus de Salicetus, Lanfranc, Gordon, and Guy de Chauliac, confined themselves to commentaries on the Arabians; and, if the latter author be excepted, they all disgraced surgery by reducing it nearly to the mere business of applying ointments and plasters. Guy de Chauliac, however, the last of the Arabians, is to be honourably excluded from such animadversion. His work, written at Avignon, in 1363, in the pontificate of Urban the Fifth, to whom he was physician, continued to be, for a long while, the only classical book in the schools. It may be observed, that as he imitated in every respect the other Arabian physicians, and like them thought, that it did not become a priest to deviate from the austerity of his profession, he has passed over in silence the diseases of women.

At length, Antonio Beneveni, a physician of Florence, began to insist upon a truth of the highest importance to the extension of surgical knowledge, viz. that the compilations of the ancients and Arabians ought to be relinquished for the observation of nature. (*De abditis Rerum Causis*. Florent. 1507. 4to.) A new era now began. The moderns were convinced, that by treading servilely in the footsteps of their predecessors, they should never even equal, much less surpass them. The labours of Vesalius also gave birth to anatomy, illuminated by which science surgery put on quite a different appearance in the hands of Ambroise Paré, the first and most eminent of the ancient French surgeons. For the credit of Italy, however, it should be recorded, that the sensible writings, published in that country prior to the time of Paré, had the greatest influence in creating a due sense of the value and importance of surgery, and in disposing men of talents and education to cultivate it as a liberal profession.

Obedying the dictates of his genius, Paré either compelled authority to yield to observation, or endeavoured to reconcile them. However, his superior merit soon excited the ignorant, the jealous, and the malignant against him; and he became the object of a bitter persecution; his discoveries being represented as a crime. Although he was the restorer, if not the inventor, of the art of tying the blood-vessels, the power of his persecutors compelled him to make imperfect extracts from Galen, and alter his text, in order to rob himself, in favour of the ancients, of the glory which this distinguished improvement deserved.

Surgeon to King Henry the Second, Francis the Second, Charles the ninth, and Henry the third, of France, Paré practised his profession in various places, followed the French armies into Italy, and acquired such esteem, that his mere presence in a besieged town was enough to reanimate the troops employed for its defence. In the execrable night of Saint Bartholomew, his reputation saved his life. As he was of the reformed religion, he would not have escaped the massacre, had not Charles the ninth himself undertaken to protect him. The historians of those days (see *Mém. de Sully*) have preserved the remembrance of this exception, so honourable to him who was the object of it; but which should not diminish the just horror, which

the memory of the most weak and cruel tyrant must ever inspire. "Il n'en voulut jamais sauver aucun (says Brantome) sinon maître Ambroise Paré, son premier chirurgien, et le premier de la Chrétienté; et l'envoya quérir et venir le soirs dans sa chambre et garderobe, lui commandant de n'en bouger; et disait qu'il n'était raisonnable qu'un qui pouvait servir à tout un petit monde, fût ainsi massacré."

Ambroise Paré was not content, like his predecessors, with exercising his art with reputation: he did not follow the example of the Quatre-Maitres of Pitard, so justly celebrated for having composed the first statutes of the College of Surgeons at Paris, in the reign of St. Lewis, whom he had attended in his excursions to the Holy Land; and of several other surgeons, the fruits of whose experience were lost to their successors: he transmitted the result of his own experience to posterity, in a work that is immortal. (See *Œuvres d'Ambroise Paré, Conseiller et premier Chirurgien du Roi, divisées en 28 livres*, in folio, edit. 4to. Paris, 1536.)

His writings, so remarkable for the variety and number of facts in them, are eminently distinguished from all those of his time, inasmuch as the ancients are not looked up to in them with superstitious blindness. Freed from the yoke of authority, he submitted every thing to the test of observation, and acknowledged experience alone as his guide. The French writers are with reason proud of their countryman Paré to this day: they allege, that he must ever hold amongst surgeons the same place that Hippocrates occupies amongst physicians. Nay, they add, that, perhaps, none of the ancients or moderns are worthy of being compared with him. (*Richerand, Nosogr. Chirurg. t. i.*)

After the death of this great man, surgery, which owed its advancement to him, continued stationary, or even took a retrograde course. This circumstance is altogether ascribable to the contemptible state into which those who professed the art fell, after being united to the barbers by the most disgraceful association.

Pigrai, the successor of Ambroise Paré, was far from being an adequate substitute for him. A spiritless copier of his master, he abridged his surgery in a Latin work, where the unaffected graces of the original, the sincerity, and the inefable charm, inseparable from all productions of genius, entirely disappeared. He received, however, equal praise from his contemporaries; doubtless because he filled a high situation: but, as Richerand remarks, his name, which is to-day almost forgotten, proves sufficiently, that dignities do not constitute glory.

Rousset and Guillemeau distinguished themselves, however, in the art of midwifery; while Covillard, Cabrol, and Habicot, enriched surgery with a great number of new observations. (See *Obs. Chir. pleines de Remarques curieuses*. Lyon, 1639, in 8vo. *Alphabet Anatomique*. Genève, 1602, in 4to. *Semaine Anatomique; Question Chir. sur la Bronchotomie*. Paris, 1620, in 8vo.)

In the next or seventeenth century, a fresh impulse produced additional improvements. Then appeared in Italy Caesar Magatus, who simplified the treatment of wounds (*De Rarâ Vulnorum Mediatione*, libri 2. Venet 1616, in folio); Fabricius ab Aquapendente, even less praiseworthy as a surgeon, than as a physiologist. (*Opera Chir.* Paris, 1613, in folio), and Marcus Aurelius Severinus,

that restorer of active surgery. (*De Efficaci Medicina*, libri 3. Francofurt. 1613, in folio. *De recondita Abscessuum Natura*, libri 7. Neapoli. 1632, in 4to.; and *Trimembris Chirurgia*, &c. Francofurt. 1653, in 4to.) Amongst the English surgeons flourished Wiseman, who was the Paré of England, (see *Several Chirurgical Treatises*. Lond. 1676, in fol.); and William Harvey, whose discovery of the circulation of the blood had such an influence over the advancement of medical science in general. (See *Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus*. Francofurti, 1653, in 4to.) In Germany, Fabricius Hildanus, (*Obs. et Curationum Centuriæ* 6. 2 vols. in 4to. 1641), who was far superior, as a surgeon, to the Italian Fabricius; Scultetus, so well known for his work, entitled *Armamentarium Chirurgicum*. Ulmæ, 1653, in folio; and Purmann and Solingen, who had the fault of being too partial to the use of numerous complicated instruments. (See *Cursus, Obs. Chir.* Lipsiæ, 1710, in 4to. *Manuale Obs. der Chirurgie*. Amsterdam, 1684, in 4to.)

Holland, restored to liberty by the generous exertions of its inhabitants, did not long remain a stranger to the improvement of surgery. This nation, so singular in many respects, presents us with one particularity, which claims the notice of a medical historian. Ruysch, who was an eminent anatomist, and merits equal celebrity for his *Obs. Anatomico-Chirurgicarum Centuriæ*. Amstelodam, 1691, in 4to., carried with him to the grave the secret of his admirable injections. (See also his *Thesaur. Anat. x.*, in 4to. *Adversarium anatomicorum medico-chirurgicorum*, Decad. 3. in 4to. Amstelodam.) Roonhuysen also made a secret of his lever, which, before the invention of the forceps, was the only resource in difficult labours. Raw, who successfully cut fifteen hundred patients for the stone, took such pains to conceal his manner of operating, that Heister and Albinus, his two most distinguished pupils, have each given a different explanation of it. Such a disposition, which is extremely hurtful to the advancement of medical and surgical knowledge, would materially have retarded the progress of surgery in Holland, had not Camper, in the following century, effaced the imputation by the great number of his discoveries, and his zealous desire to render them public.

While great improvements were going on in Italy, England, and Holland, surgery languished in a humiliated state in France. The accoucheur Mauriceau (*Traité des Maladies des Femmes grosses*. Paris, 1668, in 4to), Dionis. (*Cours d'Opérations de Chirurgie*. Paris, 1707, 8vo.) Savard (*Nouveau Recueil d'Obs. Chir.* Paris, 1702, in 12mo.), and Belloste (*Chirurgien d'Hôpital*. Paris, 1696, in 8vo.), were the only French surgeons of note, who could be contrasted with so many distinguished men of other nations. Richerand observes, that the splendid days of Louis the Fourteenth were an iron age for discouraged surgery. And yet this monarch seems to have been personally interested in the melioration of this important art; for he was very nearly falling a victim to a surgical disease, a fistula in ano, and not cured till after a great number of blundering operations, and useless experiments.

In the last century, amongst the distinguished men of France, there are two of extraordinary talents, whom, as it were, all the others

deserve to be affixed to the two most brilliant epochs of French surgery. These are J. L. Petit, whose glory was shared by the Academy of Surgery; and the celebrated Desault.

The eulogy on J. L. Petit, delivered in the midst of the Royal Academy of Surgery, of which he was one of the first and most distinguished members, represents him as blending the study of anatomy with his amusements when a boy; and ardently seeking every opportunity to increase his knowledge by observation. He had had experience enough to publish at an early period of his life his *Traité sur les Maladies des Os*. Paris, 1705. in 12mo.; a work, which, for a century was esteemed the best upon the subject. His success was most virulently opposed by envious critics; and it was not till after more than thirty years of arademical labours and extensive practice, that he was unanimously chosen the head of his associates. This acknowledged superiority, however, was the more flattering, as the honour was obtained at a period when surgery was in a flourishing state in France, and when Petit held no office, from which he could derive any influence unconnected with his personal merit. While Mareschal, La Peyronie, and La Martinière, assured him of the royal favour, Quesnay, Morand, and Louis, who corrected his writings, made him speak a language which does honour to that famous collection to which he contributed his observations, (see *Mémoires et Prix de l'Académie Royale de Chirurgie*, 10 vols. in 4to.), and in which, if some theoretical explanations be put out of consideration, nothing has lost its value by age. J. L. Petit was also the author of "*Traité des Maladies Chirurgicales, et des Opérations qui leur conviennent*. *Ouvrage Posthume*;" a production that will always stand high in the estimation of the judicious surgeon.

The history of this epoch, so glorious for the profession of surgery, is completely detailed in the *Mémoires and Prizes of the Royal Academy of Surgery*; a work, which is absolutely indispensable, and the various parts of which cannot be too often considered. In it are preserved the labours of Mareschal, Quesnay, La Peyronie, Morand, Petit, De la Martinière, Le Dran, Garangeot, De la Faye, Louis, Verdier, Foubert, Hevin, Pibrac, Fabre, Le Cat, Bordenave, Sabatier, Puzos, Levret, and several other practitioners; who, though less famous, contributed by their exertions and knowledge to form this useful body of surgical facts. Many of the preceding surgeons also distinguished themselves by other productions; which, however, I shall not here enumerate, as they are quoted in many other parts of this work.

To the foregoing list of eminent French surgeons must be added, the names of La Motte, Maître-Jean, Goulard, Daviel, Ravaton, Mejean, Pouteau, David, and Frère Cosme.

While surgery was thus advancing in France, other nations were not neglectful of it. At this period flourished in Great Britain, C. White, Cheselden, the two Monros, Sharp, Cowper, Warner, Alanson, Bromfield, Pott, Kirkland, Hawkins, Smellie, and the two Hunters.

White's Cases in Surgery, 1770. *Cheselden's Treatise on the High Operation for the Stone*. London, 1723, in 8vo.; and his *Treatise on the Anatomy of the Human Body*; *Sharp's Treatise of the Operations*, and his "*Critical Inquiry into the present State of Surgery*," *Memoirs* Works, by his son; *Warner's Cases in Surgery*, 1754; and his *Description of the Eye and its Diseases*, 1776. *Allen-*

son's Treatise on Amputation. Pott's Chirurgical Works. Kirkland's Obs. on Fractures, 1770; his Thoughts on Amputation, 1780; and his Medical Surgery, 1783. Smellie's Midwifery: and John Hunter, On the Blood, Inflammation, &c.; his Treatise on the Venereal Disease, Animal Economy, the Teeth, and all the papers written by himself and his brother, in the Phil. Trans. Med. Obs. and Inquiries, and Trans. of a Society for the Improvement of Med. and Chir. Knowledge, are productions, which reflect the highest credit on the state of surgery in England.

But, of all these eminent men, none contributed more powerfully than Percival Pott to the improvement of the practice of surgery in England. His life, indeed, forms a sort of epoch in the history of the profession. Before his inculcations and example had produced a desirable change, the maxim of "*dolor medicinus doloris*," as we learn from Sir James Earle, remained unrefuted. The severe treatment of the old school, in the operative part and in the applications, continued in force. The first principles of surgery, the natural process and powers of healing, were either not understood, or not attended to; painful and escharotic dressings were continually employed; and the actual cautery was in such frequent use, that at the times, when the surgeons visited the hospitals, it was regularly heated, and prepared as a part of the necessary apparatus. Where shall we find more sensible, or more truly practical observations on the treatment of abscesses, than in Pott's excellent treatise on the fistula in ano? Where shall we meet with better remarks on the local treatment of gangrenous parts, than in his valuable tract on the mortification of the toes and feet? What author abounds with so many just observations on the injuries of the head, blended, it is true, with rather too great a partiality to the trochan, the so frequent necessity for which is now less generally acknowledged? His description of inflammation and suppuration of the dura mater, and of the treatment, is matchless. The account, which he has left us of the disease of the vertebræ, attended with paralysis of the limbs, is perhaps his most original production. His celebrated essay on fractures was also very original, and has had in this country considerable influence over the treatment of these injuries; but, there can now be no doubt, that the effects of position were exaggerated in this part of his writings, and that surgeons ought still to make every possible exertion to render their apparatus for broken bones more effectual. (See FRACTURES.) A more really valuable production of this eminent surgeon is his remarks on amputation. The necessity for that operation in certain cases is there convincingly detailed; and the most advantageous period for its performance clearly indicated. The urgency for its prompt execution, after particular injuries, he has indeed so perfectly explained, that the late inculcations on the subject by Larrey, and several other modern surgeons, appear to be in a great measure anticipated; the only difference being that Pott's remarks applied principally to compound fractures, while Larrey's refer to gunshot wounds. All these, however, are cases of accidental violence; and, of course, should be treated upon the same general principles.

A longer comment on the writings and improvements of Percival Pott would here be requisite to do him every degree of justice; but, his name, advice, and opinions are so conspicuous throughout this volume, that I shall be excused for not saying any thing more in the present place, than that he was in his time the best practical surgeon, the

best lecturer, the best writer on surgery, the best operator, of which this large metropolis could boast.

Another character of still greater genius and originality, though of inferior education, was the ever memorable John Hunter, surgeon to St. George's Hospital, who was at once eminent as a surgeon, an anatomist, a physiologist, a naturalist, and a philosopher. Indeed, he was the greatest man that ever adorned the profession, either in ancient or modern times, without making any exception of Hippocrates, the reputed father of physic; Paré, the pride of the French; or Harvey, the still greater glory of England, the immortal discoverer of the circulation of the blood. If Pott materially improved many parts of the practice of surgery in England, and evinced himself to be the most skillful operator of his time, John Hunter was also not less importantly employed in extending the boundaries of physiological knowledge, and in the investigation of human, and particularly comparative, anatomy. The knowledge, which he derived from his favourite studies, he constantly applied to the improvement of the art of surgery, and he omitted no opportunity of examining morbid bodies, whereby he collected facts, which are invaluable, as they tend to explain the real causes of the symptoms of numerous diseases.

In the practice of surgery, whenever operations proved inadequate to their intention, Mr. Hunter always investigated with uncommon zeal the causes of ill success, and in this way he detected many fallacies, as well as made some important discoveries in the healing art. He ascertained the cause of failure, common to all the operations in use for the radical cure of the hydrocele, and was enabled to propose a mode of operating attended with invariable success. He ascertained, by experiments and observations, that exposure to atmospherical air, simply, can neither produce, nor increase inflammation. He discovered in the blood so many phenomena, connected with life, and not to be referred to any other cause, that he considered it alive in its fluid state. He improved the operation for the fistula lachrymalis, by removing a circular piece of the os unguis, instead of breaking it down with the point of a trocar. He explained, better than any of his predecessors, all the highly interesting modern doctrines, relative to inflammation, union by the first intention, suppuration, ulceration, and mortification. His writings also throw considerable light on the growth, structure, and diseases of the teeth. As instances of his operative skill, it deserves to be mentioned, that he removed a tumour from the side of the head and neck of a patient at St. George's Hospital, as large as the head, to which it was attached; and by bringing the cut edges of the skin together, the whole wound was nearly healed by the first intention. He likewise dissected out of the neck a tumour, which one of the best operators in this country had declared, rather too strongly, that no one but a fool, or a madman, would meddle with; and the patient got perfectly well. But, perhaps, the greatest improvement which he made in the practice of surgery, was his invention of a new mode of performing the operation for the popliteal aneurism, by taking up the femoral artery on the anterior part of the thigh, without opening the tumour in the ham. (See *Trans. of a Society for the Improvement of Med. and Chir. Knowledge.*) The safety and efficacy of this method of operating have now been

fully established, and the plan has been extended to all operations for the cure of this formidable disease. (See ANEURISM.)

According to Sir Everard Home, Mr. Hunter was also one of the first who taught, that the excision of the bitten part was the only sure mode of preventing hydrophobia; and he extended the time, during which this proceeding might be reasonably adopted, beyond the period generally specified.

His researches into the nature of the venereal disease, and his observations on the treatment, will for ever be a lasting monument of his wonderful powers of reasoning and investigation. If he left many points of the subject confused and unsettled, he admirably succeeded in the elucidation of others; and his work on this interesting disorder, with all its defects, will long continue to be a source of valuable information.

Even the language and mode of expression of this great man were his own; for so original were his sentiments, that they could hardly be delineated by any ordinary arrangement of words. His phrases are still adopted in all the medical schools of this country, and continue to modify the style of almost every professional book. Great as Mr. Hunter's merit as a surgeon was, it was still greater as a comparative anatomist and physiologist. In these characters, the museum of the Royal College of Surgeons in London, and his papers in the Phil. Trans., will for ever attest his greatness.

While in Great Britain the preceding distinguished men were raising the character of their profession—Lancisi, Morgagni, Molinelli, Bertrandi, Guattani, Mascagni, Matani, Troja, and Moscati, were pursuing a corresponding honourable career in Italy. *Bertrandi's Treatise on the Operations of Surgery*, and Troja's work, *On the Regeneration of Bones*, are, even at this day, works of high repute. Of late years, the credit of the Italian surgeons has been well maintained by Monteggia, Scarpa, Paletta, Quadri, Assolini, Morigi, Regnoli, and others. In Holland flourished Albinus, Sandifort, and Camper; and in Germany and the north of Europe, the immortal Haller, Heister, well known for his *Institutiones Chirurgiæ*, Platner, Bilguer, Acrell, Callisen (*Systema Chirurgiæ Hodiernæ*, 2 vols. 8vo.); Brambilla, Theden (*Progrès Ultérieurs de la Chirurgie*); Schmucker (*Vermischte Chirurgische Schriften*, b. 3. and *Chir. Wahrnehmungen*), Richter (*Traité des Hernies*, 2 vols. 8vo. *Bibl. für die Chirurgie*; *Anfangsgr. der Wundarzn.* 7 b. and *Obs. Chirurgicarum Fasc.*); Arneemann, Weidmann, Soemmering, Creutzenfeldt, Hesselbach, Hufeland, Graefe, Klein, Rust, Himly, Langenbeck, Walther, J. A. Schmidt, G. J. Bear, Cælius, Ammon, Dieffenbach, &c. Be it also recorded, as a part of the great merit of the Germans, that they rank amongst the best and most minute anatomists; that they are zealous cultivators of comparative anatomy; that their industry allows no improvement in medical science, wherever made, to escape their notice; and that surgery is greatly indebted to them for the best descriptions of the diseases of the eye.

On the continent, the Royal Academy of Surgery at Paris was long considered quite as the seat of light of this branch of science. Nothing, indeed, contributed so materially to the improvement of surgical knowledge as this establishment; and the numerous experiments, which, for a long while, gave

our neighbours infinite advantage over us, in the cultivation of this most useful profession. The French Revolution, however, did not spare even this beneficial establishment, in which emulation and talents had been so long united for the benefit of mankind. The various dissertations, published by its illustrious members, will serve as a perpetual memorial of the spirit, ability, and success with which its objects were pursued; and centuries hence, practitioners will reap from the pages of its memoirs the most valuable information. Although the Academy was deprived of the talents of Louis, who died a short time before its suppression, it still had at this period several members, worthy of continuing its labours, and supporting its reputation; Sabatier, Desault, who may be regarded as the Pott of France, Chopart, Lassus, Peyrilhe, Dubois, Percy, Baudeloque, Pelletan, Sue, &c.

The Academy of Surgery in France was succeeded by the School of Medicine (*Ecole de Médecine*). Desault, who had been almost a stranger in the former, became the leading character in the latter. Several things strongly recommended him to the remembrance and admiration of posterity; as for instance, the exactness and method which he introduced into the study of anatomy; the ingenious kinds of apparatus which he invented for the treatment of fractures; a noble ardour in his profession, which he knew how to impart to all his pupils; his clinical lectures upon surgery, which were the first ever delivered; and the boldness and simplicity of his operations. From the *Ecole de Médecine* issued Dupuytren, Boyer, Richerand, Dubois, Lheritier, Manoury, Lallemand, Petit de Lyon, Bichat, Béclard, Cloquet, &c. Bichat, as a physiologist, and man of very original genius, may be considered as the John Hunter of France; but his qualities were of a different cast, and hardly admit of comparison with those of Hunter, whose investigations were not limited to man, but extended to the whole chain of animated beings. The example of Bichat, says Richerand, proves most convincingly what Boerhaave always inculcated, and every man of experience knows, how indispensable the study and even the practice of surgery are to him, who would wish to be a distinguished and successful physician. (*Nosogr. Chir.* t. 1. p. 25.)

The brilliant career of Baron Dupuy the space of five and twenty years, at the Hôtel Dieu, justly raised him to a degree of eminence, as a surgeon and pathologist, which few, either in his own or any other country, ever attained. His recent death seems to me, indeed, to have left in France a blank in the surgical community, not likely to be immediately filled up; for a surgeon of his genius and ability cannot be expected to be born even in that favourite clime of the arts and sciences, more frequently than once in a century. The light, which his observations have thrown on many difficult parts of surgery; the rigorous exactness with which he always enforced the connection between scientific surgery and anatomy, physiology, and pathology; the important reforms which he introduced into many of the operations; his readiness and prompt resources on every emergency in practice; and the combination which he exhibited of boldness, skill, and judgment, will always be subjects of admiration, and I feel no hesitation in pronouncing him to be the pride of modern surgery in France. Great

originality will be found in his remarks on every topic which he undertook to investigate. Proofs of this will be noticed in his observations on permanent contractions of the fingers; on diseases of the testis; on prolapsus ani; on fractures of the fibula; on dislocation of the vertebrae; on strangulated hernia; on burns; on fractures of the neck of the thigh-bone; on artificial anus; on phlegmonous erysipelas; on lithotomy; on gun-shot wounds; on the growth of the toe-nails into the flesh; on dislocations of the humerus; on clubfoot; on laceration of the perineum; on congenital dislocations of the femur; on fistula lachrymalis; on ranula; on fracture of the lower end of the humerus; on exostosis of the great toe; on fibro-cellular tumours of the uterus; on tracheotomy; on erectile tumours; on fungus haematodes; on hare-lip; on anthrax; on the formation of callus; on fractures of the lower end of the radius; on amputation; on hydrocele; on bronchocele; on preparations of arsenic for cancerous and phagedenic ulcerations; on chronic gangrene; on the ligature of arteries; and on amputation of the lower jaw-bone. These, with some other subjects, constitute the contents of the four volumes, published under the title of *Leçons Orales de Clinique Chirurgicale, par M. J. e. Baron Dupuytren*, 8vo. Paris, 1834; an invaluable contribution to the sources of instruction on a vast number of most interesting surgical topics.

Amongst the public institutions in Europe for the improvement of medical and surgical knowledge, the Royal Medical and Chirurgical Society of London certainly stands pre-eminent, whether the reputation and number of its members, the importance of many of the papers which it has published, or the extent and value of its library, be taken as the criterion of the character which is here assigned to it. Many of the facts which it has collected and published are of considerable practical importance, especially those relating to the subjects of aneurism, hemorrhage, diseases of the joints, calculi in the bladder, and that least intelligible of all diseases, syphilis. Its library, which, next to that of the Royal College of Surgeons in London, is the most select, valuable, and complete collection of medical literature in Great Britain, more especially with reference to modern works, is continually receiving additions, both by large purchases at home and abroad, and by the numerous donations of its members and others. When, however, I contemplate the arrangement made by the foregoing College for the advantage of its members; when I recollect its magnificent museum; its rich and continually increasing library both open almost daily for the accommodation of its scientific members and others; the lectures annually delivered in its theatre; and the improved character of its regulations for professional education; I rejoice, that this metropolis at length seems to possess, a great and influential public institution, which is contributing most essentially to maintain the usefulness and the rank of the surgical profession.

In the course of the last thirty years, great and essential improvements have been made in almost every branch of surgery.

Before the time of Mr. Hunter, our ideas of the venereal disease were surrounded with absurdities; and it is to this luminary, and the plain facts laid before the profession by the late Mr. Rose, that we

are, in an eminent degree, indebted for the increased discrimination and reason, which now prevail, both in the doctrines and treatment of the complaint. It must be confessed, however, that much yet remains to be made out, respecting the nature and treatment of syphilitic disorders. Need I mention a greater proof of the truth of this remark, than the remarkable change of practice in some of the principal hospitals of the kingdom, mercury being now exhibited in not more than one out of every eight or ten cases, for which this medicine a few years ago was always deemed indispensable? Numerous cases, having all the characters of primary venereal sores, seem also now to be curable by simple dressings and cleanliness; and the necessity for violent salivation, in any cases, is beginning to be generally disbelieved. In short, so different is every thing from what it used to be, that many surgeons are tempted to suppose the nature of the disease totally altered. See *VENEREAL DISEASES*.

Strictures in the urethra, an equally common and distressing disease, were not well treated of until Mr. Hunter devoted his attention to the subject. He first improved the method of applying caustic within the urethra; a practice which was afterwards perfected, first by Sir Everard Home, and again by M. Ducamp.

In modern times, hernial diseases, those common afflictions in every country, have received highly interesting elucidations from the labours of Pott, Camper, Richter, Sir Astley Cooper, Hey, Gimbernat, Hesselbach, Scarpa, Lawrence, Langenbeck, Jules Cloquet, &c.

The treatment of injuries of the head has been materially improved by Quesnay, Le Dran, Pott, Hill, Desault, Dease, Hey, Abernethy, Brodie, and Velpeau.

The disease of the vertebrae, which occasions paralysis of the limbs, formerly always baffled the practitioner; but the method proposed by Pott is now frequently productive of considerable relief, and sometimes of a perfect cure. The diseases of the joints in general may also be said to be at present viewed with much more discrimination, than they were a very few years ago; and this great step to better and more successful practice reflects great honour on Sir Benjamin Brodie, while it keeps up a well-founded hope, that morbid anatomy (the study which has of late banished so much confusion from this part of surgery) will yet be the means of bringing to light other useful facts and observations, relative to the pathology of the joints.

In the time of Pott, few patients afflicted with lumbar abscesses ever recovered; for, soon after a free opening had been made, according to the method then in vogue, the constitution was usually seized with violent irritative fever, which hardly admitted of any control. Mr. Abernethy ascertained that, in some instances, much of this risk might be avoided by making only a small opening, healing it by the first intention, after the matter had been let out, and then repeating the same plan, from time to time, so as to prevent the cavity of the abscess from ever being distended, and give it the opportunity of diminishing by a natural process. Of course, success cannot be expected to attend even this treatment, when the vertebrae are carious, or any other serious organic disease prevails. It is right also to state, that Abernethy's plan has not received universal approbation.

The rarely failing plan of curing hydroceles by

means of an injection, as described by Sir James Earle, may be enumerated as one of the most decided improvements in modern surgery: at least, no doubt is entertained on this point by any surgeon of eminence in France, the British dominions, or the United States of America. Whether acupuncture will ever prove efficacious enough to become a common practice, and to supersede the foregoing mode of cure, is a question, which I apprehend will be finally answered in the negative.

The increasing aversion to the employment of the gorget in lithotomy, the many distinguished advocates for the use of better instruments, and, above all things, the clearer exposition of the right principles of the operation, now made, both by lecturers and authors, I regard as an agreeable indication of the augmented degree of success with which lithotomy is now likely to be practised, in every fair case for the operation. The necessity for the same frequent performance of lithotomy which prevailed formerly, must not, however, be now recognised by any humane or judicious surgeon; more especially since the art of crushing calculi in the bladder, so that the fragments may be voided through the urethra, has already attained great perfection. The circumstances, however, which ought to determine the preference of lithotomy or of lithotripsy, are noticed under these respective terms. The urethral forceps, recommended by Sir A. Cooper, for removing calculi through the urethra and all the ingenious inventions of Dr. Civiale, M. Le Roy, and Baron Heurte-loup, designed to break or to reduce the stone to powder, so that it may be voided with the urine through the urethra (each plan thus superseding, when it answers in fit cases, all occasion for lithotomy), are great and signal improvements, which entitle their inventors to a distinguished rank amongst those men of genius, from whose labours the present and future generations will receive inestimable benefit.

The diseases of the eyes, cases, to which English surgeons once seemed to pay much less attention than was bestowed by foreign practitioners, now obtain due attention in this country. Although we always had what are called oculists, it was not till the period of the establishment of eye infirmaries in London, about forty years ago, that regular surgeons began to study the subject, scientifically, and with much success. Until this epoch they had remained wonderfully ignorant of this part of their profession; and, uninformed on the subject, they had given up to professed oculists and quacks one of the most lucrative and agreeable branches of practice. However, the able writings of David, Wenzel, and Ware, are now familiarly known to practitioners: and the observations of Scarpa, Richter, Beer, Schmidt, Himly, Lawrence, Frick, Wardrop, Travers, Saunders, Guthrie, Mackenzie, and Middlemore, have had immense effect in diffusing in the profession a due knowledge of the numerous diseases to which the organs of vision are liable.

In the treatment of aneurismal diseases, English surgeons have much to be proud of. Many of the boldest operations in this branch of surgery have been devised by the genius, and executed by the spirit and skill of British surgeons. Even Mr. Pott himself is here obliged to confess our superiority. (*Parallèle de la Chirurgie Angloise, &c.* p. 244.) The carotid artery, the external and in-

ternal iliac, and the subclavian have all been successfully tied by surgeons of this country. The first operation, in which the external iliac was tied, I was a spectator of: it was performed by Abernethy in Bartholomew's Hospital; and has subsequently been repeated in many examples, both in this country and others, with considerable success. I had also the honour of seeing the same gentleman tie the carotid; the first instance of it, I believe, in England. This measure was resorted to by him for the stoppage of hemorrhage, from a wound of the neck. Sir A. Cooper's claim to the distinguished merit of having first applied a ligature to the carotid, for the cure of aneurism, still continues unaffected by it.

In the article ANEURISM, I have cited many examples, in which the carotid artery has been successfully tied; and the safety and propriety of the operation are now generally known and acknowledged. Indeed, so little are surgeons now afraid of the ill effects upon the brain, that the carotid artery has been tied merely for the purpose of enabling the operator to take away a large tumour, including the whole of the parotid gland, from the side of the neck, without risk of hemorrhage; a proceeding, however, which ought not to be encouraged into a common practice. (See *Med. Chir. Trans.* vol. vii. p. 112.) The example of skill, judgment, and boldness, set by the surgeons of this country, has not been lost upon foreign practitioners. In France, in Germany, in Italy, and particularly in the United States of America, operations for aneurism are familiarly practised. Indeed, in the two latter countries, the arteria innominate had been tied, previously to the publication of the 6th edition of this work; a proceeding, which, though it was originally suggested here, was not ventured upon in Great Britain, until very recently, when it was executed by Mr. Lizars. The result, however, like that of the two earlier cases, was the loss of the patient. Whether the ligature of the innominate is a justifiable proceeding, appears to me a questionable point; for experience has not yet adduced any thing in its favour. All the patients on whom it has been performed, have died of secondary hemorrhages and Brasdor's plan, as adopted by Wardrop and Mott, which brings with it the recommendation of occasional success, may be a safer expedient. (See ANEURISM.) Weiss's aneurismal needle, and some others, intended for the conveyance of the ligature under very deep arteries, where there is but little room, are also inventions, likely to prove of material service in this branch of surgery, where sometimes the most skillful surgeons have either been baffled in their endeavour to pass the ligature under the vessel, or have detained their patient so long in the operating-room, exposed to the greatest agony, ere the business was accomplished, that the chance of a happy issue was seriously lessened. Before I quit this subject, my feelings call upon me to express the high opinion which I entertain of my friend Mr. Hodgson's *Treatise on the Diseases of Arteries and Veins*, first published in 1815; a work which reflects great credit on English surgery, and contains practical precepts far superior to those of Scarpa.

In the modern practice of surgery, a variety of old prejudices are gradually vanishing. Peruvian bark, not many years ago, was regarded as a sovereign remedy and specific for nearly all cases of gangrene; and in these, and many other in-

stances, it was prescribed without any discrimination, and in doses beyond all moderation. But the false idea, that this medicine, or any preparation of it, has any specific effect in checking mortification, no longer blinds the senses of the most superficial practitioner. He neither believes this doctrine, nor the still more absurd opinion, that strength can be mysteriously extracted from this vegetable substance, and communicated to the human constitution, in proportion to the quantity which can be made to remain in the stomach.

At the present day, the subject of mortification opens to us a point for investigation of the first-rate consequence. Every surgeon is aware, that when a limb is deeply affected with mortification, amputation is commonly necessary. This is generally acknowledged; but, the performance of the operation has, since the time of Pott, only been sanctioned when the mortification has manifestly ceased to spread, and a line of separation been formed between the dead and living parts. All other patients, in whom the disorder was in a spreading state, were left to their fate. It is true, some of the old surgeons occasionally ventured to deviate from this precept; but, as they did so without any discrimination, or knowledge of the particular examples, which ought to form an exception to the general rule, their ill success cannot constitute a just argument against the plan of amputating earlier in a certain description of cases.

Now, if it be proved by modern experience, that many lives may be saved by a timely performance of amputation, under circumstances, in which it has until lately been generally condemned, it must be allowed that the established innovation will be one of the greatest improvements in the practice of the present time.

For reviving the consideration of this question, and venturing to deviate from the beaten path, the world is much indebted to that eminent military surgeon, Baron Larrey. How different his doctrines and practice are from those usually taught in the schools, the article MORTIFICATION will sufficiently prove.

Connected with this topic is *Hospital Gangrene*, a case which deserves here to be pointed out, as having received considerable attention of late years, and being much better treated, since the efficacy of the solution of arsenic, and of the strong nitrous acid, has been so completely proved by the observations of Blackadder and Welbank.

In the treatment of ununited fractures, the simple and ingenious practice, suggested by Dr. Physick of Philadelphia, merits particular notice: various successful trials have been made of it in this country and France, as well as in America, and, though liable to failure, it is yet entitled to be regarded as a valuable addition to the plans hitherto devised for these cases, which too often render the patient a helpless cripple during life. The considerations, however, which should guide us in the choice of a plan for bringing about the union of fractures, which have not admitted of bony union under ordinary treatment, have not been neglected in their proper place. See FRACTURE.

The inestimable treatise of Dr. Jones, *On Hemorrhage*, may be said to have produced quite a revolution in all the principles by which the surgeon is guided in the employment of the ligature for the stoppage of bleeding, and the cure of aneu-

risms. Instead of thick clumsy cords, small firm silks, or threads, are now generally used; and so far is the practitioner from being fearful of tying arteries too tightly, lest the ligature cut through them, that it is now a particular object with him to apply the silk, or thread, with a certain degree of force, in order that the middle and inner coats of the vessel may be divided. If this be not done, the effusion of fibrine within the artery, an important part of the process of obliteration, cannot be expected as a matter of certainty, and secondary hemorrhage is more likely to occur. But, in order to convey an adequate idea of the beneficial changes which Dr. Jones's observations are tending to produce in practice, I have been careful, in the article HEMORRHAGE, to give a tolerably full account of the results of all his interesting experiments.

Dr. Veitch, an eminent naval surgeon, deserves here to be mentioned with particular honour, since he is probably the earliest writer that laid due stress on the advantage of tying the arteries with very small ligatures; one of the greatest improvements in the treatment of wounds and in operative surgery. "My experience and reasoning (says he) led me to recommend a small ligature; and its nature and form were not left to conjecture, but clearly laid down; and the introduction of this practice to surgery is, I think, unquestionably due to me. Dr. Jones did not apply his round ligature to operations on the human body; and the practice of using the small single ligature was not adopted at the Edinburgh Infirmary, in which city his experiments were made, until the appearance of the following Essay on the Ligatures of Arteries, which was sent to the editor of the *Edin. Med. and Surgical Journal*, in 1805, but was not published until the 1st of April, 1806." (See *Obs. on the Ligature*, &c. Lond. 1824.) In justice to Dr. Jones, I should mention, that his book was published in 1805.

Besides using very small, firm, round threads, instead of large, flat tapes, or cords, as was the custom a few years ago, some modern surgeons have suspected, that much benefit might arise from cutting off both portions of the ligature close to the knot, after amputation, the removal of the breast, &c. No one has insisted so much as Mr. Lawrence upon the propriety of examining further the merits of this innovation. If no bad effects were to result from leaving so small a particle of extraneous substance in the flesh, as the little bit of silk composing the knot and noose on the artery, the practice would form a considerable improvement. The wound would then admit of being brought together at every point; the quantity of extraneous matter in the part would be lessened to almost nothing; the danger of convulsive affections would be reduced in proportion as a serious cause of pain and irritation is diminished; and the chance of accomplishing perfect union by the first intention would be materially increased. Mr. Lawrence tried the plan, and did not find any ill consequences follow, while many advantages seemed to him to be the result of it. Mr. Crosse, of Norwich, however, detailed some observations, which were adverse to the practice; and candour obliges me to state, that, with the exception of cases where the parts must suppurate, and no prospect of union by the first intention can be entertained, the plan has now few advocates. (See AMPUTATION, ANEURISM, HEMORRHAGE, and LIGATURE.)

Amongst the signal improvements in modern practice, I must not forget the present more rational method of dressing the wounds, after capital operations, with light cooling applications, instead of laying on the part a farrago of irritating pledgets and plasters, and a cumbersome mass of lint, tow, flannel, and other bandages, woollen caps, &c. The fewer the adhesive strips are, the better, if they only hold the lips of the wound together. This is all they are intended to do. Whereas, if more than are necessary for this purpose be employed, they do harm by heating the part, and covering the wound so entirely as to prevent the issue of the discharge. The isinglass plaster, introduced into use by Mr. Liston, and so commonly employed in University College Hospital, I regard also as sometimes possessing advantages over the common adhesive plaster, and likely therefore not to be discontinued. Instead of employing numerous ointments of various compositions, the generality of practitioners find more simplicity equally, if not more effectual, and in dressing of wounds and ulcers, they rarely have occasion to resort to any other applications than adhesive or isinglass plaster, lint, the water dressing, the nitrate of silver, or gently stimulating lotions of sulphate of zinc, or sulphate of copper.

Wars, which are unfavourable to most other sciences, are rather conducive to advances in surgery. The many new and interesting observations, which Baron Larrey made in the course of his long and extensive military experience, are a proof of the foregoing remark. Pitard, almost the founder of surgery in France, was a military surgeon. Ambrose Paré and Wiseman collected their most valuable knowledge principally in the service of the army. Mr. Hunter himself gained much of his practical information in the same line of life. To Baron Larrey surgeons are indebted for many highly important observations, relating to amputation in cases of gun-shot wounds. In particular, he has adduced a larger and more convincing body of evidence than was ever before collected, to prove, that, in gun-shot injuries, the operation of amputation should always be performed without the least delay, in every instance, in which such operation is judged to be unavoidable, and the ultimate preservation of the limb either impossible, or beyond the scope of all rational probability. He has established the truth of this most important precept in military surgery by innumerable facts, drawn chiefly from his own ample experience, but partly from the practice of many able colleagues. The great operations of the shoulder-joint and hip-joint amputations, he has executed with success. The necessity for the former, however, he proves may sometimes be superseded, and the limb be saved, by making a suitable incision for the extraction of the splintered portions of the upper part of the humerus. This method, which was in many instances done with success in the peninsular war, and has been also repeatedly performed with the same result by Baron Percy, was, I believe, originally proposed and practised by Boucher. (See *Mém. de l'Acad. de Chir.* t. ii. 4to.) However, it was first more particularly described, and even practised, by Mr. C. White of Manchester. (See his *Cases in Surgery*.) Mr. Morell also performed it successfully in York Hospital. (See *Med. Chir. Trans.* vol. vi.) See AMPUTATION.

Amputation at the hip-joint, performed only in the most dreadful cases, because itself the most dreadful operation in surgery, Baron Larrey performed five times, and twice (I believe) with success. It has also been performed by Brownrigg, Guthrie, Mott, Sir Astley Cooper, Graefe, Walther, Delpech, and others; and several of the cases terminated in the recovery of the patients. As must necessarily be the case, however, on account of the desperate circumstances under which the operation is performed, and the severity of the operation itself, the examples of recovery bear only a small proportion to the large number of deaths, known to have followed amputation at the hip in the many cases, in which it has now been undertaken. Yet this unfortunate truth should not be exaggerated into a reason for an unqualified condemnation of the practice, which is adopted as the only means affording a chance of saving life. But, as there may be difficulty in deciding whether the patient will have the best chance with, or without the operation, it is to be hoped, that no surgeons will perform it, except under the authority of the united opinion of a board, or consultation of the best-informed practitioners, whose circumstances will allow to assemble. It is to be hoped, likewise, that there is no man in the profession, so destitute of honour and principle, as to aim at notoriety through the medium of this terrible operation, and court the opportunity of doing it merely with this view, instead of being compelled to undertake it by the really desperate circumstances of the case. If there be such an individual in existence, his scheme of wading through blood to reputation, now that the novelty of the operation has vanished, would have but little chance of success. Be it also recollected that, while the operation itself requires only ordinary talents, the business of avoiding it, and of discriminating the exact cases, in which it should be attempted, implies an extensive acquaintance with the principles of surgery, ample experience, and more than common abilities and judgment. See AMPUTATION.

Another improvement in surgery, of an humbler, but not less useful description, than some things to which I have already adverted, is the elastic gum seton, which, for cleanliness and convenience, is far superior to what has generally been employed. The needle for it, and the slips of elastic gum, may be procured of Messrs. Weiss. The invention, I believe, is one of the results of French ingenuity.

The simple operation of dividing the tendo Achillis, in order to rectify one species of the deformity termed club-foot, a preceeding which I have known adopted with success, has not been practised so frequently as its efficacy would justify, till a very recent period. It may be enumerated as a decidedly valuable addition to the operative department of surgery.

The treatment of phlegmonous erysipelas by free incisions under certain circumstances and on the principles explained in the article Erysipelas, I regard as a practice of infinite merit. Ample opportunities of trying it, both in hospital and private practice, have filled me with this conviction, which I am glad now to acknowledge, as I formerly expressed disapprobation of the plan. Mr. A. Copland Hutchison, to whom we are indebted for suggesting the practice, and bringing it under the

consideration of the profession, seems to me thereby to have rendered a great service to the public.

The excision of more or less considerable portions of the lower jaw, in cases of irremediable disease of it, is a new proceeding exemplifying the still continued progress of the boldest parts of operative surgery. The practice also merits notice on another account: it is an extension of the most effectual part of surgery to a class of miserable and hopeless cases, first executed by our transatlantic brethren in the United States, Dr. Mott having been the means of conferring this honour upon them.

The removal of the superior maxillary bone may also be specified as another operation, the propriety of which, under certain circumstances, is now fully established. In promoting the introduction of this bold measure into practice, perhaps M. Gensoul, of Lyons, must be regarded as the leader; although I believe that Mr. Lizars was very early in the field; and it is but justice to add, that my colleague Mr. Liston may claim the merit of having brought the requisite operative proceedings to the greatest perfection.

I regret, that, in the last edition, due justice was not done to the meritorious surgeons of the United States of America. This happened, however, not from any want of desire on my part to pay the tribute of honour, where it was deserved; but from my not being then in possession of the valuable information, respecting the progress of surgery in the United States, which I have since obtained from Dr. Reese's American edition of this DICTIONARY, and other sources. I most cordially join, then, in the observation that, in a history of this kind, mention ought to be made of "the names of Drs. White, Dudley, Davidge, Dorsey, Shippen, Bard, Post, Mott, Gibson, Parrish, Barton, Mc. Clellan, Stevens, Warren, Smith, Jamieson, and a host of others, who have contributed by the pen and the knife to elevate this department of the profession: this will be admitted, unless the successful ligature of the subclavian, the common iliac, the internal iliac, and that of the innominate, the amputation of the hip-joint, and upper and lower jaw, the extirpation of the parotid gland, the excision of the clavicle, and the cure of aneurism, by tying on the distal side of the tumour, be unworthy of record. Some of these operations (continues Dr. Reese) had never been attempted in Europe, till our surgeons had led the way; and by these, and other splendid achievements in operative surgery, had demonstrated their practicability and success." In adverting to such merit in the surgeons of the United States, I feel all that heartfelt pleasure, which arises from the remembrance of their close connection with my native country by the ties of blood and language, and they may rest assured of my sincere esteem; and of my earnest wish to render full justice to them on every subject.

SUSPENSORY. A bandage for supporting the scrotum; a bag truss. In cases of inflamed testis, varicocele, some particular hernia, and several affections of the testicle and spermatic cord, a suspensory bandage is of great service.

SUTURES. (from *suo*, to sew.) A mode of uniting the edges of a wound, by keeping them in contact with stitches.

Mr. Sharp remarks, that "when a wound is recent, and the parts of it are divided by a sharp

instrument, without any further violence, and in such manner that they may be made to approach each other, by being returned with the hands, they will, if held in close contact for some time, reunite by inosculation, and cement, like one branch of a tree ingrafted on another. To maintain them in this situation, several sorts of sutures have been invented, and formerly practised, but the number of them has, of late, been very much reduced. Those now chiefly described are the *interrupted*, the *glover's*, the *quilled*, the *twisted*, and the *dry*, sutures; but the interrupted and twisted are almost the only useful ones, for the quilled suture is never preferable to the interrupted; the dry suture is ridiculous in terms, since it is only a piece of plaster, applied in many different ways, to reunite the lips of the wound; and the *glover's*, or uninterrupted stitch — which is recommended in superficial wounds, to prevent the deformity of a scar — does rather, by the frequency of the stitches, occasion it, and is therefore to be rejected, in favour of a compress and sticking plaster." (*Oper. of Surgery*.) The twisted suture is described with *hare-lip*; and *GASTROPLASTIC*, forms a distinct article in this Dictionary.

Interrupted Suture. — The wound being cleansed from all clots of blood, and its lips being brought evenly into contact, the needle, armed with a ligature, is to be carefully carried from without, inwards to the bottom, and so on from within outwards. Care must be taken to make the puncture far enough from the edge of the wound, lest the ligature should tear quite through the skin and flesh. This distance, according to Mr. Sharp, may be three or four-tenths of an inch. The other stitches required are only repetitions of the same process. The threads having been all passed, "you are in general to begin tying them in the middle of the wound; though, if the lips be held carefully together, it will not be of great consequence which stitch is tied first." (*Operations*, chap 1.)

Surgical writers, in general, state, that the number of stitches must, in a great measure, depend upon the extent of the wound. The common rule is, that one suture is sufficient for every inch of the wound; but that, in some instances, a stitch must be more frequently made, particularly when a wound gapes very much, in consequence of a transverse division of muscles. As we have already explained, it is necessary to pierce the skin, at a sufficient distance from the sides of the wound, lest the thread should cut through the flesh in a short time: but, though Mr. Sharp lays down the necessary distance, in general, as three, or four-tenths of an inch, and, others advise the needle to be always carried through the deepest part of the wound, we must receive these directions, particularly the last, as subject to numerous exceptions. When a wound is very deep, it would be absurd, and even, in many instances, dangerous to drive the needle through a vast thickness of parts. Other wounds, of considerable length, might not be, in some places, four-tenths of an inch deep; though, it is true, sutures could never be requisite at such points.

The needles for the interrupted suture will pass with the greatest facility, when their shape corresponds exactly with the segment of a circle, and they should always form a track of a sufficient size

to allow the ligatures, which they draw after them, to pass through the flesh with the utmost ease.

The interrupted suture obviously receives its name from the interspaces between the stitches; and it is the one most frequently employed. Its action is frequently assisted, and supported, either with the uniting bandage (see *BANDAGE*), or with strips of adhesive plaster, compresses, &c.

Quilled Suture.—As Mr. John Bell has observed: “When the wound was deep among the muscular flesh, the old surgeons imagined, that so large a wound could not be commanded by the common interrupted suture, however deep the stitches might be driven among the flesh; they were, besides, fearful of using the continued glover’s suture in deep gashes, lest the wound should be made to adhere superficially, while it was still open within, forming perhaps a suppuration, or deep collection of matter. They believed that a deep muscular wound could not be safely healed without a degree of suppuration: while they wished to bring it together at the bottom, they were afraid to close it very exactly at the mouth, lest the matter should be collected in the deeper parts of the wound: it was for this purpose (says Mr. John Bell) that they used, what they called the *compound or quilled suture*. It is merely the interrupted suture, with this difference, that the ligatures are not tied over the face of the wound, but over two quills, or rolls of plaster, or bougies, which are laid along the sides of the wound. In performing this suture, we make first two, three, or four stitches, of the interrupted suture, very deep; and then, all the ligatures being put in, we lay two bougies along the sides of the wound; then slip one bougie into the loop of the ligatures on one side, drawing all the ligatures from the other side, (Mr. Bell should rather have said, towards the other side), till that bougie is firmly braced down. Next we lay the other bougie, and make the knots of each ligature over it, and draw it also pretty firm; and thus the ligatures, in form of an arch, go deep into the bottom of the wound, and hold it close, while the bougies, or quills, keep the middle of the wound, and lips of it, pressed together with inordinate closeness, and prevent any strain upon the threads, or any coarse and painful tying across the face of the wound.” In a note, Mr. J. Bell says, that Dionis violently reprobates the quilled suture; but that De la Faye (the annotator on Dionis) says, it is good for deep muscular wounds. The quilled suture is now scarcely ever employed; nor has it any advantages, except, perhaps, in some wounds of the belly. (See *Principles of Surgery*, vol. i. p. 50.)

Glover’s Suture.—This had also the name of the continued suture. It was executed by introducing the needle first into one lip of the wound, from within outwards; then into the other in the same way; and in this manner the whole track of the wound was sewed up.

It was not, however, till lately, that this suture was totally abandoned; for Mr. Sharp, and several eminent writers, since his time, advised its adoption in wounds of the stomach and intestines. From what has been said in the articles *WOUNDS OF THE ABDOMEN* and *HÆMORRHOIDS*, the reader will perceive, that, even in such particular instances, the glover’s suture would not be advisable; so that it may, in every point of view, be now considered as totally obsolete in every case of surgery, which can pos-

sibly present itself. When we remember, in making this suture, how many stitches are unavoidable; how unevenly, and in what a puckered state, the suture drags the edges of the skin together; and what irritation it must produce; we can no longer be surprised at its now being never practised on the living subject. It is commonly employed for sewing up dead bodies; a purpose for which it is well fitted; but, for the honour of surgery, and the sake of mankind, it is to be hoped, that it will never again be adopted in practice.

False, or Dry Suture.—Modern surgeons commonly understand by this expression nothing more than the plan of bringing the sides of a wound together by means of adhesive plaster; nor did Mr. Sharp attach any other meaning to the phrase, which he sets down as highly ridiculous, as there is no sewing employed. For the following remarks, I am indebted to Mr. Carwardine, of Earls Colne Priory, near Halsted, Essex. Alluding to what was stated in the third edition of this Dictionary, concerning the dry suture, he observes, “You do not appear to be aware, any more than Mr. Sharp, of the precise mode of its application, or why it was so called. Indeed, it is a curious circumstance, how this method of dry suture should have been so lost, as not to be described by any modern surgeons, who laugh at the very term, speaking of it as a mere application of a strip of adhesive plaster. In the *sutura sicca*, so called in opposition to the *sutura cruenta*, where blood followed the needle, some adhesive plaster was spread on linen, having a selvage. A piece of this was applied along each side of the wound (the selvages being opposed to each other), and then drawn together by sewing them with a common needle, without bloodshed. Hence the term *sutura sicca*. The dry suture was used in all wounds of the face, to avoid scars. You will find it thus described by our countryman, Thomas Gale, in his *Enchiridion*, 1563; and also by A. Paré, who gives a figure of it in his folio work, 1579.” I feel much obliged to my friend Mr. Carwardine for this explanation, without which the expression *dry suture* is undoubtedly absurd. As the common way of dressing wounds with sticking-plaster will come under consideration in a future part of this work (see *WOUNDS*), I shall not here detain the reader upon that topic.

Sutures made with a needle and ligature were much more frequently employed by the old surgeons than by the moderns. The best practitioners of the present day never resort to this method of holding the sides of a wound in contact, except in cases in which there is a real necessity for it, and other modes will not suffice.

There were, indeed, certain instances, in which the employment of sutures was long ago forbidden. Of this kind were envenomed wounds, in which accidents the destruction of the poison always formed a principal indication in the treatment. Wounds, accompanied with considerable inflammation, were not deemed proper for the use of sutures, as the stitches had a tendency to increase the inflammatory symptoms. Also, as contused wounds necessarily suppurated, and, consequently, could not be united, sutures were not recommended for them; nor were they judged expedient for wounds attended with such a loss of substance as prevented their lips from being placed in contact. Formerly, wounds penetrating the chest were not

united by sutures; nor were those in which large blood-vessels were injured; at least, until all danger of hemorrhage was obviated by the vessels being tied.

Piërac's dissertation on the abuse of sutures, inserted in the third volume of the *Memoirs of the Academy of Surgery*, had considerable effect in rendering the employment of sutures less frequent. This judicious and enlightened practitioner, opposed the method of uniting wounds by means of sutures, which he contended ought never to be adopted in practice, except in certain cases, in which it was absolutely impossible to keep the sides of the wound in contact by means of a suitable posture, and the aid of a methodical bandage. Such circumstances Piërac represents as exceedingly rare, if they ever occur at all. He speaks of sutures as seldom fulfilling the intention of the surgeon, who, in the majority of cases, finds himself necessitated to remove them before they have accomplished the wished-for end. Piërac believes, that sutures are generally more hurtful, than conducive, to the union of wounds; and that when they succeed, they do not effect a cure more speedily than a proper bandage. He cites numerous cases of extensive wounds of the abdomen, neck, &c. for the cure of which a bandage proved effectual, and this even in many instances in which sutures had previously failed, and cut their way through the flesh. M. Louis, who adopted the opinions of Piërac, published, in the fourth volume of *Mém. de l'Acad. de Chirurgie*, a valuable dissertation, in which he endeavours to prove, that even the hare-lip can be better united by means of the uniting bandage than with sutures; a case, however, which every practical surgeon now rightly agrees to consider, for particular reasons elsewhere noticed, (see HARE-LIP) as an example in which a suture is advisable.

So far as I can judge, the fair statement of the matter is, that sutures are by no means requisite for the generality of wounds; but that there are particular cases, in which either their greater convenience, or superior efficacy, still makes them approved. Since they cannot be practised without additional wounds being made, and pain occasioned; and since the threads always act as extraneous bodies in the parts, exciting more or less inflammation, and suppuration round them; there can be no doubt that their employment is invariably wrong, whenever the sides of a wound can be maintained in contact by less irritating means, with equal steadiness and security. For what is it which generally counteracts the wishes of the surgeon, and renders his attempts to make the opposite surfaces of wounds grow together, unavailing? Is not the general cause too high a degree of inflammation, which necessarily ends in suppuration? Are not sutures likely to augment inflammation, both by the additional wounds of the needles, and the still more pernicious irritation of the threads, which always act as foreign bodies, sometimes producing not merely an increase of inflammation and suppuration in their track, but frequently ulceration, or sloughing of the parts; and, in particular constitutions, an extensive erysipelatous redness.

But even admitting, that, by the general adoption of sutures, some wounds would be united, which could not be so were this means abandoned, still it must be allowed, on the other hand, that

the cause of other wounds not uniting is entirely ascribable to the irritation occasioned by the sutures themselves. Hence, if it be only computed, that as many wounds are prevented from uniting by the irritation of sutures, as other wounds which are united by their means, and could be united by no other methods, we must still perceive, that mankind would be no sufferers, and surgery undergo no deterioration, were sutures rejected from practice. I believe, however, that every man, who has had opportunities of observation, and has made use of them with an unprejudiced mind, will feel persuaded, that more wounds are hindered from uniting by sutures than such as are healed by them, and could not be united by other means.

But we are not obliged either to condemn or praise the use of sutures, in every instance, without exception. Men of independent principles will always adopt the line of conduct which truth points out to them as that which is right; nor will they obstinately join Piërac and Louis, in contending that sutures are always improper and disadvantageous, nor imitate other bigotted persons, who may use sutures in every kind of wound whatever. Perhaps, sutures are still rather too much employed, and, in all probability, will long be so. It will be difficult entirely to eradicate the prejudices on which their too frequent use is founded, so long as teachers of surgery are seen holding up the practice for imitation in every principal hospital in the kingdom. Such surgeons, however, as are ready to imbibe fair and candid sentiments on the subject, and to qualify themselves for practising this part of surgery with judgment, should by no means neglect to read what Piërac and Louis have written on the subject. I know that the latter authors are too sanguine in their representations; but, as I have already remarked, sutures are still rather too much used, and something is yet necessary for the abolition of a certain unwarranted habit of having recourse to them without real necessity. Nothing will tend to produce this desirable change so effectually, as the perusal of every argument against their employment.

I find it exceedingly difficult to lay down any fixed principles for the guidance of the surgeon, in respect to when he ought, and when he ought not, to use sutures.

Perhaps, sutures should be made use of for all cuts and wounds which occur in parts of the body subject to an unusual degree of motion, such as would be apt to derange the operation of bandages, sticking-plaster, and compresses. Hence the propriety of using the twisted suture for the hare-lip.

Sutures are probably, for the most part, advantageous in all wounds of the abdomen, of a certain length, and attended with hazard of a protrusion of the bowels. In this situation, the continual motion and action of the abdominal muscles in respiration, besides the tendency of the viscera to protrude, may be a reason in favour of the use of sutures.

When two fresh cut surfaces positively cannot be brought into contact by sticking-plaster, bandages, the observance of a proper posture, &c. there can be no doubt of the advantages of using sutures, if they will answer the purpose. Some wounds made for the cure of certain fistulous com-

manications between the vagina and bladder, or others for the cure of similar affections in the perineum, afford instances of cases to which I allude. Sutures are generally resorted to after the operation of removing a diseased breast, castration, and operations for strangulated hernia. The reason for using sutures in the scrotum arises from the difficulty of keeping the edges of the wound in contact, owing to the great quantity and looseness of the part. Sutures are likewise employed after flap-amputations. Here they are serviceable in giving a degree of steadiness to the flap, not easily to be obtained at first by other means. When used in such cases, however, they should be withdrawn within the first twenty-four hours, or as soon as the isinglass or adhesive plaster affords sufficient support to the flap.

SYMPATHETIC BUBO. See **BUBO**.

SYNCHYSIS. (from *συνχύνω*, to confound.) The term *synchysis* sometimes denotes the confusion of the humours of the eye, occasioned by blows, and attended with a rupture of the internal membranes and capsules. Beer understands, by the expression, a dissolution of the vitreous humour, or the state of it in which its consistence is entirely destroyed. (See *Lehre von den Augenkr.* b. ii. p. 257.)

SYNECHIA. The case in which the iris adheres to the cornea, is termed *synechia anterior*; that in which the uvea adheres to the capsule of the lens, *synechia posterior*. *Synechia posterior*, on account of the frequent delicacy of the adhesions, is apt not to be detected, unless the eye be examined with particular care. A magnifying glass should be used, and the pupil be first dilated with hyoseyamus, or belladonna. The treatment, so far as the prevention and removal of such adhesions are practicable, strictly belongs to the subject of iritis. (See *OPHTHALMV.*) With the view of dispersing them, Beer praises the good effects of applying to the eye itself ointments containing preparations of mercury, or a collarium hydrarg. bichloridi to which some of the thebaic tincture is added. As an inward medicine, he says, calomel is the most effectual. When eyesalves are used, Beer recommends a little of the extract of hyoseyamus to be mixed with them, so that they may dilate the pupil, and thus suddenly break any slight threads of lymph. (B. ii. p. 58.) See *Lehre von den Augenkr.* b. ii. p. 54. and p. 263. Also Beger, *De Synechia, seu preternaturali Adhesionē Corneae cum Irīde.* Haller, *Disp. Chir.* t. i. p. 435.

SYNTHESIS. (from *σύν*, together, and *θεσις*, position, situation.) A generic term formerly used in the schools of surgery, and comprehending every operation by which parts that had been divided, were reunited.

SYPHILIS. *Laes Venerea.* The venereal disease. (See **VENEREAL DISEASE**.)

T BANDAGE. A bandage so named from its figure. It is principally used for supporting the dressings after the operation for the cure of fistula in ano, in diseases of the perineum, and those of the groin, anus, &c. It is composed of two longitudinal pieces of linen or calico, of greater or lesser breadth, according to circumstances. The transverse piece serves to go round the body above the head; the perpendicular piece is sewed, at one of its ends, to the middle of the latter; and, its general extremity is slit into two portions, or

tails, about six or eight inches long. The perpendicular piece of the T bandage extends over the sacrum to the perineum; and its two ends are carried between the thighs and the pudenda to the right and left, and fastened to the transverse piece surrounding the body. Besides the common T bandage, there is another one named *double*, which has two perpendicular pieces, sewed to the transverse one, about four inches apart. The double T bandage is said to be more particularly applicable to the diseases of the perineum; because one may make the two perpendicular pieces cross each other on the part affected, and leave the anus uncovered; an advantage which the simple T bandage certainly has not. (See **BANDAGE**.)

TALPA. (a mole.) A tumour under the skin, compared to a mole under the ground. Such is the etymology. Sometimes it means an encysted tumour on the head. (See **ATHEROMA**, and **TUMOURS, ENCYSTED**.)

TAPPING. See **PARACENTESIS**.

TARAXIS. (from *ταράσσω*, to disturb.) A slight inflammation of the eye.

TAXIS. (from *τάσσω*, to put in order.) The operation of reducing a hernia with the hand. (See **HERNIA**.)

TENACULUM. A very sharp-pointed fine hook, with which the mouths of bleeding arteries are seized and drawn out, in order that they may be tied. It has the advantage of holding the vessel without any chance of the latter slipping away, and, as soon as the artery has been seized, the instrument may be held by any person, even a child, while the surgeon applies the ligature. A tenaculum forceps (which is kept shut with a spring) is much employed at the present day for taking up bleeding arteries. Arteries above a certain size, and whose mouths are perfectly visible, are generally taken up with the common arterial forceps, their coats being very liable to be torn with a tenaculum. (See *Dupuytren, Clin. Chir.* t. iv. p. 396.) When the forceps is employed, it is better, instead of introducing the end of one of its blades into the mouth of the artery, to take completely hold of the extremity of the vessel between both the blades, for reasons specified in the article **HEMORRHAGE**.

TENDONS, WOUNDS AND OTHER INJURIES OF. A tendon, after being divided, or ruptured, if properly treated, readily unites. "The surrounding cellular membrane is thickened by an infiltration of coagulable lymph, which forms a bed that contains and adheres to the divided ends. This bed of thickened membrane shapes itself into a callosus, which gradually coheres inseparably with the ends of the tendon; and, acquiring strength and firmness after a time, shrinks to the size of the neighbouring tendon, and assumes its white colour and fibrous character." (See *Mayo's Human Pathology*, p. 120.)

The tendons are susceptible of inflammation, and, if injected with fine injection in this state, their vessels are seen to be enlarged. In University College Museum are some good specimens of the change here referred to. Like other fibrous textures, tendons exhibit a backwardness to ulcerate. The length of time required for the separation of a dead portion of tendon, is a proof of this fact.

The tendons liable to be broken by the violent action of the muscles with which they are con-

nected, are the tendo Achillis, that of the extensor muscles of the leg, and the tendon of the triiceps extensor cubiti. Mr. M'Intyre, of Newcastle, once mentioned to me a case in which he believed the tendon of the long head of the biceps had been ruptured.

The superficial situation of the tendo Achillis always renders the diagnosis of its rupture exceedingly obvious; and the accident can only become at all difficult to detect, when there is a considerable degree of swelling, which is very rare. When the tendon has been cut, the simultaneous division of the skin even brings the injury of the tendon into view. At the moment when this tendon breaks, the patient hears a sound like that of the smack of a whip. In whatever way the division of the tendon has been produced, there is a sudden incapacity, or, at least, an extreme difficulty either of standing or walking; and the patient sometimes falls down and cannot get up again. There is a palpable depression between the ends of the tendon, which depression is increased when the foot is bent; and diminished, or even quite removed, when the foot is extended. The patient can bend his foot very well, none of the flexor muscles being involved: the power of extending it is also still possible, as the peronæi muscles, the tibialis posterior, and the long flexors of the toes (see *Case by J. L. Petit*) remain perfect, and may perform this motion. (*Œuvres Chir. de Desault*, p. 1.)

The indications are, to bring the ends of the divided part together, and to keep them so, until they have become firmly united. The first object is easily fulfilled, by putting the foot in a state of complete extension; the second, namely, that of keeping the ends of the tendon in contact, is more difficult.

In order to have a right comprehension of the indications, we should consider what keeps the ends of the tendon from being in contact. The flexion of the foot has this effect on the lower portion; the contraction of the gastrocnemius, and soleus, on the upper one. The indications then are, to put the foot in an unalterable state of extension, and to counteract the action of the above muscles.

The action of the muscles may be opposed:—
1. By keeping them in a continual state of relaxation. For this purpose, the leg must be kept half-bent upon the thigh. 2. By applying methodical pressure to the muscles; methodical, because it is to operate on the fleshy portion of the muscles, and not on the tendon, the ends of which, being depressed by it, would be separated from each other, and, instead of growing together, would unite to the adjacent parts. The pressure should also operate, so as to prevent the ends of the tendon from inclining either to the right or left.

J. L. Petit first devised the plan of treating the ruptured, or divided tendo Achillis, by keeping the leg and foot in a particular posture, with the aid of an apparatus. Seeing that the extension of the foot brought the ends of the tendon into contact, it occurred to him that such extension should be maintained during the whole of the treatment, in order to bring about a permanent union. This aim is, in fact, the common basis of all the numerous methods which have since been recommended.

Dr. Alexander Monro, primus, happened to

rupture his tendo Achillis. When the accident took place, he heard a loud crack, as if he had suddenly broken a nut with his heel, and he experienced a sensation as if the heel of his shoe had made a hole in the floor. This sensation, he says, has also been observed by others, though some have complained of a smart stroke, like what would be produced by a stone or cane. Immediately suspecting what had happened, the doctor extended his left foot, in which the injury had taken place, as strongly as he could with his right hand, while with the left he pressed the muscles of the calf downward, so as to bring the ends of the broken tendon as near together as possible. In this position he sat, until two surgeons came to his assistance. They applied compresses and a bent board to the upper part of the foot and fore-part of the leg, both which they kept, as nearly as possible in a straight line, by a tight bandage made with a long roller. But as this mode of dressing soon became very uneasy, it was changed for the following one:—A foot-sock, or slipper, was made of double quilted ticking, from the heel of which a belt or strap projected, of sufficient length to reach over the calf of the leg. A strong piece, of the same materials, was prepared of sufficient breadth to surround the calf, and this was fastened with lacings. On the back part of this was a buckle, through which the strap of the foot-sock was passed, so that the foot could be extended and the calf brought down at pleasure. The leg and foot were wrapt up in soft flannel, fumigated with benzoin, and the bandage was kept on day and night, the belt being made tighter when the doctor was about to go to sleep, and loosened when he was awake, and on his guard. For a fortnight he did not move his foot and leg at all, but was conveyed in a chair on castors from one part of the room to another. After this, he began to move the ankle-joint, but in such a gentle manner as not to give any pain. The degree of motion was gradually increased, as the tendon became capable of bearing it, care being taken to stop when the motion began to create uneasiness. The affected limb was moved in this way for half an hour at a time. In a few days the hollow, between the separated ends of the tendon, became imperceptible, though the part continued soft much longer. It became, however, gradually thicker and harder, until a knot was at last formed in it, apparently of a cartilaginous nature. Though this was, at first, as large as a middling plum, and gradually became softer and smaller, yet it did not disappear entirely. Having occasion to go out six weeks after the accident, the doctor put on a pair of shoes, with heels two inches high, and contrived a steel machine to keep his foot in the proper position. This machine, however, he afterwards changed for another, made of the same materials as the former. It was not till five months after the accident, that he thought proper to lay aside all assistance, and to put the strength of the tendon to a trial. (See *Monro's Works*, p. 661.)

The following was Desault's method, which, though it was expressly designed to fulfil the above-mentioned indications, may not be a more valuable practical plan than what was adopted by Dr. Monro. After the ends of the tendon had been brought into contact by moderate flexion of the knee, and complete extension of the foot, Desault

used to fill up the hollows, on each side of the

tendon, with soft lint and compresses. The roller, applied to the limb, made as much pressure on these compresses as on the tendon; and hence this part could not be depressed too much against the subjacent parts. Desault next took a bandage, about two inches broad, and long enough to reach from the toes to the middle of the thigh, and placed it under the foot, over the back of the leg and lower part of the thigh. He then began to apply a few circles of a roller round the end of the foot, so as to fix the lower extremity of the longitudinal band. After covering the whole foot with the roller, he used to make it describe the figure of 8, passing it under the foot, and across the place where the tendon was ruptured; and the method was finished by encircling the limb upward, with the roller, as far as the upper end of the longitudinal bandage.

At the present day, it is usual not to confine the patient in bed very long, but after the inflammation, immediately following the accident, he is permitted to sit up, the heel being kept upwards and the foot extended by means of a slipper and a strap, or band, which is connected to another strap, or band, applied round the lower part of the thigh. He should also soon avail himself of the aid of a high-heeled shoe.

A rupture of the tendon of the extensor muscles of the leg requires nearly the same kind of treatment as a fracture of the patella. However, pressure exactly on the broken part of the tendon should be avoided; the limb should be kept extended, and somewhat raised; cold lotions applied, and afterwards bleeding and leeches employed, if necessary, with other antiphlogistic measures. No bandage should be put on, till the inflammation has subsided. In the course of two or three weeks, the surgeon should cause the joint to be gently moved, without any muscular exertion on the part of the patient himself.

When the tendon of the triceps extensor cubiti is ruptured, the limb is to be kept straight; cold applications are to be used for a few days; and, if necessary, strict antiphlogistic treatment pursued.

The operation of dividing the tendon of Achilles is occasionally performed. It has sometimes happened, that, after a portion of the foot has been amputated by Chopart's method, the remaining part of it is drawn permanently backward by the powerful action of the gastrocnemius and soleus. For the relief of such a case, the proposal has been made to divide the tendon of Achilles.

The same proceeding was resorted to, more than twenty years ago, by Thilenius in an example of club-foot, which could not be rectified by other means. This practice, which was afterwards followed by Delpech, is founded on the fact, that, in all cases of rupture of this tendon, an encircling bond of connection is formed, instead of direct union taking place between its extremities; and that such uniting medium then becomes lengthened and thinned, so that, at this point, the tendon ultimately loses a part of its original diameter. M. Delpech used to introduce a straight bistoury, between the tendon and the os calcis, completely through the part, dividing the skin at the inner and outer side of the heel and ocular tissue in front of the tendon, to the extent of an inch. Having withdrawn the bistoury, the tendon was next cut through from before backwards, with another knife, that had a very convex edge. The two ends of the tendon

were then kept in contact. In about a month the external wounds were nearly healed; and the union of the tendon being sufficiently firm, and the part elongated by a few lines, an apparatus was applied to bring the foot forwards, and gradually lengthen the tendon.

Stromeyer's plan, which is more simple, and deserving of preference, is executed with a curved very sharp-pointed bistoury. This is introduced two or three inches above the insertion of the tendon, between it and the tibia, the back of the knife being turned towards the bone, and the edge towards the tendon. The point should only just pass through the skin on the opposite side of the limb. The ends of the tendon are to be brought together by extending the foot: and the wound generally heals by the first intention. On the tenth day, the further extension of the foot may commence. As M. Malgaigne observes, this plan is preferable to that followed by Delpech, because the tendon remains free under the skin, whereas after the other method, the two incisions suppurate, and the cicatrix is liable to become united to that of the tendon, and to be hurtfully drawn and irritated when the limb is exercised. (See *Malgaigne, Manuel de Méd. Opér.* p. 152. ed. 2.) It is scarcely necessary to remark, that the division of the tendon of Achilles is only applicable to certain forms of club-foot, in which the action of the great muscles of the calf is decidedly concerned in preventing the part from assuming a better position, and machinery, bandages, and long-continued manual pressure will not avail. (See *Club-Foot*, as noticed in the Preface.

I lately heard of a contracted knee, in which the proposal of dividing the tendon of the biceps was under consideration, as a means of relief. Of course, success would not attend such practice, unless that muscle were particularly the cause of the permanent flexion of the knee.

TENT. A roll of lint for dilating openings, sinuses, &c.

TESTICLE, DISEASES OF THE. Sir Astley Cooper believes, that the body of the testicle is less prone to disease than the gland of the breast; but acknowledges, that it is often the seat of disease, and that the spermatic cord, and the coats of the testicle, are subject to a great variety of diseases. Among the circumstances which appear to him to offer some explanation of the frequency of diseases of the testicles, are the following:—1. Their pendulous situation, which renders them very liable to inflammation; for the blood gravitates into them, and returns with difficulty by the veins. 2. The excitement to which they are liable from passion, and which, often not admitting of being immediately gratified, leads to an accumulation of seminal secretion, and to a painful and excessive distension of the seminiferous tubes, followed by inflammation. 3. The testicles are greatly exposed to blows and pressure. 4. They are frequently involved, secondarily, in consequence of diseases of the urethra and prostate gland. 5. The changes which the testicle undergoes in old age, and at puberty, sometimes bring on disease of it. 6. The liability of the testicle to be prevented, or interrupted, in its descent into the scrotum. This movement, though usually completed before birth, is often delayed for years, and the testicle may then remain at the lower part of the abdomen, or in the groin; in which last situa-

tion it is much exposed to injury. (See Sir A. Cooper, *On the Structure and Diseases of the Testis*, part 2., p. 6.)

The diseases, in which this organ is concerned, conveniently, admit of being referred to four heads: diseases of the testis; of the tunica vaginalis; of the cord; and of the scrotum. The reader will find an account of the three last classes of diseases in the articles HYDROCELE, HÆMATOCELE, SCROTUM and VARICOCELE, so that these subjects will not require particular notice in this place.

It would perhaps be difficult to cite any department of surgery in which greater improvement has been made, within the last twenty years, than in that which relates to the discrimination and more judicious practice, adopted with regard to diseases of the testicle. The result is, that castration, which at one period used to be performed every week, and sometimes two or three times a week in the hospitals of London, is now a comparatively rare proceeding. The same beneficial reform appears, from the testimony of Dupuytren, to have been also made in France, where, he observes, that the love of operating, without any kind of true occasion for the measure, was formerly never more conspicuously exemplified than in cases of enlarged testicles. But, says he, at the present day, about a hundred patients are annually admitted into the Hôtel-Dieu for such diseases, most of whom are cured, and stand in no need of being operated upon. In the majority of instances, Dupuytren ascertained, that the enlargement of the testicles proceeds from external violence, syphilis of long standing, or from serofulous or some other unfavourable state of the general health; and hence, he made it a rule never to resort to castration, without having first tried, for a full month or six weeks, some method of treatment adapted to the cause of the complaint. (See Dupuytren, in *Clin. Chir.* t. i. p. 86—88.)

Acute Inflammation of the Testicle; Orchitis (from *ορχις*, a testicle); or *hernia humeralis*, an absurd but common name for the complaint, more especially when it arises from irritation in the urethra, whether excited by gonorrhœa, injections, bougies, or strictures. This last expression being founded, as Sir Astley Cooper justly observes, upon mistaken pathological principles, it ought to be renounced. When acute inflammation of the testicle arises from sympathy with the urethra, the first symptom is an irritation in the membranous, or prostatic portion of that canal, succeeded by tenderness in the spermatic cord, and swelling and pain in the epididymis. The swelling perhaps is generally first noticed in the latter part, the testicle next swells, soon increasing to two or three times its natural size, and becoming so tender that the pressure of the thigh on it can scarcely be endured. Its weight being also increased, it draws the spermatic cord painfully downwards; and, in this state, the patient obtains some relief by supporting the part with his hands. The pain is obtuse, resembling the suffering caused by squeezing the testicle. The pain and swelling extend along the spermatic cord into the inguinal canal, and great uneasiness is experienced in the groin, hip, inner part of the thigh, and especially the loins, in consequence of the origin of the spermatic nerves from the lumbar. "From the communication between the renal and spermatic nerves, with the nerves of the stomach by the solar plexus, and with those

of the intestines through the mesenteric plexus, the stomach is affected with nausea, [and sometimes severe vomiting," and pain in the intestines," and obstinate constipation are usually experienced. (Sir Astley Cooper, *Op. cit.* part 2. p. 8.)

Although the testicle is so augmented in size, that the rugæ of the scrotum are effaced, it still retains its originally oval form, being rounded at its fore-part, but somewhat flattened at its sides; and it feels exceedingly hard. The scrotum, the rugæ of which are obliterated by the distention, presents a smooth appearance, and is redder than natural; and, as serum is effused in its cellular tissue, it often pits on pressure. Its veins are quite turgid and prominent, and, if punctured, bleed very freely. With reference to its original dimensions, the epididymis always swells more than the testicle itself; which Sir Astley Cooper ascribes to the covering of the former part being less compact. The epididymis remains also longer swollen than the testicle, the globus major and minor being more enlarged than its body, and the swelling of the first generally very perceptible in front of the spermatic cord. The pressure made by the tendon of the external oblique on the swollen cord is the occasion of severe pain, which sometimes undergoes severe exacerbations from spasms of the cremaster.

During the violence of the inflammation, the constitution is often greatly disturbed; the tongue becoming furred, the pulse quick and hard, the skin hot, the bowels confined, and blood, taken from the arm, presenting a buffy and cupped appearance. It is an observation, made by Sir Astley Cooper, that when acute inflammation of the testicle arises from sympathy with the urethra, it rarely proceeds to suppuration; but when it is the effect of a blow, or of vicissitude of temperature, suppuration sometimes, though not frequently, follows; and then all the symptoms are aggravated, and shiverings added to those already described. In fact the purulent matter being confined by the fibrous covering of the albuginea, a texture that ulcerates with difficulty, much time elapses before the abscess bursts; and when this happens, several openings and sinuses are frequently formed, which discharge both pus and seminal fluid, and are difficult to heal. (Sir Astley Cooper, *Op. cit.* p. 10—12.)

I once attended a soldier, with acute inflammation of the testicle, in the Military Hospital of Canterbury, who experienced so much pain in the abdomen on the fifth day of the attack, accompanied by vast swelling of the cord, almost incessant vomiting, complete and obstinate stoppage of the stools, and severe constitutional disturbance, that a suspicion of hernia was raised. The absence of tension in the abdomen, the limitation of the pain to one side of the belly, the inability of feeling any thing like the testicle of its ordinary size below the tumour, as in a bubonocoele, and the history which made it impossible that the case could be a congenital hernia; were circumstances, which prevented an erroneous view of the complaint from being adopted. "But (as Sir Astley Cooper observes), if a hernia had existed on the side in which a blow has been received, and the patient has a swelling attended with exquisite pain, sickness, and vomiting, redness of the scrotum, or even a purple appearance of it, constipation, of two or three days continuance, with tenderness of the abdomen, then great caution will

be required in forming a judgment of its nature, and in determining on its treatment. It will be best to give a purgative injection immediately, as well as an aperient medicine; and free evacuation from the intestines will determine the question. The swelling will be harder than hernia, its form different, and there will be a greater pain in the part." (*Op. cit.* p. 13.)

With respect to the causes of acute inflammation of the testicle, the greater number of examples of it unquestionably arise from irritation in the urethra, especially its prostatic and membranous portions. In the early stage of gonorrhœa, inflammation of the testis rarely occurs, but between the tenth and twenty-first day, it frequently takes place. Sir Astley Cooper's investigations lead him to believe, that it happens in consequence of the verumontanum, and termination of the seminal ducts, becoming irritated, and the inflammation extending along the interior of the vas deferens to the testicle. (*Op. cit.* p. 15.) When inflammation of the testicle comes on in gonorrhœa, the urethral discharge generally stops, or undergoes a considerable diminution, so that it appears to some pathologists as if there were a translation of the inflammation from the urethra to the testicle; a view to which Sir Benjamin Brodie inclines, and which is entirely different from the other, to which I have been adverting. He admits, however, that "inflammation of the testicle seems to be sometimes independent of the translation of the inflammation, or of the suppression of the discharge from the urethra; and it must then be attributed to the extension of the inflammation of the urethra and vasa deferentia to the testicle." (*Sec Lond. Med. Gaz.* vol. xiii. p. 218.)

By many surgeons the employment of injections for the cure of gonorrhœa, is regarded as a frequent cause of inflammation of the testicle. If they be used, Sir Astley Cooper is of opinion that the patient should be directed to compress the urethra two inches from its orifice, so as to prevent the fluid from passing beyond that point, and towards the membranous and prostatic portions of it.

It is well known to every surgeon of experience, that the irritation of the urethra with bougies, or catheters, often brings on inflammation of the testicle; but, according to Sir Astley Cooper's observations, this rarely happens, except when the instrument is passed beyond three or four inches. Any injury (he adds) of the prostate gland, may have the same effect, as is sometimes noticed after lithotomy. "The prostate gland, which seems almost a concomitant of age, is sometimes accompanied with inflammation of the testis. Inflammation in the neck of the bladder produces this disease; and a calculus in the bladder, pressing upon the orifice of the urethra, has been known to occasion it, although it generally produces only a spasm of the cremaster muscle. A blow upon the testis is a frequent cause; and, if it be severe, it produces vomiting at the instant." (*Sir A. Cooper, Op. cit.* p. 18.)

The same distinguished surgeon has remarked, that "a wound of the testis does not produce the pain and inflammatory effects which might be expected; for (says he), I have several times known a lancet, and even a trocar, thrust into its substance. It is followed by a sickening pain, and the patient sometimes vomits; but the wound heals rapidly, and without suppuration. In one

case, however, in which the trocar was twice thrust into a testis, violent inflammation and suppuration succeeded." (*Op. cit.* p. 19.) The testicle, not yet descended into the scrotum, may inflame from blows, or the pressure of a truss; and give rise to excessive pain, vomiting, constipation, tenderness in the abdomen, and severe febrile disturbance.

Acute inflammation of the testicle often produces a considerable effusion of serous fluid in the cavity of the tunica vaginalis; but, on the subsidence of the inflammation, this kind of hydrocele is absorbed. Another effect, noticed by Sir Astley Cooper, is adhesion and thickening of the above membrane, which effects sometimes remain a good while, and may be mistaken for a disease of the testicle itself. The adhesion of one portion of the tunica vaginalis to the other may be either partial or complete. The epididymis also swells, sometimes at its lower, and sometimes at its upper part. When such swelling is at the lower, it is believed by Sir Astley Cooper to be situated in the cellular tissue of the vas deferens, where it forms its first convolutions; and frequently it does not depend upon any effusion in the interior of the duct, and consequently the function of the testis continues perfect. When the swelling occupies the upper part of the epididymis, or its globus major, adhesive matter is effused into the cellular tissue, "between the coni vasculosi, at their termination in the epididymis; and sometimes a sac, containing a mucilaginous fluid, is found in this part. This portion of the epididymis is more frequently diseased than any other part of it, or the testis; but the result is less important than in other parts, because some of the vasa efferentia and coni vasculosi still carry the semen from the testicle to the epididymis. The coni vasculosi, under this state of disease, are thickened, hardened, and of a dark brown colour." Sir Astley Cooper possesses also a preparation, in which, after inflammation, a tumour, somewhat larger than a pea, was seated amidst the seminiferous tubes, surrounded by an exceedingly vascular surface. In general (says he) I observe, that where there are marks of inflammation upon the tunics of the testis, such as adhesions, the substance of the gland itself is changed, the septa are much more apparent than usual, the number of the seminiferous tubes is diminished, and their size so reduced, that many are converted from tubes into mere cords. (*Sir Astley Cooper, Op. cit.* p. 21.)

The induration, left after inflammation of the testicle, is described by Sir Benjamin Brodie as dependent upon effusion of lymph into the interstices of the glandular structure, and as not producing any permanent injury of the functions of the organ. In six, or twelve months, the hardness disappears: but, he adds, "there are a few cases, in which the inflammation is so severe, as actually to injure some portion of the glandular structure. I examined the body of a gentleman, who had had inflammation of the testicle from a gonorrhœa twenty years before. The testicle, which had been inflamed, was from that time smaller than the other, and a part of it remained considerably indurated. I knew these facts previously, and I was curious to examine the state of the testicle by dissection. On making a section of it I found, that about two-thirds of the tubuli testis remained in their natural condition, while

the remainder had become converted into a white substance, having the consistence, but not the fibrous structure, of ligament." (See *Lond. Med. Gaz.*, vol. xiii. p. 219.)

Atrophy, or a wasting away of the testicle, which is an occasional consequence of inflammation of it, is observed by Sir Astley Cooper to take place more frequently at puberty than any other age. A person receives a blow on the part, or the testicle inflames spontaneously; or more rarely, the atrophy follows hernia humoralis from gonorrhœa. The change consists in an absorption of the whole of the glandular structure, the tunica vaginalis being left adherent to the tunica albuginea, with the septa within the latter. In a wasted testicle at St. Thomas's Hospital, quicksilver descended in the vas deferens only about half-way between the abdominal ring and the epididymis. (Sir Astley Cooper, *Op. cit.* p. 24.) A patient with acute inflammation of the testicle should wear a suspensory, and keep himself quiet on a sofa, or even in bed in the recumbent position. Leeches should be applied to the scrotum, and, if the local and general symptoms be severe, it may be necessary to take blood from the arm, or from the loins by cupping. When leeches cannot be obtained, the surgeon may puncture three or four veins of the scrotum, with the point of the lancet introduced transversely with respect to these vessels, which will then bleed freely, more especially if the parts be placed in warm water.

The recumbent position does not obviate the necessity for supporting the testicle with a suspensory bandage, or handkerchief; and, as Sir Astley Cooper remarks, the inflamed part should thus be brought towards the abdomen, and not suffered to fall between the thighs, which would destroy the salutary influence of the recumbent posture. The suspensory bandage should have four tapes: two in front, and two behind. "The two anterior are carried to the loins, which they cross, and are tied on the forepart of the abdomen; whilst the two behind ought to be brought up to the forepart of the groin upon each side, and should be fastened to those which surround the abdomen. Thus a real support is given; but if the hinder tapes are carried between the thighs to the loins, as they usually are, the testicles are painfully drawn back, rather than supported." (Sir Astley Cooper, *Op. cit.* p. 25.) When the patient has not a regular suspensory bandage, he may support the part very well with a handkerchief, which may be fastened at each end to another handkerchief, or band, placed round the loins; or a handkerchief may be "doubled in a triangular form, and a piece of tape attached to the middle of its base, and carried between the thighs to the back, where two of the ends of the handkerchief are to be tied, whilst the third angle is brought forward and upwards before the scrotum." (*Op. cit.* p. 26.)

With respect to local applications, cold ones frequently answer best when the pain is not very severe; but, in other instances, fomentations and poultices are generally preferable. When leeches are used, it is an excellent plan, after they drop off, to apply a poultice, into which the bites will still continue to bleed for some time very freely, without any occasion for the surgeon or patient to take further trouble to promote the hemor-

rhage. Warm emollient applications are supposed to act beneficially by their relaxing effect on the textures covering the swollen testicle.

In addition to the foregoing means, the bowels should be kept open with antimonial saline purgatives; and, during the prevalence of severe pain, or great nervous irritation, eight or ten grains of the compound powder of ipecacuanha, or half a grain of the muriate or acetate of morphia, should be given every evening.

The liquor plumbi subacetatis dilutus, with or without a small quantity of spirit of wine added to it; or the liquor ammon. acet., if no leech-bites are present; or a solution of one drachm of the muriate of ammonia in a pint of water, are all of them applications in common use, when cold ones are judged advantageous. Unless the inflammation yield quickly, the local bleeding must be repeated, and even in some cases venesection. Emetics and nauseating doses of tartare of antimony are occasionally resorted to. Mr. Hunter states, that he has known a vomit remove the swelling almost instantaneously. "The effects of the vomit most probably arise from the sympathy between the stomach and the testicle." (*On the Venereal Disease*, p. 91.) Sir Astley Cooper notices certain irritable constitutions, in which the continuance of depletion will not succeed; here, says he, "the best practice, when the pulse is jerking, the patient irritable, and the part painful, is to give the submuriate of mercury with pulvis ipecacuanhæ comp."

If suppuration occur, fomentations and poultices are to be applied; and, as soon as the matter can be perceived, it should be discharged, as otherwise the secreting substance of the testis is destroyed, and several openings, instead of one, are produced. (Sir Astley Cooper, *Op. cit.* p. 30.)

It is generally a long time before the swelling of the testicle entirely subsides; previously to its becoming less, it usually becomes softer. "It is still much longer (as Mr. Hunter observes), sometimes even years, before the epididymis returns to its natural state; sometimes it is never reduced to its natural size and softness; however, this is not of much consequence, as no great inconvenience results from the continuance of the hardness simply, though sometimes, perhaps, such testicles are rendered totally useless. I never had an opportunity of examining the testicle of one that was known to have this complaint; but have examined testicles where the epididymis has had the same external feel, and where the canal of the vas deferens has been obliterated. But this I suspect seldom happens; for there are people who have both testicles swelled, and, notwithstanding, discharge their semen as before. It is in this stage of the complaint, that resolvents may be of service, such as mercurial friction joined with camphor." (*Hunter on the Ven. Disease*, p. 92.) Ointments, containing the hydriodate of potash, are also now sometimes employed with the view of dispersing the induration; so likewise are poultices composed of vinegar and oatmeal; the emplastrum ammon. cum hydrargyro; or a lotion, consisting of muriate of ammonia and vinegar, mixed with bread. A suspensory bandage, lined with oil-silk, is recommended by Sir Astley Cooper as an excellent application. He combines with local means constitutional treatment, as small doses of the bichloride of mercury, or pil. hydrarg. gr. ij., ant. tart. gr. ½, or extract.

colocynth; comp. gr. ij. with 'pocacumh. gr. ij., made into a pill, and taken every night. If nausea be excited, this he deems advantageous. He speaks also favourably of the effects of the liquor potassæ, the pil. hydrarg. chloridi comp., and the tincture of iodine, its effects being carefully watched.

In *cynanche parotides*, there is occasionally a transfer of the inflammation to the testicle; a case requiring the exhibition of liq. ammon. acet., with sulphate of magnesia, or the saline mixture with tartarised antimony, and a pill containing calomel and antimonial powder. Leeches, with a poultice, or cold lotion, are also proper. (*Sir Astley Cooper, Op. cit. p. 78.*)

The granular swelling of the testicle, as it is termed, is a protrusion of granulations from an abscess either of the epididymis or testis, and may be the result of acute or chronic inflammation. The granulations, as they arise, being compressed by the unyielding nature of the tunica albuginea, protrude through the ulcerated opening in it, and form a swelling, which often projects through the scrotum. This disease has received the names of *tipoina* and *fungus testis*, but very improperly, as it consists neither of a fatty substance, nor of a real fungus. (*Sir Benjamin Brodie* gives the following account of it, as an occasional consequence of chronic inflammation of the testicle. "The testicle becomes adherent to the skin at one part, and here the skin inflames and ulcerates; and then a fungus, of small size at first, protrudes through the ulcerated opening, but gradually becomes larger afterwards; and, on the surface of this fungus, you find some of the same kind of yellow substance which is within the testicle itself. What is called a fungus, however, is not a fungus in reality, but the glandular structure of the testis itself. The same experienced surgeon joins *Sir Astley Cooper* in comparing its formation to that of *hernia cerebri*, following ulceration of the *dura mater*. "If, (says the former) you dissect the parts in this stage of the disease, you will find, not only that the skin has ulcerated, but that the tunica vaginalis and the tunica albuginea have ulcerated also; and that the glandular structure of the testicle projects through all these openings. You may ascertain the same thing in the living person; for, when the fungus is large, no portion of the testicle remains within the scrotum, and you may distinctly trace the spermatic cord into the centre of the fungus. There are a few cases in which an abscess forms in the substance of the testicle, and bursts externally, without the protrusion of a fungus; but these are comparatively rare. The inner surface of such an abscess secretes the yellow substance which I have described; and you will find large masses of it, with a laminated structure, coming out of the cavity of the abscess. The disease, if it be arrested in the early stage, leaves the testicle with the glandular structure not at all impaired. If it be arrested after it has advanced some way, the glandular structure is partially destroyed; but if it be allowed to run its course, the whole of the glandular structure disappears; and you find in lieu of it a new-formed white organised substance, having the consistence of ligament, but without its fibrous character." In the early stage, the testicle is not increased to many times its natural size; but, as the disease is suffered to proceed, the large mass appears, and merely a knob or tubercle

is left, connected with the slender remains of the spermatic chord. (*Sir Benjamin Brodie, in Lond. Med. Gaz. vol. xiii. p. 221.*)

This disease was briefly noticed by me in an early edition of another publication, and described as "a particular affection of the testicle, in which a fungus grows from the glandular substance of this body, and, in some instances, from the surface of the tunica albuginea. The excrescence is usually preceded by an enlargement of the testicle, in consequence of a bruise, or some species of external violence. A small abscess takes place, and bursts, and from the ulcerated opening the fungus gradually protrudes." I then proceeded to represent how unnecessary and improper it was to extirpate the testicle, on account of this affection, and recommended the fungus to be cut off, or else destroyed with caustic. I founded my advice on a successful attempt of the first kind, which was made in St. Bartholomew's Hospital, by *Sir James Earle*, a little while before my book was published. (*See First Lines of the Practice of Surgery, p. 399.*)

An interesting paper was written on the subject by my friend *Mr. Lawrence*, who favoured the public with a more particular account, and nine cases illustrative of the causes, symptoms, and progress of the disorder. The patient generally assigns some blow, or other injury, as the cause of the complaint; in other instances, it originates in consequence of *hernia humoralis* from gonorrhœa, and sometimes appears spontaneously. A painful swelling of the gland, particularly characterised by its hardness, is the first appearance of the disease. After a certain length of time, the scrotum, growing gradually thinner, ulcerates; but the opening, which is thus formed, instead of discharging matter, gives issue to a firm, and generally insensible fungus. The surrounding integuments and cellular substance are thickened and indurated by the complaint, so that there appears to be altogether a considerable mass of disease. The pain abates, and the swelling subsides considerably, when the scrotum has given way. In this state, the disorder appears very indolent; but if the fungus be destroyed by any means, the integuments come together, and a cicatrix ensues, which is inseparably connected with the testicle. *Mr. Lawrence* observes, that if the part be examined while the fungus still remains, the excrescence is found to have its origin in the glandular substance of the testicle itself; that the coats of the part are destroyed to a certain extent; and that a protrusion of the tubuli seminiferi takes place through the aperture thus formed. *Mr. Lawrence* has ascertained the continuity of the excrescence with the pulpy substance of the testicle, of which more or less remains, according to the difference in the period of the disorder. He thinks that the glandular part of the testicle experiences an inflammatory affection in the first instance, in consequence of the violence inflicted on it; and that the confinement of the swollen substance, by the dense and unyielding tunica albuginea, sufficiently explains the peculiar hardness of the tumour, and the pain which is always attendant on this stage of the disorder. The absorption of the coats of the testis, and of the scrotum, obviates the tension of the parts, and thereby restores ease to the patient, at the same time that the fungus makes its appearance externally.

The excrescence may be removed with a knife, or, if the nature of its attachment permit, with a ligature, or it may be destroyed with escharotic applications. Mr. Lawrence gives the preference to removing the tumour to a level with the scrotum, by means of the knife, as the most expeditious and effectual mode of treatment. He can discern no ground whatever for proposing castration in this complaint, since, in no part of its progress, nor in any of its possible consequences and effects, can it expose the patient to the slightest risk. I remember the time, however, when the testicle was often removed on account of this disease. But no surgeon of the present day would ever think of such a proceeding.

Mr. Lawrence also mentions the possibility of there being other kinds of fungi, which grow from the testicle, and quotes an instance, in which Dr. Macartney found a fungus, of a firm and dense structure, growing from the tunica albuginea, while all the substance of the testicle itself was sound. Dr. Macartney was so kind as to show me the preparation, affording a clear specimen of the second kind of fungus. (See *Edinb. Med. and Surg. Journal*, for July, 1808.) Callisen represents the excrescence, as sometimes originating from the surface of the tunica vaginalis.

Sir Benjamin Brodie, instead of cutting away the protruding mass, which he deems objectionable, on account of the tubuli testis being thus sliced away, keeps the patient in the recumbent posture in bed; gives him mercury; sprinkles the projecting substance every day with finely levigated nitric oxide of mercury, and applies over this simple dressing. Under such treatment, the surface soon becomes covered with red healthy granulations. Then lint, dipped in a weak solution of copper in camphor mixture, may be used as a dressing.

The reader will discern some discrepancy in the accounts given of this disease by different writers, some representing the substance as consisting of fungous granulations; and others as being actually a protrusion of the glandular substance of the testicle itself. I should say, that both forms of disease occur, but that they should not be confounded together.

Chronic Inflammation, or Enlargement of the Testicle.—Sir Astley Cooper adverts to the frequency of this disease, and to its being sometimes mistaken for one of a malignant nature. "It begins (says he) with a hardness and swelling of the epididymis, is at first unattended with pain, and is discovered by accident after it has acquired a considerable bulk." The testicle at length becomes involved, the form of the epididymis is preserved, although its size is augmented; and its separation from the testicle may still be distinctly traced. The latter, when enlarged and hardened, generally retains its natural smoothness, but its form is rounder than natural; frequently, a clear transparent serous fluid is effused in the tunica vaginalis, making one of the cases to which the term *hydro-sarcocoele* is applied. "Each epididymis and testicle is frequently contemporaneously affected; and hydrocoele often exists, on one side, but not on the other; yet sometimes on both sides. One testis may cease to swell, and the other then becomes enlarged. The testicle and epididymis continue smooth under great increase, and the spermatic cord is not usually hardened, but its veins are a

little swollen, and it is consequently somewhat increased in size. When the enlargement in the testis and epididymis is considerable, slight pain and a sense of weight are complained of in the loins and thighs." The disease may remain in this state for months, requiring merely to be supported; but from catarrh, a slight blow in riding, some indiscretion in drinking, or other excess, the swelling is disposed to increase, attended with great pain in the part and loins, and swelling and redness of the scrotum. These inconveniences are relieved by leeches and purgatives; but, in a few weeks, on the patient again taking exercise, and returning to his usual mode of living, the disease is once more suddenly augmented. The repetition of such attacks at length makes the patient anxious to have the part removed. In the course of time, an abscess forms, denoted by an obscure fluctuation; and, if punctured, a thick pus of bad quality is discharged. When the abscess is formed in the body of the testis, the tunica albuginea greatly retards the progress of the matter to the surface.

According to Cruveilhier, the body of the testicle is affected only consecutively; "and then (says he), either the tubercular infiltration takes place along the fibrous radiating prolongations, which, proceeding from the corpus Highmorianum, penetrate the substance of the testicle; or else tubercles, more or less numerous, form at different points of the texture of that organ." (*Cruveilhier, Anat. Pathol.*, livr. ix.)

Sir Benjamin Brodie represents the testicle as being at first somewhat knobby and irregular; but, as it increases in size, and becomes harder, the different knobs seem to run into one another, and, at last, the part constitutes one large, hard, uniform oval swelling. He admits, that the disease generally commences in the epididymis, but not always. (See *Lond. Med. Gaz.*, vol. xiii. p. 220.)

In the dissection of a testicle thus affected, a yellow unorganised matter is found collected in small masses in its glandular structure, and, in a more advanced stage of the disease, these masses are larger in certain places; while, in others, the glandular structure retains its natural appearance. All this is well represented in Cruveilhier's 9th *Livraison*. pl. 1. In a still more advanced stage, the yellow-deposit forms distinct hard masses, and generally more or less laminated. (*Sir B. Brodie*.) Dupuytren also describes the tubercular degeneration as one of the principal characters of the disease; and he states that, in most instances it affects the fibro-cellular tissue around the epididymis, and also the substance of the testicle itself. (*Clin. Chir.*, t. i. p. 101.) Cruveilhier, who has published an accurate description of it, illustrated by plates, regards it as the result of chronic inflammation of the epididymis. (*Anat. Pathol.*, livr. ix. pl. 1.) In what Sir Astley Cooper terms the adhesive stage, the testicle and epididymis, when dissected, have a general yellowish appearance, and considerable solidity. "When (says he) I make a section of a chronic enlargement of the testis, throw it into water, and agitate it, a whitish yellow fluid proceeds from the seminiferous tubes, which are extremely dilated, and then appear emptied. But still the same bulk of the testicle remains, owing to the cellular membrane of the part being loaded with a yellow fibrine; the rete is filled with the same secretion as the tubuli; the epididymis is similarly diseased; and sometimes the vesiculae,

seminales, and vasa deferentia are distended with a similar deposit. Cruveilhier gives one example, in which all these parts, and also the ejaculator ducts, and prostate gland, contained tubercular matter. Sometimes abscess and ulceration are met with, and in this case a part of the testicle is destroyed, and the complete recovery of its functions is impossible. Occasionally sinuses lead into these abscesses, the cavities and outlets of which, still secreting semen, are prevented from closing till the secreting surface be healed, or destroyed. (Sir A. Cooper, *Op. cit.* p. 37.) The protrusion of high granulations from such abscesses, and termed the *granular testicle*, I have already noticed. Chronic inflammation of the testicle sometimes comes on as a consequence of local injury; but much more frequently as the result of some constitutional derangement, as that from syphilis or rheumatism. (See Dupuytren, *Clin. Chir.*, t. i. p. 88.; Sir B. Brodie, &c.) According to Sir Astley Cooper, it often takes place in persons who have been scrofulous in their youth. (Also Dupuytren, *vol. cit.* p. 100.) It is frequently the product of a constitution worn and broken by intemperance. It often follows a long course of mercury; and "it arises in habits in which the vital powers are diminished, and in which we often find sloughing of the cellular membrane in the form of chronic carbuncle. Frequent exposure to wet, cold, or fatigue, and an excessive indulgence of the passions, also dispose to its production. The most frequent occasional cause is urethral disease." (Sir Astley Cooper, *Op. cit.* p. 39.)

Malignant or cancerous sarcoceles are represented by Cruveilhier as generally beginning in the body of the testicle; tubercular sarcoceles in the epididymis. "The former (says he) are commonly spontaneous; the latter mostly arise either from a venereal cause, a scrofulous constitution, or a contusion." (*Anat. Pathol.*, livr. ix.)

When chronic enlargement of the testicle arises from syphilis, it is sometimes called the *venereal sarcocele*. The criterion of this case, so far as the part itself is concerned, has not hitherto been well ascertained. Indeed, Sir Benjamin Brodie observes, that, under whatever circumstances chronic enlargement of the testicle takes place, "the symptoms are precisely the same." He has not overlooked, however, its combination with venereal ulcers, or eruptions, as throwing light on the case. (*Vol. cit.* p. 222.) Dupuytren remarks, that "it would not seem difficult at first to discriminate venereal enlargements, or those produced by friction, from others which are scrofulous: I must confess, however, that, in many examples, they begin absolutely in a similar manner, and do not exhibit their true character till after a certain space of time has elapsed. The scrofulous (he says) do not generally yield to ordinary means; they are indefinitely protracted, are often accompanied by affections of the same nature, and are connected with a scrofulous constitution." (*Clin. Chir.*, t. i. p. 100.) The venereal chronic enlargement of the testicle is mostly described as coming on without pain or uneasiness, except that produced by mere distention and the weight of the tumour; but, according to Mr. Cusack, the inflammation occasionally comes on rather suddenly, and in a subacute form. The disease "commences in the body of the testis; there is little alteration in the size of the organ in the first instance; but, as the disease advances, the tumour becomes more

globular, the epididymis soon becoming involved, and lost in the general mass; the tumour has a fleshy feel, but differs much in density in different parts. It is said to be smooth and uniform on the surface, and primarily it certainly is so generally: partial adhesions in the cavity of the tunica vaginalis, however, combined with effusions into that cavity, even independent of the internal changes which may be going on, render this a very uncertain symptom: so uncertain, indeed, and so little uniform are the primary appearances, that Mr. Cusack believes the best practitioners would be unable to make a perfect diagnosis, if unacquainted with the history of the case, and the attending circumstances. The termination of the disease is either resolution, or suppuration, or induration, and the formation of granular bodies, ending in total destruction of the functions of the organ. Mr. Cusack hesitates to believe, and is unable to affirm, from his own experience, that this affection of the testis is met with in the earlier stages of secondary symptoms, or during the presence of any of the forms of true papular eruptions.

"The acute form alluded to is met with, accompanying venereal hectic pains in the bones, and either a scaly eruption, or perhaps a solitary spot, apparently belonging rather to the genus Acne; but these are instances comparatively rare. The patients who suffer from this form of the disease, are such as labour under affections of the periosteum and bones, and bear the marks of having suffered from pustular and tubercular eruptions." (See *Dublin Journ. of Med. Science*, vol. viii. p. 304.)

I once attended with Mr. Doughty, of University College, a horrible example of phagedenic sloughing of the penis, followed by painful enlargement and ulceration and abscess of the testes, one of which protruded in the form of a large fungus-like mass, and gradually sloughed away. The patient ultimately fell a victim to the further ravages of the disease. With respect to the diagnosis of a venereal chronic enlargement of the testicle, Dupuytren observes, that we daily meet with patients who have a swelling of this organ, for which they can assign no cause. They have not received any blow or external injury, the swelling has subsided and attacked the other testicle, or has continued in one or the other to the present time. "If the tumour is oblong, or cylindrical; causes no lancinating pain when touched; the patient has had old venereal complaints; and one testicle, after having been diseased for six months, a year, or a year and a half, has resumed its healthy state, and been followed by disease of the other; there is strong reason, to presume, that the case is of a syphilitic nature; for a cancerous affection would not thus change its place." (See Dupuytren, in *Clin. Chir.* t. i. p. 107.)

In chronic enlargement of the testicle, though a solid deposit may have taken place in its tubes, and even in its substance, or epididymis, a cure is yet practicable. This opinion, deduced by Sir Astley Cooper from a field of immense experience, and delivered by him in his lectures, receives confirmation from every quarter. "Je pense (says M. Cruveilhier) que dans l'état actuel de la science les infiltrations de matière tuberculeuse, dans l'épididyme et même dans le corps du testicule, ne sont par des raisons suffisantes pour l'extirpation." (*Anat. Pathol.*, livr. ix.) Sir Astley Cooper directs the patient to observe the recumbent

position for a month, so as to prevent gravitation of the blood into the affected organ. Three grains of calomel and one of opium are to be given every night and morning, and the gums kept sore for at least a month. Every fourth morning a sennâ draught with half an ounce of sulphate of magnesia, and fifteen or twenty drops of liq. ant. tart., is to be prescribed. Leeches are to be applied twice a week, the scrotum fomented thrice a day, and a lotion of the liq. ammon. acet., with spirit of wine, employed, or else equal parts of camphor mixture and vinegar. (Sir Astley Cooper, *Op. cit.* p. 40.)

If mercury be employed, when the disease has not been going on more than two or three months, the testicle will generally be restored to a healthy state; but at a later period, it will not accomplish so much. The mercury will only stop the inflammation that exists, without having the power to restore the structure which has been already destroyed. Mercury may now relieve the pain and tenderness, and diminish the swelling; but some induration and enlargement will remain, over which mercury has no control. (Sir B. Brodie, in *Lond. Med. Gaz.* vol. xiii. p. 222.) If calomel or the blue pill disagree with the stomach, mercurial ointment should be rubbed on the thigh. When the swelling is combined with a syphilitic eruption or ulcers, the bichloride of mercury, joined with sarsaparilla, will sometimes prove the best medicine. Dupuytren found, that small doses of the bichloride had a better effect than full ones: his custom, therefore, was to give thrice a day, one pill, containing $\frac{1}{4}$ of a grain of the bichloride, $\frac{1}{4}$ a grain of extract of opium, and 2 grains of extract of gualacum. The dose was very gradually increased to $\frac{1}{2}$ a grain of the bichloride, which quantity was never exceeded. The compound decoction of sarsaparilla and sudorifics were likewise prescribed. (See *Clin. Chir.* t. i. p. 89.)

When chronic enlargement of the testicle is in the form of *hydro-sarcocele*, the fluid in the tunica vaginalis is usually absorbed under the influence of mercury, and the same remedies which cure the disease of the testicle, cure also the hydrocele. "There are cases, however, in which the hydrocele attains a large size, and in which the remedies which cure the testicle are not equal to the cure of this secondary disease. Under these circumstances, you should treat the disease of the testicle first by the exhibition of mercury; and after a mercurial course, but not till then, you may inject the hydrocele." "What would happen (asks Sir Benjamin Brodie) if you were to make an error in the diagnosis, if you were to mistake a hydrocele of this kind for a common hydrocele, and inject it before you had cured the primary disease? I did (says he), in one instance, make this mistake, and I will tell you the result. A gentleman (a West Indian) many years ago, consulted me about a hydrocele. There was a considerable collection of fluid, perhaps about eight ounces; I found the testicle somewhat indurated, which I thought was merely from a thickening of the tunic vaginalis; I did not therefore hesitate to inject the hydrocele. After the operation, no violent inflammation followed, but it did not subside as usual, and a small abscess formed in one part of the testicle, which I opened. After this several abscesses formed in succession in the testicle, which, all the while, went on growing larger and larger. Now I began

to see the error which I had committed, and to suspect that the patient laboured under a chronic inflammation of the testicle, the hydrocele being merely a secondary affection. I put the patient under the influence of mercury, and at the moment that it acted on the gums, the abscesses ceased to form, the testicle rapidly became reduced, and, in about another month, there was an end both of the disease in the testicle and of the hydrocele; so that, in fact, every thing turned out as well as if I had adopted the proper mode of treatment in the first instance." (Sir B. Brodie, *Op. cit.* vol. xiii. p. 222.)

Scrofulous Disease of the Testicle.—I have already noticed the opinion of Baron Dupuytren, that, although it may not seem difficult at once to distinguish an enlargement of the testicle produced by syphilis, or by an external injury, from another which is scrofulous, yet, in their beginning they sometimes absolutely resemble one another, and their true character cannot be made out till a later period. "In general (says he), scrofulous enlargements do not yield to common treatment; they continue indefinitely, are frequently accompanied by other affections of the same nature; and are connected with a strumous constitution. (See *Clin. Chir.*, t. i. p. 101.)

The following is the description given of the scrofulous testicle by Sir Benjamin Brodie. The patient experiences a slight pain in one part of the testicle, and there a little enlargement is felt, generally at one end of the epididymis. Then a slight pain is experienced at another part, and here is perceived another enlargement, which is commonly also in the epididymis. These small tumours increase in size, and gradually become more painful. Sometimes as many as three or four of these tumours are found on the surface of the testicle, generally connected with the epididymis. The skin becomes adherent to them, and one of them is converted into an abscess, which bursts through the external skin. A similar abscess forms in another, and runs the same course. These abscesses discharge very little matter, and they do not heal like a healthy abscess. When a probe is introduced into one of the sinuses thus formed, it passes down into the centre of the tubercle, or tumour, in which the abscess originated. In some instances, the disease will go on, until the whole of the testicle is disorganised. Sometimes it is confined to one testicle; sometimes both are similarly involved. Occasionally it will completely destroy one of the testicles; but, more frequently the testicle is only partially injured, and a great deal of the glandular structure remains in a natural state. In the advanced stage, the testicle sometimes becomes uniformly enlarged, and hard throughout; yet, on careful examination, the remains of the projecting tumours, which existed in the beginning, may be perceived. The disease is generally connected with other scrofulous symptoms; as enlarged glands in the neck, scrofulous disease of the spine, or hip, or of some of the joints. (See *London Med. Gaz.*, vol. xiii. p. 377.)

It is remarked by Dupuytren, that the tubercular degeneration is one of the principal characters of these scrofulous enlargements. In the majority of cases, he says, the disease attacks the fibro-cellular tissue surrounding the epididymis, but that it may also occur in the substance of the testicle itself. The tubercles are developed slowly,

and may continue three or four years. The mode in which they commence, their progress, their long duration, are the signs indicative of their nature. "Scrofulous swellings of the testicle are not so hard as scirrhus ones; but they are harder than those which depend upon inflammation. They are free from heat and redness; and cause a sense of weight and numbness. The subcutaneous cellular tissue is ordinarily free," or, rather, Dupuytren should have said it is so, except at the points where abscesses advance to the surface. "The shape of the tumour is commonly uneven and irregular, while, in a scirrhus enlargement, the testicle is globular, and the epididymis knobby; the spermatic cord being mostly spared, but now and then implicated. As the scrofulous disease of the testicle makes progress, certain points within the organ soften, and, when touched, seem as if they contained a soft substance. Soon after this, small bluish projections are noticed. Here the skin ulcerates, and from the openings is discharged a thin pus, and a yellowish cheese-like or pultaceous substance, evidently a product of scrofula. Fistulae are next formed, out of which is voided a serous imperfect kind of pus. The disease may go on for years. (*Dupuytren in Clin. Chir., t. i. p. 101.*)

The testicle, even in very young children, sometimes becomes enlarged and very hard, but without pain; and this indolent increase of it may remain for many weeks, months or years; and, as the health improves, ultimately subside. More frequently the disease comes on at puberty, or between that period and the age of twenty; and, not uncommonly, it attacks both testicles. If suppuration occur, which happens even in children, but still more frequently at puberty, the matter often forms in the globus major of the epididymis, though sometimes in the globus minor. According to Sir Astley Cooper, the body of the testicle rarely suppurates; "but, after the epididymis has ulcerated, the testis becomes affected, and the scrotum assumes a livid hue; ulceration ensues, and an abscess forms, which discharges ill-formed pus, and some semen, at least after the age of puberty; and the opening is extremely difficult to heal, continuing for months, and even for years." One or both testicles at length waste, until but a small portion is left, and the seminal secretion almost entirely ceases.

In dissections of the epididymis and testis affected with scrofulous disease, Sir Astley Cooper has found a yellow spot surrounded with a zone of inflammation in the globus major, or sometimes, though less frequently, in the globus minor. When the spot ulcerates in its centre, the matter which is voided, is not pure pus, but composed of fibrine and serum, and having a slight yellow tinge. "In the testes there are several similar yellow spots, accompanied by the same kind of inflammatory zone; and several yellow streaks are also found amidst the tabuli. Scrofulous abscesses in the testes are sometimes accompanied by a granular swelling, like that which exists in the simple chronic disease." (*Sir Astley Cooper, Op. &c. p. 97—98.*)

Surgery, which proves so efficient in the ordinary chronic enlargement of the testicle, does harm in the scrofulous disease of it. No specific remedy for it is known; but the patient should have a diet of pure air, and especially of that of the diet should be nutritious, and ale, or

porter, or wine and water be the drink at dinner. Sir Astley Cooper speaks also in favour of tepid sea-bathing. The medicines which he commends, are hydr. cum creta with rhubarb; powder of calumba with rhubarb and soda twice a day; vinum ferri; tinct. ferri muriatis; tinct. ferri ammon.; or pills composed of rhubarb and carbonate of iron; quinine with infus. rosæ comp.; liquor potassæ; the bichloride of mercury in minute doses, joined with the compound decoction of sarsaparilla, or with tincture of bark, or of rhubarb.

Sir Benjamin Brodie enjoins a regulated diet, residence at the sea-side, and the exhibition of steel medicines, or quinine, where they seem to be required, as they generally are. But he has seen more benefit derived from the liquor potassæ than any other medicine. It is to be combined with tincture of gentian, and taken in the dose of half a drachm three times a day, blended with a wine-glass of table-beer. The acetate of potash, which may be produced by this mixture, Sir Benjamin conceives has also a good effect, by acting as a diuretic. (See *Lond. Med. Gaz.*, vol. xiii. p. 378.) Preparations of iodine are well known to be serviceable in this disease; and the tincture, or what is better, the ioduretted solution of the hydriodate of potash, may be exhibited with caution.

In the indolent stage, previously to suppuration, the ointment of iodine, or linimentum hydrargyri, may be rubbed on the part, the emplastrum hydrargyri applied, or lotions of the liquor ammon. acet. and spir. vin. used. If the disease suppurate and ulcerate, a solution of one grain of sulphate of copper in an ounce of distilled water may be employed as a lotion, and also as an injection for the sinus, or liq. calcis ζ iv and hydrarg. chloridi 3j: nitrate of silver lotions are also eligible.

The cystic, or, as Sir Astley Cooper names it, the hydatid, or encysted disease of the testicle, is comparatively rare, and described by him as a specific, yet entirely a local disease, as he has seen it in persons who enjoyed excellent health, and in whom no relapse occurred after the part had been removed. It is chiefly met with in persons between the ages of 18 and 35; and is alleged to begin with enlargement of the epididymis. It is not painful until the part is large, and the unyielding tunica albuginea makes pressure on it. When handled, there is no feeling of tenderness manifested, unless the pressure be considerable. The frequently healthy look of the patient is apt to create suspicion of hydrocele. The spermatic veins and those of the scrotum are distended. The natural form of the testis is preserved, being rounded in front, and flattened at the sides, and not spyriform as in hydrocele. When the swelling is handled, it communicates an impression that it contains a fluid, for it easily yields to pressure; yet there is no true fluctuation, for the tumour does not rise at a distance, as it sinks under the pressure of the finger; but it yields only at the spot compressed. If strongly compressed, a sickening pain in the groin and loins is produced. The weight of the testicle is obviously increased, and after a time, this causes pain in the lumbar region, and its bulk is a great inconvenience. The complaint seems to Sir Astley Cooper to be so local, that, were it not for its weight and size, it would scarcely call for removal; for the spermatic cord does not become affected, nor are the absorbent glands in the loins or groin irritated by it.

In the dissection of this disease, the tunica vaginalis is found thickened, and partially adherent; and the tunica albuginea, both of the epididymis and testicle, is much denser than natural. The testicle consists partly of a solid structure, and partly of cysts, varying in size from that of the head of a large pin, to that of a small marble. The small cysts contain a transparent, yellow, serous fluid; the larger, a mucous secretion. The cysts, which contain serum, are highly vascular. Sir Astley Cooper suspects the cysts to be enlargements of the seminiferous tubes from obstruction; but on this point he is doubtful. He admits, that they are certainly not of the nature of animal hydatids. The cysts in the epididymis do not become so large as in the testicle. There are some fine specimens of this disease in the various pathological museums of London; the best which I have seen are in those of the late Mr Abernethy, and of Mr. Liston.

The marks of distinction, between this cystic disease and hydrocele, are that the former is characterised rather by a yielding than a fluctuation; by a heavier swelling; by the swelling being less pyriform than a hydrocele; by the entire absence of transparency; by the sickening pain caused by strong compression of the tumour; and by the dilated state of the veins of the spermatic cord and scrotum.

The removal of the part by operation is the only means of relief; for the change of structure, attending the disease, manifestly amounts to a disorganisation of the part not admitting of benefit from any internal or external remedies. "A system of depletion and abstinence for a week (observes Sir Astley Cooper) will make the patient bear the operation well; and it is one which, for this disease, I never knew unsuccessful." (*Op. cit.* p. 86.) The following modification of this statement, however, deserves well to be remembered. "The fungoid (medullary) and encysted disease may be combined in the same testis, and then the case may prove fatal; but this will be ascertained by the dissection of the removed part, which will lead to a favourable prognosis in the encysted disease, and to a very decidedly unfavourable opinion in the other. Cruveilhier, (*livr. v. pl. 1. fig. 1 and 2.*) has given a most correct view and description of one form of the latter unfortunate combination, which he terms *cancer alvéolaire avec matière perlée*, on account of some of the cysts containing a pearl-coloured substance, but others a serous fluid, and others again a pulaceous matter. In this case, castration was performed, and the wound quickly healed; but six months afterwards, medullary tumours formed in the substance of the bodies of the seventh cervical and fifth dorsal vertebræ, and by compressing the medulla, occasioned paralysis, first of the upper, and then of the lower extremities, abdominal parietes, &c.; terminating in death.

Medullary Cancer of the Testicle. Fungus Hematodes. Pulpary Testicle. Medullary Sarcoma. Fungoid Disease of the Testicle.—Organic diseases of the testicle are found to be less common at the present time than they were believed to be formerly, when chronic enlargements of that organ were always confounded with them. The discrimination of one class of cases from the other, the result of which has been to render the extirpation of this part a comparatively rare operation, ap-

pears to me to be one of the greatest improvements in modern surgery. Medullary cancer of the testicle, a disease bearing such a variety of names, usually begins with an enlargement of the body of this organ, which is at first attended with considerable hardness, and the swelling often increases rather quickly, "so that in three or four months, the whole of the testicle will become diseased." It then affects the epididymis from one extremity to the other. Whilst the complaint is confined to the testis, the swelling is globular; but when the epididymis is also diseased, it becomes pyriform, and has so much the form of hydrocele as at first sight to be easily mistaken for it. This deception is rendered the more easy, as a small quantity of water is often effused, so that the complaint has been called *hydro-sarcocele*. When carefully examined by manipulation, the solid swelling is felt through the water, and the sides are found flatter than its forepart, which is the form of the testicle in its natural state. The surface of the testicle is frequently uneven; but this symptom is not a concomitant of this disease in its early stages. At first, the complaint is not painful; but it is soon followed by occasional darting pains in the part, and in the course of the spermatic cord to the groin and loins, and, if it be much handled, it leaves a tenderness and increased pain in the part. Its growth is very uncertain; it sometimes increases quickly, and acquires great size; at others, eight or ten months elapse, before the swelling is considerable. It also does not grow steadily and equally; but becomes very painful for two or three days, and during that time rapidly increases; and then it is stationary for two or three weeks." At first, the colour of the scrotum is not changed, and the spermatic cord is not swollen, excepting that the veins are slightly enlarged. In the second stage, it is covered with varicose veins, and the testis, instead of being hard, yields to pressure, and both the elastic feel and the pyriform shape of the tumour raise a suspicion of its being a hydrocele. The spermatic cord becomes enlarged up to the abdominal ring, and the spermatic veins are fuller than natural. The patient's countenance is sallow; sometimes he is constipated, sometimes he has profuse diarrhoea; his appetite fails; his rest is interrupted by pain; and he falls into a state of great emaciation.

In the third stage, the testicle becomes adherent to the scrotum, and the skin can no longer be readily moved over the tumour. In the groin on the diseased side, one or more absorbent glands enlarge from irritation; and after many glands there have become affected, those in the opposite groin also enlarge. The surface of the testicle now feels knobby and unequal; and sometimes the spermatic cord, besides being enlarged, indurated, and varicose, becomes adherent to the pubes, and to this point the testicle is firmly bound. At length, at a particular point of the scrotum, a purple blush appears, under which a fluctuation seems so distinct, that the surgeon is often induced to make a puncture; but merely blood is discharged. Although the wound thus made heals, yet soon afterwards ulceration ensues, and a fungus projects, bleeds, and discharges a profuse quantity of thin serous fluid, which has a peculiar faint odour. In two or three weeks, the ulcer spreads to the breadth of the palm, sloughs frequently, is extremely offen-

sive, occasionally very painful, but not tender to the touch; and if the testicle be compressed, a brain-like substance issues from the fungus. At last, the patient sinks from hemorrhage, serous discharge, and continued irritation. (Sir Astley Cooper, *Op. cit.* p. 118—120.) I have never seen the disease in that advanced condition where ulceration has occurred, and a mass of fungoid substance has protruded. I believe, with Sir Benjamin Brodie, that the opportunities of doing so are rare, because the testicle is generally amputated, or the patient dies, long before the disease gets to this point. It is certain also, that the tumour may grow to an enormous size, without any ulceration of the scrotum, or protrusion of the medullary substance taking place. In one or two examples, in which I was led by the elastic feel of the tumour to make a puncture, the wound healed up, and never gave any further trouble. This agrees with the observations of Sir Benjamin Brodie; but, I should remark, that the punctures in my cases were made in an earlier stage than that referred to by Sir Astley Cooper, the purplish blush not presenting itself at the point where the lancet was introduced.

The writings of Professor Carswell convey most accurate views of the chief characters of medullary cancer, or *cephaloma*, as he calls it. In his able work, entitled "*Illustrations of the Elementary Forms of Disease*," this subject is considered in a manner which cannot fail to be highly interesting to every inquirer into the pathology of surgery. But as I have noticed his statements in other articles (See CANCER, and FUNGUS HÆMATODES), it is unnecessary here to repeat them. With respect both to scirrhous and medullary cancer, sometimes the new deposit takes place in the molecular structure of the part affected, after the manner of nutrition; while, in other instances, it is thrown out on a free surface, rather in the manner of secretion; or, as Sir Benjamin Brodie has explained, there are some cases, in which a particular organ loses its natural structure, and becomes converted into a diseased one; and there are other cases, in which the morbid growth is altogether a new formation—a tumour, growing in a particular part of the body, which remains entire, and retains its natural organisation. Now, with respect to medullary cancer, or fungus hæmatodes, it appears that, in some cases, the glandular structure of the testicle is actually converted into this diseased structure; but there are others in which the new deposit collects in a distinct mass, and the glandular structure of the testicle is, for a time at least, entire. Sometimes the new deposit accumulates in a mass in the centre of the testicle, and the glandular structure is expanded, as a thin layer, upon its outside. Mr. Wardrop relates a case, in which the glandular structure was natural, the tumour having grown from the surface of the tubuli testis, immediately beneath the tunica albuginea. Sir Benjamin Brodie refers to a specimen, in which the glandular structure continued sound, while there was a large medullary tumour completely occupying the cavity of the tunica vaginalis. "However distinct the testicle may have been in the first instance, it becomes at last confounded with the disease; and there is then a tumour of an oval shape, and in this respect different from hydrocele. It is also heavier than a hydrocele; opaque instead of

being transparent; harder at some parts than others; and without the smooth regular surface of hydrocele. The softness and elasticity of the tumour, however, have often caused it to be mistaken for hydrocele, and punctured." (See Wardrop on Fungus Hæmatodes; Earle, in *Med. Chir. Trans.*, vol. iii. p. 60.)

Notwithstanding the deceitful feel of fluctuation, dependent on the elasticity of the swelling, a well-informed surgeon will generally arrive at a correct diagnosis; but if there be doubt, Sir Benjamin Brodie sanctions puncturing the tumour with a very small trocar. "If it be a hydrocele, the serum escapes, and the tumour disappears; but if it be fungus hæmatodes, there comes out a little blood, and that is all. No harm is done by the puncture." The bleeding soon stops, and the wound heals. (Sir B. Brodie, in *Lond. Med. Gaz.*, vol. xiii. p. 407.)

I have already mentioned the occasional combination of the disease with hydrocele, constituting one of the cases, sometimes termed *hydro-sarcocele*. More frequently, the cavity of the tunica vaginalis is obliterated by adhesion; or there may be partial adhesions, and partial hydrocele.

In the dissection of a testicle, which was the seat of this disease in the early or first stage, Sir Astley Cooper found, that the excessive hardness of the part did not arise from the solid nature of the substance deposited in it, but from the excessive distension of the tunica albuginea, and from its not readily yielding to the pressure from within. "The substance, which was effused, was fibrous, of a yellowish white colour tinged with blood, partially vascular, and, when macerated, it became flocculent, and had the appearance of matted wool. The seminiferous tubes ceased to be observable at that part of the testis; but, in other parts, they remained entire. In the dissection of the testis in the second stage of the disorder, it is found filled with a similar soft and white fibrous matter, which occupies the testis and epididymis, and the parts of which readily yield to pressure. And there is intermixed, with the soft effusion a yellow fibrine." When macerated in this state, the soft fibrine is removed, and the tendinous septa of the testis, in which it has been enclosed are left, representing a kind of cellular structure. In the third stage, when the testis is excessively enlarged, the tunica vaginalis contains a good deal of fluid; the tunica albuginea has given way; and a portion of the disease projects through it. The interior of the testis may likewise contain cysts of serum, as well as coagulated blood, and the white soft fibrous matter already noticed, from which, when compressed, a substance issues like cream tinged with blood, and sometimes compared to putrid brain; the epididymis is enlarged, and where serum has not been effused, the tunica vaginalis is adherent to the testicle. (Sir Astley Cooper, *Op. cit.* p. 121.) The same distinguished surgeon notices the frequent enlargement and induration of the spermatic cord, and its exemption from the disease in certain other cases which have even had a fatal termination. On this point Sir Benjamin Brodie remarks, that "when the disease first exists, the spermatic cord is in a natural state, and, in many cases, it never seems to be much enlarged; but, in other instances, the disease extends to the spermatic cord, and this to a very great extent. Seeing this, you will not

wonder that disease should take place in the loins, where some parts of the spermatic cord originate. The disease, however, will show itself in the loins, although the spermatic chord be healthy. This I have seen many times in examining bodies after death." (See *Lond. Med. Gaz.*, vol. xiii. p. 408.) The same fact was exemplified in a case in University College Hospital, where, at the earnest entreaty of the patient, a man about 30, I removed a testicle affected with this disease; and, though he afterwards fell a victim to an enormous tumour of the same nature in one of the lumbar glands, the portion of the spermatic cord removed, and also that left within the inguinal canal, were free from disease. In another case where I operated, the part of the cord taken away, contained little bodies like millet seeds in size; and, notwithstanding this unfavourable circumstance, the patient recovered, and was apparently in health, at least two or three years after the operation; and, so far as I know, may even continue well to the present day, which is six or seven years from the time when the testicle was removed.

Frequently a quantity of serum is found in the abdomen, and behind the duodenum, "a large tumour, to which that intestine adheres on the forepart, and the aorta and vena cava are placed behind it. It is in different subjects of a size from that of the clenched hand to that of the head of a child. When cut into, it contains a soft, but still a solid fibrine, with which is intermixed a fluid like cream, slightly tinged with blood. In some persons, the tumour in the abdomen begins from the lower part of the loins, and extends to the diaphragm, involving the kidney; and, when it is attempted to be dissected, a large quantity of a thick cream-like matter bursts from it at different parts. The aorta and vena cava are diseased, and fungous tubercles and effusion are produced in their coats, and fungous (medullary) effusion into the interior of the aorta." In many of these cases, the mesenteric glands are similarly diseased. Frequently the liver is loaded with tubercles of the same nature; and in the museum at St. Thomas's Hospital is a preparation in which the thoracic duct is obliterated by this disease. (See *Sir Astley Cooper, Op. cit.* p. 121—124.) In an example dissected by Mr. Lawrence, the swelling of the testicle consisted of cellular septa, filled with pulpy matter; numerous tubercles of the disease were found in the omentum, and in various parts of the pelvis, intermixed with recently effused coagula. A mass of soft matter, equal in size to a man's head, lay on the spine, behind the aorta and vena cava, which last vessel was closed for some extent. The spermatic vessels could not be found. (See *Med. Chir. Trans.* vol. viii. art. 13.)

The young man from whom I removed a testicle in University College Hospital, on account of this disease, was afterwards destroyed by the effects of an enormous swelling of one of the lumbar glands, which was as large as a man's head. It not only compressed the duodenum and vena cava, but a portion of it had made its way into the pelvis of the kidney. This patient suffered excessive pain for several weeks before he died, and was reduced to an extreme state of emaciation, the stomach having been able to retain scarcely any thing in it. The swelling of the lumbar gland could

be plainly felt through the abdominal parietes. It is observed by Sir B. Brodie, that "in many cases, the tumour in the loins gives the patient no pain, and but little inconvenience; while, at other times, it is attended with the most extraordinary suffering. A gentleman (he adds), with whom I was acquainted many years ago, had this disease in the testicle; Mr. Cline was consulted, and he recommended the amputation of the testicle, and performed the operation. A year afterwards, the patient became weak in his lower limbs, and at last they became completely paralytic. He died; and, on examining the body after death, there was found a large tumour in the loins, which had affected the vertebræ, so as at last to press on the medulla spinalis; thus accounting for the paraplegia." (Sir B. Brodie, in *Lond. Med. Gaz.*, vol. xiii. p. 408.)

Dr. Macfarlane has recorded an instance, in which the patient died of peritonitis: the particulars confirm several circumstances in the preceding account. "The abdominal cavity contained a pound of sero-purulent fluid. The peritoneal coat of the stomach and intestines was extensively inflamed, and covered with patches of lymph. The liver was enlarged, softened, and had a motley appearance. There was a tumour nearly as large as a child's head, situated under the transverse arch of the colon, and covered by the small intestines. It lay close upon the spine, and was firmly attached to the aorta, vena cava, and left kidney. A section of the mass shewed it to be composed of a soft brownish substance, which resembled brain mixed with blood, and from the more solid parts a fluid, like pus, was squeezed out. The inferior part of the testicle presented the same appearance and structure as the abdominal tumour, but the upper half was firm, greyish, and slightly fibrous. The epididymis was enlarged; the tunica albuginea thickened, &c. The spermatic cord was sound. (See *Macfarlane's Hospital Reports.*)

In Sir Astley Cooper's valuable work on the *Structure and Diseases of the Testis*, is an interesting plate (viii.), representing the appearances presented in an instance, where the castration had been performed, but a relapse occurred. There the end of the spermatic cord is seen forming a considerable tumour; a large tumour may be noticed in the groin; and a very considerable mass between the left kidney, ureter, and sigmoid flexure of the colon.

The only chance of a cure (and this is a very poor one) must be derived from the early performance of castration, before the disease has extended to the lumbar or inguinal glands, or far up the spermatic chord. Indeed, very little hope should be placed in the removal of the testicle; for, fungus hæmatodes appears to be rather a constitutional, than a local disease. Nearly every case on record has terminated fatally, and, upon dissection, either the liver, the lungs, the brain, the lumbar or mesenteric glands, or other internal parts, have been found affected with the same disease. In one case dissected by Mr. Lawrence, tubercles of a similar structure to the disease in the axilla, were found in the lungs, heart, and, in short, in nearly all the thoracic and abdominal viscera, though the contents of the skull were free from disease. (See *Cases recorded by Wardrop, Earle, Lawrence, and Langstaff, in Med. Chir. Trans.*, vol. iii. and viii.)

Mr. Travers states, that he has never known an

instance of the non-recurrence of the disease after castration. (See *Med. Chir. Trans.*, vol. xvii. p. 335.) And Sir Astley Cooper observes, that of all the operations of surgery, there is scarcely any which is so generally unsuccessful as that of castration for this disease; and there is no hope of the patient's life being saved, unless the operation be performed as soon as the nature of the complaint is ascertained. (*Op. cit.* p. 131.)

Dr. Baillie observes, that the testicle is often found converted into a hard mass of a brownish colour, and generally intersected with membranes. Sometimes there are cells in the tumour, which are filled with a sanious fluid. (*Morbid Anatomy*, &c. p. 352—353. ed. 2.) This is what is usually termed the *scirrhus testicle*, which is attended with great hardness, severe pains darting along the spermatic cord to the loins, and an unequal knotty feel. In general, the health becomes impaired. To use Mr. Pott's words, sometimes the fury of the disease brooks no restraint; but making its way through all the membranes which envelope the testicle, it either produces a large, foul, stinking, phagedenic ulcer, with hard edges, or it thrusts forth a painful gleetung fungus, subject to frequent hemorrhage. (*Pott's Chir. Works*, vol. ii. p. 390. edit. 1808.)

Pott's description probably comprises several forms of disease, and confounds them together, as for instance fungus hæmatodes, scirrhus cancer, and even chronic enlargement with protrusion of fungous granulations and a portion of the substance of the testicle. Now, it deserves attention, that the kind of disease formerly recognised by surgeons as *scirrhus* and *cancer of the testicle*, and specified by Dr. Baillie, is found at the present day to be at all events not a common occurrence. Mr. Travers declares himself "incredulous as to the fact of the scirrhus cancer affecting the testis." (*Med. Chir. Trans.*, vol. xvii. p. 327.) Sir Astley Cooper remarks:—"I much doubt the existence of this disease in the same form and appearance as it assumes in the breast, viz. an excessively hard swelling, intersected by a network of strong fibres, or bands. I have seen a few instances of a very solid enlargement of the testis, accompanied with great weight, attended with severe occasional pain, beginning in the body of the testis, never becoming soft, like fungus, or producing a fungoid and very vascular bleeding surface, but feeling tuberculated, irregular, and excessively hard, but never becoming so large as the fungoid disease; the pain extending to the loins; the spermatic cord enlarged, hardened, and tuberculated; a smaller tumour than that of the fungoid disease, forming in the abdomen. Some water is secreted into the tunica vaginalis. At length, a dropsical effusion into the cellular membrane of the leg and thigh of the diseased side is produced, and then the other leg becomes similarly affected." On dissection, instead of the seminiferous tubes, a hard white substance is found in tubercles of little vascularity and sometimes interspersed with small portions of cartilage, or bone. The epididymis contains the same kind of deposit; and the spermatic cord, which is enlarged, has small white tubercles in it. The tumour in the abdomen is also of a white solid texture, very unlike that of the fungoid disease. This disease has less tendency than the fungoid or medullary, to involve different parts of the body together, and is slower in advancing to its fatal termination. Hence the disease affords more time

for the trial of calomel and opium, with leeches, evaporating lotions, and the recumbent posture; but, as Sir Astley Cooper rightly adds, great care must be taken not to defer the operation of castration so long, as to let the disease implicate the spermatic chord, or a tumour to be formed in the abdomen. (*On the Structure, &c. of the Testis*, p. 152—154.)

Neuralgia of the Testicle. Irritable Testicle.—By these expressions is signified a highly sensitive, and exceedingly painful affection of the part, generally unaccompanied by any swelling, or other obvious change in it. The suffering is frequently of the most excruciating kind, and of long duration, though subject to occasional remissions. "A patient frequently complains of pain in the testicle when there is no disease in it. There is a state of the nerves of the part, which makes him feel pain in it, although there is no inflammation, nor any other actual disease; and this is all that we mean when we talk of a neuralgic affection, in this or any other part of the body. You will find an example of it in persons in whom a large calculus passes from the kidney to the bladder. As soon as the calculus has passed a little way down the ureter, the patient complains of pain in the testicle, which is at the same time frequently drawn up by the spasmodic action of the cremaster muscle into the groin. When you examine it, you find it of its natural size, natural shape—at first not even tender, although excessively painful; in short, there is a painful affection of the testicle, depending not on any disease of the organ itself, but on the influence which the calculus, in passing down the ureter, exercises on the spermatic plexus of nerves. Disease in the kidney will sometimes produce pain in the testicle, although there is no reason to believe that a calculus, or other substance, has escaped from the kidney into the ureter." (*Sir Benjamin Brodie, Lond. Med. Gaz.*, vol. xiii. p. 620.) From the observations, delivered under the head of *Neuralgia*, the reader will perceive, that neuralgic affections may depend upon a great variety of circumstances, and especially on derangement of the general health. In the dissection of a testicle that has been the seat of neuralgia, no change of structure can be found. In one instance, which I attended, there was occasionally a little enlargement of the organ, though for the most part it remained free from all swelling or other manifest alteration. If the complaint be connected with functional disturbance of the liver or stomach, the chance of relief must depend upon the possibility of curing this primary affection. In many cases, which appear to be entirely nervous, or not associated with any other perceptible fault in the system, large doses of the sulphate of quinine, or of the carbonate of iron, may be prescribed; or, if the disease assume an intermittent type, and come on periodically, the liquor arsenicalis. In some cases, the muriate of morphia, opium, or hyosciamus, joined with calomel, will answer best; and, if the liver be disordered, and the secretion of the skin checked, calomel, opium, and James's powder, should be tried. As local applications, leeches, ice-cold lotions, ice itself, or a plaster, one third of which consists of extract of belladonna, and two thirds of soap cerate, or the veratria ointment, deserve to be particularly specified. For additional remarks relating to neuralgic affections, see NEURALGIA.

Atrophy, or wasting of the Testicle.—Some times this organ is either partially or completely absorbed. This may happen from a blow, or other injury which causes violent inflammation of the part, and disorganisation of it. Obliteration of the vas deferens has been observed to be attended with a dwindling away of the testicle; a circumstance, which would be expected from the recollection of the functions of the organ being necessarily destroyed by such obliteration. Varicocele sometimes leads to atrophy of the testis; and sometimes the obliteration of the principal spermatic veins with a ligature, or forceps, adopted for the cure of varicocele, has been followed by this change in the testicle. Acute inflammation of the testicle from gonorrhœa; chronic enlargement of it from other causes; and especially scrofulous disease of the organ, may, in the end, lead to atrophy of it: in the first case, possibly in consequence of the vas deferens becoming sometimes permanently obstructed; but in the other two examples, no doubt, from disorganisation of the testicle itself. The pressure of a large hernial swelling I have often known occasion atrophy of the testicle; and the strong compression of the spermatic cord by a truss would appear to be capable of producing the same consequence. Atrophy of the testicle was remarked by Baron Larrey to occur with remarkable frequency after the deep sabre-cuts of the back of the neck, received by the French soldiers in Egypt, in their contests with the Turks. Onanism and excessive venery are believed to lead in some instances to atrophy of the testicle.

The *induration and swelling* of the testicles resulting from effusion of urine in the scrotum, and often accompanying fistulæ in perineæ, will subside after the disease of the urethra has been cured. (See *J. Cloquet, Pathologie Chir.*, p. 44.) Every surgeon of experience must have witnessed this fact.

The late Mr. Ramsden thought, that some sarcoceles might be relieved by removing with bougies a supposed morbid irritability of the urethra, with which his theories led him to connect the origin of the complaint. (See *Pract. Obs. on Sclerocele*, &c.) No doubt many chronic enlargements of the testicle have subsided during this treatment, especially when aided by calomel and other means; but, a doubt may be entertained, whether the bougie had any essential share in producing the benefit obtained. The practice, at all events, is not at present much adopted, though on the first suggestion of it, many trials of it were made.

See *Pott's Chirurgical Works*, vol. ii. ed. 1808. *Abernethy*, On Tumours. *James Wardrop*, On Fungus Hæmatodes. *Baillie's Morbid Anatomy*, p. 352. ed. 2. *Delpech*, Précis. Elém. des Maladies Chir., t. iii. p. 564. *Richerand*, Nosogr. Chir., t. iv. p. 300, &c. ed. 4. *Baron Dupuytren*, Leçons Orales de Clinique Chir., t. i. art. iv and vi. 8vo. Paris, 1832. *Sir Astley Cooper*, On the Structure and Diseases of the Testis, 4to. Lond. 1830. *Cusack*, in Dublin Journal of Med. Science, No. 23. *Beagj. Travers*, in Med. Chir. Trans., vol. xvii. *Sir Benjamin Brodie*, in Lond. Med. Gaz., vol. xlii. 8vo. Lond. 1834. *J. Cloquet*, Pathol. Chir. p. 99, &c. *Crucveilhier*, Anatomie Pathol. du Corps humain, fol. Paris, 1829—35. *Mayo's Outlines of Pathology*, chap. iii. 8vo. Lond.

TETANUS. (From *tétos*, to stretch.) Tetanus is defined by all authors to be a more or less violent and extensive contraction of the muscles

of voluntary motion, attended with tension and rigidity of the parts affected.

The excessive contraction of the muscles is generally kept up, without any intervals of complete relaxation; in which respect the disorder differs from ordinary spasms and convulsions, where the contractions and relaxations alternate in rapid succession. In tetanus, the powers of sensation and intellect also remain unimpaired, in which particular it forms a contrast to epilepsy. (*Reese's Cyclopadia*, art. *Tetanus*.)

When its effects are confined to the muscles of the jaw and throat, it is called *trismus*, or *locked-jaw*; when a greater number of muscles are involved, but the trunk retains its ordinary straightness, the case is named *tetanus*. When the body is bent forwards, the disease is termed *emprosthotonos*; and *opisthotonos*, when the muscles of the back are principally affected. To these four forms, some writers add a fifth, which is denominated *pleurosthotonos*, and characterised by the body being drawn to one side. It is the *tetanus lateralis* of Sauvages. The different terms applied to tetanic affections, do not then imply so many particular diseases, but only the seat and various degrees of one and the same complaint. Trismus is invariably a part of each of the other varieties.

A still more important division of tetanus is into *acute* and *chronic*, according to its greater or lesser intensity. The first is exceedingly dangerous, and usually fatal; while the latter, on account of the more gradual progress of the symptoms, affords more opportunity of being successfully treated. (*Larrey*, in *Mém. de Chirurgie Militaire*, t. i. p. 235, 236.)

Tetanus is also divided into *traumatic*, or that arising from wounds, being the case with which surgeons have principally to deal, and occasionally termed *symptomatic*; and into *idiopathic*, or that proceeding from other causes.

Traumatic tetanus sometimes comes on in a surprisingly sudden manner, and quickly attains its most violent degree. The most rapidly fatal case, that has ever been recorded, is one that we have on the authority of the late Professor Robison of Edinburgh. It occurred in a negro, who scratched his thumb with a broken china plate, and died of tetanus a quarter of an hour after this slight injury. (See *Rees's Cyclopadia*, art. *Tetanus*.) But, commonly, the approaches of the disorder are more gradual, and it slowly advances to its worst stage. In this sort of case, the commencement of the disorder is announced by a sensation of stiffness about the neck; a symptom, which, increasing by degrees, renders the motion of the head difficult and painful. In proportion as the rigidity of the neck becomes greater, the patient experiences in the throat a sense of dryness and soreness, and about the root of the tongue an uneasiness, soon changing into a difficulty of mastication and swallowing, which after a time become totally impossible. The attempt at deglutition is attended with convulsive efforts, especially when an endeavour is made to swallow liquids; and so great is the distress, which accompanies these convulsions, that the patient becomes very reluctant to renew the trials, and occasionally refuses all nourishment. Sometimes it even inspires him with a dread of the sight of water, and a great resemblance to hydrophobia is produced.

One of the next remarkable symptoms is a severe pain at the bottom of the sternum, darting from this point backward to the spine, in the direction of the diaphragm. As soon as this pain commences, the spasms of all the muscles about the neck become exceedingly violent, and the head is drawn backwards, or forwards, according as the contraction of the extensor or flexor muscles happens to be strongest; but in the majority of cases the head and trunk are pulled backwards, and the contractions increasing in force, the body is frequently raised in the form of a bow, resting upon the head and feet alone; a state which is more particularly denominated *opisthotonos*. At the same time, the muscles, which close the lower jaw, and which were affected with spasm and rigidity in the very beginning of the disorder, now contract with great power, so as to maintain the lower jaw-bone inseparably applied to the upper. The last state, which has been considered as a particular affection under the name of *trismus*, or *locked-jaw*, Boyer conceives, may be regarded as the pathognomonic symptom of tetanus, which in many instances is limited to such an affection of the jaw. (*Mat. Chir.*, t. i. p. 288.)

Although the contraction of the muscles rarely ceases so completely as to form an intermission, there are occasional remissions; and, in two cases under Dr. Parry, there were marked intervals. (Dr. Symonds, in *Cyclop. of Practical Med.*, art. *Tetanus*.)

The continuance of the disease leads to increasing spasm of the diaphragm, which now returns every ten or fifteen minutes, and is instantly succeeded by a stronger retraction of the head and rigidity of the muscles of the back, and even of those of the lower extremities. A violent stabbing pain is felt in the situation of the diaphragm; and, if the disorder increases, comes on at shorter and shorter intervals. The abdominal muscles are also strongly contracted, so that the belly feels as hard and tense as a board. By the violence of the contractions, indeed, the recti muscles have been known to be lacerated, as I shall relate an example of hereafter. Sometimes the spasm and tension extend only to the muscles on one particular side of the body: the *tetanus lateralis* of Sauvages, and the *pleurosthotonos* of other nosologists.

When the disease reaches its most violent stage, the flexor muscles of the head and trunk contract so powerfully, that they counterbalance the force of the extensors, and hold those parts in a straight, fixed, immovable position. This is the condition, to which the appellation of *tetanus* more particularly belongs. The muscles of the lower extremities become rigid; and even the arms, which till now were little affected, also partake of the general spasm and stiffness, with the exception of the fingers, which often retain their moveableness to the last. The tongue likewise continues a long while endued with the power of voluntary motion; but, at length, the violent spasms do not leave it unaffected, and it is then liable to be forcibly propelled between the teeth, where it is occasionally dreadfully lacerated. Sometimes the teeth are broken by the violence of the spasm. The sphincters are variously affected: thus the urine is sometimes discharged with great and sudden impetus during the violent spasm of the abdominal muscles; at other times, it is retained. The anus

is in general obstinately closed, though cases have occurred in which the contents of the rectum have escaped involuntarily. (*Symonds*.)

In the extreme period of the disorder all the muscles destined for voluntary motion are affected; among others those of the face: the forehead is drawn up into furrows; the eyes, sometimes distorted, are generally fixed and motionless in their sockets; the nose is drawn up; and the cheeks are retracted towards the ears; so that the features undergo a most extraordinary change. When tetanus arrives at this stage, and the spasms are universal, a violent convulsion usually puts an end to the patient's misery.

Wherever the muscular contractions are situated in cases of tetanus, they are always accompanied with the most excruciating pain. They sometimes last, without any manifest remission, to the end of the disorder; but, in almost all cases, their violence, and the sufferings excited by them, undergo periodical diminutions every minute or two. The relaxation, however, is never such as to let the muscles which experience it yield to the action of their antagonists; and it is in nearly all cases followed in ten or twelve minutes by a renewal of the previous contractions and suffering. The recurrence of these aggravated spasms frequently happens without any evident cause; but it is often determined by efforts which the patient makes to change his posture, swallow, speak, &c.

When the spasms are general and violent, the pulse is contracted, hurried, and irregular; and the respiration is similarly affected; but during the remission, the pulse and respiration may return to their natural state. There is generally, however, a progressive alteration of the pulse. "At the beginning, it is pretty hard and full, but towards the close, it becomes more frequent and feeble, and often is irregular and intermittent. The heat of the skin also appears to depend on the violence of the spasms: it has been found by Dr. Fribro, of Geneva, as high as 110° Fahrenheit. The perspiration is generally profuse over the whole body; but sometimes is confined to the face and chest. It continues during the whole course of the disease, and has a peculiar pungent odour. The urine presents nothing remarkable as to quantity or quality; some describe it as always high-coloured (*Rochoux, Dict. de Med.*, t. xx.; *Fournier Pessay, Dict. des Sc. Med.*, t. ix.), while others have observed it to be as often quite unchanged. (Cullen noticed its occasional suppression, or its evacuation with difficulty.) Torpor of the intestines in a degree, that resists the most powerful purgatives, is allowed by all who have witnessed the disease, to be a more invariable accompaniment than any other. Such dejections as are obtained, are excessively offensive and unnatural." (*Symonds, in Cyclop. of Pract. Med.*, art. *Tetanus*.)

In this disease the head is seldom affected with delirium, or even confusion of thought, till the last stage of it.

Vomitings sometimes appear early in the disease; but commonly they are not continued: and it is usual enough for the appetite to remain through the whole course of the disease; and what food happens to be taken down, seems to be regularly enough digested. In several instances, a milary eruption has appeared upon the skin; but whether this be a symptom of the

disease, or the effect of a certain treatment of it, is undetermined. (Cullen, in *First Lines of Physic*, vol. iii.)

According to Baron Larrey, opisthotonos is not so often observed in Egypt as emprosthotonos; and the experience of this gentleman taught him, that the former was the most rapidly fatal. We must not adopt, however, his curious opinion, that the violent extension of the vertebra of the neck, and the manner in which the head is thrown back, cause strong compression of the spinal marrow, and a permanent contraction of the larynx and pharynx (*Mém. de Chirurgie Militaire*, t. i. p. 240.), since this sort of compression, if it did not at once destroy the patient, would at any rate paralyse most of the muscles, and instantly stop their extraordinary contraction.

This experienced writer notices how much the nerves of the neck and throat seem generally to be affected on the invasion of this disease. The consequent contraction of the muscles of these parts, he says, is soon attended with difficulty of deglutition and respiration. The patients then experience, if not a dread of liquids, at least a great aversion to them, which often prevents the administration of internal remedies; and if the wound is out of reach of the interference of art, the patient is doomed to undergo the train of sufferings attendant on this cruel and terrible disorder. Nothing can surmount the obstacles which present themselves in the œsophagus. The introduction of an elastic gum catheter into this canal, through the nostrils, is followed by convulsions and suffocation. "I have tried this means (says Larrey) on the person of M. Navailh, a surgeon of the second class, who died of a locked-jaw, brought on by a wound of the face, accompanied with a comminuted fracture of the bones of the nose, and part of the left orbit.

"In the examination of the bodies of persons dead of tetanus, I have found the pharynx and œsophagus much contracted, and their internal membrane red, inflamed, and covered with a viscid reddish mucus.

"Hydrophobia, hysteria, and several other nervous diseases, likewise produce their chief effects upon these organs, and the result appears to be the same. So, I have just remarked, when tetanus is arrived at its worst degree, the patients have a great aversion to liquids, and, if they are forced to swallow them, immediate convulsions are excited. This circumstance was particularly observed in M. Navailh."—(*Mém. de Chirurgie Militaire*, t. i. p. 247, 248.)

Sometimes tetanic affections deviate from their ordinary course and nature. The most singular of these anomalies is recorded by Sir Gilbert Blane: it is a case, in which tetanus prevailed to a very considerable extent, without any degree of pain. The spasms were accompanied with a tingling sensation, which was even rather agreeable than distressing. The case, however, terminated fatally; but, to the last, no pain was experienced. In two examples, mentioned by the same author, the spasms affected only the side of the body, in which the wound was situated.

The dissection of patients, who have died of tetanus, has thrown no light upon the nature of this fatal disorder. Sometimes slight effusions are found within the cranium; but, in general,

no morbid appearance whatever can be detected in the head. There is always more or less of an inflammatory appearance in the œsophagus and in the villous coat of the stomach about the cardia. But those who are conversant with dissections must be well aware, that these appearances are common to a great number of diseases, and are uniformly met with in every case of rapid, or violent death. Besides the redness and increased vascularity of these parts, Baron Larrey, as I have already stated, found the pharynx and œsophagus much contracted, and covered with a viscid reddish mucus. He also found numerous lumbrici in the bowels of the several patients who died. (See *Mém. de Chir. Militaire*, t. iii. p. 287.) This, however, could only be an accidental complication, and not a cause. In several cases, Dr. M'Arthur found the intestines much inflamed; and in two of them a yellow, waxy fluid, of a peculiar offensive smell, covered their internal surface; but, whether the inflammation was primary, or only a consequence of the pressure of the abdominal muscles, which contract so violently in this disease, he is unable to decide. (See *Med. Chir. Trans.*, vol. vii. p. 475.; and *Rees's Cyclopædia*, art. *Tetanus*.)

Dr. Lionel Chalmers, of Charlestown, South Carolina, states, that when the disease forms very quickly and invades the unfortunate persons with the whole train of its mischievous symptoms, in a few hours, the danger is proportioned to the rapidity of the attack, and that the patients thus seized generally die in 24, 36, or 48 hours, and very rarely survive the third day. But when the disease is less acute, few are lost after the ninth, or eleventh. (See *Med. Obs. and Inq.*, vol. i. p. 92, 93.) It is the common belief, that death takes place from asphyxia.

From the valuable report of Sir James Macgregor, it appears that several hundred cases of tetanus occurred in our army during the late campaigns in Spain and Portugal. The disease was observed to come on at uncertain periods after the receipt of the local injury; but it terminated on the second, third, and fourth days, and even as late as the seventeenth and twentieth days; though it was usually not protracted beyond the eighth. (*Med. Chir. Trans.*, vol. vii. p. 353.) I had a patient, however, who lingered in the military hospital at Oudenbosch five weeks, with chronic tetanus, before he died. This happened in the year 1814, soon after the assault on Bergen-op-Zoom, where the patient had been wounded, and suffered amputation of the thigh.

Although tetanus is a disease which has been observed in almost all parts of the world, experience proves, that its frequency is much the greatest in warm climates, and especially in the hot seasons of those climates. It is also more common in marshy situations, and countries bordering upon the sea, than in places which are very dry, elevated, and at a distance from the sea-coast. Every class of individuals is exposed to its attacks; but infants, a few days after their birth, and middle-aged persons, are said to be oftener affected than older subjects, or others in the youthful period of life. The male sex more frequently suffer than the female; and the robust and vigorous more frequently than the weak.

According to Dr. Cullen and other medical writers, the causes of tetanus are cold and moist-

ture, applied to the body while it is very warm, and especially the sudden vicissitudes of heat and cold. Or the disease is produced by punctures, lacerations, or other injuries. Cullen admits, however, that there are probably some other causes, which are not distinctly known.

Baron Larrey observed, that gunshot wounds in the course of the nerves, and injuries of the joints, often produced tetanus in the climate of Egypt, particularly when the weather, or temperature passed from one extreme to the other, in damp situations, and in those which were adjacent to the Nile, or the sea. What he terms dry and irritable temperaments were the most subject to the disorder, the event of which was found to be almost always fatal. (*Larrey, Op. et loc. cit.*)

Traumatic tetanus is remarked to proceed oftener from wounds of the extremities, and especially the fingers and toes, than from similar injuries of the trunk, head, and neck. Sometimes it originates at the moment of the accident, as in the instance mentioned by the late Professor Robison of Edinburgh; but, in general, it does not come on till several days afterwards, sometimes not till the wound is nearly or perfectly healed, and free from all pain and uneasiness. It would seem that a wound would sometimes not have the effect of exciting the disorder, if the patient carefully avoided sudden exposure to cold. In 1833, I attended a gentleman who had met with a lacerated wound of the scalp by being thrown from his horse. From this accident he was recovering in the most favourable manner; but, on going out into the cold air, at the end of a fortnight, when the wound was nearly healed, he was attacked with trismus, which soon assumed the form of universal tetanus, and he died in six or seven days from the commencement of the disorder. Dr. Murray relates a case in which a midshipman trod on a rusty nail one evening at nine o'clock, and after exposing himself to the cold night air in keeping watch, had tetanic symptoms the following morning at eight. (See *Lond. Med. Gaz.* for 1832-33, p. 623.) Tetanus occurs in all conditions of wounds; in some of a healthy, and others of an ill-conditioned appearance; sometimes, as I have just given an instance of, when they are almost, or even entirely healed. In one case, mentioned by Dr. Hennen, cicatrization was completed on the same day that life terminated. It occurs too, whether the wound be large or small. Dr. Elliotson had a case, as severe as any he ever saw, where there had been merely a contusion of the thumb. An example is given in the *Trans. of the Lond. Med. Society*, in which the disease followed a burn, at a time, when there was merely a dry scab on the leg; nay, as Dr. Elliotson observes, the disease has sometimes declined and ceased, while the wound every day grew worse and worse. Larrey, however, lays considerable stress on the condition of the wound, which is generally either dry, or covered with a thin serous exudation. Dr. Rush also speaks of an absence of inflammation in wounds, that cause tetanus. (*Med. Reg.* vol. i.)

Dr. Reid knew of a case in which tetanus followed the mere stroke of a whip-lash under the eye, though the skin was not broken. Andral refers to an instance, in which the formation of a septon on the chest, occasioned a fatal attack of tetanus. (*Clinique Méd.*, t. iv. p. 445.) Mr. Morgan

also speaks of one case in which the stroke of a cane across the back of the neck, and of another, in which a blow on the hand with the same instrument, produced the disease: in both, the result was fatal. (*Lect. on Tetanus*, 1833.) The extraction of a tooth has produced the disorder.

Wounds, then, of every description may give rise to tetanus, and, in warm climates, very trivial injuries produce it. Thus, in Egypt, Larrey had one case which proceeded from the lodgment of a small piece of fish-bone in one of the sinuses of the fauces. (*Mém. de Chir. Militaire*, t. i. p. 254.) In colder regions, traumatic tetanus seldom happens, except from contused, punctured, or lacerated wounds; or wounds of the ginglymoid joints, with lacerations of the tendons and ligaments; compound fractures, or dislocations; deep pricks in the sole of the foot; and especially lacerations or ulcerations of the fingers and toes. A partial division of a nerve has been suspected as a frequent cause; but as some nerves must be imperfectly cut through in almost every wound, and yet tetanus does not arise, this cause is not invariably effectual. Baron Larrey, however, has recorded a fact which favours this doctrine, as I shall presently notice; and a case, in which the branch of the median nerve, going to the thumb, was found partly torn through, and its extremity inflamed and thickened, has been related by Mr. Liston. (*Ed. Med. and Surg. Journ.*, No. lxxix, p. 292.) The inclusion of the nerves in ligatures, applied to arteries, is another alleged cause of tetanus; but as this fault is very common, and tetanus rather rare in this country, while it may follow all sorts of wounds, whether from accidents or operations, we must believe that some particular state of the system is required to render this cause efficient. However, there are some cases and observations on this point adduced by Larrey, which will be quoted in the sequel of this article. (See t. iii. of his *Mém. de Chir. Mil.*) At the same time, I do not mean to hint, that the nerves are not sometimes tied in tetanic cases, or that the practice is not on every account blameable. Amputation and castration are the only great surgical operations to which I have seen tetanus succeed; though it may follow the employment of the knife on less severe occasions. In St. Bartholomew's hospital, it once followed the operation of removing the breast.

There cannot be a doubt, that difference of climate makes considerable difference in the degree and danger of tetanus. Larrey found, that, in Egypt, the disease was more intense, and bore a greater resemblance to hydrophobia, than in the colder climate of Germany. In both these countries, he remarked, that, when the wounds, causing tetanus, injured nerves situated on the forepart of the body, emprosthotonos was occasioned; that if the posterior nerves were hurt, episthotonos followed; and that when the wound extended quite through a limb, so as to injure equally both descriptions of nerves, complete tetanus ensued. He noticed, also, that the disease commonly arose from wounds, when the seasons and temperature passed from one extreme to another. Exposure to the cold damp nocturnal air, he found particularly conducive to it. (See *Mém. de Chir. Milit.*, t. iii. p. 286.)

In the late campaigns in Spain and Portugal, according to the report of Sir James Macgregor, tetanus occurred in every description, and in every

stage of wounds, from the slightest to the most formidable: it followed the healthy and the sloughing; the incised and the lacerated; the most simple and the most complicated. It occurred at uncertain periods; but it was remarked that if it did not commence in 22 days from the date of the wound, the patient was safe. (See *Med. Chir. Trans.*, vol. vi. p. 463.) In Egypt, as we learn from Larrey, the latest period of the commencement of tetanus after a wound, was from the fifth to the fifteenth day. (*Mém de Chir. Militaire*, t. i. p. 263.)

It is observed by Dr. Dickson, that as the acute form of tetanus is so uniformly fatal, it is of the greatest consequence to attend to whatever may assist in detecting the disease early, or in warding it off. Richerand states, that, in wounds threatening convulsions and tetanus, a persevering extension of the limbs during sleep often manifests itself, before any affection of the lower jaw; and we should naturally pay more attention to any admonition of this kind in punctured, or extensive lacerated wounds, particularly of tendinous or ligamentous parts, and especially in injuries of the feet, hands, knee-joint, back, &c. Some prelusive indications of danger may often be derived from the increase of pain, irritation, restlessness, nervous twitches, pain and difficulty in deglutition, or in turning the head; spasms, or partial rigidity of some of the voluntary muscles; pain at the scrobiculus cordis; a suppressed or vitiated state of the discharge, &c. which mark the slower approaches of the disease. Larrey adduces several instances of tetanus, in which the wound was either dry, or afforded only a scanty serous exudation, and where the symptoms were relieved on suppuration being re-established; and Dr. Reid (*Edinb. Med. and Surgical Journal*, for July 1815) remarks, that on removing the dressing, the wound was covered with a darkish unhealthy looking matter, and that he had seen this change the forerunner of tetanus in two other instances. A torpor of the intestines has generally been observed to precede, as well as accompany the disease, and Boyer, in particular, enumerates an obstinate constipation amongst the predisposing causes. (*Mal. Chir.*, t. i. p. 287.) Mr. Abernethy informs us, that in four cases, where he inquired into the state of the bowels, the evacuations were not like feces; and he proposes as a question, in investigating the cause, what is the state of the bowels, between the indication of the injury, and the appearance of this dreadful malady? (*Surgical Works*, vol. i. p. 104.) Dr. Parrey thinks the velocity of the circulation an useful criterion of the danger of the disease, and observes, that if the pulse be not above 100 or 110, by the fourth or fifth day, the patient almost always recovers; but that, if it be quickened early, the disease mostly proves fatal, and yet there are a few instances of recovery, where the pulse rose to 120 on the first day. Baron Larrey remarks, that when the perspiration, which so often attends the disease, is symptomatic, it begins upon the head and extremities; but that when it is critical, it occurs over the chest and the abdomen. (*Mém. de Chir. Militaire*, t. i. p. 256.) It must be confessed, however, that in many cases, perspiration flows very freely, without bringing relief. (*Rees's Cyclopadia*, art. *Tetanus*.)

I next proceed to consider the treatment of tetanus, a subject of infinite difficulty, because the

disease frequently baffles every mode of practice, and, in certain instances, gets well under the employment of the very same remedies which decidedly fail in other similar cases of the disorder. Every plan has occasionally succeeded, and every plan has still more frequently miscarried. The great difficulty, therefore, is to ascertain, amongst numerous discordant accounts, what practice is found on the whole to be attended with the least ill success. For, in the present state of our knowledge, the most credulous practitioner will not flatter himself with the supposition, that any effectual remedy for tetanus has yet been discovered. As, however, acute tetanus was regarded by Hippocrates and the ancients as certainly mortal, and it does not always prove so in modern times, it seems allowable to conclude, that the recoveries which now happen must be ascribed to improvements in practice. This reflection should lead us not to give up the subject as hopeless; but to redouble our exertions for the discovery of a more successful method of treatment, and, if possible, of some new medicine, possessing more specific power over the disorder.

As is justly observed by a well-informed writer, when we reflect upon the obscurity which involves both the *ratio symptomatum*, and the proximate cause of tetanic affections, we need not wonder that the practice in these disorders should still be entirely empirical. The indication of cure, which is generally applicable to all diseases, namely, the removal of the exciting causes, is scarcely admissible in a disorder which is the consequence of causes which, in general, have ceased to act, or which it is not in our power either to remove or control. In some cases, where local irritation might be suspected to be still operating, the most effectual method of counteracting its effects on the system would obviously be to intercept all communication between the seat of the irritation and the sensorium. If, however, the disease has already established itself, and severe symptoms have come on, it does not appear that this would commonly succeed in arresting the course of the disorder. Experience too fully proves, that amputation of the limb, from the injury of which the tetanus has arisen, will seldom procure even a mitigation of the symptoms, if performed after a certain period from their first appearance. (*Rees's Cyclopadia*, art. *Tetanus*.) Baron Larrey is the greatest modern advocate for amputation where tetanus depends upon a wound of the extremities; but the facts which he adduces in its favour are not numerous, and he limits his recommendation of the measure chiefly to chronic cases, and extends it to no others, except on the very first accession of the symptoms.

"The equally unexpected and entire success (observes Larrey) obtained by the amputation of the injured limb, in the person of an officer attacked with chronic tetanus, leads me to propose the question, whether, in this disorder, occasioned by a wound of some part of the extremities, it would not be better to amputate the injured limb immediately the symptoms of tetanus commence, rather than expect from the resources of nature, and from very uncertain remedies, a cure which so seldom happens?"

"If tetanus is chronic, as is sometimes observed, amputation may be done at every period of the disorder, provided a choice be made of the time, when there is an intermission of the symptoms.

The operation would not answer so well in acute tetanus, if the disease were advanced, and the muscles to be divided were strongly contracted and rigid, as I observed at the siege of Acre, in a soldier, who was seized with tetanus, in consequence of a gunshot wound of the left elbow." (*Mém. de Chir. Militaire*, t. i. p. 262.)

Larrey did, indeed, try amputation in a few instances of acute tetanus. In the case last cited, the symptoms were already considerably advanced when the experiment of amputating the arm was made; yet, says he, the operation was followed by considerable ease. The symptoms recurred, however, a few hours afterwards, and proved fatal on the third day. In another example, this gentleman repeated the experiment, though acute tetanus had begun. The operation is described as having stopped all the symptoms, as it were by enchantment; the patient even passed twelve hours in perfect ease; but, being exposed to the damp cold air, the disorder returned, and carried him off. (See *Mém. de Chir. Militaire*, t. i. p. 263—269.) In a case of acute tetanus, where Mr. Liston amputated the wounded hand, the opisthotonos subsided the following day; yet, the case ended fatally, and it is a question, whether the degree of temporary benefit, which was obtained, did not proceed from other remedies, tried in conjunction with the operation. (See *Ed. Med. and Surg. Journ.*, No. lxxix. p. 293.) *

Larrey records some cases in favour of amputation at the commencement of tetanus from wounds, and especially for the relief of the disease in the chronic form. He has likewise adduced an interesting example, in which speedy relief and a cure followed cutting off all communication between the nerves of the wounded part and the sensorium by a suitable incision.

In this place it may be right to remind the reader, that, although Baron Larrey once or twice amputated when acute tetanus had somewhat advanced, he does not advise the practice; and he expressly restricts his sanction of amputation to chronic or quite incipient cases of tetanus, and to a few instances, in which the ginglymoid joints are fractured, accidents which, independently of tetanus, would generally require the operation. (See *Mém. de Chir. Mil.*, t. i.) The report of Sir James Macgrigor fully confirms the statement of Larrey; namely, that free incisions are of little avail in the acute and fully formed disease, and that amputation fails in the same kind of case. After the battle of Toulouse, this operation was extensively tried; but without success. The French are also said to have lost an immense number of soldiers from tetanus after the battle of Dresden, when Sir James infers, that the practice of amputation must have been fairly tried. (See *Med. Chir. Trans.*, vol. vi. p. 456.) We have seen, however, that according to the precepts of Larrey, the French surgeons would only have performed the operation in chronic cases, which are not the most frequent, or if in other instances, only on the very first accession of the symptoms. But, upon the whole, notwithstanding the partial degree of success attending Larrey's experiments, I have no hesitation in declaring my belief, that amputation of the injured part in chronic tetanus will never be extensively adopted. The uncertain efficacy of this extreme measure, and the frequent possibility of ending this form of the complaint by milder

plans, will for ever constitute insuperable arguments against the practice.

Sir Astley Cooper's statements tend to confirm the opinion which I have always given upon the subject. In one case of tetanus, from a compound fracture just above the ankle, the operation seemed to precipitate the fatal event. In another case, the finger was amputated without any good; and a third case is referred to, in which the operation also failed in saving the patient's life. In chronic tetanus, amputation is regarded by Sir A. Cooper as unjustifiable, as the patient often recovers without this proceeding. The medicine which has appeared to this gentleman most useful in such cases is the submuriate of mercury, joined with opium. (*Surgical Essays*, part ii. p. 190.)

Mr. Abernethy also disapproves of amputating any material part of the body, with the view of relieving tetanus, unless the injury require the operation on other grounds: he acknowledges, however, that he has seen tetanus mitigated by the practice, though the patients ultimately fell victims to the disease.

On the subject of making incisions for the purpose of separating the nerves of the wounded part from the sensorium, Larrey states, that they should be practised before inflammation has come on; for if this has made progress, they would be useless and even dangerous. They should comprehend, as much as possible, all the nervous filaments and membranous parts; but he condemns all incisions into joints, as exasperating the symptoms of tetanus, instances of which he has witnessed. The practice of nearly surrounding the wound by a deep incision has been practised in University College Hospital, and most of the cases have been in favour of the plan. Baron Larrey has recorded some convincing proofs of the benefit, sometimes arising from completely dividing the trunk of the injured nerve. In one instance, tetanic symptoms followed an injury of the supraorbital nerve, but were immediately stopped by dividing some of the fibres of the occipito-frontalis, and the nerves and vessels, down to the bone.

The case of the midshipman, who trod upon a rusty nail, which penetrated the left foot, between the metatarsal bones of the great toe and the adjoining one, is strongly in favour of this practice. As I have already mentioned, the patient kept watch on deck after the accident, and was exposed to the cold damp nocturnal air. At eight o'clock on the following morning, locked jaw had commenced. Under the administration of opium, the disease gained ground. Dr. Murray, therefore, cut down to, and divided the posterior tibial nerve, about an inch behind the malleolus internus. Although the patient had not been able to speak before the operation, he immediately opened his mouth with an exclamation, and expressed himself already much relieved. The original wound was then dilated, and covered with a poultice containing laudanum. The case terminated in the patient's recovery. (See *London Med. Gaz.*, 1832-33. p. 623.) Another case, in which the division of the neighbouring nerve was beneficial, may be found in the *Dubl. Journal of Medical Science*, vol. v. p. 311, extracted from the *Calcutta Med. and Physical Trans.*

On the principle of destroying the parts which are the seat of the local irritation, Larrey also frequently applied the actual and potential caustery

to the wound. The application of caustics, says he, may be practised with advantage on the first attack of the symptoms, the same precept being observed as in making the incisions. Bleeding, if necessary, and the use of topical emollients and anodynes, may follow these operations; though in general they have little effect. (*Mém. de Chir. Militaire*, t. i. p. 249.) In the third volume of this interesting work, p. 297, &c. are several cases, in which the cautery was employed with success. We must not conclude, however, that much dependence ought to be placed upon the use of the cautery, since Larrey observes in another place: "The moxa and actual cautery, recommended by the Father of Medicine, have been equally unavailing. The moxa was employed at Jaffa upon three wounded men: yet the disease followed its usual course, and terminated fatally.

"I have cited a striking instance of the inefficacy of the second method, in a case of opisthotonos." (T. i. p. 258.) This author adduces some cases, which tend to support the opinion, that tetanus occasionally proceeds from the inclusion of a large nerve in the ligature applied to an artery. The son of general Darmagnac died of tetanus consequent to amputation, and, upon examining the stump, the median nerve was found included in the ligature with the artery, and its extremity reddish and swollen. (*Mém. de Chir. Mil.* t. iii. p. 287.) In another case, Larrey suspected the tetanic disorder to proceed from a principal branch of the crural nerve being tied together with the femoral artery, and he cut the ligature; but the relief was only partial and temporary. The cautery was therefore applied deeply to the whole surface of the stump. A marked amendment took place a few hours afterwards, and the patient recovered. A diaphoretic mixture, with camphor and opium, was also exhibited. (T. iii. p. 297.)

Amongst other local means for the relief of tetanus, I may notice the employment of blisters as near as possible to the wound, or their application, or that of the ointment of cantharides, to the wound itself. Almost all modern writers have observed, that tetanus is accompanied at its commencement and in its progress with an interruption, or total cessation of suppuration in the wound. Hence the indication to excite this process again, by the means which I have specified. Larrey seems to have adopted both plans; but he particularly applied the ointment of cantharides to the wound itself in an early stage of the symptoms, and in cases where there not only was a suppression of the discharge, but where he suspected the nerves of the wounded part had suffered from exposure to the cold damp air on the detachment of the sloughs. For facts in favour of these local means, the reader must refer to the first and second volumes of the *Mémoires de Chirurgie Militaire*.

It appears also from Larrey's experience in Egypt, that poultices, made of the leaves of tobacco, and applied to the wounds of persons labouring under tetanus, were followed by no advantageous effect. The alkalies also proved of no service. (T. i. p. 257.)

Dr. Rush recommended the wound to be dilated and dressed with oil of turpentine (see *Trans. of the American Philos. Society*, vol. ii.); and, for this purpose, some of our naval surgeons have used tincture of opium.

A great degree of obscurity prevails respecting the most eligible *general* or *constitutional* plans of treating tetanus, and I am afraid it must be confessed that our internal remedies cannot be more depended upon than the local means already described. This opinion is fully confirmed by advertising to the discouraging fact, recorded by Sir James Macgrigor, viz. that out of several hundreds of cases which occurred in the British army during the late campaigns in Spain and Portugal, there were very few which terminated successfully, or in which the remedies, however varied, seemed to have any beneficial influence, after the disease had made progress. (*Med. Chir. Trans.* vol. vi. p. 449.) In the same countries, Dr. O'Beirne witnessed two hundred cases, not one of which recovered. (*Dubl. Hospital Reports*, vol. iii.) Hennen acknowledges, that he never saw a case of "acute symptomatic tetanus" recover; and, with respect to the same form of disease, Dr. Dickson states, that he found all plans of treatment followed by unqualified disappointment.

The possibility of doing good by internal medicines is sometimes totally prevented by the inability of swallowing. In short, the present state of our knowledge respecting tetanus will not allow us to indulge much hope of cure from any means yet discovered, except in the chronic form of the complaint; the instances of success in the treatment of acute tetanus being by no means numerous, and not the result of any determinate plan of treatment.

Of all medicines, opium is that which has raised the greatest expectation, and been the most extensively tried. Indeed, there cannot be a doubt, that, in many chronic, mild cases, it is competent to effect a cure. But, for this purpose, it is absolutely necessary, that its use be begun from the earliest appearance of the symptoms; that it be given in very large doses; and that the doses be repeated at short intervals, so that the system be kept constantly under the influence of the remedy. It is, indeed, astonishing how the system, when labouring under a tetanic disease, will resist the operation of this and other remedies, which, in its ordinary state, would have been more than sufficient to overpower and destroy it. Patients with tetanus will bear, with impunity, quantities of opium, which at any other time would be certainly fatal. Instances are upon record of five, ten, and even twenty grains, being taken every two or three hours, for many days, without any extraordinary narcotic effects being produced upon the sensorium. It is always advisable, however, to begin with comparatively moderate doses, such as forty or sixty drops of the tincture of opium, which may be repeated at intervals of three or four hours, and increased at each repetition, until some sensible effect is produced on the spasms. It seems requisite to augment the dose rapidly, as the disease presses upon us every hour, and no time must be lost while there is yet a chance of controlling its fury. The approaching closure of the jaw, and difficulty of deglutition, which may increase so as to render it hardly possible to introduce medicines into the stomach, are additional motives for pushing our remedies before such obstacles arise. (*Rees's Cyclopædia*, art. *Tetanus*.) I once supposed it possible to overcome this impediment by introducing a flexible catheter down the oesophagus from one of the nostrils; but the at-

tempt to do this always brings on a violent paroxysm of spasms, attended with such a sense of suffocation that it cannot be endured. The experience of the late Mr. Cruttwell, of Bath, and that of Baron Larrey, fully prove that no assistance can be derived from the use of flexible tubes. (See *Mém de Chir. Militaire*, t. i. p. 247.) Sometimes, however, the obstacle to the administration of medicines, arising from the closure of the jaw, is prevented by loss of some of the incisor teeth, and, in a few instances, Baron Larrey adopted the plan of extracting two of them. This would be useless, however, when deglutition is totally hindered, as happened in one instance recorded by the latter eminent surgeon. (*Op. cit.* t. iii. p. 301.) Clysters are the only resource, when the spasm of the fauces cannot be overcome. In this way, as much as a drachm of the extract of opium has been introduced into the bowels at one dose. Opiate frictions upon the jaws, throat, and other parts of the body, have been practised. Opiate plasters have also been applied to the masseter muscles, and behind the ears. This external use of opium, however, can only be regarded as a feeble, and probably useless means.

A curious fact, noticed by Abernethy, seems to offer some explanation of the little effect of some of the most powerful medicines in tetanus: on opening the stomach of a patient, who had died of tetanus, after taking large doses of opium, thirty drachms of this substance were found undissolved in the stomach.

I believe it to be now generally admitted, that opium answers only in the milder or idiopathic form of the disease. The testimony of Rush, Macgrigor, and Fournier-Pescay, is decidedly against the efficacy of this medicine in other examples of tetanus.

As the costiveness, always produced by tetanus, is rendered still more obstinate by opium, laxative medicines and clysters should constantly accompany its employment. It is on this ground, that opium is frequently objected to as rather injurious. The testimony of the army physicians, as we learn from the report of Sir James Macgrigor, is highly in favour of a rigid perseverance in the use of purgatives, given in adequate doses to produce daily a full effect. Dr. Forbes states, that a solution of sulphate of magnesia, in infusion of senna, was found to answer better than any other purgative; and it was daily given in a sufficient quantity to procure a copious evacuation, which was always dark-coloured and highly offensive; and to this practice he chiefly attributes, in one severe case, the removal of the disease. (*Med. Chir. Trans.* vol. vi. p. 452.) Dr. Good condemns drastic purgatives, seemingly in forgetfulness that mild ones have no effect. Strong cathartics have, indeed, frequently proved of great service, and none has higher repute than croton oil. Thus, in a case recorded by Dr. Briggs, half a drachm of calomel, as much scammony, and fifteen grains of gamboge, were given in one dose, followed by a clyster of half an ounce of turpentine, and two drachms of aloes. As these powerful means produced the effect, two drops of the oil of croton were given in the evening, and a clyster of four ounces of sulphate of magnesia in a pint of infusion of senna. In less than an hour, a black stool was voided, and relief immediately experienced. (*Edinb. Med. Journ.* No. 85. p. 277.)

A spasmodic rigidity of the muscles being the most prominent symptom of tetanus, it was natural for practitioners to try the efficacy of some other antispasmodic medicines besides opium; and these, which have been principally the subject of experiment, are castoreum, ether, the conium maculatum, musk, camphor, and latterly the digitalis. In many cases, opium and camphor have been exhibited together. Indeed, Larrey asserts that, of all the medicines hitherto proposed by skilful practitioners, the extract of opium combined with camphor, and the nitrate of potassa, dissolved in a small quantity of the almond emulsion, and given in doses, more or less strong, produces the most favourable effects, since patients, who have an aversion to other fluids, take with pleasure this mixture, the action of which must be promoted by bleeding, if necessary, and blisters, under the circumstances which have been specified. (See *Mém. de Chir. Militaire*, t. i. p. 271.) In the same work, several cases are detailed, which were benefited by such treatment.

Although some practitioners have fancied that they saw good effects result from musk, yet the majority, who have made trial of both this and camphor, in cases of tetanus, have found no reason to recommend these medicines. One hundred and fifty grains of musk were given, in the space of twelve hours, to a girl thirteen years old, affected with incipient tetanus; but no salutary effect was produced.

We learn also from Sir James Macgrigor, that ether, camphor, musk, and other antispasmodics, as likewise the alkalies, were tried by our military surgeons in Spain, and found unsuccessful. (*Médecine-Chir. Trans.* vol. vi. p. 458.)

From the same authority we find, that digitalis, in large doses, was tried in several cases in the Peninsula; and that it, with several other medicines enumerated, failed in almost every case of acute tetanus which occurred. (P. 454.) In one case, the jaw remained fixed to the last, and the patient was never entirely free from spasms. (P. 458.) Prussic acid and belladonna have been tried, but do not retain at present many advocates in this country. Prussic acid was tried, however, by Dr. Reese, in America, in combination with the application of caustic along the spine, and the patient recovered.

Analogy has led to the employment of the warm bath, as a plan which seemed to promise great benefit, by producing a relaxation of the contracted muscles. But, notwithstanding this means has appeared, in a few instances, to occasion some little relief, particularly when the practitioner has been content with mere fomentations, it generally fails, and often has even done mischief. This may perhaps be, in some measure, ascribable to the disturbance and motion which the patient must necessarily undergo in order to get into the bath; for it is very well known, that every exertion on the part of the patient is apt to excite most violent paroxysms of spasms. The author of the article *Tetanus*, in the *Encyclopédie Méthodique*, had seen the warm bath do harm in two or three cases, in which it was expected to have done good. Though numerous writers have recommended the trial of the plan, it would be difficult to trace, in their accounts, any facts, which decidedly show that its adoption was ever followed by unequivocal benefit. The warm bath

was tried in Spain, and found to produce only momentary relief. (*Medico-Chir. Trans.* vol. vi. p. 457.) Dr. Hillary, who practised a long while in the warm climate of America, where tetanus is very common, disapproves of this method of treatment. He observes, that, although the use of the warm bath may appear to be very rational, and promise to be useful, he always found it much less serviceable than emollient and antispasmodic fomentations; and he also mentions, that he had sometimes seen patients die the very moment when they came out of the bath, notwithstanding they had not been in it more than twenty minutes, the temperature of the water being likewise not higher, than 29 or 30 of Reaumur's thermometer, (See *Hillary on the Air and Diseases of Barbadoes*.) De Haen also relates a similar fact of a patient dying the instant he was taken out of the warm bath.

Hippocrates was an advocate for the application of cold water. The advantages of the cold bath were first particularly explained by Dr. Cochrane, in the *Edinb. Medical Commentaries*; and the plan subsequently received the praises of Dr. Wright, Dr. Currie of Liverpool, and others. Of all the remedies which have been employed in cases of tetanus, the cold bath is represented by some authors as that which has been attended with the greatest success. Dr. Wright published, in the *Med. Obs. and Inq.* vol. vi. a paper, containing a narrative of the first trials of this method, which were all successful. The plan is said to be preferred throughout the West Indies. It consists in plunging the patient in cold water, and in that of the sea, when at hand, in preference to any other, or else in throwing from a certain height several pails of cold water over his body. After this has been done, he is to be very carefully dried with a towel, and put to bed, where he should only be lightly covered with clothes, and take twenty or thirty drops of laudanum. The symptoms usually seem to give way, in a certain degree, but the relief which the patient experiences is not of long duration, and it is necessary to repeat the same measures at the end of three or four hours. They are to be repeated in this manner, until the intervals of freedom from the attacks of the disorder increase in length. This desirable event, it is said, generally soon follows, and ends in a perfect cure. Wine and bark were sometimes conjoined with the foregoing means, and seemed to co-operate in the production of the good effects. Dr. Wright concludes the account with the following remark, sent to him with a case, by Mr. Drummond, of Jamaica:—"I am of opinion, that opiates and the cold bath will answer every intention in tetanus and such like diseases; for whilst the opium diminishes the irritability, and gives a truce from the violent symptoms, the cold bath produces that wonderful tonic effect, so observable in this and some other cases. Perhaps the bark, joined with these, would render the cure more certain. May we not then have failed in many cases, by using opiates alone in large doses, or, what probably is worse, with the warm bath, instead of the cold bath? And have we not reason to suspect, that the increased doses of opium, which seemed requisite when the warm bath was used, may have proved pernicious?" (Vol. vi. p. 161.)

Our army surgeons, however, who were in Spain, found the cold bath worse than useless,

(*Med. Chir. Trans.* vol. vi. p. 254.) Dr. Parry's testimony is almost as condemnatory of it. Mr. Morgan relates an instance that occurred in St. Thomas's Hospital, in which a tetanic patient was plunged into a cold bath at his own request; all the symptoms disappeared in a moment, and he was almost immediately taken out of the bath; but he was taken out lifeless." (*Lecture on Tetanus, &c.*) Dr. Elliotson also relates a case, in which, after a pail or two of water had been dashed upon the body, the patient fell down dead, as if shot. Here I beg to remark particularly, that the plan seems to present no hope of benefit in cases of tetanus from wounds, however strong the evidence may be of its utility in other examples of the disease. This was the opinion of Hippocrates, and, in modern times, that of Dr. Cullen, Callisen, &c. "Immersio subita iterata totius corporis in aquam frigidam in tetano a causa interna mire prodest, in tetano a causa externa minorem effectum præstat." (*Systema Chirurgiæ Hodiernæ*, part i. pp. 169, 170. edit. 1798.) On the subject of cold effusion and bathing, there are on record two cases, which are curious. One is related by Baron Larrey. It was an instance of tetanus from a gunshot wound. The cold bath was used. The two first trials gave the patient extreme pain, and no amendment followed. The sight of the bath the next time filled him with an invincible dread of the water, into which he refused to be put. He was covered, however, with a blanket, and immersed. The tetanic stiffness was immediately increased, and dreadful convulsions excited. It became necessary to remove him directly from the bath, and put him to bed. Deglutition was from this moment utterly impeded, and the contraction of the muscles carried to the most violent degree. A tumour, about as large as an egg, suddenly made its appearance near the linea alba, below the navel. After death, this was found to be caused by a rupture of one of the recti muscles, and a consequent extravasation of blood. (See *Mém. de Chir. Mil.* t. iii. p. 287—289.) This case is decidedly in support of the truth of the sentiment expressed on this subject by Hippocrates, Cullen, and Callisen. The next is not so: it is mentioned by Sir James Macgrigor, that, in the march of the Guards through Galicia, one of them was attacked with tetanus, in consequence of a slight wound of the finger. As it was impossible to think of leaving the man in the wretched village where he was taken ill, he was carried on a bullock car, in the rear of the battalion. During the first part of the day he was drenched with rain, the thermometer standing at 52°; but, after ascending one of the highest mountains in Galicia, the patient was in a cold of 30°; to which he was exposed from six in the morning till ten at night, when he was found half starved to death, but free from every symptom of tetanus. (See *Med. Chir. Trans.* vol. vi. p. 450.)

Mr. Abernethy, in his lectures, expresses his conviction, that in tetanus, and all nervous affections, it is a most material point to operate on the brain, through the medium of the digestive organs, and that the production of secretions from the alimentary canal has a more beneficial effect than any other means. He particularly commends the exhibition of calomel and jalap, mixed with treacle, as answering better than salts. Where much difficulty occurs in making the patient swallow common purgative medicines, I would strongly

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recommend to the recollection of practitioners, the oleum tiglii, a drop of which, blended with a little mucilage, and put on the root of the tongue, will operate powerfully on the bowels.

Another remedy, said to have frequently effected a cure in tetanus, is mercury. (See *Journ. de Méd.* p. 45.) Mercurial frictions, practised so as to bring on a quick affection of the mouth, and in an early stage of the disorder, are preferred. Others contend, that it matters not whether mercury be rubbed into the body or given internally. It is generally allowed, that opium may be advantageously exhibited at the same time. This practice was first adopted in the West Indies (see *Edinb. Physical and Literary Essays*, vol. iii.), where it succeeded in many cases. Whatever benefit, however, may have been experienced from this plan in mild cases, it completely fails in the acute form of the disease. In Egypt mercurial frictions appeared to Baron Larrey to aggravate the symptoms. (*Mém. de Chir. Mil.* t. i. p. 257.); and Dr. Emery, Mr. Guthrie, and other medical officers, attached to our army in the Peninsula, tried inunction of the whole body, three times a day, with strong mercurial ointment, in unlimited quantity, with no degree of success. After the battle of Toulouse, a fatal case even occurred in a man strongly under the influence of mercury, which he had been previously using for the cure of the itch. (Sir J. Macgrigor, in *Med. Chir. Trans.* vol. vi. p. 454.) I have repeatedly seen mercury tried, and almost invariably without success. The submuriate of mercury, combined with ipecacuanha, is also generally inefficacious in acute cases; but, in chronic ones, it proves serviceable by keeping open the bowels.

Another method of treating tetanus is that of administering the most powerful tonics and stimulants, such as wine, brandy æther, preparations of ammonia, bark, cordials, &c. The introduction of this plan was chiefly owing to the eminent Dr. Rush, Professor of Medicine in Philadelphia, who published, in the *Trans. of the American Philos. Society*, vol. ii., a paper entitled, "*Obs. on the Cause and Cure of Tetanus*." Dr. Rush considers tetanus as a disease essentially connected with debility, and he recommends for it the exhibition of the preceding class of remedies. He particularly advises the liberal use of wine and Peruvian bark; and, as we have already stated, when tetanus arises from a wound, he directs the dilatation of it, and dressing with oil of turpentine. Considerable success is represented as having attended the practice. Several other instances of success are also recorded by Dr. Hosack. (*American Medical Repository*, vol. iii.)

Dr. Elliotson, considering neuralgia, paralysis agitans, chorea, and tetanus, to be "affections of the nerves, or of those parts of the brain and spinal marrow which are immediately connected with them," was induced to try the effect of subcarbonate of iron in three examples of traumatic tetanus, in consequence of the success with which it had been exhibited in the other complaints above specified. Constiveness was obviated by giving ʒij of the *ol. terebinthinæ*, followed, when requisite, by the *ol. ricini*. The subcarbonate of iron was given in doses of ʒij. and even half an ounce, two hours. It was mixed with twice its of treacle; and blended with strong
Two of the cases recovered; the third,

which was one where the spasms were excessively violent, and the pulse 140, was too rapid in its progress for an effectual trial of the remedy, the patient dying the day after commencement of the plan. (See *Med. Chir. Trans.* vol. xv. p. 161, &c.) I tried the subcarbonate in one case of traumatic tetanus, but it was in an advanced stage, and the patient died on the following day. According to Dr. Elliotson, it has been given in the West Indies with considerable success.

Nothing is a more certain proof of our not being acquainted with any very effectual method of treating a disease, than the multiplicity of remedies, which are as opposite as possible in their effects. We have seen that Dr. Rush conceived, that tetanus was a disease connected with debility; and he has recorded examples, in which it was successfully treated with tonics and stimulants. Dr. Bright has lately published a case, in which the free exhibition of sulphate of quinine, with bark and stimulants, was followed by the patient's recovery. (See *Guy's Hospital Reports*, vol. i.) We learn from Dr. Reese, that there are, in America very many surgeons who pursue the stimulating plan of Dr. Rush: "among these is Professor Hosack, who relies upon Madeira wine; while there are many others who adopt the opposite theory, and not only bleed unsparingly, but combine the whole antiphlogistic battery; and instances of their success are reported, quite as numerous as those of the opposite theory and practice." (See Amer. ed. of this *Dictionary*, part 2. p. 346.) Many practitioners are advocates for venesection, especially in the early stage of tetanus. Dr. Dickson thinks, that, in a full habit, where the wound is swelled, inflamed, and painful, venesection, with free purging, and such other means as are calculated to allay the general and local irritation, affords the fairest chance of averting the danger. (See *Med. Chir. Trans.* vol. vii. part 2.) Larrey has also published several cases, in which bleeding had a good effect. We are informed by Sir James Macgrigor, that, in our military hospitals in Spain, venesection had a fair trial. In three cases at St. Andero, detailed by Mr. Guthrie, this was the principal remedy. One patient with tetanus, from a wound of the back part of the hand, was bled nearly *ad deliquium* several times with good effect, calomel and diaphoretics being also given, and he recovered. Another patient was bled in the same manner with such amendment, that he suffered but little from spasm, and could open his mouth very well, when he was seized with diarrhoea, which, in his debilitated state, carried him off. In the third case, which was one of acute tetanus, venesection, pushed to the utmost, totally failed. (*Op. cit.* vol. vi. p. 455, 456.)

Sir Astley Cooper represents bleeding as hurtful in tetanus, and I have seen cases in which it seemed to me to shorten the patient's life. Dr. Elliotson pronounces bleeding not to be of any service, unless the wound be inflamed, or there be some decided internal inflammation present, or the patient is in a state of plethora.

The powerfully relaxing effect of tobacco clysters, in hernia and enteritis, suggested a trial of them in tetanus. This plan is strongly recommended by Dr. O'Beirne, (see *Dublin Hospital Reports*, vol. iii.) and Dr. Anderson, of Port Spain, Trinidad. (See *Edinb. Med. Chir. Trans.*

vol. i. p. 187.) In one very acute case, the plan was tried by Mr. Earle, but it only afforded a temporary alleviation of the spasms, and, as it caused severe agitation, it was discontinued. According to Sir James Macgrigor, tobacco clysters, tried in the advanced stage of the disease, seemed to have no effect. He considers tobacco fume, however, as deserving further trial.

A remarkable case is recorded by Dr. Phillips, in which the jaw suddenly fell, upon the exhibition of an enema with oil of turpentine. (See *Med. Chir. Trans.* vol. vi. p. 65.)

According to Baron Larrey, frictions, with oily liniments, as recommended by some authors, were tried by the French surgeons at Cairo; but they produced no change in the state of the disease. We learn, from the same authority, that the application of blisters to the throat also failed in checking the symptoms.

The Barbadoes tar, mentioned by Cullen, electricity, the colchicum autumnale, recommended by Dufresnoy, and several other means formerly in repute for tetanus, have now been fully proved by experience to possess little or no claim to this character.

In consequence of the general failure of all remedies hitherto tried in acute tetanus, Mr. Morgan proposes to introduce into the system a substance which has the property of producing on the nervous system a condition directly opposite to that which is developed in tetanus, viz. paralysis. In support of the plausibility of this scheme, he adduces some experiments, in which the artificial tetanus, induced by inserting into the wound a poison called, "chatic," and obtained from Java, was removed or abated by the counteraction of ticunas, a North American poison.

From the share which the state of the medulla spinalis is conceived to have in the production of the disease, the practice of applying a blister the whole length of the spine has been derived. Dr. Reid is an advocate for this practice, combined with the employment of powerful cathartics. (See *Trans. of King's and Queen's College of Physicians*, vol. i. p. 122.) The same plan, dressing the part with tartar emetic ointment, and purging, are the chief remedies advised by some others. (See *Sym's Paper in Glasgow Med. Journ.* vol. iii.)

After adverting to the opposite modes of stimulant and antiphlogistic treatment, sometimes followed in America, Dr. Reese informs us, that of late, the practice in that country has very much changed, extensive vesication, especially on the region of the spine being very generally relied upon, and with singular success. "One of the most severe cases of tetanus (says he) I ever witnessed, arose from a gunshot wound, a load of shot having entered the back and penetrated into the dorsal and lumbar vertebrae." The disease speedily assumed the form of opisthotonos, and was treated by the application of caustic potash to the spine, from the cervical vertebrae to the sacrum. About an inch in width of the skin was destroyed all the way down, and the only internal medicines relied on were prussic acid, in large doses, and elaterium as a cathartic. The case had a successful termination. (See *Amer. Med. Recorder* for 1825, and Reese's ed. of this Dictionary, part ii. p. 346.)

Cupping and leeching the spine have also been resorted to, and occasionally found useful.

I have known one or two cases of chronic tetanus get well during the free exhibition of tartarated antimony, but I have more frequently seen it fail.

Consult Hippocrates de Morbis Popularibus, lib. v. et. vii. *Celsus Aurelianus* De Morbis acutis. Med. Obs. and Inq. vol. i. p. 1, 87.; vol. vi. p. 143. *Hillary* On the Air and Diseases of Barbadoes, 8vo. 1765. Edin. *Physiocal and Literary Essays*, vol. iii. Dr. *Cavert*, in Medical Trans. Dr. *Cochrane*, in Edin. Medical Commentaries. *Cullen's* First Lines of the Practice of Physic, vol. iii. *Rush*, On the Cause and Cure of Tetanus, in vol. ii. of Trans. of the American Philosophical Society. *Sir Gilbert Blanc*, On the Diseases of Seamen, ed. 3. M. *Ward*, Facts establishing the efficacy of the Oplute Friction in Spasmodic and Febrile Diseases, &c. 8vo. Manchester, 1809. *Larrey*, Mémoires de Chir. Militaire, t. i. p. 235. &c.; t. iii. p. 236, &c. *Calliæus*, Systema Chirurgiæ Hodiernæ, pars i. p. 163, &c. *Sir James Macgrigor*, in Med. Chir. Trans. vol. vi. p. 449, &c. Dr. *Phillip's* Case in the same work and volume, p. 65. *Dr. Dickson's* Observations on Tetanus, and *Dr. Macarthur's* Letter in vol. vii. p. 448, &c. of the same book. *Tranka de Krowitz*, De Tetano Commentarius, Vindob. 1777. *Richerand*, Nosogr. Chir. t. ii. p. 338, &c. ed. iv. Edinb. Med. and Surgical Journal, vol. i. p. 67. vol. ii. p. 256-430; vol. iv. p. 46, &c. &c. *Boyer*, Mal. Chir. t. i. p. 285, &c. Paris, 1814. *Rees's* Cyclopædia, art. Tetanus. C. H. *Parry*, Cases of Tetanus, and Rabies Contagiosa, &c. 8vo. Lond. 1814. *John Morrison*, On Tetanus, 8vo. Newry, 1816. *Robert Reid*, On Tetanus and Hydrophobia, 8vo. Dublin 1817. *Stewart*, in Med. Chir. Journ. Oil of Turpentine tried. *Sir Astley Cooper*, Surgical Essays, pt. ii. p. 190. *Burnmaster*, in Med. Chir. Trans. vol. xi. *Elliotson*, Op. cit. vol. xv. and in Lectures. *Morgan*, Lecture on Tetanus, 1833. *Abercrombie*, On the Brain and Spinal Cord, p. 395. *Fournier-Pescay*, Dict. des Sc. Méd. t. iv. *Desportes*, Hist. des. Mal. de St. Dominge, t. ii. p. 171. *O'Bernie*, in Dublin Hospital Reports, vol. iii. *Jennens's* Military Surgery. *Good's* Study of Med. vol. iii. ed. 4. T. B. *Curling*, On Tetanus, 8vo. *Currie's* Med. Reports, vol. i. p. 148.

THORAX, WOUNDS OF. See WOUNDS OF THE THORAX.

THROAT, WOUNDS OF, are often attended with considerable danger, on account of the great number of important parts liable to be implicated; but mere cuts of the integuments of the throat and neck are not, generally speaking, dangerous, and do not materially differ from common incised wounds of the skin in any other part of the body. They are not liable to be followed by any particular consequences, and require the same kind of treatment as cuts in general. (See WOUNDS — INCISED WOUNDS.)

In wounds of the throat and neck, however, the larynx and trachea, pharynx and œsophagus, the common carotid artery, and all the principal branches of the external carotid, the jugular vein, the pneumogastric nerve, the descendens noni, the laryngeal nerves, are all exposed to injury; some much more so than others, but all of being occasionally reached by the edge of the knife, or razor, or the point of the sword, or other instruments.

It would be absurdity to offer an account of what is to be done in cases attended with some part of the mischief above pointed out; for no patient, thus wounded, would ever be found alive. A wound of the pneumogastric nerve was generally considered fatal, though some doubts begin to be entertained on the point. Indeed, Klein positively states, that such an injury is not fatal. (See *Journ. der Chir.* b. i. p. 123. 8vo. Berlin, 1820.) However, if the wound of one of these nerves be not absolutely fatal, there can be no doubt of its being highly perilous. The nerve, as is well known, proceeds down the neck, in the same sheath which includes the carotid

artery, lying between the artery and the internal jugular vein.

A wound of the carotid artery must generally prove immediately fatal, in consequence of the great and sudden loss of blood. However, were any surgeon on the spot at the moment, he should instantly secure the vessel. In tying the carotid, one caution is highly necessary, viz. always to be sure that the pneumogastric nerve is excluded from the ligature; for were this nerve to be tied, the mistake, if not absolutely mortal, would leave but a slight possibility of recovery.

If the mouth of the vessel could not be at once secured, pressure should be instantly resorted to, for the purpose of inducing a temporary suppression of the hemorrhage. The surgeon should then either make the necessary enlargement of the wound in the integuments, with a due and constant recollection of the important parts near the vessel, or in the case of the carotid being punctured, he should cut down to this vessel in the manner explained in the article ANEURISM.

In lacerated wounds, the carotid artery may be injured, and yet the patient not immediately bleed to death; for it is the nature of all wounds, attended with much laceration and contusion, not to bleed so freely as clean cuts. Abernethy has related a case, in which the carotid, and all the chief branches of it, were wounded in a man, who was gored in the neck with a cow's horn; yet death did not directly follow, and there was time to have recourse to the ligature. Baron Larrey even reports one or two cases in which the bleeding from the carotid, injured by gunshot, was permanently stopped by pressure. (See *Mém. de Chir. Mil.*) Dr. Hennen refers to another instance of a similar nature. (On *Military Surgery*, p. 106. ed. 2.)

Punctured wounds might obviously injure the carotid, or the internal jugular vein, without the patient expiring of hemorrhage at once; because the smallness of the wound in the skin might hinder the fatal effusion of blood. Moderate pressure would also arrest the venous hemorrhage, and thus the patient might be permanently saved.

Persons who attempt suicide, by cutting their throats, do not often divide the carotid artery, on account of their incision being made too high up. Where the carotid arteries emerge from the chest, they are situated by the side of the trachea, and even a little more forward than it. However, as these vessels proceed up the neck, they become more laterally situated with respect to the wind-pipe; and when they have arrived at the upper part of the neck, where persons, who aim at suicide, almost always cut, they become situated more backward than the trachea, inclining towards the angle of the lower jaw.

The œsophagus is so deeply situated, lying close to the bodies of the vertebrae, and behind the trachea, that one might *a priori* expect that it would not often be concerned in any incised wounds, which do not immediately prove fatal, in consequence of the division of other important parts. Yet numerous cases are recorded, in which the œsophagus is said to have been wounded; and what is usually set down as a criterion of the fact, is the passage of victuals through the wound. In many of these instances, the writers seem to have forgotten, that made above the hyoid bone as they fre-

lage, may penetrate to the fauces, and the victuals escape through the cut without the œsophagus or pharynx being really involved. A case of the latter kind was lately brought to University College Hospital, attended with complete detachment of the epiglottis. The patient lived but a few hours. (See EPIGLOTTIS.)

I have seen several cases in which the œsophagus was wounded, together with the trachea, not only without the patient perishing so immediately as to be incapable of receiving any succour, but without every chance of recovery being destroyed. Stabs and gunshot wounds may injure the œsophagus, and leave all other important parts untouched. Nay, when other parts of consequence are injured, the patient is sometimes saved. (See *Hennen's Military Surgery*, p. 363. ed. 2.)

Even when the œsophagus is known to be wounded, its deep situation would prohibit us from doing any thing to the breach of continuity in the tube itself. The best plan would be to have recourse to antiphlogistic means, and to introduce a flexible elastic gum catheter, from one of the nostrils into the œsophagus, for the purpose of conveying nourishment and medicines into the stomach, without any risk of their passing out at the wound. An instrument of this kind will lie in the above situation for any length of time, without occasioning much inconvenience; and, besides being advantageous for injecting nourishment and medicines down the passage, and keeping them from issuing through the wound, it prevents all necessity for the wounded œsophagus to act, and become disturbed by the action of the muscles of deglutition, when there is occasion to take any kind of liquids, whether in the way of medicine or food. The outer wound should be brought together, and treated on common principles.

When persons cut their throats, as I have explained, they do not often divide the carotid artery, owing to their incision being usually made high up in the neck, where this vessel has attained a more backward situation. When any serious hemorrhage does arise, it is sometimes from the lower branches of the lingual artery, but more frequently from the superior thyroid arteries. Such arteries may occasion a fatal bleeding, which indeed, would more frequently be the event than it actually is, did not the patient often faint, in which state the bleeding spontaneously ceases, and gives time for the arrival of surgical assistance. I need hardly observe, that these arteries are to be tied, and that this important object is the first, to which the surgeon should direct his attention. The danger of bleeding to death being obviated, as soon as possible, the other requisite measures may be more deliberately executed.

With respect to extensive wounds of the trachea, or larynx, the same plan of conveying food and medicines into the stomach, through an elastic gum catheter, introduced from one of the nostrils down the œsophagus, is highly proper, though too much neglected; for nothing creates such disturbance of the wound as the convulsive elevation and depression of the larynx and trachea in the act of swallowing.

When the larynx or trachea is cut, the patient's power of forming the voice is more or less impaired, in consequence of the air passing into and out of the lungs, chiefly through the wound. Besides air, a considerable quantity of the natural

mucus of the passage is also continually coming out of the wound.

The grand means of healing wounds of the larynx and trachea, are a proper position of the head, and a rigorous observance of quietude. By raising the patient's head with pillows, and keeping his chin close to his breast, the edges of the wound in the skin and in the trachea or larynx, are placed in contact, even without any other assistance, unless the division be exceedingly large. Some surgeons endeavour to promote the effect of a suitable position with strips of sticking plaster, and sometimes with a suture or two, but not always. These strips, however, are not perhaps of much utility at first, and many practitioners omit them altogether. On this point, Mr. Liston believes that "no purpose is to be gained by closing the wound accurately by stitches and plasters. If it extend laterally to a great extent, a single point of suture may be inserted near each extremity, of course only *through the integument*; but the centre cannot heal, and no attempt need or ought to be made to close it. (*On Practical Surgery*, p. 339). But the necessity for sutures must depend on the extent of the division; for unless most of the circle of the larynx or trachea be cut, and position be neglected, the wound in it will not gape. The stitches should never be passed through the lining of the trachea, as this method would be likely to make it inflame, and occasion considerable coughing and irritation, attended with pernicious effects.

The plan of completely closing wounds of the larynx and trachea with sutures, is much less frequently followed at the present day than formerly. I have seen many cases in which the patient would have died of suffocation, if the stitches had not been quickly removed. Perhaps no surgical writer has insisted upon this danger so much as Mr. Liston. "The immediate apposition of the divided surfaces, (he observes,) is attended with great danger, the blood, as it flows from the vessels, and encouraged by the confinement of soft coagulum, passes by suction into the windpipe: some of it may be ejected; but the lower part of the tube is not very irritable, and the power of coughing is diminished, so that great part trickles down, and fills gradually the extreme branches of the tube. The breathing is quickened and slightly embarrassed; yet every thing may be supposed to promise well: the patient, however, in making some slight exertion, without warning to the inexperienced, falls suddenly into a state of asphyxia, and is lost. The same thing happens at a later period from the secretion of serum, or the accumulation of mucus." A case then follows, in which a young woman in University College Hospital, who cut her throat, and had had the irregular incision in thyroid cartilage closely sewed up previously to her admission, was at the point of death from asphyxia from this cause and the further interruption of respiration by a clot of blood. The patient was saved by instantly cutting the stitches and taking away the coagulum. "By position of the head, by approximating the chin to the top of the sternum, securing it there by the turn of a double-headed roller, the ends being fixed to a band embracing the chest, gaping and retraction of the edges are prevented, and the parts put in a favourable state for union by the second intention. So long as air passes through the wound, no dressing need be applied, the discharges being wiped

away, and the neck covered "with a muslin or gauze handkerchief, a worsted comforter, or Jeffrey's respirator." (*See Liston on Practical Surgery*, p. 338—40.)

Mr. Liston notices an error sometimes committed of feeding the patient through the wound in the neck, and not promoting the healing of the part by position, so that the surfaces cicatrize separately. "The voice is consequently lost, the patient is rendered perfectly incapable of exertion, not having any control over his respiration, and being thus unable to keep his chest expanded. The patient is moreover put in great jeopardy; he is subject to bronchitic attacks, and to inflammatory oedema, of the orifice through which the air enters. He may thus be cut off suddenly if in the hands of ill informed or inexperienced surgeons, or he may be worn out by cough, and profuse expectoration. It is possible occasionally to remedy even such mismanaged cases; the contracted air-passage above may be widened by the introduction of instruments, and the edges of the wound pared and brought together." (*Op. cit.* p. 341.)

When from the obstruction of the rima glottidis by swelling of the lining of the larynx, respiration is dangerously interrupted, the wound in the trachea not being free, or even being nearly closed, tracheotomy or the enlargement of the original wound, together with the use of a tube, may be necessary to save the patient's life.

A few surgeons entertain considerable apprehension about the ill effects of the entrance of unwarmed atmospheric air into the air-passages. It is not a doctrine, however, to which the generality of the hospital surgeons of London attach any importance.

It appears from the investigations of M. Velpeau, that wounds in the thyro-hyoid space are more difficult to heal and more likely to become fistulous than others affecting the larynx or trachea. The healing of such fistulous opening is also less easily accomplished. The practice of M. Velpeau, for the relief of this case, consists in taking a flap of skin from the front of the larynx, paring off the edges of the fistulous opening, and fixing the flap correctly with the twisted suture. Many interesting particulars, respecting this plan, are detailed by M. Velpeau in his tract "*Des Fistules Aériformes, et de la Broncho-Plastique*."

Should there be much coughing, apparently arising from inflammation in the larynx or trachea, bleeding is proper. The spermaceti mixture, with opium, is frequently of great service. I never saw a wound of the trachea unite by the first intention.

See *John Bell, On Wounds*, ed. 3. *Hennen's Military Surgery*, p. 356, &c. ed. 2. 8vo. Edinb. 1820. Amongst other references made by Dr. Hennen, the following seem to me to merit particular notice:—An interesting case of wound of the neck, succeeded by hemiplegia, and another of gunshot wound of the throat, succeeded by paralysis and convulsions, are given by *Forestus* in his *Surgical Observations*. Another, with loss of motion in the arm, from a wound in the neck, is to be found in the *Edin. Med. Essays*, vol. i. And in the *Med. Commentaries*, by *Dr. Duncan*, vol. iv. p. 434. and vol. vii. p. 366., are two interesting cases. *Mursinna*, in his *Med. Chir. Beobachtungen*, relates a case of removal of the thyroid gland by a cannon-ball; the patient survived fourteen days, and died of dysentery. Wounds of the oesophagus often remain open for an indeterminate period, as is exemplified in a case reported by *Tricou*, in his *Fasciculus Observationum*, p. 40. Lugd. 1745. *Mr. Bruce* has recorded an interesting case of wound of the oesophagus, in *Med. Chir. Journ.* vol. i. p. 369. I would also refer to various

parts of Mém. de Chir. Milit. et Clinique, t. iv., of *Baron Larrey*. *Thomson's* Report of Obs. made in Mil. Hospital, in Belgium, 8vo. Edin. 1816. *Robert Liston*, On Practical Surgery, 8vo. Lond. 1837. *W. H. Porter*, On the Surgical Pathology of the Larynx and Trachea, 8vo. Lond. 1837. *F. Ryland*, On the Diseases, &c. of the Larynx and Trachea, 8vo. Lond. 1837.

THROMBUS. (from *θρόμβος*, coagulated blood.) A clot of blood. The term is also applied to a tumour, formed by a collection of extravasated, coagulated blood, under the integuments after bleeding. When not considerable, it is usually called an *ecchymosis*.

A thrombus, after bleeding, generally arises from the opening in the vein not corresponding to that in the skin. The patient's altering the posture of his arm, while the blood is flowing into the basin, will often cause an interruption to the escape of the fluid from the external orifice of the puncture; and consequently it insinuates itself into the cellular substance in the vicinity of the opening in the vein. In proportion as the blood issues from the vessel, it is effused in the cellular membrane between the skin and fascia; and this with more or less rapidity, and in a greater or less quantity, according as the edges of the skin more or less impede the outward escape of the fluid. Sometimes, also, a thrombus forms after venesection, when the usual dressings, compress and bandage, have been put over the puncture, and the patient imprudently makes use of the arm on which the operation has been performed.

When the extravasation is not copious, it is of little importance, for the tumour generally admits of being easily resolved, by applying linen dipped in any discutient lotion.

It sometimes happens, that a thrombus induces inflammation and suppuration of the edges of the puncture. The treatment is now like that of any little abscess: a common linseed poultice may be applied, and a considerable accumulation of matter prevented by making an opening with a lancet in proper time. As soon as the inflammatory symptoms have ceased, discutients should be employed again, for the purpose of dispersing the remaining clots of blood, and surrounding induration.

When the quantity of blood is large, many authors recommend opening the tumour at once; and despairing of the power of the absorbents to remove the extravasation, they direct as much of the blood as possible to be pressed out of the incision. However, the making of an opening is seldom necessary, and often brings on inflammation and suppuration, when they might be avoided. I have never seen any case in which this practice seemed necessary.

THYROID GLAND, DISEASED. (See BRONCHOCLE.)

THYROID GLAND, EXTIRPATION OF. That such an operation, though attended with great difficulties, is not impracticable, is proved by the following example:—

On the 20th of March, 1791, a woman presented herself for admission at the Hôtel Dieu, with a tumour of the right portion of the thyroid gland. The swelling was two inches in diameter, round, hard, and attached to the right and middle part of the trachea, and it pushed outwards the sterno-mastoid muscle. Independently of its being sensibly raised by each pulsation of the arteries, it followed the motions of deglutition, and, in a great degree, impeded the passage of solid ali-

ment. Desault made an incision through the middle of the tumour, beginning one inch above, and finishing one inch below the swelling. By the first stroke, he cut down as far as the gland, dividing the integuments, the platysma myoides, and some fibres of the sterno-hyoid and sterno-thyroid muscles. An assistant, with the view of fixing the tumour, drew it towards the inner edge of the wound, whilst the operator detached it from the sterno-mastoid muscle. In dissecting the cellular substance, two small arteries were divided, which were secured with ligatures. The outer portion of the tumour being thus disengaged, the inner was detached in the same way. The tumour was then drawn outwards by means of a hook, that it might be separated with more ease from the trachea. In the course of this dissection, the branches of the thyroid arteries were successively tied, as fast as they were divided. The assistant who held the hook, pulled the gland from within and forwards, whilst the surgeon finished the dissection outwards and from above downwards. This part of the operation was the most difficult: it was necessary continually to wipe away the blood with a sponge, which necessarily prevented the parts from being easily distinguished, and obliged the surgeon to cut but a little at a time, and always to examine well with his finger those parts which he was about to cut. By this cautious dissection, the superior and inferior thyroid arteries were laid bare, and afterwards tied with the aid of a blunt crooked needle. They were then transversely divided, and the remaining part of the tumour detached from the trachea, to which it strongly adhered. The wound, resulting from this operation, was nearly three inches in depth; outwardly bounded by the sterno-mastoid muscle, inwardly by the trachea and œsophagus; and posteriorly by the carotid artery, and par vagum, which were exposed at the bottom of the wound. The extirpated tumour was five inches in circumference, and on examination was found to differ in no particular from scirrhus glands, except that in the centre there was a cartilaginous nucleus. The patient got well and left the hospital on the thirty-fourth day after the operation. (See *Desault's Parisian Chir. Journ.* vol. ii. p. 292. 296.)

The extirpation of the thyroid gland is an operation so extremely difficult and dangerous, that whether it ought to be recognised as a justifiable operation is a question on which well-founded doubts may be entertained. The number and size of the arteries divided, the proximity of the trachea, œsophagus, jugular vein, and carotid, near which the knife must necessarily pass, are the principal dangers, which have deterred the majority of practitioners from performing the operation. The first time that Gooch undertook it, he was deterred from finishing it by the hemorrhage, and his patient died on the eighth day. The second time he succeeded better, but was incapable of securing the vessels; and the hemorrhage, which would have been mortal, was only stopped by the pressure of the hands of assistants for the space of eight days. (*Gooch's Med. and Chir. Obs.* p. 130. *Bell's System of Surgery*, vol. v. p. 525. *Richter's Bibl.* t. ii. p. 128.)

Vogel and Theden also performed the operation with success; but no surgeon who has attempted this bold operation has signalised himself so much

by it as Dr. Hedenus, of Dresden, who has removed the diseased thyroid gland in six instances with success. His reasons for resorting so often to this difficult operation, he says, are—1st, because he has seen a patient with enlarged thyroid gland, for which the seton had been employed, seized on the ninth day with violent tetanus, which proved fatal in seventeen hours; 2dly, because he considers setons and other similar means unlikely to do good, as he has almost always found portions of cartilage or bone within the diseased part. In one of his cases, the gland was as large as a skittle-ball; it covered the whole of the front of the neck, reaching from the os hyoides to the upper part of the sternum, and pushing back on each side the sterno-cleido-mastoideus and adjacent parts. The circumference of its base was fourteen inches, and its transverse diameter seven. It had a firm, tense, heavy feel. The skin was full of enlarged veins; and the tumour communicated to the hand a throbbing motion, which might have been taken for that of an aneurismal swelling.

The patient was laid on a mattress. Dr. Hedenus then divided the skin in a longitudinal direction, from the hyoid bone to the top of the sternum, and dissected and turned back the skin and platysma myoides, on each side, to the extent of two inches. The sterno-hyoid and sterno-thyroid muscles were then seen firmly adherent to the whole tumour. An attempt was made to separate them from the swelling; but, scarcely had the dissection extended a quarter of an inch, when a copious stream of blood proceeded from numerous small arteries, which could neither be tied, on account of their minuteness, nor stopped with styptics. Hedenus, therefore, determined immediately to cut through the above-named muscles at their points of attachment, above and below, and to remove the intervening portions with the tumour.

Respecting this part of the operation, it merits particular notice, that, after the cure, the motions of the hyoid bone and larynx, and the functions of respiration, speech, and deglutition, all remained unimpaired; which was also the case in four other instances, in which Hedenus removed portions of the sterno-hyoidei and sterno-thyroidei muscles.

Hedenus next separated the swelling, above and below, from the sterno-cleido-mastoid and omo-hyoid muscles, and also from the jugular vein and carotid arteries, to which it was closely adherent, until he had freed it as far as the point, where the thyroid arteries originate. He then tied the superior and inferior thyroideal arteries, close to the tumour, and, on account of the free anastomoses, applied to each vessel two ligatures, and divided it in the interspace. The more deeply the dissection now reached, the more hazardous did the operation appear, as, at every cut of four or five lines, he was obliged to tie two or three arteries, which was done with great difficulty. After most cautiously dissecting to the base of the tumour, which was firmly attached to the thyroid cartilage, and the three upper rings of the trachea, he met with so many arteries, for the most part as large as the radial, or digital, that, in order to prevent further loss of blood, he decided to tie the base of the swelling, and then cut away the tumour above the ligature. For this purpose, he used a blunt-pointed aneurismal needle, armed with two

four-threaded ligatures. This was passed through the middle of the base, while the tumour was pulled upwards; and one ligature was then firmly tied over the lower, and the other over the upper half of the base. For the sake of being still more sure of commanding the hemorrhage, Hedenus also applied a third ligature all round the swelling, and he then extirpated the diseased gland, without any bleeding from the part included in the ligatures. These were now fastened at the sides of the wound with adhesive plaster. The whole surface of the wound was sprinkled with powdered gum arabic, over which was laid agaric, wet with Heden's vulnerary lotion. These applications having been covered with charpie, the lips of the wound were drawn towards each other with adhesive plaster, which was also covered with compresses, wet with vinegar, and renewed every six or eight minutes.

It is quite unnecessary for me to follow the narrative of this case in all its details. The patient, between the period of the operation and that of his cure, suffered a great deal of indisposition, which at first chiefly consisted of difficult deglutition, severe pain all over the right side of the head, imperfect use of the arm, frequent cough, and hoarseness. In the afternoon, blood began to flow through the bandage, and, as the bleeding had not abated, after an hour's pressure with the hand, the dressings were removed, and the blood found to proceed not from any particular artery, but from all the wounded surface. The wound was again sprinkled with gum arabic, which was covered with sponge and a bandage: two surgeons were also directed to keep up pressure with their hands. The day after the operation, the febrile symptoms ran high, but in two days subsided again. On the eighth day, all the ligatures came away, even that which had encircled the tumour, and a large quantity of fetid matter was discharged. Soon afterwards a considerable bleeding arose, which however was stopped with sponge and alum powder. On the sixteenth day, another serious hemorrhage was occasioned by a convulsive cough, and life was endangered by the loss of not less than two pounds of blood. The bleeding, which came from the upper angle of the wound, was stopped by means of a piece of sponge, dipped in rectified spirit, and covering the wound and indeed the whole neck with compresses, wet with vinegar, pressure being also kept up on the sponge with the hand. The dangerous state of the patient may be conceived, when it is known, that there was now a deadly paleness of his whole body, languid eyes, dimness of vision, loss of hearing and speech, and extreme prostration of the vital powers. With the aid of judicious treatment, however, he rallied, and in the end left the hospital quite cured.

In another case operated upon by Hedenus, the difficulties were even greater, owing to the extension of a portion of the right lobe of the thyroid gland, as far back as the transverse processes of the cervical vertebrae; but after the third day from the operation, the progress to recovery was not interrupted by any bleedings. (See *Graefe's Journ.* b. ii. p. 237, &c. or the *Quarterly Journ. of Foreign Med.* No. xix.)

There can be no doubt, that the method adopted by Hedenus was well calculated to obviate the great source of immediate danger, viz.

the bleeding. So long as it was practicable, he took up every vessel, which he exposed or divided; and when this plan could not be continued, he tied the base of the tumour, ere he detached the enlarged gland from the larynx. This tying of the base of the swelling, though sometimes practised on other occasions, as in the removal of diseased axillary glands, constitutes the chief peculiarity of Hedenus's method.

Mr. Liston has more than once removed enlarged portions of the thyroid body, which had caused serious inconvenience, and with safety, by combining incision and ligature. The coverings of the tumour are divided and turned back, the dissection is continued towards the base of the mass, as far as it can be done with safety; strong needles, fixed in handles, are passed underneath it from above downwards, and from the side; crossing the first at right angles. (*On Practical Surgery*, p. 276.) By means of these, the tumour is strangulated. I saw one case in University College Hospital, where Mr. Liston thus extirpated a considerable portion of a large bronchocoele from a young woman's neck.

A case has been published, in which Klein attempted the removal of an enlarged thyroid gland: the patient, a boy, eleven years of age, died on the operating table. (See *Journ. der Chir. b. i. p. 120. 8vo. Berlin, 1820; or the Quarterly Journ. of Foreign Medicine*, vol. ii. p. 380.) The removal of the thyroid gland was attempted by M. Roux: after an operation, which lasted above an hour, and the application of 47 ligatures, about one half of the gland, of the size of an orange, was removed; the patient surviving 56 hours. The Hôpital-Interne, who relates this case, remarks, that we may place this amongst the operations which the prudent surgeon will scarcely feel himself justified in undertaking. (See *J. G. Crosse, in Provincial Med. Chir. Trans.* vol. v.)

TIC DOULOUREUX. A French expression applied to a disorder, the most prominent character of which consists in severe attacks of pain, affecting the nerves of the face; most frequently, the filaments of that branch of the fifth pair, which comes out of the infra-orbital foramen; but sometimes the other branches of the fifth pair, and occasionally the numerous filaments of the portio dura of the auditory nerve, which are distributed to the face. The complaint is not continual, but occurs in violent paroxysms, which vary in duration in different instances. It is the *trismus dolorificus* of Sauvages; the *faciei morbus nervorum crucians* of Dr. S. Fothergill; and of that order of diseases which Professor Chaussier so aptly denominated *neuralgies* (from *neuron*, a nerve, and *algos*, pain); for many other parts of the body are subject to a similar affection.

The first excellent description of tic douloureux was published in the year 1776, by the late Dr. Fothergill. (See *Med. Obs. and Inq.* vol. v.) It is not true, however, as is generally stated, that he was the first author who noticed the complaint. This, indeed, is so far from being correct, that we even find an account of an operation performed long ago by Louis, for the relief of the disease, (see No. xxxvi. de la *Gazette Salulaire*, 1766); and this identical case actually became a subject of hot dispute between the physicians and surgeons of the French metropolis. (See a Thesis, entitled "*Utrum in paralyticis capitis et faciei doloribus aliquid pro-*

desse possit, sectio ramorum nervi quinti parisi Proponebat Viellart, 1768, conclusio negativa.")

Tic douloureux conveniently admits of being divided into four species, called by the French *frontal, sub-orbital, and maxillary neuralgia, and the neuralgia of the facial nerve.*

In the frontal neuralgia, the pain usually begins in the situation of the supra-orbital foramen, extending at first along the branches and ramifications of the frontal nerve, distributed to the soft parts upon the cranium, and afterwards shooting in the direction of the trunk of the nerve towards the bottom of the orbit. In a more advanced stage, the conjunctiva and all the surface of the eye participate in the effects of the disorder, and become affected with chronic inflammation, which is described as a particular species of ophthalmia. At length, the pain passes beyond the distribution of the branches of the frontal nerve, and affects all the corresponding side of the face and head. It seems as if it extended itself to the facial, sub-orbital, maxillary, and even to the temporal and occipital nerves, through the communications naturally existing between the filaments of all those organs of sensation. Each paroxysm produces a spasmodic contraction of the eyelids, and a copious effusion of tears.

The sub-orbital neuralgia is first felt about the sub-orbital foramen. The seat is probably in the nerve of this name, and the pain extends to the lower eyelid, the inner canthus of the eye, the muscles about the zygoma, the buccinator, cheek in general, ala of the nose, and the upper lip. At a later period, the pain appears to extend backward to the trunk of the nerve, and these branches which are given off in its passage through the sub-orbital canal. Hence, pains are then experienced in the upper teeth, the zygomatic fossa, the palate, tongue, and within the cavity of the nose. As the disorder advances, it may extend like other neuralgiæ of the face, to all the same side of the head. During the paroxysms, when the disease is fully formed, an abundant salivation usually takes place. In general, the attendant toothach deceives the practitioner, who, in the belief that the pain arises from another cause, uselessly extracts several of the teeth.

The tic douloureux of the lower jaw, or maxillary neuralgia, is usually first felt about the situation of the anterior orifice of the *canalis mentalis*, and it extends to the lower lip, chin, neck, teeth, and temple. This form of the complaint is more uncommon than the preceding; but after it has prevailed some time, is equally remarkable for its intensity.

With respect to the neuralgia of the facial nerve, or portio dura of the auditory nerve, it is a case which very soon cannot easily be distinguished from the other species of tic douloureux. The pains at an early period are no longer confined to the passage of the principal branches of this nerve between the parotid gland and ramus of the jaw. The numerous communications of the portio dura with the rest of the nerves of the face seem to facilitate the extension of the disease, so that the agony is soon felt over the whole side of the head. The original source of the disorder can only be detected by attentively considering the progress of the complaint in all its stages. (See *Delpech, Maladies Chir. t. iii. sec. vii. p. 214, &c.*)

Tic douloureux may be known from rheumatism by the paroxysm being excited by the slightest touch, by the shortness of its duration, and the extreme violence of the pain. In acute rheumatism, also, there is fever, with redness, heat, and generally some degree of swelling; and, in chronic rheumatism, the pain is obtuse, long continued, and often increased at night; none of which symptoms characterise tic douloureux. It may easily be distinguished from hemicrania by the pain exactly following the course of the branches of the affected nerve. It is known from the toothach by the comparative shortness of the paroxysms; the quickness of their succession; the intervals of entire ease; the darting of the pain in the track of the particular nerve affected; the more superficial and lancinating kind of pain; and the convulsive twitches which sometimes accompany the complaint.

The causes of tic douloureux may be said to be in general unknown; but a few instances are recorded, which appear to have been the consequence of external violence, wounds, contusions, &c. Distant irritations especially of the splanchic nerves, often produce this disease, and Sir H. Hallford met with cases, where the discharge of portions of diseased bone, even from a distant part, cured the complaint. (*Med. Chir. Review*, No. ix. vol. iii.)

A modern writer has related a curious instance of a resembling disease in the arm, where the affection proceeded from the lodgment of a small bit of bullet in the radial nerve. (*Denmark in Med. Chir. Trans.* vol. iv. p. 48.) Dr. Parry attributed the pain to increased vascularity, or determination of blood (perhaps amounting to inflammation) to the neurilema, or vascular membranous envelope of the nerves affected.

Sir Astley Cooper states, however, that the nerves in this disease are certainly not in an inflamed state; for they are found of their natural colour, and rather diminished than enlarged. The latter fact was ascertained in a dissection made by Mr. Thomas. An occasional thickening of the nerve is mentioned by Larrey, Delpech, &c.

Stimulating embrocations, blisters, caustic issues, fomentations, leeches, friction with mercurial ointment (*Edinb. Med. and Surg. Journ.* vol. iii.), electricity, opium in large doses, the arsenical solution, and a variety of antispasmodic medicines, are the principal means which have been tried; but, for the most part, they only afford partial and temporary relief. Lasserre reported two cases, which were cured by bark, joined with opium and sulphuric ether; and two other examples, which yielded to pills composed of the extract of hyoscyamus, valerian, and peroxide of zinc. (*Journ. Univ. des Sciences Med.* No. lxix. art. 14.) Belladonna has often been tried, and often failed. Two cases in which it answered in doses of two grains, and two grains and a half, were published by Mr. Thompson of Whitehaven. (See *Lond. Med. Repository*, for July 1822.) The application of veratria ointment is recommended by Dr. Turnbull. (*On Veratria*, p. 40.) M. Piedagnel cured a neuralgia of the infra-orbital nerve, with the sulphate of quinine, ten grains of which were blended with equal portions of orange-flower water and syrup, and taken in four doses; the medicine being continued afterwards in weaker doses for a short time. M. Du-

pré has also published various observations, representing the sulphate of quinine as a very powerful remedy for neuralgia in its various forms. The testimony of Dr. Kabey is also in favour of its exhibition, and his opinion is backed by two cases in which he tried the medicine with success. (See *Magendie's Journ. de Physiol.* April, 1822. &c.) In the article NEURALGIA I have noticed Sir Benjamin Brodie's testimony in favour of this medicine. An example of violent frontal neuralgia yielded to pills, containing in each $\frac{1}{2}$ of a gr. of arsenious acid, made up with soap. This case was the consequence of an injury of the os frontis. (*Journ. Complem. du Dict. des Sciences Med.* No. xlviii.) From certain facts, published by Dr. Marcet, the extract of stramonium, in doses of $\frac{1}{2}$ and $\frac{3}{4}$ a grain thrice a day, seems to be sometimes capable of alleviating the distressing agony of the present disorder. (See *Med. Chir. Trans.* vol. vii. p. 75, &c.; also *Kirby's Cases*, 8vo. Lond. 1819.)

In 1820, Mr. B. Hutchinson published several cases tending to prove, that the subcarbonate of iron, in doses of $\mathfrak{z}\text{ij}$. or $\mathfrak{z}\text{j}$. two or three times a day, is often an excellent remedy for tic douloureux. In fact, if the sulphate of quinine be excepted, this medicine at present possesses more reputation than any other, for its virtues in this complaint. It is highly commended by Sir A. Cooper.

The strongest fact, in proof of the efficacy of the subcarbonate of iron, is mentioned by Dr. Crawford: a severe case was benefited soon after its exhibition; but, by mistake, the carbonate of potass was then given for a few days, during which time the spasms returned with their usual violence and frequency: but when the iron was given again, the good effects formerly experienced from it returned. (See *Med. and Phys. Journ.* for Feb. 1823.)

The operation of dividing the trunk of the affected nerve, and even of dissecting out a portion of it, so as to prevent all chance of a relapse from the reunion of the ends of the nerve, is a plan which has sometimes been practised with permanent benefit. Thus, any one of the three branches of the fifth pair of nerves may be divided at the point, where it comes out upon the face. But, before having recourse to this means, the surgeon should be sure that the particular nerve, which he is about to expose and divide, is really the principal seat of the disease; for when all the nerves of the face generally are affected, or when the branches of the portio dura are especially concerned, there is little hope of success. In fact, it must be confessed, that the operation has had many failures and relapses, either from the cases not having been duly discriminated, or from the neglect to remove a portion of the exposed nerve. Richerand, Delpech, and most of the leading surgeons in France, express their preference to the application of the moxa, or cautery, which, they say, proves more frequently successful than the knife. This should be done directly over the apertures, from which the nerves emerge on the forehead, cheek, or chin; and Richerand asserts, that, by such treatment, the pains may always be cured, or at all events rendered supportable. (*Noeogr. Chir.* t. ii. p. 218. ed. 4.) Delpech affirms, that the section of the nerve often fails, but that issues, and the repeated use of the cautery, have been attended with the greatest success. (See *Précis des Mal. Chir.* t. iii. p. 213.)

The disfigurement of the countenance by burning applications must, however, be very objectionable. Delpech confesses, that when the pains seem to be the consequence of a ganglion, or thickening of a part of a nerve, the excision of such part is indispensable. There can be little doubt, that this would have been more proper than amputation, in Mr. Denmark's case, to which I have already referred. The theories of Dr. Parry, senior, who was generally inclined to refer the effects of disease to increased determination of blood to the parts affected, led him to believe, that the operation of cutting the nerve, as performed by Dr. Haighton and others, did good rather by the division of the arterial branch supplying the affected ramification of the trigeminus nerve, than by the division of that ramification itself. (Parry, *Elements of Pathology*, &c.)

There have been many examples of tic douloureux, which, after resisting all attempts to cure them, have been left to themselves, and, after a long time, spontaneously subsided. (Delpech, *Maladies Chir.* t. iii. p. 212. 215.) This author has seen the operation of dividing the chief branches of the portio dura, in front of the parotid gland, undertaken, and even a portion of the soft parts cut away; but without any favourable consequences. (P. 218.)

When the infra-orbitary nerve is to be divided, Sir A. Cooper recommends it to be done a quarter of an inch below the orbit. The supra-orbitary nerve should be cut through just where it passes out of the supra-orbitary foramen. An instance, in which this measure produced an immediate alteration in the seat of the pain, may be read in the 8th No. of the *Quarterly Journ. of Foreign Med.*; but the cure was not complete, till the integuments had been divided from the root of the nose to the temple. The method of dividing the inferior maxillary nerve, is to cut down to the foramen mentale on the inside of the lip, directly under the bicuspid tooth. By the division of this nerve, M. Bouillard effectually cured one very severe case. (See *Lond. Med. Repository*, No. lxxix.)

According to Dr. Reese, Dr. Mott adopted the practice of dividing the nerve in almost every case of neuralgia where it was practicable. He repeated this operation on the infra-orbitary, mental, and other nerves so frequently and with so great success, that he confidently recommends it to his pupils and patients. He sometimes insulates a portion of the nerve by repeated incisions through it at small distances from each other, preferring this to the removal of a portion of the nerve, as recommended and practised by others.

"My own experience," says Dr. Reese, "leads me to believe, that in those cases in which the division of the nerve, by the knife, the insulation or removal of portions of it, all fail of success, that we have a remedy in the *potass. pur. vel lapis infernalis*, which will seldom, if ever, fail. I have several times cured the disease in its worst form in the pes anserinus, and in the infra-orbitary nerve, by applying this vegetable caustic until it acted upon the nerve. Stramonium and the tincture of iodine have justly obtained reputation as internal remedies in this disease."

Professor Hosack has published among his medical essays some valuable observations on tic douloureux, in which he contends that neuralgia

is not a local affection or disease of a particular nerve, and to be removed by the division of such nerve; but a disease dependent upon the whole system, and only to be counteracted by remedies adapted to the peculiar state or condition of the constitution." (See Reese's *Amer. ed.* of this *Dictionary*.)

I have already stated, that the nerves of the extremities are subject to affections very analogous to tic douloureux. The following instance is related by Mr. Abernethy. A lady became gradually affected with a painful state of the integuments under, and adjoining to, the inner edge of the nail of the ring-finger of the left hand. No injury to the part was remembered, which could have brought on this disease. The pain occurred at irregular intervals, and was extremely severe during the time of its continuance, which was for a day or two, when it usually abated. Accidental slight injuries always produced great pain, and frequently brought on the paroxysms, which, however occasionally occurred spontaneously, or without any evident exciting cause. In all these particulars, the disease correctly resembled tic douloureux. As the pain increased, the disorder seemed to extend up the nerves of the arm. After the patient had endured this painful affliction for seven years, she submitted to have the skin, which was the original seat of the disorder, burnt with caustic. This application gave her intense pain, and, on the healing of the wound, she found her sufferings rather augmented, than diminished, by the experiment. After four more years of suffering, she consulted Mr. Abernethy, when the circumstances of the case were such as to render an operation indispensably necessary. The pain of the part was intolerable, and it extended all up the nerves of the arm; and this general pain was so constant during the night, as to deprive the patient of rest. The muscles of the back of the neck were occasionally affected with spasms. The integuments of the affected arm were much hotter than those of the opposite arm, and sometimes the temperature was so increased as to cause a burning sensation in them. Under these circumstances, Mr. Abernethy did not hesitate to divide the nerve of the finger, from which all this disorder seemed to originate. He laid it bare by a longitudinal incision of about three quarters of an inch in length, from the second joint of the finger, and divided it opposite to that joint, by a curved sharp-pointed bistoury, which was conveyed under it. He then took hold of the nerve with a pair of forceps, and reflecting it downwards, removed a portion of it, half an inch in length, so that the possibility of a quick reunion might be prevented. The wound was brought together with sticking plaster, and it united by adhesion; but the upper part of the wound, opposite to the upper end of the nerves, became slightly inflamed, and was very painful. However, in the course of three weeks, the appearance of inflammation gradually went off. After the operation, Mr. Abernethy pinched the originally affected integuments sharply with his nails, without causing any sensation; but, if in so doing, he moved the finger, then pain was felt.

The result was, that, nine months after the operation, the general pains in the nerves had become very trivial; but the sensation in the integuments at the end of the finger had gra-

dually increased, and the skin had now its natural sensibility, so as accurately to distinguish the tangible properties of any body applied to it. If also the originally affected part was slightly compressed, painful sensations, resembling those which formerly occurred, took place. (*Abernethy's Surgical Works*, vol. ii. p. 203.) In a case resembling the former, but the consequence of a wound of the finger, Mr. Lawrence also cut down to the nerve and removed a portion of it, with permanent success. In a case of severe pain in the thumb, extending up the arm to the neck, and causing a distortion of the neck, fits, &c., Sir A. Cooper cut down upon the radial nerve, by the side of the flexor carpi radialis longus, and cut out about five-eighths of an inch of it. The result was a complete cure.

For additional remarks on this subject, see NEURALGIA.

Fothergill's Paper in vol. v. of the Medical Orbs, and *Inq. Dr. Hays's* Obs. in the Med. Records and Researches. *Darwin's* Zoonomia. *Abernethy's* Surgical Works, vol. ii. p. 203, &c. *Richerand*, Nosog. Chir. t. iii. p. 216, &c. edit. 4. *Delpech*, Précis des Maladies Chir. t. iii. p. 206, &c. *Dr. S. Fothergill's* Systematic Account of Tic Douloureux, 1804. Med. Chir. Trans. vol. iv. p. 48; vol. vii. p. 575, &c. *Krby's* Cases, 8vo. Lond. 1819. *B. Hutchinson*, Cases of Tic Douloureux, 8vo. 1820. Also 2d edit. 1822. *Richmond*, in Lond. Med. Phys. Journ. Sept. 1821: a case in favour of subcarbonate of iron. *Wadell*, in Edinb. Med. Journ. No. 32: case to the same purport. *Lisars*, in same work, No. 69. *Carter's* Case in Med. Repository, No. 89. *L. D. Yeate's* Review of a severe Case of Neuralgia, &c. with observations, 1822. *Dr. Stewart Crawford*, in Med. and Phys. Journ. Feb. 1823. Also A. T. Thomson, in the same No.; and additional cases by various other practitioners in the Nos. for April, June, and September, 1823. *A. Wilson*, in Ed. Med. Journ. No. 75: a case cured by purgatives, followed by bark, after the subcarbonate of iron and liq. arsenicalis had failed. *H. Jeffries*, Neuralgia of the Median Nerve, after a burn on the thumb, cured by subcarbonate of iron. See Med. and Phys. Journ. May, 1823. *T. Taylor*, in Edinb. Med. Journ. No. 76: carbonate of soda, hemlock, and the prussic acid, prescribed with success. *Swan*, On Injuries and Diseases of the Nerves, 8vo. Lond. 1834. *P. J. Descot*, Sur les Affections Locales des Nerves, 8vo. *N. Chapman* On Tic Douloureux, in Amer. Journ. of Med. Sciences, No. 28. 1834. *Sir Benjamin Brodie*, On Local Nervous Affections, 8vo. Lond. 1837. *Turnbull*, On Ranunculaceæ, and their Alkaloids, 12mo. Lond. 1835; and on the External Application of Veratrida, 8vo. Lond. 1834.

TINCTURA CANTHARIDIS. Sometimes employed in gleets, leucorrhœa and incontinence of urine, arising from a want of proper action in the sphincter vesicæ muscle. The usual dose is from ten to forty drops twice or thrice a day; but its effects should be carefully watched; for it is apt to occasion dangerous inflammations of the urinary organs, violent strangueries, and retention of urine. It is occasionally added to liniments, when the object is to stimulate the skin considerably, and rouse the action of the nerves and absorbents, as in certain cases of ptosis, paralysis, &c. Dr. Anthony Todd Thomson found it a useful application to mortification of the extremities, sometimes happening without any apparent cause; and also to frost-bitten parts. (*London Dispensatory*, p. 658. ed. 2.)

TINCTURA FERRI MURIATIS has sometimes been exhibited in gleets; but a more important use was assigned to it by Mr. Cline, who ordered it in dysuria, from stricture, in the dose of ten drops, every twenty or thirty minutes, until nausea was excited. Where chalybeates are indicated, this preparation is one much approved. In the proportion of 5j to a pint of

water, it makes an excellent astringent lotion, one frequently used in prolapsus of the rectum.

"Mr. Justamond's liquid for external use in cancers, and which the original inventor called his *panacea anticancrosa*, partook considerably of the nature of this tincture, which, indeed, with an equal quantity of spirit of wine, was sometimes substituted for it.

"Lastly, it is remarkably efficacious in destroying venereal or other warts, either used alone, or diluted with a small proportion of water." (*Pharm. Chir.*)

TINCTURA IODINI. Take of Alcohol, 7 dr. 52 gr. troy; Iodine, gr. 39. $\frac{1}{2}$ troy: dose, 10 drops three times a day in a little sweetened water. (See IODINE, and *Magendie's Formulary*, 2d. ed. translated, p. 35.) The dose may be very gradually increased, if necessary, to 25 or 30 minims thrice a day; but I believe that Lugol's plan of employing only small doses, is the best.

TINCTURA THEBAICA. See VINUM OPII. **TINEA CAPITIS.** See PORRIGO.

TOBACCO is sometimes used for promoting the reduction of strangulated hernia, either in the form of a fluid clyster, or of smoke, which latter is introduced up the rectum by means of an apparatus. Excepting the operation, the power of tobacco, particularly when assisted by the topical application of cold to the tumour, is the most powerful in bringing about the return of the protruded viscera; but on account of its deleterious effects, it must be resorted to with caution. (See HERNIA and ENEMA.) Tobacco clysters have been tried with advantage in traumatic tetanus. (*O'Beirne*, in *Dublin Hospital Reports*); and Mr. Earle found tobacco clysters efficacious in certain cases of retention of urine. (See TETANUS, and URINE, RETENTION OF.)

Consult T. Fowler, Medical Reports of the Effects of Tobacco, 8vo. Lond. 1785. A. P. Wilson, An Experimental Essay on the Manner in which Opium and Tobacco act on the living animal Body, 8vo. Edinb. 1795. R. Hamilton, De Nicotianæ Viribus in Medicina, &c. 8vo. Edinb. 1780.

TONGUE, DISEASES OF. This part is subject to various diseases, as inflammation, ulcers, cancers, paralysis, tumours, and a rapid swelling of it, sometimes causing imminent danger of suffocation.

When any morbid action is set up in the tongue, many things contribute to maintain it. "The extreme mobility of the organ; the almost continual use of it in eating, drinking, and speaking; the contact of the teeth, which are often irregular and decayed; are quite sufficient to interrupt any efforts to restore a healthy action. It often happens, too, that the part is so very tender, that the patient cannot bear to cleanse the mouth and teeth, which soon become incrustated; and, from this source alone, the complaint will be greatly aggravated, and the discharge rendered fetid, and irritating." (*H. Earle*, in *Med. Chir. Trans.* vol. xii. p. 283.) The matter, with which the teeth become incrustated in these cases is composed of phosphate of lime and mucus; and in a case recorded by Paletta, the quantity of it was very considerable.

Carious teeth, with points and inequalities, producing continual irritation, are the most frequent cause of ulcerations of the tongue. The sores, thus arising, often resist every kind of remedy, and ignorance of the cause sometimes

leads the practitioner to consider them as irremediable; whereas a cure may easily be effected by extracting the carious tooth, or simply filing off its sharp irregularities, as was anciently directed by Celsus.

The glandular papillæ, situated on the dorsum of the tongue, have a narrow base, and a broad termination or head, like a mushroom. They are capable of becoming considerably enlarged, so as to form preternatural tumours, which may be mistaken for cancerous excrescences. A young man, eighteen years of age, had on the middle of his tongue a circumscribed tumour, about as large as a middle-sized nutmeg. Louis, who was consulted, perceived that the swelling was only of a fungous nature, and he tied its base with a ligature, with the noose of which he contracted the diameter of the pedicle, while, with the ends, he kept down the tongue. Then, with one stroke of a pair of curved scissors, he cut off the tubercle. Caustic was afterwards applied to the base of the tumour, and the patient was perfectly well in five or six days. (*Mém. de l'Acad. de Chir. t. v.*) Similar tubercles are mentioned by Morgagni.

A peculiar disease of the tongue was met with in a boy by Mr. Earle. "Clusters of very minute semitransparent vesicles pervaded the whole thickness of the tongue, occupying nearly one-half, and projecting considerably both above and below that organ. The slightest injury caused them to bleed profusely, and, in some places, the clusters were separated by deep clefts, which discharged a fetid irritating sanies. This disease, which had resisted various plans of treatment, both local and constitutional, gradually yielded to perfect quiet, cleanliness, large doses of hyoseyamus, which were increased to 5j. of the extract daily." (*Med. Chir. Trans. vol. xii. p. 285.*) The same medicine, he says, he employed with most unequivocal good effect in many cases of ragged irritable ulcers of the tongue.

The tongue is occasionally affected with a true cancerous disease; one of the most afflicting cases, indeed, which can possibly happen, as may be conceived, when it is known, that, in the advanced stage of the disease, the patient can hardly take his food, which must be conveyed over the tongue by some means, or another, before it can be swallowed, while he is obliged to write whatever he wishes to say. (See *Home's Pract. Obs. on Cancer*, p. 112.) Cancer of the tongue seems to differ from other carcinomatous affections in sometimes occurring in youngish subjects. In the course of the disease, the glands behind the jaw and in the neck become affected. M. Louis saw a lady, who had an ulcerated cancerous tubercle on the left edge of the tongue. The little swelling was circumscribed; its size did not exceed that of a filbert; the pains were lancinating; the sore had penetrated deeply; and its tuberculated edges were affected with scirrhus hardness. Extirpation of the disease seemed to present the only chance of cure; but the patient refused to accede to any thing but palliative plans, and she died in the course of a few months.

One of the best descriptions of cancer of the tongue, is that of Mr. Travers. The disease, he says, "is not a smooth and firm rounded tubercle, such as is often met with in this organ, but an irregular ragged knob in its first stage, generally

situated in the anterior third, and midway between the raphé and one edge. It sometimes, but seldom, extends across the middle line, although it often extends alongside of it. The hardness is unyielding, inelastic, and the mucous surface puckered and rigid. It also gives to the finger and thumb of the surgeon the sensation of solidity or of its penetrating the entire muscular substance, being perceived equally on either surface. Sharp shoots of pain are felt through the side of the affected organ, towards the angle of the jaw and ear. The disease tends to run backward towards the base or posterior edge. It sometimes acquires great bulk before ulceration takes place, so as to project the tongue from the mouth. In this state, a female patient of mine was seen some time ago in St. Thomas's Hospital, in whom the permanent projection of the diseased organ, beyond the widely distended lips, was from three to four inches. Life was sustained for a time by nutritive injections. The ulceration often extends from the edge of the tongue to the membrane of the mouth and gums, when the elevated and distended membrane at length gives way, and ulceration is rapid. The surface of the ulcer is very uneven, clean and bright granulations appearing in parts, and in others deep and sloughy hollows. The darting pain is very acute, but only occasional. There is a dull aching always present, and as constant a spitting as in deep salivation. The irritation is such as soon impairs the powers of life. It happens to strong and hitherto healthy persons, for the most part males from the age of forty onwards. There is generally an evening paroxysm of pain; and the nights are much disturbed by the secretion accumulating in the throat, and exciting cough. Often the patient is roused by a painful compression of the tongue falling between the jaws. The leaden hue of the countenance, the loss of flesh, and difficulty of taking food, although symptoms of the advanced stage of the disease, are observed long before the appetite or muscular powers fail in proportion. Frequent moisture with mild fluids, as tepid milk and water, or confectioner's whey, is grateful to the patient. Towards the fatal termination of the disease, occasional profuse hemorrhages take place at shortening intervals, and alarm and weaken the patient, who ultimately dies tabid and exhausted, generally with symptoms of more extensive disease of the mucous membrane in other parts." (*Med. Chir. Trans. vol. xv. p. 245.*)

Forestus relates the cases of four women, who were attacked with cancer of their tongues, and died from the ravages of the disease and hemorrhage. In the writings of Hildanus, there is a description of the origin and progress of a cancerous tubercle on a young man's tongue, whose breath was intolerably fetid, and who died in the most excruciating pain. The same author informs us of another case, exhibiting the good effects of sedative remedies in palliating a cancerous ulcer of the tongue, and the fatal consequences of an opposite line of conduct.

In order to fix the part, M. Louis recommended the employment of forceps, with blades terminating in hook-like extremities, the vulsellum, as it is sometimes named. With this instrument, the part of the tongue about to be amputated can be secured and kept steady.

When the diseased portion is favourably situ-

sted, and not extensive. Mr. Liston prefers the vulsellum and knife, "there being no great difficulty in holding the organ so as to secure any vessel, or take other means of arresting the flow of blood." (*On Practical Surgery*, p. 250.)

When any part of the tongue has been amputated, the bleeding vessels are to be tied, if possible; but when this cannot be accomplished, powerful styptics may be applied, and if these fail, the actual cautery. When only a piece of the tongue is cut out, in the shape of the letter V, the best mode of stopping the bleeding is to bring the sides of the incision together with a suture; by which means the deformity will also be lessened, and the union expedited, as was exemplified in a case recorded by Langenbeck. (*Neue Bibl. b. ii. p. 489.*) Rather than suffer a patient to die of hæmorrhage, if the cautery and other means fail, the lingual artery should be taken up where it passes over the cornu of the os hyoides.

Diseased portions of the tongue admit of removal with the ligature. (*La Motte, Chirurgie, Obs. 208.*; *Godart, in Journ. de Méd. t. xiii. p. 66.*; *Sir E. Home, Pract. Obs. on Cancer, p. 207.*; *Inglist, in Edin. Med. and Surgical Journ. 1803. No. i. p. 34.*) Sir E. Home generally passed a double ligature through the centre of the tongue, behind the diseased portion, and then tied the threads tightly over each half of the organ, so as to make all the part in front of the constriction slough away. If a large portion of the tongue is involved, Mr. Liston has recourse to ligatures: "these are passed wide of the disease, by means of needles fixed in handles, the perforations for the thread being close to their points. Two or more ligatures are introduced, and by these others and stronger ones are drawn through and tied, so as to strangle the whole base. With the view of saving pain, and abridging the process, as much as possible, they should be drawn with extreme tightness. The salivation is most profuse, and the discharges and effluvia very offensive. Some lotion to correct this, as much as possible, may be prescribed, and, after the separation of the dead part, the healing promoted by all possible means. Tumours situated on the posterior part of the tongue, and projecting from it, may be thus removed, care being taken, in introducing the needles, to guard with the finger the epiglottis, &c." (*See Liston on Practical Surgery*, p. 250.)

Mr. Travers is of opinion, that cancer of the tongue only admits of palliative treatment. He has seen but one case in which the ligature or knife had been employed, and in which he did not witness or hear of a recurrence of the disease, before a twelvemonth had elapsed. Excision he sets down as hardly safe, when practicable through the sound parts. The actual cautery and the lunar caustic, he says, decidedly aggravate the malady. All stimulant applications, myrrh, alum, zinc, copper, and even borax, he has found to increase the pain and mischief. The carbonate of iron, and alkaline carbonates, according to his experience, are useless. A wash made of two oz. of lime-water and half a drachm of calomel, suspended in it by means of mucilage, he deems the best application. Opium, locally applied, he says, rarely has an anodyne effect; and he represents the disease as not being permanently influenced either by mercury, steel, arsenic,

iodine, prussic acid, bark, or any other medicine. (*See Med. Chir. Trans. vol. xv. p. 247.*)

However, some exceedingly painful ulcers on the tongue have been cured without the removal of the part; and certain obstinate cases have yielded to the repeated application of leeches under the tongue, after a vast number of other remedies had been tried in vain. In the *Encyclopédie Méthodique*, art. *Langue*, there is an account of an affection of the tongue (reputed to be cancerous, though this may be doubted), which got completely well under a very simple plan of treatment. A woman, thirty-five years of age, subject to cutaneous diseases, and ill-conditioned ulcers, complained, for seven or eight months, of little swellings, accompanied with heat and pain, which made their appearance on the edge, and towards the apex of the tongue. At length, the part began to swell, harden, and to be the seat of lancinating pains. Its surface became irregular and rough, and all one side of it was considerably swollen. The patient could not put her tongue out of her mouth, nor swallow any thing except liquids; and her breath was intolerably fetid. Various sedative remedies had been employed without success. Cicuta had been used as a topical application; it had also been exhibited internally in large doses; the patient had taken, for a long while, the bichloride of mercury; but nothing proved of any avail. At length, the patient was so tired of trying the effect of medicines and applications, that she gave them up entirely; and contented herself with trying the experiment of keeping honey continually in her mouth. As this method seemed to give her some ease, she was prevailed upon to persist in it, and in this way the pains were gradually appeased; the swelling was diminished, and, at the end of two or three months, she was quite well, except that an indurated cicatrix remained on the part affected, and considerably obstructed the extension of the tongue on that side.

On this case, however, it might be remarked, that the retardation of the cure seems also ascribable to the injury of the health produced by the hemlock, mercury, &c. and that the amendment following their discontinuance, might rather have arisen from the consequent improvement of the patient's health, than from any effect of the honey.

Some inveterate diseases of the tongue may be cured by hemlock. In the work last cited is mentioned an instance of a very unhealthy-looking ulcer, near the apex of the tongue; attended with a considerable thickening of the part, and of some duration, which was cured by giving large doses of cicuta. But of all the medicines which have the greatest reputation for their beneficial effects upon malignant ulcers of the lip and tongue, none perhaps is deserving of so much confidence as arsenic. (*See C. Lane's Case of ill-conditioned Ulcer of the Tongue, successfully treated by Arsenic; Med. Chir. Trans. vol. viii. p. 201.*) Mr. Earle's report of the favourable effects of hyoscyamus, I have already noticed: he speaks also in praise of the pulp of carrots, retained on the ulcer, and frequently changed. (*Op. cit. vol. xii. p. 286.*)

However, notwithstanding many facts of this kind, on record, medicines should not be tried too long, that is to say, so as to let the disease

TONGUE.

attain a condition, in which it will no longer admit of being cut away. When the disease makes progress, the knife should be employed before it is too late.

The whole of the tongue sometimes inflames, and becomes considerably enlarged, either spontaneously, and without any apparent cause, or in consequence of some other disease; or else from some particular irritation, such as that of mercury, or some poisonous substance. Slegel, who was at Paris about the middle of the 17th century, saw a patient in a salivation, whose tongue became so enormously enlarged, that the mouth could not contain it. Pimprenelle, an eminent surgeon of that time, was sent for, and, finding that all trials to relieve the affection were in vain, amputated one-half of the tongue, with the view of averting its mortification. After the wound ad healed, it is said, the patient could articulate very well. Louis, from whom this fact is quoted, justly remarks, that the measure, resorted to by Pimprenelle, was an exceedingly violent one, for he had often seen urgent symptoms occasioned, during a salivation, by a rapid and enormous swelling of the tongue, quickly yield to bleeding, purgative clysters, change of air, and the discontinuance of mercury. Several facts confirming this statement, have fallen under my own notice.

Trincavellius mentions two women, who had considerable enlargements of their tongues. One, who was young, had been rubbed with mercurial ointment on her head; but, in the other, who was about fifty years old, the complaint arose from the small-pox. The excessive swelling of the tongue, in both these instances, terminated in resolution. Another case of ulceration, enlargement, and protrusion of the tongue, is recorded by Paletta, who recommended the reduction of the part into the mouth, keeping the jaw closed with a bandage, and the frequent use of vinegar and alum gargles. The result is not stated. (See *Journ. of Foreign Med.* No. xix. p. 457.)

When the urgency is such, that an immediate diminution of the swelling becomes necessary for the relief of the symptoms, the plan of making one or two deep incisions along the tongue is strongly recommended. See the cases inserted by De la Malle, in the 5th volume 4to. of the *Mém de l'Acad de Chirurgie*, and some others, related by Louis in the paper above cited.

A man, recovering from a bad fever, was suddenly attacked with pain in his tongue, followed by a swelling equally large and rapid in its formation. In less than five hours, the part became thrice as large as it is in its natural state; and, in this space of time, De la Malle, who had been consulted, bled the patient successively in his arm, neck, and foot. The man felt very acute pain; his skin was excessively hot: his face was swelled; his pulse was hard and contracted; and his look wild. He could hardly breathe: the tongue filled all the cavity of the mouth, and protruded between the lips. In this very urgent case, three parallel incisions were made along this organ; one along its middle, and the other two between the one in the centre and the edges of the part affected. The cuts extended through two-thirds of the tongue, and had all the good effect which could possibly be desired. There

largement of the tongue subsided so much, that, an hour after the operation, the patient was able to speak. The next day, the incisions had the appearance of being only superficial scarifications, and the tongue was in its natural state. In short, the incisions healed in a few days, with the use of a simple gargle.

De la Malle quotes several other cases, all of which exhibit the success which he met with from this practice in other similar cases. He quotes also the testimony of authors, antecedent to him, who recommended the method; and, in particular, he cites Job à Meckren, who adopted the plan in a case where the tongue, together with the tonsils and palate, became spontaneously affected with a sudden and dangerous degree of swelling. This treatment is found to answer by modern practitioners. (See *Journ. Universel*, &c. June, 1823.)

Dr. Graves has recorded the particulars of an interesting case of an idiopathic glossitis, affecting only one half of the tongue, the median line forming a perfect boundary between the swollen and the healthy parts. The swelling nearly filled the entire cavity of the mouth, which could scarcely be closed, on account of the protrusion of the tongue. "Two or three applications of six leeches at a time to the inflamed half, part of which, at my first visit, appeared on the verge of gangrene, produced a speedy decrease of the tumour and inflammation. The bleeding from the leech-bites was very great. In consequence of the detumescence of the tongue, articulation and deglutition, which before had been very difficult, were quickly restored. The patient is at present (two years since the attack) able to speak perfectly, although the left half of his tongue is still perceptibly increased in size." (Dr. Graves, in *Dublin Hospital Reports*, vol. iv. p. 43.) As this gentleman has observed, true idiopathic glossitis is an extremely rare disease. J. P. Frank only saw one case of it during his whole life. In none of the four cases, observed of late years in different parts of Europe, was the inflammation limited to one half of the tongue. (See *Elbuig in Graefe and Walther's Journ.* b. vii. 2 tes. Heft. and *Edinh. Journ. of Med. Science*, No. i.) The disease is formidable and tedious, unless blood be taken directly from the tongue. For this purpose, Dr. Graves prefers leeches both to incisions in the dorsum of this organ, and to puncturing the sublingual veins.

For further information on idiopathic glossitis, I refer to a paper by Orgill. (See *Glasgow Journ.* vol. iv.)

Under the name of *glossanthrax*, or *malignant pustule of the tongue*, a variety of gangrene has been described, which has its seat in this organ. It commences with a vesicle, which appears on some point of the surface of the part, and is filled with bloody serum. From being at first livid, it soon puts on a black appearance, bursts, and under it the gangrenous ravages may proceed further and further, until the whole of the tongue is left in the state of sphacelus. In a case of this degree of severity, delirium comes on, and the patient soon dies. It is alleged to be a common disease in horses kept in damp places and upon moist food. (See *Andral, Anat. Pathol.* s. 2. p. 243.) The treatment should be conducted according to the plans found most efficient in other examples of malignant pustule.

I have already noticed Dr. Graves's case of idiopathic inflammation, restricted to one half of the tongue. Baron Dupuytren refers to an instance of *paralysis of the left half of the tongue*, with an atrophy confined to the same portion of it: the faculty of taste, however, was retained, which led Dupuytren to suspect that the lingual nerve was principally concerned. The patient lived two years with this affection, preserving his intellectual powers nearly to the last moment of his existence; but his genital functions had been much impaired. A few days before he died, symptoms of compression came on. In the *post mortem* examination, many hydatids were found at the base of the cerebellum, one of which had insinuated itself into the anterior condyloid foramen, and made pressure on the lingual nerve. This fact seemed to Dupuytren to corroborate the physiological doctrine, that this nerve is more especially concerned in motion and nutrition. (See Dupuytren, in *Clinique Chir.* t. iii. p. 364.)

Sometimes *polypi* grow from the tongue. A case of removal of such a tumour is given in a modern work. (See *Edinb. Med. Chir. Trans.* vol. iii.)

TONGUE, PROLAPSED OF. I am indebted to Mr. Crosse, of Norwich, for the following observations. In some infants, at the time of birth, the tongue projects constantly beyond the lips, forming the first stage of this disease; and if irritants or astringents be not applied, so as to cause the tongue to retract itself into the mouth, the displacement will gradually increase, until it assume a formidable appearance, and create serious inconveniences. When once a portion of the tongue remains permanently out of the mouth in this prolapsed state, it goes on augmenting in size, from constant irritation by exposure, from dependent position, and from constriction of the sphincter oris, and at length hangs over the chin, causing eversion of the lower lip. The organ is elongated and hypertrophied, without any separate organic disease being present. The great weight of the dependent mass draws up the *os hyoides* and *larynx*, whilst it depresses the mental portion of the lower jaw, and gives to the front teeth a forward or horizontal direction. The saliva escapes continually; the speech is defective; food can only be very imperfectly taken into the mouth, and is swallowed with effort. When the malady has existed for years, several inches of the tongue are permanently exposed, the upper surface becoming furred and parched, and the inferior ulcerated by pressure of the decayed incisor teeth. The patient, a disgusting object, suffers in his health from being imperfectly nourished, and perhaps also from being mentally depressed.

In numerous instances where this malady has been present in an extreme degree, and its nature and causes not clearly understood, excision by the knife or ligature has been practised, and a recovery effected; but the right and more scientific treatment, ably pointed out by Professor Lassus, though adopted by few of his successors, consists in the gradual reduction of the prolapsed and swollen mass by leeches, lotions, bandages and support, until the tongue can be replaced within the mouth, where it will return to its normal size, even before there has been sufficient time for the deformity of the lower jaw, and of the teeth to be corrected by proper mechanical aid, and for the lower front teeth to meet the upper. In a girl six

years of age, where the tongue prolapsed between three and four inches, and was above six inches in circumference, Mr. Crosse, of Norwich, recently succeeded in replacing the prolapsed part within the mouth in a few weeks, avoiding the severe operation of excision, which it is rarely, if ever justifiable to perform for the disease in question. (*Lassus, Pathologie Chirurgicale*, t. ii. p. 160. *London Med. and Phys. Journal*, vol. vi. p. 354. *Edinb. Med. and Surg. Journal*, vol. i. p. 317. *Mr. Crosse's Memoir*.)

Solid tumours, generally fatty, are sometimes formed in the loose cellular tissue, under the tongue, and cause the same kind of inconvenience as a ranula. Mr. Liston has removed some tumours of large size from this situation, by dividing freely the membrane of the mouth, and detaching the swellings with the finger from its cellular attachments. (See *Liston on Practical Surgery*, p. 249.) I remember a good specimen of this disease in Mr. Liston's museum.

Louis, in *Mém. de l'Acad. de Chir.* t. v. *J. Rowland*, *Aglossostomographie, ou Description d'une Bouche sans Langue*, laquelle parle, et fait naturellement toutes ses autres Fonctions. 12mo. Saumur, 1630. *Louis*, Sur les Maladies de la Langue, in *Mémoires de l'Acad. de Chir.* t. v.: also the Memoir of *De la Malle* in the same volume. *Encyclopédie Méthodique*, Partie Chir. art. Langue. *Sir Edward Home's Pract. Obs. on Cancer*, 8vo. Lond. 1805. *Langenbeck*, *Neue Bibl.* h. ii. p. 487. 8vo. Hanover, 1820. *C. Lane and H. Earle*, in *Med. Chir. Trans.* vols. viii. and xii. *B. Travers*, *Op. cit.* vol. xv. *R. Liston*, *On Practical Surgery*, p. 250. 8vo. Lond. 1837; and other works cited in this article.

TONSILS. The tonsils, like all other parts at the back of the mouth, are subject to different kinds of swelling, which vary as much in their nature as their consequences. Some are rapid in their progress, and these are frequently observed to affect persons of, what is termed, a sanguineous temperament. They are also prone to attack young people, and such as labour hard, and they have all the essential characters of inflammation.

Other swellings of the tonsils are slower in their progress, occur in damp cold weather, and in indolent or phlegmatic constitutions.

Lastly, another kind of enlargement of the tonsils, which is usually contagious, readily falls into a sloughing, gangrenous state, sometimes extends to the neighbouring parts, and too often proves fatal. Hence, the various species of angina have been named by some writers inflammatory, catarrhal, and gangrenous. The two first kinds frequently terminate in resolution; but, sometimes, the affected tonsils afterwards assume great hardness, and obstruct respiration and deglutition, so that it becomes indispensably necessary either to extirpate them with the ligature or knife.

In some instances, the ancients followed the plan most approved at the present time; they seized the diseased tonsil with a kind of hook, and then cut it away with a bistoury, which, *Paulus Ægineta* informs us, was concave on the side towards the tongue.

The moderns who, for a long while, were timid in the employment of both these methods, adopted plans of a more cruel description. The actual cautery was proposed, and some partial success, which followed its use, at once established its reputation. Caustics were afterwards employed, instead of actual fire; but the inconvenience of not being able to limit their action, and the hazard of their falling down the oesophagus, soon caused

them to be relinquished by all rational practitioners. Then the operation of cutting away the tonsils was revived; and it was performed, sometimes in the manner of the old surgeons, sometimes with various kinds of curved scissors or knives. Instead of the simple tenaculum, used by the ancients, a sort of double one came into fashion.

The following is the common plan:—The mouth being opened very wide, and the tongue depressed with any flat instrument, held by an assistant, the operator is to take hold of the diseased tonsil with a tenaculum, and with a common scalpel, having the back half of its blade covered with rag, he now removes as much of the tonsil as ought to be taken away. In common cases, it is deemed sufficient to cut on a level with the pillars of the velum pendulum palati. The operation being finished, the patient is frequently to wash his mouth with proper gargles. The internal carotid artery, not being far from the external side of the tonsil, is a consideration that has intimidated some surgeons from employing a cutting instrument for the removal of an enlarged tonsil; but, if the cut be made, as now directed, only on a level with the pillars of the soft palate, and in such manner as merely to remove the superfluous portion of the tonsil, or, in other words, not the whole, but only just such a part of it as will enable the patient to swallow and breathe with freedom, there will never be any troublesome degree of bleeding. During the operation, however, the head, more especially if the patient be a child, must be kept steady by an assistant. To the preceding method, one objection was urged by Desault, viz. that when the end of the knife is conveyed far into the mouth, it may do mischief to the membranous covering of the palate, in a place not corresponding to the tonsils. Desault thought this objection was the more forcible, as, when the hook is introduced into the tonsil, the danger of the above mischief is considerably increased by a general spasm, which seems to affect every part of the mouth. Hence, this eminent surgeon used to employ, for the removal of diseased tonsils, an instrument, which was first invented for dividing cysts of the bladder. It consisted of a sharp-edged blade, which was included in a silver sheath. The latter had at its extremity a kind of notch, in which the gland, about to be extirpated, was received.

The surgeon seizes the tonsil with a double hook, with which he is to raise and draw it, a little forwards. He is then to take the cystotome, and put the tonsil in the notch, on a level with the place, where the incision is intended to be made.

When the portion, which is to be cut off, is engaged in the notch, the operator is to draw the part towards him, so as to stretch it, and press the instrument against it from below upward. The blade being next pushed across the notch, the necessary section is accomplished. When the division is not complete—which is particularly liable to happen, when the diseased gland is of considerable magnitude—the blade is to be drawn back, and the section completed by applying the instrument to the wound, which it has already made. Sometimes, even a third application may possibly become requisite.

Bichat states, that this plan of operating, adopted by Desault, is as simple and easy as the method now related, with the advantage of being safer. He also describes the construction of the blade of the instru-

ment, that when it slides across the notch, it presses against, and steadily fixes the parts, which are to be divided; an advantage which neither the knife nor scissors have, under the action of which the parts are quite moveable. Hence, there is difficulty in cutting them. When the introduction of the instrument from above downward is difficult, it is better to withdraw it; and after turning the notch in the opposite direction, pass it from below upward. In general, however, the first of these methods is preferable, because the gland, when half cut through, cannot now fall back and obstruct the rima glottidis, so as to bring on danger of sudden suffocation; a circumstance, which Wiseman and Moscati saw happen. With the view of preventing this occurrence, Louis recommended the common scalpel to be used, with its edge directed upward.

The necessity for any operation may generally be superseded by local and constitutional treatment, especially the exhibition of iodine, and carbonate of soda with rhubarb, and rubbing the enlarged tonsil repeatedly with nitrate of silver. This answers better than astringent gargles. But when these or other means fail, and the isthmus faucium is so obstructed, that serious difficulty of deglutition and respiration are occasioned, the removal of part of the tonsil should not be deferred. As Mr. Liston observes, "it is by no means necessary to remove the whole tonsil, and the attempt would be attended with the greatest danger. The enlargement is but an opening out, or simple hypertrophy of the gland. The surface heals kindly, and there is no reproduction of the tumour." Mr. Liston directs the patient to be placed opposite a strong light; the surgeon depresses the tongue with the fore-finger of one hand, and seizes the body of the gland with the vulsellum held in the other. He then introduces the narrow straight blunt pointed knife, with its edge directed upwards under the gland, and by a few gentle sawing motions severs it on a level with the folds of the velum. (See *Liston's Practical Surgery*, p. 251.)

As a general method, I consider, that the excision of an enlarged tonsil is a better practice, than the extirpation of it with a ligature. The chief objections to the ligature are, that its operation is rather tedious, sometimes productive of a great deal of irritation, and, on the whole, at least as painful as the knife. Moscati having once adopted this plan, very severe pain and inflammation ensued: the difficulty of swallowing and breathing compelled him to amputate the tumour at the place where the ligature was applied, and all the bad symptoms immediately ceased. Besides; when the ligature is used, there is no oozing of blood from the vessels, a circumstance which tends so much to diminish the inflammation. The base of the swelling is also sometimes broader than its upper part, and does not admit of being properly surrounded with a ligature. And, when it has a narrow base, it can then be so easily removed with a scalpel, or with Desault's instrument, and with so little pain, that one of the last modes is generally preferable.

The ligature is strongly disapproved of by Mr. Liston, by Professor Smith of the United States, and numerous other surgeons. The last named practitioner prefers for the excision of part of an enlarged tonsil, a pair of scissors, the blades of which have a lateral curve, and each a hawk-bill

curve towards the other, so that when the blades are shut, the points pass by each other to some extent. To the side of each blade are attached two small steel points, so that when the scissors are completely closed, the tonsil, exterior to the place of the incision, will be seized by the points, and brought away from the fauces when the instrument is withdrawn. This invention seems to me one of considerable merit. See a more particular account, and an engraving of it, in the *British and Foreign Med. Review*, vol. i. p. 267.; and *Amer. Archives of Med. Science*, No. 2. Nov. 1834.

The ligature, however, has had its advocates. Heister recommends it in certain cases; Sharp praises it; and others approve its use; while the plans of employing it have been as various as the inventive genius of the different partisans of the practice. Some make use of Levret's double cannula, which is furnished with a silver-wire noose, in which the tumour is to be engaged. By twisting the instrument, the diseased part becomes constricted. Some, after putting the noose of a ligature over a kind of tenaculum, take hold of the tonsil, push the ligature over the enlarged gland, which they tie, without having any means of increasing the constriction afterwards. Others employ Belloque's instrument for putting the ligature over the tonsil. Graefe's ligature-encircling apparatus would be the best contrivance for this purpose. Sir A. Cooper, who prefers the ligature to excision, gives to an eye-probe the requisite curve, and then passes the ligature with it behind the enlarged tonsil. The probe being then removed, the knot is made with tonsil-irons, if the fingers are not long enough for the purpose.

Desault employed an instrument, which the French call *un serre-neud*, which is in fact nothing more than a long, narrow, round piece of silver, terminating at one end in a little ring, or hole, and, at the other, in a kind of groove, or notch. The patient was seated on a high chair, with his head held back, on an assistant's breast; his mouth was opened very wide, his tongue depressed, and the diseased tonsil taken hold of with a double hook. The surgeon took the *serre-neud*, in which a ligature had been passed, so as to form a noose. The noose was put over the handle of the hook, which was committed to the charge of an assistant, and the noose then pushed over the tonsil, so as to embrace it completely. The surgeon now drew the ligature strongly towards him, and pushed forward the *serre-neud*, so as to produce the requisite constriction of the tumour. In general, the ligature was not made very tight the first day. When the necessary constriction had been made, the double hook was withdrawn, and the ligature twisted round the notch, at the outer end of the instrument.

The next day the gland became unusually large, in consequence of the impediment to the return of the venous blood. The ligature was unfastened from the notched end of the instrument, and drawn more out, so as to increase the constriction, after which it was again twisted round the notch. This plan was followed up, till the tumour had been detached, which usually happened on the fourth, or fifth day. The *serre-neud* may be considered as superseded by Graefe's superior instruments.

The late Mr. Chevalier described a particular mode of passing and securing the ligature. He passed a flat spear-pointed hook behind the dis-

eased tonsil, and its point was then pushed forward, so as to perforate it through the middle of its base. The needle was then withdrawn, an eye-probe, very much curved, and armed with a long double ligature, was then readily passed through the perforation, and brought out at the mouth, the ligature divided, and one portion tied round the upper half of the tonsil, and the other round the lower. "A single knot being first made upon one end of the thread, the end so knotted is to be brought forward upon the other, and to make a single noose upon itself including the other, and to be drawn tight upon it, close to the first knot. The free end of the thread is then to be passed" through a ring at the end of an instrument for the purpose, and "being then held firm, and the ring pushed forward upon the knot, the loop, now formed, may be readily tightened, so as completely to strangle the diseased part; and, in the same manner, it may be tightened, from day to day, till the part is entirely detached." (See *Med. Chir. Trans.* vol. iii. p. 80. &c.) The subject is more intelligible with the plate.

In the *Medical and Physical Journal* of Philadelphia, No. 1. Dr. Physick has given a description of a method of removing enlarged tonsils by a double cannula and iron wire. This method has been so long before the profession, that it is unnecessary to describe it here, especially as removing tonsils with the knife is now generally preferred. The same distinguished surgeon also constructed an instrument for excision of the tonsils, which he latterly preferred to the ligature. It is composed of two steel pieces: attached to one end of each is a steel ring; between the two is a lancet-shaped blade moveable on two screws which connect the pieces. The tonsil is fixed in the rings, and the blade thrust forwards by pressing with the thumb on a button at the extremity of the handle, when it will be divided. In the *American Medical Recorder* for 1828, Dr. Matthews, of Philadelphia, has recommended another instrument for the same purpose. Professor Stevens, of New York, has described in the *New York Med. and Phys. Journal* for 1828, an instrument for the removal of the tonsils by a wire ligature, which is greatly preferable to that of Dr. Physick, when this method is adopted instead of the knife. Dr. Cox, of New York, likewise proposed a method of excising the tonsils, which seems to Dr. Reese to be superior to either of the numerous processes which have been published by way of improvements in this operation. A description of his instrument may be found in the *New York Med. and Phys. Journal* for 1829.

Sometimes, in angina, the tonsils are suddenly attacked with such a degree of swelling, that respiration is dangerously obstructed. This case is analogous to the occasional enormous inflammatory swelling of the tongue, and, if it resist venesection and leeches, the most prompt mode of relief is that of making several deep scarifications with a knife in the parts. Many examples, confirming the good effects of this practice, have been seen by Langenbeck. (See *Neue Bibl.* b. ii. p. 492, &c.)

TOPHUS. A swelling, which particularly affects a bone, or the periosteum. See **NOSE**.

TORTICOLLIS. (From *torqueo*, to twist; and *collum*, the neck.) A wry-neck. See **WRY-NECK**.

TOURNIQUET. (*French, from tourner, to turn.*) An instrument for stopping the flow of blood into a limb, until some requisite operation has been performed, or a more permanent plan of checking hemorrhage has been put in practice.

The old surgeons used to surround the limb with a band, with which they made such a degree of constriction, that the circulation was quite stopped. They also believed, that the pressure of the band was advantageous, in benumbing the limb, and moderating the pain of operations. The violent pain and contusion, however, which such a tourniquet occasioned, being frequently followed by abscesses, and even by mortification, surgeons found it necessary to devise some other method. The application of the circular band was first improved, so that it caused less pain, and less mischief to the skin. The limb was surrounded with a very thick compress, over which the band was placed. Two small sticks were next put under the band; one on the inside, the other on the outside of the limb; and they were twisted till the band was rendered sufficiently tight. It is in this manner, says Dionis, in his *Traité d'Opérations*, that carriers tighten the cords, which fasten the bales of goods in their carts. A French surgeon, named Morel, made this first improvement in the application of tourniquets.

In 1718, J. L. Petit presented to the Academy of Sciences a tourniquet of his own invention, which was much more perfect, though certainly complex, when compared with that used by modern practitioners; still it is the original of the latter, and both are constructed on the same principles. All the pieces of modern tourniquets are connected together; and, instead of two pieces of wood, used by Petit, there is a brass bridge, which is capable of being elevated, or depressed, by means of a screw, made of the same metal. Over this bridge a very strong band proceeds, and by passing under two little rollers, at each end of the bridge, it always remains connected with the instrument. A convex firm pad is sewed to the band, and put immediately over the artery, when the instrument is applied. There is no cushion for the opposite side of the limb under the screw; but a thick piece of leather, through which the band proceeds in two places, is always situated under the lower surface of the brass, and serves to prevent any bad effects of its pressure. It is usual also for the surgeon to fold some rag, and to put it in this situation, at the time of applying the instrument. (See *HEMORRHAGE*.)

The following are the advantages of the modern tourniquet, formed on the principles of that first invented by Petit: 1. It compresses the lateral parts of the limb less than the tourniquet previously in use. 2. It requires the aid of no assistant; either to hold, tighten, or loosen it. 3. The operator is able of himself to stop the flow of blood in the artery, by means of the screw. 4. When there is any danger of hemorrhage after an operation, it may be left on the limb, and, in case of bleeding, the patient, if no assistant be at hand, can tighten the instrument himself. 5. Its constriction produces less danger of mortification, because it does not altogether stop the flow of blood through the collateral arteries.

Although the employment of the tourniquet in amputations is still continued by the majority of surgeons in this metropolis, a certain

number of them dispense with it. In University College Hospital, I have never seen it applied. Mr. Guthrie states, that he usually amputates without it; and one of my colleagues is decidedly against its employment. "In the greater amputations (says he) the flow of blood into the limb may be effectually checked by exact compression with the hand on the principal vessel. This mode of arresting hemorrhage during operations on the limbs, possesses considerable advantages. The pressure is not made till the instant the incisions are commenced, and then only on one point. The limb, therefore, is not gorged with blood, and the soft parts can be much more readily carried back from the bone, than when they are confined by a circular band. A strong spring, with pads, one placed in the course of the vessel, and the other on the opposite point, may be used in cases where there is a scarcity of assistants, or where there is a probability of many vessels requiring ligature." (See *Liston On Practical Surgery*, p. 297.)

Dr. Moore, of Massachusetts, has described, in the *New England Journal*, a tourniquet of his invention, which is very generally adopted by the surgeons in that country who have not laid aside the use of this instrument in their amputations. Many of the most distinguished American surgeons dispense with the tourniquet altogether, preferring to rely upon compression made on the principal artery of the limb by a competent assistant. It is asserted, that much less hemorrhage attends an amputation without a tourniquet, than when any modification of this instrument is used, and, in very many cases, the success of the operation is overthrown by the loss of blood.

That the use of the tourniquet does increase the hemorrhage, Dr. Reese thinks, will be apparent to all who compare the two methods, "and although the bleeding is chiefly from the portion of the limb amputated yet the debility induced is not the less on this account. On the first application of this instrument to the thigh, for example, the compression is made on the superficial veins, the return of the blood prevented, and the morbid state of the limb often favours the consequent engorgement. As the instrument is screwed, the turgescence of the limb, below the point at which the compression is made, continues to increase until the circulation is stopped. No sooner is the incision made, than a hemorrhage of very considerable extent takes place, and the assistant is directed to tighten the instrument, which fails to suppress it, because the blood flows from the vessels of the limb below the incision, thus unnaturally distended. Every operative surgeon must have suffered inconvenience, and often anxiety from this source, and yet few have blamed the tourniquet, which is the true cause of the mischief.

"I have operated myself, and witnessed the amputation of the thigh by Dr. Bushe and others, where the femoral artery was suddenly compressed by the fingers of an assistant, and the hemorrhage was always very inconsiderable, often not more than half a pint during the whole operation. I believe the time is not very remote when this instrument will be every where abandoned, except where the surgeon is obliged to operate without an assistant, and in such cases the inconvenience will have to be submitted to of course." (See *Reese, in American Ed. of this Dictionary*.)

In the article *HEMORRHAGE*, I ought to have

noticed the ring tourniquet, which is adapted to cases of compound fracture complicated with hemorrhage, wound of the brachial artery in venesection, aneurism, &c. The ring tourniquet consists of a metal ring, having a diameter larger than that of the limb, to which it is to be applied, and a width of about an inch. The circumference is pierced at one point, so as to admit a screw, to the inner extremity of which a pad is fixed, and to the outer end a small handle to turn the screw with, by the action of which the pad can be carried towards, or away from, the centre of the circle. This instrument, when applied, makes pressure only on two parts; viz. by the pad on the site of the artery, or by the portion of the ring immediately opposed to the pad, on the surface of the limb directly opposed to the position of the artery. Thus it does not interfere with the lateral circulation. (See Tyrrell, in *St. Thomas's Hospital Reports*, p. 20.) Sir Astley Cooper informs me, that he has often known hemorrhage from broken limbs stopped by the use of this instrument. It merits a trial, therefore, before following the practice of Dupuytren and Delpsch, which consists in exposing and tying the femoral artery at a distance from the seat of injury in the leg. The employment of ring tourniquets has prevailed more in some hospitals than others; and I know that it was sometimes resorted to by Dupuytren himself, as well as by some of the surgeons of Italy, and other parts of the world. The late Sir William Blizard long ago had an instrument constructed on the same principles, for the compression of the artery in cases of aneurism.

The interruption of the circulation in parts of the body by the tourniquet, has been tried as a means of relieving diseases. (See *G. Kellie, Obs. on the Medical Effects of Compression by the Tourniquet*, 8vo. Edinb. 1797.)

TRACHEA, WOUNDS OF. See THROAT.

TRACHEOTOMY. (from *τραχεια*, the wind-pipe, and *τομή*, to cut.) The operation of cutting an opening into the windpipe for various surgical purposes. It is performed either for the purpose of making a passage for the air into and out of the lungs, when any disease or accidental injury prevents the patient from breathing through the mouth and nostrils; or of extracting foreign bodies, which have accidentally fallen into the trachea: or, lastly, in order to be able to inflate the lungs in cases of suspended animation. BRONCHOTOMY, (from *βρόγχος*, the wind-pipe, and *τομή*, to cut), is now generally understood to comprise the making of an incision, either in the trachea, or the larynx. This last is particularly termed *laryngotomy*; a proceeding already described. (See LARYNGOTOMY.) With respect to tracheotomy, its performance cannot be regarded as either difficult or dangerous: "*dummodo* (says Fabricius ab Aquapendente), *qui secat sit anatomes peritus, quia sub hoc medico et artifice omnia tutissime et felicissime peraguntur.*"

Mr. Porter, after giving a masterly sketch of the pathology of mucous membranes, enumerates the following accidents and diseases, for the relief of which the operation of bronchotomy has either been practised or proposed:—"The idiopathic affections of the larynx and trachea falling within this description, are acute inflammation of the mucous membrane, occurring in the child, constituting croup, or cynanche trachealis; spasmodic croup, without the existence of inflammation; in-

flammation of the submucous tissue of the larynx in the adult, or acute cynanche laryngea; thickening of the mucous membrane, or chronic cynanche laryngea; ulcerations of the mucous membrane, whether of a specific nature, or otherwise; diffuse inflammation of the cellular tissue around the larynx or trachea; alteration of structure in the laryngeal cartilages, or phthisis laryngea; sloughing and death of the cartilages; and the pressure exercised by abscess, aneurism, or other tumour in the neighbourhood of the windpipe, obstructing the passage of the air.

"The affections of the larynx, arising from accident, are, the irritation and inflammation occasioned by the swallowing of boiling water, or the stronger acids; the admission of foreign bodies within the windpipe; and the injuries inflicted by wounds, principally in attempts to commit suicide. Bronchotomy must also be considered as part of the means it might be necessary to resort to for the recovery of suspended animation." (See *W. H. Porter on the Surgical Pathology of the Larynx and Trachea*, &c. p. 20. ed. Lond. 1837.)

1. Cynanche laryngea sometimes creates a necessity for the operation, and this is particularly the case when the disease is situated in the edges of the rima glottidis, which, opening, becomes so contracted, as scarcely to leave the smallest space. For this reason, and on account of the tension of the ligaments of the glottis, the voice is rendered excessively acute, and hissing as it were. Suffocation is imminent; the lungs not being expanded, the blood accumulates in them, and the return of the blood from the head is more or less impeded. There can be little doubt, that many patients who have perished under these circumstances, might have been saved by a timely incision in the trachea. The majority of writers, who have treated of tracheotomy, as a means of preventing suffocation in inflammatory diseases of the larynx, have regarded this operation as the ultimate resource. Both the Greeks and Arabians were of this sentiment; and Avicenna only recommends tracheotomy in violent cases of cynanche, when medicines fail, and the patient must evidently die from the unrelieved state of the affection. Rhazes also advised the operation only when the patient was threatened with death. Thus, in former times, though practitioners were aware of the principle on which tracheotomy became necessary, they generally found the operation fail, because it was deferred too long, and rarely performed ere effusion had commenced in the lungs.

Tracheotomy, says M. Louis, will always be done too late, when only practised as an extreme measure. In cases of inflammation about the throat, the danger of perishing by suffocation, as this author remarks, has been known from the very dawn of medicine. The advice of Hippocrates, to remedy this urgent symptom, is a proof of it; and he observes, that the danger is evinced when the eyes are affected and prominent, as in persons who have been strangled, and when there is great heat about the face, the throat, and neck, without the appearance of any external defect. He recommends *fistula in fauces ad maxillas intrudenda, quâ spiritus in pulmones trahatur*. No doubt, he would have advised more, had it not been for the doctrine of his time, that wounds of cartilages were incurable.

This method, defective as it was, continued till

the time of Asclepiades, who, according to Galen, was the first proposer of tracheotomy. Since Asclepiades, this operation has always been recommended, and practised in inflammatory diseases about the throat threatening suffocation, notwithstanding the inculcation of Cælius Aurelianus, who treated it as fabulous. The mode of performing it, however, had not been well detailed till the time of Paulus Ægineta, who is precise and clear. "We must (says he) make the incision in the trachea, under the larynx, about the third or fourth ring. This situation is the most eligible, because it is not covered by any muscle, and no vessels are near it. The patient's head must be kept back, in order that the trachea may project more forward. A transverse cut is to be made between two of the rings, so as not to wound the cartilage, only the membrane."

Mead noticed in Wales, especially on the sea-coast, an epidemic catarrhal quinsy, which carried the patients off in two or three days. In these instances, bleeding was not of much use, and tracheotomy, which was not performed, seemed to him the only means by which the patients might have been saved.

In angina and croup, some modern practitioners are less sanguine in their expectation of benefit from tracheotomy, than Louis or Mead. From the observations of Dr. Cheyne, it would appear, that in croup, the operation cannot be necessary for the purpose of admitting air into the trachea; for, in those who died of the disease, he found a pervious canal one quarter of an inch in diameter, and through a tube of such diameter, even an adult can support respiration for a considerable time. According to the same writer, tracheotomy is equally unfitted for the removal of the membrane formed by the effusion of lymph or fibrine; for, from its extent, variable tenacity, and adhesions, this is, in almost every case, totally impracticable, and even could the whole membrane be removed, still the function of respiration would be but little improved, the ramifications of the trachea and bronchial cells remaining obstructed. (See *Cheyne's Pathology of the Larynx and Bronchia*.)

No doubt, Dr. Cheyne's statement of what is found in the dead subject is correct; and, yet the operation may be necessary to prevent suffocation, which might otherwise be induced, partly by the diminution of the natural passage for the air by disease, and partly by the action of the muscles of the glottis; a circumstance to which Dr. Cheyne has, perhaps, not assigned sufficient importance. On this point, the sentiments of Sir Charles Bell may be more correct: speaking of the membrane of croup, formed by the effusion of coagulable lymph, and of the cause of death in these cases, he says, "It has not appeared to me, that it was the violence of the inflammation which destroyed the patient, nor the irritation directly from the inflamed membrane; but that the presence of this secreted membrane, acting like a foreign body, at the same time occasions spasms in the glottis, obstructs the passage, and confines the mucus. But, I am bound to state in the strongest terms, that death is ultimately a consequence of effusion in the lungs, occasioned by the continued struggle and difficulty; for, on opening the chest, I have uniformly found, that the lungs did not collapse, and that the bronchia were full of mucus. This corresponds with the symptoms; for before death, the violence of

the cough and struggle has given place to coldness and insensibility, with a pale swelling of the face and neck, and when the child has fallen into this state, giving freedom to the trachea will be of no avail." (*Surg. Obs.* p. 16.)

In the cases of croup, which Mr. Chevalier examined after death, he found the trachea obstructed with mucus, and he believed it to be more by this secretion, than by that of coagulable lymph, that suffocation is finally produced. At all events, he succeeded in saving a boy on the point of suffocation, by making an incision in the trachea, and letting out an ounce, or an ounce and a half, of reddish brown, frothy mucus. And a case, of a very similar description, in which the same practice answered, I attended, a few years ago, with Mr. Lawrence and the late Dr. Blicke. This case, however, was different from Mr. Chevalier's, in the circumstance of a tube being required for a couple of days after the operation, when the removal of the instrument was followed by no inconvenience.

Pelletan joins several modern writers in representing tracheotomy as generally useless in croup; the only example in which he thinks the operation might be serviceable, being that in which the disease is confined to the larynx; a case, which he sets down as uncommon, and difficult to be distinguished. "*En supposant enfin l'angine avec concretion bien caractérisée, on se trouvera encore entre la crainte de pratiquer une opération inutile, si les concrétions se prolongent jusque dans les bronches, et l'impossibilité de juger si ces concrétions sont bornées au larynx. C'est en effet dans ce seul cas que l'opération peut être fructueuse; elle facilitera la respiration pendant que la nature, aidée de l'art, travaillera à dissoudre, détacher, et faire expectorer les fausses membranes qui obturent la glotte et le larynx.*" (*Clinique Chir.* t. i. p. 28.)

With reference to the treatment of acute croup, Mr. Porter divides the case into three stages. "In the commencement, the disease is incipient inflammation; and the indication is to subdue this morbid action, and prevent the production of an artificial membrane within the larynx, or trachea. The second stage is, after the lymph has been secreted, and then, if we possessed the means, the object should be to procure an artificial passage for the air, which would afford the double advantage of preserving the lungs from congestion, and allowing repose to the larynx, whilst, by the common process of nature, the adventitious membrane might be separated and expelled. And the last stage of croup presents itself when the functions of the brain have become impaired, in consequence of being supplied with blood of improper quality, and, of course, all the energies of the animal machine are weakened in proportion. The result at this period must be fatal; for, even if free respiration could be restored, the brain would not be able to recover, so as again to perform its healthy functions." (*See Surgical Pathology of the Larynx and Trachea*, p. 29.)

The arguments for and against the practice of bronchotomy in croup, are most ably laid down by Mr. Porter. "Those (says he), who would argue in favour of the operation, might advance, that it has succeeded more than once, when resorted to nearly at the termination of the disease, and when every other hope had fled; that it produces immediate relief, and that, even when not

ultimately successful, the tranquillity it affords the patient more than compensates for any pain he may have suffered; that the diseased action is in the great majority of cases circumscribed to the larynx alone; that even, if inflammation be present in the bronchial membrane, there is no reason to suppose, that it would be aggravated by the operation; that thus a free exit would be provided for the effused lymph, or for any accumulation of mucus that might occur; and that without some effort of the kind, the disease must have a fatal termination." Mr. Porter admits, that these observations are more or less founded on fact; but they go a very short way in establishing the advantage, much less the necessity, for the operation. "The effusion of coagulated lymph (he allows) is very generally confined to the larynx alone; still, in a number of cases, the inflammation commences in the bronchial cells, and proceeds upwards into the windpipe. This is an affection, in which an operation could not possibly be of service; and there is no mode of distinguishing accurately as to what has been the original seat of the disease. This one consideration must involve every case in obscurity, and render the success of an operation more dependent on chance, than on judgment. Again, if it be true, that inflammation interferes with the functions of the bronchial membrane, and that the blood will be imperfectly arterialised when such disease is present, it will be of little consequence, whether air be admitted or not. The brain will as surely be affected, as if no artificial opening had ever been practised, and all the relief the patient will experience, can amount to no more than a cessation of that extreme muscular exertion, which is necessary to carry on respiration at all. I saw this admirably exemplified in the case of a little girl, on whom bronchotomy was performed for the cure of croup: the disease had been originally confined to the larynx; but, after the operation, the bronchial cells became affected, and the inflammation spread upwards nearly to the place in which the trachea had been opened. In this instance, there was no deficiency of air; the aperture was much larger than the natural size of the rima glottidis, yet the patient had convulsions, exhibited every symptom of cerebral congestion, and finally died comatose." (Porter, *Op. cit.* p. 35.)

It appears to this gentleman, that, in the earlier stages, when the membrane is red and swollen, and no lymph as yet effused, there can be no object in making an incision, which will be much more likely to aggravate the disease, than relieve it. When the adventitious membrane has been formed, he suspects that, in the majority of cases, sufficient mischief has been already accomplished to render a recovery very problematic. In the latter stages of croup, he condemns the notion, that an operation would be beneficial "unless it be supposed, that a wound of the windpipe could remove cerebral congestion, and therefore (says Mr. Porter), whenever convulsions have occurred, or the patient appears comatose, or sinking, let no man undertake it as a last resource." (*Op. cit.* p. 33.)

Mr. Porter admits, however, the propriety of the operation in a case, where respiration is dangerously obstructed by a copious accumulation of mucus in the trachea; or where, after the total subsidence of inflammation, the membranous

lymph exists in the trachea, purely in the condition of a foreign body. Yet, he thinks the discrimination of these cases impracticable.

With regard to *acute cynanche laryngea*, Mr. Porter, after noticing its frequently rapid course to a fatal termination, observes that, if bloodletting be resorted to, it should be adopted to a large extent, and without delay; and if it produce a decided alleviation of symptoms, and is followed by the exhibition of tartarised antimony, so as to keep the patient in a state of depression several hours, the case will probably terminate favourably. But, this will not be likely to happen, if a serous effusion (*oedema*, as it is termed), has already taken place in the submucous tissue. Here, this distinguished surgeon is an advocate for bronchotomy. (*Op. cit.* p. 87.)

The importance of an early recourse to bronchotomy, where acute laryngitis threatens suffocation, is well exemplified in two cases recorded by Flajani: in one, where the operation was not undertaken till a late period of the disease, the patient died; in the other, where the practice was adopted earlier, life was preserved. (*Collezione d'Osservazioni, &c.* t. iii. p. 230—233.)

A few years ago, Dr. Baillie produced three cases, in which death was produced in the adult subject, and this in a very few days by a violent inflammation of the larynx and trachea. The disease had a strong resemblance to croup; yet was different from it. There was not the same kind of ringing sound of the voice as in croup, and no layer of coagulable lymph was formed upon the surface of the inner membrane of the larynx and trachea, which, according to Dr. Baillie, uniformly attends the latter disease. In one of these cases, the cavity of the glottis was found to be almost obliterated by the thickening of the inner membrane of the larynx at that part. The inner membrane of the trachea was likewise inflamed; but in a less degree. The lungs were sound. If, in thirty hours, no relief should be derived from bleeding and deliquium, and the exhibition of opiates, Dr. Baillie conceives, that, in this sort of case, it might be advisable to perform the operation of bronchotomy at the upper part of the trachea, just under the thyroid gland. This operation, he thinks, would probably enable the patient to breathe, till the inflammation in the larynx, more especially at the aperture of the glottis, had time to subside. (See *Trans. for the Improvement of Med. and Chir. Knowledge*, vol. iii. p. 275. 289.)

An acute affection of the membrane of the glottis, proceeding rapidly to a fatal termination by suffocation, has also been particularly described by Drs. Farre and Percival. (See *Med. Chir. Trans.* vols. iii. and iv.) In some bodies, which Mr. Lawrence examined after death, he found appearances analogous to those mentioned by the above physicians. "The patients died of suffocation: but the progress of the complaint was much slower than in those cases; the symptoms were not acute, nor did the inspection of the parts disclose any evidences of active inflammation. The membrane, covering the chordæ vocales, was thickened, so as to close the glottis, and a similar thickening extended to a small distance from these parts, accompanied with an oedematous effusion into the cellular substance under the membrane. The epiglottis did not partake of the

disorder. In one or two instances, this thickened state of the membrane was the only change of structure observed; but in others it was attended either with ulceration of the surface near the glottis, appearing as if it had been formed by an abscess, which had burst; or with a partial death of one or more of the cartilages of the larynx, viz. the arytenoid, thyroid, or cricoid. The rest of the air-passages and the lungs were healthy." (*Med. Chir. Trans.* vol. vi. p. 222.)

In such examples, this gentleman is a zealous advocate for the early performance of bronchotomy, and he has cited several instances in which this operation was successfully performed, both for the relief of quinsy and the extraction of foreign bodies from the trachea. It is in chronic cynanche laryngea, as Mr. Porter remarks, that "bronchotomy has been most frequently followed by fortunate results, and it is one, in which it will always be successful, if not delayed too long. The disease is here caused by a mere thickening of the mucous membrane, without any morbid alteration of structure; but, the circumstance of the larynx being in constant use, tends to maintain the action, that is going forward, and finally, if not relieved, to produce such a thickening of the part, as will be incompatible with the maintenance of its functions. It is thus that creating an artificial passage for the air operates in promoting recovery, &c. (See Porter, *op. cit.* p. 115.) Of course, if there is time, the power of mercury should always be fairly tried before the operation is resorted to. In some instances, Mr. Porter has given calomel in 10 grain doses, four times a day.

2. Another form of chronic laryngitis, considered by Mr. Porter with reference to the performance of bronchotomy, is that resulting from ulceration sometimes of the mucus membrane alone, but more frequently involving the deeper structures, and producing a permanent disorganisation of the part. Some sporadic ulcers usually commencing above, either in the soft palate, or the back of the pharynx, and spreading downwards, and taking place in bad constitutions, are described by Mr. Porter as being little under the influence of medicine; and "operation, however it may prolong existence, scarcely holds out a hope of ultimate recovery. In general, however, ulcerations of the larynx appear to be of a specific nature, and are commonly referred to a venereal taint; yet, although they are doubtless sometimes so produced, it is probable, they are more usually the results of frequent, protracted, or irregular courses of mercury, more particularly in patients of a strumous habit." The loss or imperfection of voice will much depend on the situation of the ulcers; "but the difficulty of breathing and general distress are by no means a criterion by which the extent of destruction of parts can be estimated; for, sometimes there is uncommon suffering where the ulceration is extremely limited. Very frequently these ulcers, particularly if the epiglottis is engaged, produce symptoms of difficult deglutition, exactly resembling those of stricture of the oesophagus; but this is only during the time that the sores are actually open; for, when healed, swallowing is performed with astonishing facility, even although the greater part of the epiglottis may have been carried away." Mr. Porter's judgment concerning bronchotomy for these cases is delivered in the following words: "To be really useful, the operation

should be performed at an early period, before extensive destruction has taken place; and, at this stage, mercury is so generally efficacious in arresting the progress of the disease for a time, that few persons would have recourse to the ulterior measure, even if the patient were willing to submit." (*On the Surgical Pathology of the Larynx and Trachea*, p. 116—118.) At the same time this gentleman admits, that the venereal cases, published by Mr. Carmichael (see *Dubl. Journ. of Med. Science*, vol. ii. p. 155.; and *Essay on the Venereal Disease*, p. 213. ed. 2.), are extremely satisfactory, so far as they go, and that they afford evidence of the success of bronchotomy, even when performed as a last resource in syphilitic ulceration of the larynx. (*Op. cit.* p. 121.)

Mr. Carmichael observes, "The presumed *modus operandi* of an opening in the trachea, as a remedy, is to allow the patient to breathe through the artificial opening, and permit the larynx to remain undisturbed by a constant current of air, and thus induce that favourable state of quiescence, which is necessary to the healing of an ulcer in any situation." (*On Ven. Dis.* ed. 2. p. 213.)

With regard to tracheotomy for croup, cedema, or ulcer of the glottis, all practitioners, I believe, will agree with Mr. Crosse, that "it is much less successful, than when demanded on account of a foreign substance getting into the trachea."

3. What is termed *phthisis laryngea* is another disease, which may require the performance of bronchotomy. Every disease of the respiratory tube, producing difficult or imperfect respiration, accompanied by cough, purulent, or bloody expectorations, pain in the larynx or trachea, and exhibiting the usual phenomena of hectic fever, such as night sweats, and colliquative diarrhoea, has been described under the name of *phthisis laryngea*. Mr. Porter arranges the states, which may give rise to such symptoms, as follows: 1. *A thickened state of the mucous membrane of the larynx and trachea, accompanied by chronic inflammation.* 2. *Acute asthma.* 3. *Abscess in the neighbourhood of the larynx.* 4. *Abscess complicated with disorganisation of one or more of the laryngeal cartilages.* 5. *Abscess, with mortification of the same cartilages.*

Dismissing from present consideration acute asthma, I concur with Mr. Porter respecting the propriety of generally discharging abscesses near the larynx by an external incision, and that they are not cases calling for bronchotomy. I have been fortunate enough to save life in several instances of this kind where the patients were nearly at the point of suffocation. When chronic disease of the larynx induces ulceration and disorganisation, the case, as Mr. Porter observes, frequently admits of relief from medicine; but often not; and then bronchotomy may become indispensable. "It will be most valuable in affording repose to the diseased organ; it will remove the danger of the lungs becoming congested and engorged; and it will free the patient from those terrible paroxysms of spasmodic suffocation, which constitute his most distressing symptoms." (*Porter, Op. cit.* p. 142.)

In abscess complicated with caries and exfoliation of the cartilages, bronchotomy holds out the only hope of relief, but, according to Mr. Porter, with the alternative of breathing through a tube for ever afterwards.

4. What Bayle calls *l'ademe de la glotte*, and others *laryngitis œdematosa*, may be the effect of the same kind of disease as that noticed by Mr. Lawrence. One case of it, in which tracheotomy was performed with success; and another, in which the patient died suddenly suffocated, in consequence of the operation not being done, have been published by Mr. Liston. (See *Edin. Med. and Surg. Journ.* vol. xix. p. 568.) "Any time previous to congestion in the lungs, the operation will almost certainly save the patient's life, and at any time subsequent, it will as surely fail. (See *Porter, Op. cit.* p. 90.) The truth of this was fully exemplified in a young man on whom I performed bronchotomy in the infirmary of the Fleet prison, this last summer (1838). In two or three hours after the operation, he felt so much relief, that he requested to be allowed to sit up to supper; but early the next morning, he fell a victim to a return of spasms, and impeded respiration. The affections of the larynx requiring bronchotomy, would seem, indeed, to be more numerous and diversified, than is usually supposed: thus Sir C. Bell mentions the case of a medical student, who was attacked with shivering, fever, and sore throat, and in three days died of suffocation. On dissection, no obstruction in the larynx was observed, but only an inflammation of its membrane, and a spot like a small-pox *pustule*, upon the margin of the glottis. (*Surgical Obs.* part i. p. 14.)

5. Children sometimes inadvertently drink boiling water from the spout of a tea-kettle. "The effects of this accident (says Dr. Hall) are not as might be supposed *à priori*, the symptoms of inflammation of the œsophagus and stomach, but of inflammation of the glottis and larynx, resembling those of *croup*; and the case constitutes another instance, in which the operation of laryngotomy, or of tracheotomy, may be performed with the effect of preventing impending suffocation, and perhaps of saving life." (*Med. Chir. Trans.* vol. xii. p. 2.) The cases and remarks collected by Dr. Hall, Mr. Gillman, and Mr. Stanley, on this subject, cannot fail to be interesting to practitioners. In the *post mortem* examination, instituted by the latter gentleman, however, there was inflammation in the œsophagus. "The tongue, cheeks, and fauces are inflamed, the uvula detached in spots and patches, and vesications are formed particularly at the root of the tongue. The larynx above the rima is also more or less inflamed, and very frequently œdematous. In some cases, it is so swollen and punctured, as completely to close the glottis. Below the rima, the larynx and trachea are frequently seen perfectly healthy and unaltered, as if the irritation of the heated material had caused a powerful spasm of the muscles here, and prevented its influence from extending further downwards. Such will be the appearance, if the patient has survived the accident only a few hours; but, if he has lived two or three days," the mucous membrane of the trachea and bronchial tubes may be inflamed, swollen, and of a deep red colour, as far as it can be traced; the lungs may scarcely collapse; and the trachea may be filled with a copious serous effusion. In cases of long standing, the inflammation of the bronchial membrane may produce a true and adventitious membrane, as in *croup*. Again, the affection sometimes terminates in pneumonia and complete solidification of more

or less of the lung. Mr. Porter has never seen an instance of the lower part of the œsophagus, or of the stomach having sustained injury. (*On Surgical Pathology of Larynx, &c.* p. 182.)

On account of the free bleeding caused by tracheotomy in children, and their inability to bear the loss, Mr. Porter regards this operation as peculiarly dangerous in them. Hence, and on account of the occasional success of antiphlogistic measures, he thinks a trial of them should always be continued, until the breathing becomes so affected "that there is every reasonable probability of the operation becoming necessary." Indeed, as Mr. Ryland observes, the operation should not cause antiphlogistic means to be stopped; and one frequent reason of its failure is, that it is not followed up by plans proper to subdue laryngeal and bronchial inflammation, which go on after the operation just as much as before it. The design of the latter measure is not exactly to cure the disease, but to supply air until the inflammation has been subdued by mercury or other means. (See *Ryland, On Dis. of the Larynx, &c.* 8vo. Lond. 1837.)

In a case of the foregoing description, Mr. Wallace, of Dublin, performed tracheotomy with success, and so did Mr. Adams. (See *Lond. Med. and Phys. Journ.* for July, 1822.) Mr. Burgess, who has seen five cases, in which boiling water was taken into the throat, thinks that death when it follows, is almost always produced by obstructed respiration. In one of the examples, bronchotomy was the means of saving the child. (See *Dublin Hospital Reports*, vol. iii.) Mr. Wallace occasionally superseded the necessity for the operation by the free exhibition of calomel; and in University College Hospital we have had instances of similar success from the same means.

The attempt to swallow corroding substance may be followed also by a necessity for bronchotomy.

6. Great mechanical injury of the larynx, caused by a blow or fall, may likewise require the performance of bronchotomy, as is proved by a case reported by Mr. Liston. (See *Ed. Med. and Surg. Journ.* vol. xix. p. 570.)

7. The compression of the trachea by foreign bodies, lodged in the pharynx, or by tumours, formed outwardly, and of sufficient size to compress the windpipe, but not admitting of immediate removal, is an equal reason for operating, more or less expeditiously, according to the symptoms. Mr. B. Bell mentions two instances of suffocation from bodies falling into the pharynx. Respiration was only stopped for a few minutes; but the cases were equally fatal, notwithstanding the employment of all the usual means. This author thinks, that tracheotomy would have been attended with complete success, if it had been performed in time. For remarks on this point, see (*Esornacus*).

The author of the article *Bronchotomy*, in *l'Encyclopédie Méthodique*, says that about twenty years ago, he opened a man, who had died of emphysema, which came on instantaneously. He had had, for a long while, a bronchocele, which was of an enormous magnitude towards the end of his life. The cavity of the trachea was so obliterated, that there was scarcely room enough to admit the thickness of a small piece of money. Bronchotomy, performed before the

emphysema made its appearance, the author suspects, might have prolonged this man's days.

Habicot successfully performed this operation on a lad fourteen years old, who, having heard that gold, when swallowed, did no harm, attempted to swallow nine pistoles, wrapped up in a piece of cloth, in order to hide them from thieves. The packet, which was very large, could not pass the narrow part of the pharynx; and here it lodged, so that it could neither be extracted, nor forced down into the stomach. The boy was on the point of being suffocated by the pressure, which the foreign body made on the trachea; and his neck and face were so swollen and black, that he could not have been known. Habicot, to whose house the patient was brought, attempted in vain, by different means, to dislodge the foreign body. At length, perceiving the patient in evident danger of being suffocated, he resolved to perform bronchotomy. This operation was no sooner done, than the swelling and lividity of the face and neck disappeared. Habicot pushed the pieces of gold down into the stomach with a leaden probe, and the pistoles were discharged from the anus, eight or ten days afterwards. The wound of the trachea soon healed. (See *Mém. de l'Acad. de Chirurgie*, tome xii. p. 243. edit. in 12mo.)

8. Foreign bodies in the trachea may render it necessary to practise bronchotomy.

M. Louis proved more convincingly, than all his predecessors, the necessity of the operation in circumstances of this kind. The following case fell under his observation.

On Monday, the 19th of March, 1759, a little girl, seven years of age, playing with some dried kidney-beans, threw one into her mouth, and thought she had swallowed it. She was immediately attacked with a difficulty of breathing, and a severe convulsive cough. She said, that she had swallowed a bean, and such assistance as was thought proper, was given her. Several surgeons were successively sent for, who in vain employed different means for extracting foreign bodies from the œsophagus, or forcing them into the stomach. A fine sponge, cautiously fastened to the end of a whalebone probang, was repeatedly introduced through the whole extent of the œsophagus. The little girl, who made a sign with her finger, that the foreign body was situated in the middle of the neck, thought that she felt some relief, when the sponge was conveyed below the place which she pointed out. She had, every now and then, a violent cough, the efforts attending which produced convulsions in all her limbs. Deglutition was unobstructed; and warm water and oil of sweet almonds had been swallowed without difficulty. Two whole days had been passed in sufferings, when the relations called in M. Louis. The little girl, with all possible fortitude and sense, was several times held in her friends' arms, ready to die of suffocation. M. Louis, well aware of what had happened, came into the child's room. She was sitting up in her bed, suffering no other symptom, than a very great difficulty of breathing. M. Louis inquired where she felt pain, and she made such a sign in reply, as left no doubt concerning the nature of the accident. She put the index finger of her left hand on the trachea, between the larynx and sternum. The fruitless attempts which had been made in the œsophagus, from the view of dislodging the foreign body; the pain, and the smallness of this body, which was

not such as would be stopped in the passage for the food; and the facility of swallowing; were negative proofs, that the bean could not be in the œsophagus. Respiration was the only function disturbed; it was attended with difficulty, and a rattling in the throat. The little girl expectorated a frothy fluid, and she pointed out so accurately the painful point where the object producing all her sufferings was situated, that M. Louis did not hesitate to declare to the relations, from this single inspection, that the bean was in the windpipe, and that there was only one way of saving the child's life, which was to make an incision, for the purpose of extracting the foreign body. He apprised them, that the operation was neither difficult nor dangerous, that it had succeeded as often as it had been practised, and that the very pressing danger of the case only just allowed time to take the opinion of some other well-informed surgeons, respecting the indispensable necessity for such an operation. M. Louis thought this precaution necessary, in order to acquire the confidence of the parents, and to shelter himself from all reproach, if the event of the case should not correspond with his hopes. He now went home to prepare all the requisites for bronchotomy, and in two hours, he was informed that the other surgeons consulted waited for him. After his departure, the child had become quiet, and was now lying on its side asleep. The opinion he had delivered, had been ill explained by the friends and attendants, and had been discussed, before his return. They, who had been rendering their assistance on the supposition, that the foreign body was in the œsophagus, evinced surpriſe at the proposal of extracting, by an operation, a substance, the presence of which, in any part of this tube, was not obvious. M. Louis explained his advice, in regard to bronchotomy, and did not expect a doubt to be set up against so positive a fact. It was objected, that a substance as large as a bean could not insinuate itself into the trachea. Still he brought every one into his sentiment, by a short explanation of cases of this sort, with which he himself had been acquainted. The little girl was examined: she was better than when M. Louis saw her before, and a very palpable emphysema was seen above the clavicle, on each side of the neck, a symptom which did not exist two hours previously. This swelling led M. Louis to conclude, that the urgency for the operation was still greater. The friends, whose confidence had been shaken by the opposition he had experienced in bringing about unanimity, were in the greatest embarrassment, when they were told that the child might die of an operation, which he had represented as only a simple incision, free from all danger. M. Louis was repeatedly asked, if he would be responsible for the child's life during the operation, and he in vain replied, that if there were any thing to fear during the operation, it would be from the accident itself, and not from the assistance rendered. This distinction was not perceived, and M. Louis withdrew, at the same time refusing his consent to the exhibition of two grains of emetic tartar, the effect of which would be useless, and might be dangerous. The medicine was given in the night; the child was fatigued by its operation, and left quite unbenefited. On Tuesday morning, M. Louis found the little girl very quiet, and they who had paid their visits earlier, found her wonderfully well. The respiration, however, continued to be still attended with the rattling noise, heard also in the evening, when the breathing

had been more laborious. The child was nearly suffocated several times in the course of the day, and died in the evening, three days after the accident.

The body was opened, before a numerous assembly of persons. After making a longitudinal incision through the skin and fat, along the trachea, between the sterno-hyoid muscles, Bordenave slit open the trachea, cutting three of its cartilages. At this instant, every one could see the bean, and Louis took it out with a small pair of forceps. From the ease, with which this was effected, there was every reason to believe, that on the living subject, it would have saved the child's life. (*Mém. d'Acad. Royale de Chirurgie*, t. xii. p. 293, &c. ed. in 12mo.)

This case strikingly illustrates the symptoms, which result from the presence of foreign bodies in the trachea, and exemplifies the only surgical proceeding which can be of use. But among the phenomena, apparently difficult of explanation, is the calm, which, at intervals, followed the afflicting cough. (See *Dr. Hunt's Case*, in *Med. Chir. Trans.* vol. xii. p. 27.) Anatomy, however, has dispelled much of the doubt on this matter. It is known, that the whole canal of the trachea is much less sensible than the rima glottidis. A foreign body, like a bean, may remain a certain time in that canal without much inconvenience, the passage being only somewhat obstructed, according to the position of the substance. It may even remain several days, months, or years, without producing any symptom of its presence, except a trivial sensation of obstruction, and this is what happens, when the body lodges in one of the ventricles of the larynx. Facts of this kind are to be found in Tulpius, Bartholine, and many other observers. But, when the extraneous substance quits its situation, and is carried into the trachea, the irritation, which it produces there, and particularly about the larynx, occasions coughing; and if, in the fits, the foreign body should become fixed between the lips of the glottis, it may cause instantaneous death, as probably has happened in many of the cases of suffocation from extraneous substances.

Another remarkable circumstance, which deserves more attention, as it confirms the presence of a foreign body in the trachea, is the emphysema, which appeared about the clavicle, towards the termination of the case. M. Louis did not believe that any of the persons, who saw the patient, could entertain a just idea of the origin of this symptom. The supposition, of the obstruction, which the foreign body caused, for two days, to the free passage of the air, occasioning a forcible distention of the trachea, and a rupture of the membrane, which connects together the cartilaginous rings of this tube, was dispelled by the examination after death. The windy tumour had not originated in the circumference of the trachea: here its limits were only seen. The very substance of the lungs, and the mediastinum, were emphysematous. The air, confined by the foreign body, had ruptured the air-cells during the violent fits of coughing, and thus insinuated itself into the interlobular cellular texture of the lungs. Thence it had passed into the cellular substance of the lungs; and afterwards into that connecting the pleura pulmonalis with

the outer surface of these organs; and by the communication of these cells with each other, it had produced a prodigious swelling of the cellular substance, between the two layers of the mediastinum. The emphysema, in its progress, at length made its appearance above the clavicles. The swelling of the lungs, and the circumjacent parts, in consequence of the insinuation of air into the cellular tissue, is a manifest cause of suffocation. According to Mr. Porter, this symptom has only been noticed in the single case under M. Louis. (*Op. cit.* p. 203.)

Foreign bodies in the trachea, however, do not always cause death so suddenly, which may be owing to their smallness, their smoothness, or the situation in which they are fixed. An example is related in the *Ephemer. Cur. Naturæ*, Decad. 2. Ann. 13. As a monk was swallowing a cherry, the stone of the fruit passed into the trachea. A violent cough, and excessive efforts, as it were, to vomit, were the first symptoms of the accident, and of these the patient thought he should have died. A sleep of some hours followed this terrible agitation, and the patient afterwards did not feel the least inconvenience during a whole year. At the end of this time, he was attacked by a cough, attended with fever. These symptoms became worse and worse every day. At length the patient evacuated a stone as large as a nutmeg. It was externally composed of tartareous matter, to which the cherry-stone had served as a nucleus. A copious purulent expectoration followed the discharge of the foreign body, and the patient some time afterwards died consumptive. No mention is made of the body being opened; but, from the symptoms, there is every reason to believe, that an abscess must have arisen in the substance of the lungs, from the presence of the foreign body. That foreign bodies in the trachea, even when they do not induce pressing symptoms of suffocation, may ultimately kill the patient by inducing disease of the lungs, is proved by several cases on record, and particularly by one, which occurred to Desault: a cherry-stone was lodged in one of the ventricles of the larynx; the patient would not consent to an operation, and died in two years d'une *phthisie laryngée*. (See *Œuvres Chir.* t. ii. p. 256.) Baron Dupuytren relates one instance, in which the patient lived ten years with a small coin in a tubercular cavity of the lungs, and then fell a victim to its effects. (*Clin. Chir.* t. iii. p. 584.) M. Sue gives the case of a girl, who suffered from the lodgment of the rump-bone of a chicken in different situations in the respiratory tube during seventeen years; at the end of which time she coughed up the bone; but died eighteen months afterwards with purulent expectoration and hectic.

To detect the presence of a foreign body in the air-passages, auscultation often gives important assistance. Its application to this particular case is chiefly due to Dr. Stokes. On this part of the subject Mr. Porter observes, that since the stethoscope has begun to be universally employed, cases of this nature have been more numerous made out. In the autumn of 1829, three successful operations were performed in the Meath Hospital alone, for the removal of the stones of fruit from the windpipe, and not a year now passes without such case presenting itself. (*Op. cit.* p. 193.) If a body be impacted firmly in the larynx, as in one

of the ventricles, it will produce more or less violent and incessant attacks of cough and dyspnoea, in which the lungs are found by auscultation to be sound, and the larynx to be the seat of the constriction; the permanency of which, together with the history, will point out the nature of the case. When a foreign body is in the trachea, it generally gets into one of the bronchial tubes (almost always the right, as first observed by Mr. Key, because this is larger, and lies more in the axis of the trachea), and here will produce signs of obstruction, which may be quite distinctive. When the body is smooth and round, as a plum-stone, or bean, it may from time to time entirely block up the bronchus, and the consequent sudden and total absence of respiration on that side only, whilst the sound on percussion remains good, will plainly show the nature of the affection. The evidence becomes stronger, when, on violent coughing, the air is suddenly heard again to enter the lung, and when the inert use of laryngeal irritation implies, that the body has been removed back into the trachea. (Stokes.) — See *British and Foreign Med. Rev.* No. x. p. 440.)

When the substance is loose, it is frequently heard, as it moves upwards and downwards, to strike against the sides of the tube with a peculiar rattling sound. This is most clearly heard, when the patient makes a forced expiration, and the foreign body is driven up towards the larynx. If this is not perceived, the substance is probably lodged in the right bronchus, through which it will more or less prevent the transmission of air, and there will then be a feebleness or perhaps a total absence of respiratory murmur in the right lung, although that side of the chest may sound clear on percussion. (See *Porter, Op. cit.* p. 201.)

Some valuable observations, confirming the necessity of an early recourse to bronchotomy, in cases where foreign bodies are lodged in the trachea, were published by Pelletan. In one case, in which a bean had fallen into a child's trachea, and in which the most urgent symptoms of suffocation had prevailed for four days, and convulsions during the last thirty-six hours of this space of time, Pelletan performed the operation, which a timid practitioner, under whose management the young patient was first placed, had neglected to do at an earlier period. Upon the incision being made in the trachea, the bean was immediately thrown out to the distance of two feet, and the child for a time was relieved. The little boy was so extremely weak, that it was at one time supposed he was dead. However, with some assistance, he gradually revived, even regained his senses, called his parents, and asked for such things as he wanted. This hopeful state lasted eight or ten hours, after which, convulsions came on again, and the child died in fourteen hours after the operation.

Notwithstanding the turgid appearance of all the blood-vessels of the brain, as detected after death, the boy had yet received a degree of relief at the instant of the foreign body being extracted. Pelletan deems it unnecessary to insist on the great probability of success, that would have attended the operation, had it been performed at an earlier period.

Of such success, Pelletan gives us the following example.

In the month of May, 1798, a child, about three years old, was brought to the Hôtel-Dieu, while in playing with some French beans, and

putting them into its mouth, let one of them slip into the trachea. For three days, the child was afflicted with a continual cough, and sometimes the symptoms of suffocation were most pressing. This time had been spent in administering emetics, introducing instruments into the œsophagus with the design of forcing the foreign body into the stomach, and in inspiring the relations with a pernicious confidence, arising from the very long intervals of repose, which the child experienced, during which, however, a rattling in the throat continued, a characteristic mark of the accident. Pelletan immediately decided to perform the operation. The child was very fat, and this circumstance, together with the small diameter of the trachea at this age, rendered the exposure of the anterior portion of this tube difficult. Pelletan was at this moment struck with the reflection, that bronchotomy should never be attempted except by men of science, coolness, and experience in operations. The rings of the trachea, however, were at length cut, and there was no sensible interval between the incision and the expulsion of the foreign body. The bean had swelled considerably with the moisture. The child seemed restored to life; it spoke freely; it was only troubled with coughing, the effect of a small quantity of blood insinuating itself into the trachea, which fluid was instantly rejected again. This event has the appearance of convulsions, and may alarm those who do not understand it; but, according to Pelletan, it is the guarantee of the patient's life, by expelling incessantly, and without difficulty, whatever happens to get into the trachea. The wound was healed in twenty days, and the child's voice was not perceptibly altered.

In another interesting case, recorded by the same writer, a pebble was lodged in the windpipe, and the case not being understood, was treated, for about three weeks, as a simple inflammation of the lungs. At last tracheotomy was performed, and, by placing the child in a horizontal position, the stone was soon discharged through the incision. The patient was immediately relieved; but, the effects of the inflammation of the lungs, and injury which these organs had sustained, could never be entirely cured, and the child died phthisical eight months afterwards.

Pelletan details other cases, in which the foreign body, being fixed in the trachea, could not be forced out by the breath, as soon as the incision had been made, but required further means to disengage it. In one instance, Pelletan made a long cut in the windpipe of a child; but nothing made its appearance. A probe, wrapped round with some oiled linen, was then introduced several times up and down the larynx, without creating a great deal of uneasiness, and the child continued to respire very well through the opening. The foreign substance was presently brought to the wound and extracted: and it proved to be part of the jaw of a mackarel, with many sharp teeth in it. This child soon experienced a perfect recovery.

In another instance, a young man came to the Hôtel-Dieu, in consequence of being afflicted, for six weeks, with a severe cough, frequently accompanied with a sense of suffocation. These complaints, on inquiry, were ascertained to arise from a button-mould having fallen into the trachea. An opening was, therefore, made in this tube; but, though the button could be felt, it could not

be extracted with the finger. The cricoid cartilage was now divided, and the foreign body taken out of the left ventricle of the larynx. The man recovered.

In one case, related by Pelletan, a piece of tendon of veal got down the glottis, and gave rise to most dangerous symptoms. The foreign body was described as being so large, that this surgeon could not but suppose, that the complaints were owing to its lodgment in the œsophagus, as it seemed to be incapable of entering the glottis. The introduction of instruments down the pharynx, however, produced no relief; but, on dividing the thyroid cartilage, Pelletan passed his finger within the larynx, and, without knowing it, pushed the piece of tendon towards the glottis, when, with the aid of a probang, it was forced into the pharynx and swallowed. The patient experienced immediate relief, and recovered. (*Clinique Chir.* t. i.)

In the London Hospital, there was lately a case, in which no discharge of the foreign body took place, till the edges of the wound had been drawn apart, when it was voided with considerable force.

With respect to bronchotomy, for cases in which extraneous substances are supposed to be lodged in the trachea, one important caution seems necessary, viz. whenever the foreign body is above a certain size, a probang should always be passed down the œsophagus before the windpipe is opened; for very similar symptoms to those, which proceed from extraneous substances in the trachea, may be caused by the lodgment of foreign bodies in the œsophagus. In fact, bronchotomy has actually been performed, while the extraneous substance was in the œsophagus, from which last situation no attempt had been made to displace it, and the patient lost his life. (See *Œuvres Chir. de Desault*, t. ii. p. 261.)

Dr. Houston has recorded an interesting case, in which in the attempt to extract one of the large molar teeth, the greater portion of it slipped into the trachea. From the mildness of the symptoms, at first, and the doubts entertained by some gentlemen consulted, whether the tooth had passed into the trachea, or down the œsophagus, tracheotomy was not performed: pneumonia and bronchitis ensued; first in the right, and then in the left lung, and the patient died on the eleventh day. In the *post mortem* examination, the tooth was discovered lying in the right bronchial tube, about one inch beyond its commencement. As Dr. Houston observes, if the lodgment of the foreign body had been clearly made out, an attempt to extract it, through an incision in the trachea, by means of the forceps, with long narrow blades, recommended by Mr. Key, ought to have been made. (See *Houston in Dublin Journ. of Med. Science*, vol. v. p. 42.) The only case, in which such an operation has been accomplished, was, perhaps, that under the care of Mr. Liston. The patient, a female, was suffering dangerously from the effects of a piece of mutton bone, that had slipped into the trachea, about six months before she was seen by Mr. Liston. A pair of forceps was introduced about three or three and a half inches down the trachea through an incision, and the foreign body seized and extracted from the right bronchus. (See *Liston on Practical Surgery*, p. 347.)

As a mode of relief, in the case of a foreign body

in the trachea, Desault speaks of the introduction of an elastic tube into the trachea; but as Mr. Porter justly remarks, this plan not only cannot effect a cure, but cannot afford even temporary relief. "Except when the foreign body is impacted in the larynx, there is no impediment to the free ingress of air: the rima glottidis is completely open, and consequently the introduction of a tube must be useless; but, it is worse. I pass the consideration, that this accident usually occurs to children; and that in persons, under twelve or thirteen years of age, the rima glottidis is so small, that the introduction of a tube would be nearly impossible: if the foreign body is loose, it is liable at any moment to be thrown against or into the rima, and thus instantly destroy the patient. What then is more likely to occasion this melancholy catastrophe than the cough, which the irritation of a tube would inevitably occasion?" (*Porter, Op. cit.* p. 213.)

9. Bronchotomy has been proposed in cases, in which the tongue is so enlarged as totally to shut up the passage through the fauces. Richter mentions an inflammation of the tongue, in which it became four times larger than in the natural state. Valescus had made the same observation: "*Ego aliquando vidi ita magnificatam linguam, propter humores, ad ejus substantiam venientes, et ipsam imbibentes, quod quasi totum os replebat, et aliquando ex ore exibat.*" (*Lib. ii. cap. 66.*) These prodigious swellings of the tongue sometimes occur in malignant fevers, and small-pox. They may also be the result of accident, as, for instance, in cases which happen from the stings of insects, or the unskilful employment of mercury. Mr. B. Bell gives an example of the latter sort. He says, that the patient had taken, in a short time, so large a quantity of mercury, that the part became alarmingly swollen in a few hours, and, though all the usual remedies were tried, none had the least effect. Bronchotomy was delayed till the patient was nearly suffocated; but he was restored as soon as an opening had been made in the trachea. This practice, however, can rarely be necessary, because the making of incisions in the dorsum of the tongue, or the direct application of leeches, will almost invariably be followed by a rapid reduction of the swelling. See *TONGUE*.

In cases of the preceding description, Desault would have advised the introduction of an elastic gum catheter, from the nose into the trachea, in order to enable the patient to breathe, until the swelling of the tongue had subsided. (See *Œuvres Chir.* t. ii. p. 246.)

10. Bronchotomy has been recommended, when both the tonsils are so enlarged, as dangerously to impede respiration. Here the inflammatory swelling is not meant; this commonly soon suppurates, and the spontaneous bursting of the tumour, or the opening of it with a pharyngotomus, will surely remove all necessity for so extreme a measure. But, even in acute inflammation and great enlargement of the palate, tonsils, &c. attended with imminent danger of suffocation, the practice has been sometimes deemed necessary, as proved by the cases cited from Flajini, in the preceding columns. The disease, however, which I here wish particularly to specify, as raising the question whether bronchotomy ought to be performed, is a chronic enlargement of the tonsils, the case mentioned in the article *TONSILS*. From the remarks

there made, however, it will be seen that the right practice is the excision of a portion of the tonsils, and not the operation now in question. Besides, before the glands are so large as to threaten suffocation, they should be cut away, in preference to performing bronchotomy, which might relieve the urgency, but could not remove the cause of the difficulty of breathing. In general, there is no urgent danger of suffocation, till the swelling is such as not only to shut up the posterior aperture of the mouth, but also the posterior openings of the nostrils, which must be exceedingly rare. In cases of obstructed respiration from enlargement of the tonsils, Desault preferred the introduction of the elastic catheter, from the nose into the larynx, to the operation of bronchotomy; but the right practice I have already specified. Boerhaave mentions a case, in which the patient was suffocated, as the surgeon was going to extirpate a polypus. Polyp, growing in the larynx itself, are very rare, but examples are recorded; and if such tumours happen to obstruct the glottis, the patients are instantly suffocated. Some instances of this kind are related by Bichat. (See *Œuvres Chir. de Desault*, t. ii. p. 254, 255.) I cannot imagine, that a surgeon of the present day is ever likely to be called upon to perform tracheotomy in any cases of the foregoing description.

11. Bronchotomy has been recommended to be performed on persons recently suffocated or drowned. Detharding treated of the necessity of this operation in a letter addressed to Schroeck, entitled *De Methodo subveniendi Submersis per Laryngotomiam*. Haller approves of the practice provided the mucous secretion, with which the lungs are loaded, should require to be discharged in this manner. Detharding maintains, that in drowned persons no water passes into the lungs, that they perish from want of air and respiration, and that while the person is under water, the epiglottis applies itself so closely over the glottis, that not one drop of water can pass. But, these assertions entirely disagree with numerous experiments made by M. Louis, who drowned animals in coloured fluids, and proved that such as are drowned, imbibe a quantity of the liquid into the lungs. M. Louis also opened persons who had perished under water; but, in them, he never found the epiglottis applied to the glottis, in the manner described by Detharding. Detharding's theories were wrong, and, as he did not use any power to distend the lungs with air, his mere practice of bronchotomy must have been useless. If there be a free communication between the cells of the lungs and the atmosphere, the air of course will not expand these organs, when the inspiratory muscles can no longer act.

In the stomach, there is almost always found some portion of the fluid, in which the person has been drowned, and the quantity is sometimes considerable. De Haen was of opinion, that death is occasioned by the water flowing into the lungs. Dr. Cullen's investigations led him to believe, that frequently no water passes into those organs, and never any quantity likely to impair their organization. (Letter to Lord Cathcart.) This question appears to be settled by Dr. Goodwyn's experiments, who, like M. Louis, drowned animals in a coloured liquid. By this means, he ascertained, that only five drachms of the fluid, in which a cat was drowned, entered the lungs while the animal

was drowning. Now, in order to determine whether or not this could occasion the death of the animal, he confined a cat in the erect posture, made a small opening in the trachea, and introduced through it two ounces of water into the lungs. The only effects produced were a temporary difficulty of breathing and a weak pulse. The animal then lived several hours afterwards without experiencing further inconvenience. At the end of this time, it was strangled, and two ounces and a half of water were found in the lungs. Similar experiments were made with other fluids, and with nearly the same result. Hence, Dr. Goodwyn concluded that, in drowning, a small quantity of water does usually pass into the lungs; that it enters during the efforts to inspire, and mixing with the pulmonary mucous, forms a frothy fluid; but, that the whole of this fluid is insufficient to produce the changes that take place in drowning. (*Connection of Life with Respiration*, p. 19.) The accuracy of Goodwyn's experiments has since been confirmed by Mr. Kite, Mr. Coleman, and Professor Meyer, who employed water, in which hydrocyanate of potash had been dissolved, and tested the fluid found in the lungs with the muriate of iron. (See *Med. Repository*, vol. iii. p. 436; *New Series*.) The quantity of water and froth in the lungs will be trivial, where the drowned person has sunk at once, without any struggle to keep himself on the surface.

Detharding was right in his opinion, that drowning is a species of suffocation, and that the privation of oxygen gas is the cause of death. Hence, the foundation for the practice of introducing fresh air into the lungs as speedily as possible, whenever animation has not been so long suspended, that every hope of restoration is over. This measure is highly proper, in conjunction with electricity, or galvanism; the communication of warmth to the body; the application of strong volatiles to the nostrils; rubbing the body with warm flannels; and the injection of warm wine, or brandy and water, into the stomach, through a hollow bougie. Tobacco clysters, which once had the sanction of the Royal Humane Society, should be reprobated, as the qualities of this plant are peculiarly destructive of the vital principle, and not simply stimulating. I am sorry to find this last means commended by so respectable a surgeon as Baron Larrey, who, however, joins many other writers in condemning electricity and bronchotomy. He speaks in favour of opening the jugular vein, exposing the body to the fire, friction, &c. On dissecting the bodies of some drowned persons, Larrey found, as Louis had done long since, that the air-tubes of the lungs contained water, instead of air, and that the epiglottis was raised. (See *Mém. de Chir. Militaire*, t. i. p. 83—85.)

Numerous practitioners consider bronchotomy needless in cases of suspended animation, first, because the glottis is open; and secondly, because it is contended, that, as the patient is always destitute of sensation, a tube may easily be passed into the larynx from the nose or mouth, for the purpose of inflating the lungs, or even by the simple process of closing the nostrils, pressing the larynx backward so as to close the oesophagus, and the surgeon blowing air from his own mouth into that of the patient with a tube, the alternate movements of the ribs being at the same time artificially kept up by pressure, and the elasticity of their

cartilages. Either the curved pipe of a pair of bellows may be introduced into the glottis through the mouth, or an elastic gum catheter may be passed into it from the nose. "*On peut mettre ce moyen à exécution (says Pelletan) chez les asphyxies, ou les enfans nouveaux nés, qui ne respirent pas; parceque, dans ces différens cas non seulement il n'y a pas d'inflammation, mais même toute sensibilité est suspendue, et la canule est commode pour souffler de l'air dans les poumons, en même temps qu'elle peut causer une irritation salutaire. M. Baudeloque, mon célèbre confrère, m'a témoigné se servir habituellement, et avec succès de ce moyen pour appeler à la vie les nouveaux nés dont la respiration ne s'établit pas.*" (Clinique Chir. t. i. p. 29.) Desault likewise conceived, that the lungs might be easily inflated, without performing bronchotomy. (*Ouvres Chir. t. ii. p. 339.*) Mr. A. Burns adopts the same sentiment. (*Surgical Anatomy of the Head and Neck, p. 384.*) "An artificial opening of the windpipe (Mr. Liston observes) is not at all necessary to inflate the lungs in cases of suspended animation; a curved tube can readily enough be introduced for this purpose through the natural passage; the tongue is brought forward, and the instrument guided on the finger in the mouth, or pushed through the nostril." (*On Pract. Surgery, p. 355.*) If a surgeon knows that he can inflate the lungs as completely and expeditiously, without performing bronchotomy, as he can by making an incision in the trachea, he is right in dispensing with the latter operation. But, in some cases of suspended animation (that of new-born infants excepted, where tracheotomy or laryngotomy would be an objectionable undertaking), the operation may sometimes be the best and most speedy means of enabling the surgeon to distend the lungs with air. If you follow Desault's suggestion, you are likely to be some minutes longer in getting a catheter from the right nostril into the larynx, than you would be in cutting into the trachea, and passing into the incision the muzzle of a pair of bellows. I shall say nothing of the probability, that many practitioners would be unprovided with the requisite tube. If a pair of bellows, with a curved pipe, be employed, many surgeons would be a considerable time in getting the muzzle into the glottis, and, in the meanwhile, every spark of life might be extinguished. It is very true, however, that the rima glottidis remains open, and consequently that, if air be blown into the mouth, while the nostrils are closed, and the larynx pressed back, to hinder the air, from descending through the œsophagus, the object may be accomplished very well and with promptitude; and a kind of artificial respiration be kept up by alternately compressing the sternum, and then letting it rise again by the elasticity of the ribs. In this way, the object was well fulfilled in one of my patients in University College Hospital.

The following is Mr. Porter's advice: "If a person is drowned in the immediate neighbourhood of an institution where a suitable apparatus is kept, or if he can be conveyed to it, without a perilous loss of time, bronchotomy would be totally uncalled for. Or if the practitioner, who first sees the case, happens to have about his person any tubes, or other instruments that can facilitate the inflation of the lungs, without making a direct opening into the trachea, most assuredly no one

ought to object to their employment. But such fortunate coincidences do not occur in practice, &c. If the patient is to be preserved, it must be by quickness and decision; and I think it would be a matter of reproach to a surgeon to delay the inflation of the lungs, by means of bronchotomy, in order to wait for more perfect instruments, and perform a bloodless operation." (See Porter, *Op. cit. p. 234.*) In all cases of asphyxia, where an operation is called for, this gentleman prefers making the opening in the crico-thyroid space; for there the tube is superficial, most easily reached, and no important blood-vessel in the way. (*Op. cit. p. 239.*) See LARYNGOTOMY.

The custom of operating however on persons whose animation is suspended from immersion, is certainly on the decline, and the lungs are generally inflated by other processes. "In situations where no apparatus is at hand, air should be blown with force into the lungs, by applying the mouth of the operator to that of the patient, closing his nostrils with one hand, and gently expelling the air again by pressing the chest with the other, so as to imitate the strong breathing of a healthy person. If any difficulty be found in inflating the lungs in this way, it may be attempted by blowing through one of the nostrils, keeping, at the same time, the other closed. This operation is much facilitated by interposing a short wooden pipe, of a size adapted to the nostril, &c. The same tube will also be useful for receiving the pipe of a pair of bellows." (*Dr. Roget in Cyclop. of Pract. Med. art. Asphyxia.*)

As the air sent into the lungs ought to contain its full proportion of oxygen, whenever a bellows can be procured for the inflation of these organs, it seems preferable to the employment of the breath of another person. "The pipe of the bellows being inserted into one of the nostrils of the patient, the assistant must close the mouth and opposite nostril, and, at the same time, gently press back the trachea, directing it also a little downwards, by pressing his finger upon the pomum Adami. The bellows is then to be opened, and immediately afterwards closed, so as to force air into the lungs. Its action is now to be stopped; the nostril, that had been closed, should be allowed to open, and the lungs made to collapse by pressing down the chest, so as to expel the air as completely as possible. These actions should be repeated about fifteen times in a minute, &c." (*Roget. loco. cit.*)

The bellows, employed by the Royal Humane Society, only differs from the ordinary kind in being made more accurately, and in having a short flexible tube, one end of which is adapted to the nozzle of the bellows, and the other is inserted into a silver tube, which is introduced into the nostril. In the operation, particular care must be taken to press the larynx against the vertebra; so as to close the œsophagus, and prevent the air from descending into the stomach. For further instruction on this subject, I refer to *Dr. Curry's Obs. on Apoparent Death, &c. p. 48.*

With respect to the choice of tracheotomy, or laryngotomy, it has long been decided, that where the larynx is obstructed by the effects of chronic inflammation, the formation of an opening in the trachea is preferable to injuring or meddling directly with the diseased part itself. Mr. Liston seems to prefer tracheotomy generally. "Laryngotomy, it is true (says he) is much more simple,

There is but slight risk of any vessel traversing the crico-thyroid membrane, likely to cause trouble, and this structure can be divided, together with the superimposed skin, at once, and without dissection, or precaution of any kind, &c. Sufficient room cannot be well made in the crico-thyroid membrane for the examination of the site, or for the removal of a foreign body; and in operating for disease, the opening falls in the middle of it." (*On Pract. Surgery*, p. 349.) For additional remarks on this point, see LARYNGOTOMY.

Previously to describing the operation of tracheotomy, I may notice a few leading points of surgical anatomy in relation to it. In the space, extending from the cricoid cartilage to the sternum, the trachea, which becomes more deeply placed the lower it descends, is covered, first, by the integuments; secondly, by the cervical fascia; thirdly, by the sterno-hyoid and sterno-thyroid muscles; fourthly, by the isthmus of the thyroid gland, the breadth and position of which vary. Below the isthmus is a considerable plexus of veins, and the thyroid artery of Neubauer, when it exists. Fifthly, behind all these textures is a quantity of cellular tissue, and then the trachea itself, which, behind the first bone of the sternum, is crossed by the left subclavian, or brachio-cephalic vein, which in the patient's efforts may ascend a little above the upper edge of the sternum. Lastly, as M. Malgaigne observes, in cases of foreign bodies, or of croup, all the cellular tissue of the neck may contain gas, or a serous fluid, and the veins are gorged with an unusual quantity of blood. (See *Man. de Méd. Opér.* p. 486, ed. 2.)

The patient being laid on a bed or table with his head extended backward and his chest raised, an incision is made, which is to begin just below the cricoid cartilage, and in an adult to be continued downward, about an inch and a half or two inches along the space between the sterno-thyroid muscles, precisely in the central line. Care should be taken not to cut the lobes of the thyroid gland, lest a troublesome and dangerous bleeding be occasioned; and, as the left subclavian vein lies a little below the upper part of the first bone of the sternum, and the interclavicular ligament, the incision should never extend so low as this point. The knife must not be carried either to the right or left, in order to avoid all risk of injuring the large blood-vessels situated at the sides of the trachea. The incision in the integuments having been made, the sterno-hyoid and sterno-thyroid muscles are to be pushed a little towards the sides of the neck, and the cellular tissue divided, so as to bring the trachea fairly into view. "The incision (Mr. Porter observes) should be carried deeper between the sterno-hyoidei muscles, and so on, until a fascia is discovered lying before the trachea, which must be carefully removed. Behind this membrane, the windpipe is seen moving upwards and downwards, according to the degree of disordered respiration, and the patient's efforts to relieve himself; and, if an attempt be made to open the trachea, without removing this fascia, the aperture in the one will not correspond with that in the other. The patient will not be relieved, and the introduction of a cannula will be difficult, if not impossible. This membrane is easily laid hold of by a pair of dissecting forceps, and removed with the knife or scissors." (*Porter, Op. cit.* p. 267.) In performing the operation, I have not found oc-

asion to remove any portion of fascia, as thus recommended by Mr. Porter.

Many authors recommend the point of the knife to be introduced between the third and fourth cartilages of the trachea, and the opening to be enlarged transversely. It is true, that, in this way, an opening may be safely made, large enough to allow a small cannula to be introduced. It is safer, however, in all cases, to enlarge the opening in the perpendicular direction, by cutting from within outward. There is no advantage in avoiding a wound of the cartilages of the trachea, the only reason assigned for cutting the membrane between them, in a transverse direction; while a sufficiently large opening cannot thus be safely obtained, in cases in which it is necessary to introduce the muzzle of a pair of bellows, in order to inflate the lungs or forceps for the removal of a foreign body.

Differences of opinion prevail, respecting the best situation for the incision in the trachea. M. Velpeau specifies the fourth, fifth, and sixth rings, and the third and seventh, if the wound require enlargement. On this point, I consider the observation of M. Malgaigne judicious; namely, that as anatomy teaches us, that the lower the incision passes, the deeper and also the nearer to the great vessels it becomes, it may be better to comprise in the incision the first ring of the trachea. (See *Man. de Méd. Opér.* p. 488.)

If a foreign body be entangled in the larynx, and cannot be removed with forceps through the wound already made in the trachea, the incision may be extended upwards, through the cricoid and part of the thyroid cartilage. "Indeed (says Mr. Porter) it becomes a general rule, that the incision for the removal of extraneous substances from the larynx and trachea must be much larger, than when the operation is performed for any other object. Fortunately, this can in general be easily accomplished, even in young subjects, in whom, in ordinary cases, there is trouble or embarrassment from hemorrhage; for the symptoms here are seldom so very urgent, as to require the operation to be rapidly proceeded with, and the surgeon can leisurely tie the vessels, or otherwise control the bleeding before he opens the trachea." (*Porter, Op. cit.* p. 214.)

Although the extension of the head backward, facilitates the division of the parts, Baron Dupuytren found it not the best position either for facilitating the passage of air, or that of a foreign body, through the incision when completed. Hence, he recommended inclining the head forwards for these purposes, after the incision had been made. (*Dupuytren, Clin. Chir. t. iii. p. 591.*)

We read in Desault's work, that, in one instance, the carotid artery was wounded. The following cautions, given by Mr. A. Burns, seem entitled to notice. "The arteria innominata is in risk in some subjects. I have seen it mounting so high on the fore-part of the trachea, as to reach the lower border of the thyroid gland. Even the right carotid artery is not always safe. I am in possession of a cast, taken from a boy of twelve years of age, which shows the right carotid artery, crossing the trachea in an oblique direction. In this subject, that vessel did not reach the lateral part of the trachea till it had ascended two inches and a quarter above the top of the sternum.

"Where both carotid arteries originate from

the arteria innominata, there is considerable danger in performing the operation of tracheotomy, for, in such cases, the left carotid crosses the trachea pretty high in the neck. Professor Scarpa has seen a specimen of this distribution in a male subject, and I have met with five.

"These varieties in the course of the arteries are worthy of being known, and remembered; they will teach the operator to be on his guard, since he can never, *à priori*, ascertain the arrangement of the vessels with any degree of certainty. It will impress on his mind the impropriety of using the knife further, than merely to divide the integuments and fasciæ. If he then clear the trachea with the fingers, he will never injure any of the large arteries. When, with the finger, he has fairly brought the trachea into view, he ought to examine carefully, whether any of the large arteries lie in front of it, and, if he find one, he ought to depress it towards the chest, before he penetrates into the windpipe.

"In cutting into the trachea, the preferable plan is to cut the rings from below upward, avoiding injury of the thyroid gland." (See A. Burns, *On the Surgical Anatomy of the Head and Neck*, p. 393, 394.)

As Mr. Francis White of Dublin was performing tracheotomy in a case of cynanche laryngea, "on separating the edges of the sterno-thyroid muscles, the two thyroid veins were exposed, together with a considerable arterial branch, the pulsation of which was quite perceptible, directing its course upwards towards the cross-slip of the thyroid gland." Mr. White states, that the artery here spoken of, was the branch which Mr. Harrison, in his work, *On the Surgical Anatomy of the Arteries*, describes under the appropriate name of middle thyroid artery; and, though looked upon as an irregular distribution, it is sufficiently frequent to make it necessary for the surgeon to be upon his guard. (See *Dublin Hospital Reports*, vol. iv. p. 563.)

Mr. Macilwain has met with three instances, in which the arteria innominata crossed the trachea in the situation where this tube is usually opened. (*On Dis. of the Mucous Canals, &c.* p. 330.)

When bronchotomy is performed for the purpose of inflating the lungs, the cut in the wind-pipe must be made of sufficient size to admit the pipe of the bellows, or other requisite tube.

When tracheotomy has been performed in a case where mucus is secreted in such abundance, that the patient is threatened with suffocation from its accumulation, and his inability to cough it up, owing to the wound in the windpipe, Dr. Cullen is an advocate for the use of a large cannula for the sake of permitting free expiration, the only substitute for coughing, which the patient can no longer effect. (See *Edin. Med. Journ.* No. 94. p. 82.) The plexus of veins divided in bronchotomy, occasionally bleed so much, as to create apprehension, and even prevent the continuance of the operation. There is a case in Van Swieten's Commentaries, confirming this remark. A Spanish soldier, aged twenty-three, was in the most urgent danger from an inflammation of his throat. It was thought nothing could save him, except bronchotomy. After the longitudinal cut in the skin, and the separation of the muscles, the trachea was opened between two of the cartilages; but the blood insinuated itself into this canal, and excited

so violent a cough, that the cannula could not be kept in by any means, though it was replaced several times. Here I may observe, that the cannula was probably neither of the right shape nor size; and that one of proper construction retained with tape would not have been forced out by the cough. M. Louis remarks, that, in this instance, the patient's head should have been turned downward, in order to keep the blood from flowing backward into the trachea. It is asserted, that the opening in this tube did not always remain opposite the external wound, in consequence of the convulsive action of the muscles, and that the patient on this account could hardly breathe. Hence, Vigili was induced to slit open the trachea, down to the sixth cartilaginous ring; and it was only then that he inclined the patient's head forward. The bleeding now ceased, the patient breathed with ease, and, on the second day, the inflammation was so much better, that respiration went on without the aid of the opening in the trachea. Baron Dupuytren's advice to direct the patient to make free inspirations, in order to stop the venous hemorrhage, here merits remembrance, but would only be applicable, where the patient was endued with reason, and perfectly docile.

In one example, M. Roux saved his patient's life by immediately sucking the blood out of the trachea with his own mouth. (See *Velpeau, Méd. Opér.* t. ii. p. 217.)

However, if these expedients fail, the most simple and natural mode of obviating all trouble from the entrance of blood into the trachea, is to tie any bleeding branch of the thyroid artery or veins, before the windpipe is opened. "After having divided the isthmus of the thyroid gland to the extent of an inch, and the venous plexus below it (if such veins cannot be pushed aside) the trachea is exposed. Then the patient should be directed to make deep inspirations, in order to lessen the venous hemorrhage, and next such vessels as continue to bleed should be tied." (*Malgaigne, Man. de Méd. Opér.* p. 487.)

Sometimes the cannula becomes obstructed with mucus, or clots of blood. Such an accident nearly suffocated a patient at Edinburgh. An ingenious person happening to be at hand, suggested the introduction of a second cannula into the first; the second one being taken out, and cleaned as often as necessary, and then replaced.

The use of the cannula must be continued as long as the causes obstructing respiration remain. Thus, in one very interesting case of cynanche, detailed in a modern publication, the patient, thirteen months after the operation, had not been able to discontinue the tube. (See *Méd. Chir. Journ.* vol. v. p. 7.) This example was attended in its progress with a singular circumstance, viz. the expulsion through the cannula of several portions of calcareous matter, or bone. In the case operated upon by Mr. F. White, the tube had been worn two years; and in the well-known case of Mr. Price of Plymouth, the instrument had been worn ten years. (See *Dublin Hospital Reports*, vol. iv. p. 565, 566.)

When respiration is suspended by the presence of a foreign body in the trachea, and the extraneous substance does not make its appearance at the opening, a trial may be made to discover its situation by means of a probe. When it lies downward, which is rarely the case, the wound in the

trachea may be enlarged in this direction, and the body extracted with a pair of long narrow forceps. The extraneous substance is mostly forced out by the air, as soon as the incision in the trachea is opened. When it cannot be immediately found, some practitioners have succeeded by keeping the lips of the wound asunder with a cannula, or silver wire, and the force of the air in expiration has, in a few hours, expelled the foreign body.

My friend, Mr. Andrews, informed me of a case, which was lately brought to the London Hospital, in which the foreign body did not escape till the edges of the incision were held apart with a piece of silver wire, and then it was immediately discharged to a considerable distance.

When tracheotomy has been performed, on account of impediment to respiration, from obstruction of the larynx by disease, the keeping of a tube in the incision is indispensable to enable the patient to derive benefit from the operation. Richter long ago preferred for this purpose a curved cannula; a shape, which modern experience seems to proclaim as most advantageous. The tube should also be of ample size. I once lost a patient after bronchotomy, as it seemed to me, from the impossibility of procuring at the time a well made cannula. The tube should be of a conical shape, and flattened laterally; for "the edges of the incision throughout are compressed by it, and oozing prevented; the vitiated mucus can be easily removed by the nurse or assistant by means of a feather, or a curved probe, with a bit of lint fixed in the eye and wrapped round it. After a time, the patient can attend to all this himself; he can remove his tube, clean it out, and replace it. Then a smaller one, of the same calibre throughout, may be substituted. It may be made double, if the practitioner fancies it more convenient or safe; and directions may be given to withdraw the inner one, if suffocation is threatened, from accumulation of mucosity." (See *Liston's Practical Surgery*, p. 355.) An ingenious tracheotomy trocar was invented by the late Mr. John Wood: a description of which may be found in the *Med. Chir. Trans.* vol. xvii. The particularity of it consists in its jointed construction, by means of which it accommodates itself to the curvature of the cannula. The trocar has a lancet point. The invention is exceedingly ingenious; but not likely to be much employed, in consequence of the objections generally entertained against plunging any kind of trocar into the larynx or trachea. In my judgment, Mr. Wood's cannula is also less advantageous than the conical flattened one, already recommended.

In some instances, like that referred to above, a cannula has been borne quietly in the trachea, while, in others, it has produced so much irritation, cough, and sense of choking, as to render its immediate removal necessary. Mr. Lawrence, in speaking of the obstruction of the glottis from the disease already adverted to in this article, observes, that, when the cannula causes inconvenience, he should advise a longitudinal incision, of about half an inch, in the middle of the trachea, and the removal of a thin slip of the tube, which would leave an artificial opening for respiration, equal in size to the natural one. (See *Med. Chir. Trans.* vol. vi. p. 249.) The same plan was followed by Mr. F. White, and is also sanctioned by Mr. Carmichael. (See *Dublin Hospital Re-*

ports, vol. iv. p. 563, &c.; and *Trans. of Anst. Physicians*, vol. iii. p. 174.) When this practice is not adopted, Mr. Carmichael recommends the use of as large a cannula as can be introduced.

With regard to the scheme of excising a portion of tube, Mr. Porter is of opinion, that, if the operation is performed on the larynx, there can be no objection to this mode of proceeding, because "the wound is not extensive, and the hemorrhage must be trivial. But the trachea lies deep; there is more likelihood of meeting with a troublesome, or embarrassing flow of blood to delay the operation; and even supposing, that no vessel of consequence is wounded, the patient at every inspiration sucks in a quantity of blood from the open sides of the incision, and the cough, expectoration of bloody mucus, and other harassing symptoms, are thus continued." (*Porter, Op. cit.* p. 268.) M. Velpeau deems the plan useless; inasmuch as a simple incision will always serve for the introduction of a cannula, and the removal of a slip of the trachea is likely after cicatrization to be followed by an irremediable diminution in its diameter. (See *Velpeau, Méd. Opér.* t. ii. p. 214.)

The kind of cannula of a proper size and of conical shape, as already described and employed at University College Hospital, I should say, renders the foregoing plan at all events unnecessary. It completely fulfils some of the objects noticed in the following passage of Mr. Porter's valuable work: "It is evident (says he) that if a cannula occupied the entire space in the aperture of the trachea, a drop of blood could not enter, notwithstanding the existence of even a profuse hemorrhage; and, therefore, if this instrument is employed, it will be necessary to be accurate in opening into the windpipe, so that it should occupy the entire wound. This object would be well answered by performing the operation with a trocar, which might be employed in perforating the windpipe; but, this requires some dexterity, and might possibly be the cause of an unpleasant accident. However, under every circumstance requiring instant decision, I would endeavour to make use of a cannula; for, it has happened, that a patient has been lost, whilst the surgeon (Desault) delayed the opening into the trachea, in order previously to control an alarming hemorrhage. Besides, the objection, that the presence of the instrument causes irritation, is not valid with respect to the trachea." (*Porter, Op. cit.* p. 269.)

All experienced surgeons attest the greater difficulties of tracheotomy in the child, than the adult. The distance of the trachea from the surface is here generally much increased by fat, and the trachea in subjects under the age of 13 or 14, is very small. In children the hemorrhage is more considerable, the convulsive elevations, and the struggles and unmanageableness of the little sufferer, add seriously to the difficulties of the operation. Mr. Porter knows of an instance, in which the surgeon could not find the trachea, and did not finish the operation; which is as bad as another case reported to me, in which a distinguished surgeon could not find the brachial artery, and therefore left an operation for aneurism at the bend of the elbow unfinished.

It seems to me, that much of this difficulty may be obviated by following the method first suggested by Dr. James Murray of Dublin, in a thesis written at Edinburgh in 1827, and printed

in 1629, and which consists in taking hold of, and fixing the exposed portion of the trachea with a tenaculum, or hook, so as to give the surgeon an opportunity of making an incision in it with safety. By this means, "no start, spasm, coughing, nor unsteadiness of the patient can lead to risk of the knife touching the left subclavian vein below, the lobes of the thyroid gland above, either of the carotid arteries at the sides, or its point wounding the back of the trachea behind." In one case of a child, Mr. Carmichael secured the trachea with a double hook, and cut out a circular piece of the tube with a pair of scissors, which part of the operation, he says, was completed in a moment. The child, aged two years, had inflammation of the glottis from drinking hot water out of the spout of a tea-kettle. The case ended successfully; and a year afterwards, notwithstanding the excision of a piece of the trachea, the voice remained clear and natural. (See *Dublin Journ. of Med. Science* vol. ii. p. 163.)

Hevin sur les Corps Etrangers qui sont arrêtés dans les premières Voies, et qu'il faut tirer par Incision, in *Mém. de l'Acad. Royale de Chirurgie*, t. iii. p. 131, &c. édit. 12mo. *Louis*, Mémoire sur une Question Anatomique relative à la Jurisprudence, on l'on établit les principes pour distinguer, à l'inspection d'un corps trouvé pendu, les signes du suicide, d'avec ceux de l'assassinat. *Harbec*, Question Chirurgicale, par laquelle il est démontré que le Chirurgien doit assurément pratiquer l'Opération de la Bronchotomie, &c. 12mo. Paris, 1620. *Louis*, Mémoire sur la Bronchotomie, in *Mém. de l'Acad. de Chirurgie*, t. xii. édit. 12mo. Second Memoir on this subject, inserted by the same writer in the said volume. De la Résection des Amygdales, t. xiv. p. 283, &c. Précis d'Observations sur le Gonflement de la Langue, &c. par M. de la Malle, t. xiv. p. 408. *Leccore*, sur un portion d'Amande de Noyau d'Abricot dans la Trachée Artère, t. xiv. p. 427. Suite d'Observations sur les Corps Etrangers dans la Trachée Artère, t. xiv. p. 432. Expériences sur les Cas, par M. *Favier*, t. xiv. p. 445. De la Martenore, sur les Corps Etrangers, dans la Trachée Artère, Op. cit. t. v. 4to. *Bertrandi*, Traité des Opérations de Chirurgie, p. 402. édit. 1784. *Sabatier*, de la Médecine Opératoire, tom. ii. p. 283. édit. 1. Œuvres Clin. de Desault, par *Dichat*, t. ii. p. 236, &c. *Pelletan*, Clinique Chirurgicale, t. i. first Memoir. *Cheyne*, Pathology of the Larynx and Bronchia, Edin. 1809. *A Burns*, Surgical Anatomy of the Head and Neck, p. 377—401. *J. F. Double*, Traité du Croup, 8vo. Paris, 1811. *Richter's* Aulang-gründe der Wundarzneikunst, b. iv. p. 225, &c., Göttingen, 1800. *W. Lawrence*, On some Affections of the Larynx which require the Operation of Bronchotomy, in *Medico-Chir. Trans.* vol. vi. p. 221, &c. *Baillie*, in *Trans.* of a Society for the Improvement of Med and Chir. Knowledge, vol. iii. *Troussel-Drehecourt*, Corps Etrangers arrêtés dans les Voies aériennes, *Nouveau Journ. de Méd.* par *Béclard*, &c. t. vii. p. 101. *Philos. Trans.* 1730. No. 416, art. 5. *Journal de Médecine*, t. xxxviii. p. 358. *J. A. Albers*, Comm. de Tracheitide Infantum, vulgo Croup vocata, 4to. Lips. 1816. Case of Chronic Infl. of the Larynx, in which Laryngotomy was performed. See *Méd. Chir. Journ.* April, 1820. *F. J. Bourlart*, de Bronchotomia Diss. in Coll. Diss. Lovan. b. 175. *C. Detharding*, Eplst. Med. de Methodo subtrahendi Submersis per Laryngotomiam. *Histobich*, 1714. *Klein*, in *Chir. Bemerkungen*, Stuttgart, 1801; in *F. Siebold's* *Chiron*, b. ii. p. 649; in *Græf's* *Journ.* b. i. p. 441. and b. vi. p. 225. *Michaëlis*, in *Hufeland's* *Journ.* b. ix. p. 2. and b. xi. p. 3. *Pajani*, *Observazioni*, &c., di Chirurgia, t. iii. Roma, 1802. *R. Colard*, Abhandlung über den Croup, 8vo. Hannov. 1814. *T. Chevalier's* Case of Croup, in *Med. Chir. Trans.* vol. vi. p. 151. &c. *Andree's* Case, in vol. iii. same work, p. 335, with the Obs. of *Dr. Farre*, on Cyaniche, in the same part of the work; and those of *Dr. Percival*, on the same subject, in vol. iv. p. 207. *C. W. Eberhard*, De Musculis Bronchialibus in Statu et Morbosa Actione, 8vo. Marburg, 1817. *R. Sprengel*, Geschichte der Chirurgie, th. i. p. 177. 8vo. Halle, 1805. *Dict. des Sciences Méd.* art. Bronchotomie, t. iii. 1812. *Surgical Obs.* by *Str. C. Bell*, part i. p. 14, &c. 8vo. Lond. 1816. Case of Cyaniche Laryngea requiring Tracheotomy, and the continued use of a Cannula, ever since the Operation, in *Med. Chir. Journ.* vol. v. p. 4. 8vo. Lond. 1818. *W. H. Porter*, Case of Cyaniche Laryngea, in which Tracheotomy and Mercury were successfully employed; *Med. Chir. Trans.* vol. xi. p. 414. *R. Liston*, two Cases

in which Tracheotomy was performed with success; one for œdema glottidis, &c. the other on account of an injury of the larynx; *Edin. Med. and Surg. Journ.* vol. xix. *Burgess*, in *Dublin Hospital Reports*, vol. iii. *Dr. Hall*, in *Med. Chir. Trans.* vol. xii. *W. J. Hunt*, Case of Bronchotomy; *Med. Chir. Trans.* vol. xii. p. 27, &c. *R. Carmichael*, in *Trans. of Assoc. Physicians*, Ireland, vol. iii. p. 170. &c. *F. White*, in *Dublin Hospital Reports*, vol. iv. *Dr. Cullen*, on Bronchotomy, in *Edin. Med. Journal*, No. xciv. *R. Carmichael*, in *Essay on Venereal Diseases*, ed. 2. p. 213; also in *Dublin Trans.* vols. ii. and iv., and *Dublin Journ. of Med. Science*, vol. ii. p. 155. *Dr. Murray*, in same work, vol. iv. p. 107. *R. T. Evanson*, and *John Houston*, in same work, vol. v. pp. 19. and 42. *Aff. Velpeau*, *Nouv. Élém. de Méd. Opér.* t. iii. p. 194. *J. J. Malgaigne*, *Man. de Méd. Opér.* p. 486, ed. 2. 12mo. Paris, 1837. *R. Liston's* *Practical Surgery*, 8vo. Lond. 1837. *Dupuytren*, *Clinique Chir.* t. iii. p. 583. 8vo. Paris, 1838. *Wm. Stokes*, on Diseases of the Chest, part i. 8vo. Dubl. 1837. *W. H. Porter*, on the Surgical Pathology of the Larynx and Trachea, new ed. 8vo. Dublin, 1837. *Frederick Ryland*, on the Diseases and Injuries of the Larynx, 8vo. Lond. 1837. *M. M. Trousseau et Jellac*, *Traité de la Phylisie Laryngée*, &c. 8vo. Paris, 1837. *John Wood*, on Inflammation of the Larynx; and the Operation of Bronchotomy, in *Med. Chir. Trans.* vol. xvii. *G. Macnaman*, on Dis. of the Mucous Canals, &c. p. 319. 8vo. Lond. 1830.

TREPAN. (From *τρῑπάνον*, to perforate.) *Trepanum*; *Terebellum*; *Modiolus*. A circular saw, by means of which the skull is perforated in the operation called *trepanning*, or a circular portion of any bone may be sawed out. It bears a considerable resemblance to the well-known instrument named a wimble, and is worked in the same manner. Formerly the saw was sometimes made of a conical shape; but this construction rendered the action of the instrument difficult. In this country, the trepan is now superseded by the instrument called a *trephine*, which has a different handle, and is not worked in the same way. On the continent, however, the trepan still has the preference.

TREPHINE. The instrument now commonly preferred for perforating the cranium, for purposes which I shall presently explain. It consists of a simple cylindrical saw, with a handle placed transversely like that of a gimlet; and, from the centre of the circle, which the teeth of the saw describe, a sharp little perforator projects, named the centre-pin. The upper part of the centre-pin is made to screw in a corresponding hole at the inside of the top of the saw, and is capable of being taken out or put in, at the surgeon's option, by means of a little key for the purpose. Its use is to fix the trephine when it is first applied, that is, before the teeth of the instrument have made a sufficient circular groove, in which they can steadily work. When this has been accomplished, the centre-pin must always be removed; because now it is not only unnecessary, but, if left, would retard the progress of the operation, and inevitably wound the dura mater and brain, when the teeth of the saw had cut to a certain depth through the cranium. Many trephines have centre-pins which slide up or down, and are fixed in either position by turning a little screw.

The cylindrical part of the trephine is termed the *crown* of the instrument. The surgeon should have at least two or three cylindrical saws of various sizes; for it is always a commendable rule never to saw away any more of the cranium than is absolutely requisite for the accomplishment of some rational object. There is no occasion, however, for having more than one handle, which may be made to fit any of the saws.

Trephines are also occasionally applied to other bones, besides those of the cranium. In the articles,

TREPINE.

ANTRUM, BONES, CARIES, EXOSTOSIS, FRACTURES OF THE STERNUM, NECROSIS, SPINA VENTOSA, other cases are mentioned, in which the employment of these instruments sometimes becomes proper.

It is not always desirable to remove a complete circular portion of the cranium, the taking away of a piece of smaller size, and of a different shape, being frequently much more advantageous. Some surgeons, who object to removing any unnecessary quantity of the cranium, occasionally employ a trephine, terminating only in a semicircular, instead of a circular saw, by which means they can often cut across the base of a depressed portion of the skull, and take it away, without any occasion for removing also a circular piece of bone. An instrument of the latter kind may be sometimes useful.

The saws, however, which Mr. Hey has described, should constantly be kept in every case of trephining instruments. This practical writer remarks, that "the purposes for which any portion of the cranium is removed are, to enable the surgeon to extract broken fragments of bone, to elevate what is depressed, and to afford a proper issue to blood or matter that is or may be confined, &c."

"When a broken fragment of bone is driven beneath the sound contiguous part of the cranium, it frequently happens, that the extraction cannot be executed without removing some of the unbroken part, under which the fragment is depressed. This might generally be effected with very little loss of sound bone, if a narrow portion of that which lies over the broken fragment could be removed. But such a portion cannot be removed with the trephine. This instrument can only saw out a circular piece. And, as in executing this, the central pin of the saw must be placed upon the uninjured bone, it is evident, that a portion of the sound bone, greater than half the area of the trephine, must be removed at every operation. When the broken and depressed fragment is large, a repeated application of the trephine is often necessary, and a great destruction of sound bone must be the consequence."

"When the injury consists merely of a fissure with depression, a small enlargement of the fissure would enable the surgeon to introduce the point of the elevator, so as to raise the depressed bone. But a small enlargement of the fissure cannot be made with the trephine. When it is necessary to apply the elevator to different parts of the depressed bone, a great deal of the sound cranium must be removed, where a very narrow aperture would have been sufficient."

"The same reasoning will apply to the case of openings, made for the purpose of giving a discharge to extravasated blood or matter."

"If a saw could be contrived which might be worked with safety in a straight or gently curvilinear direction, it would be a great acquisition to the practical surgeon. Such a saw I can now with confidence recommend, after a trial of twenty years, during which time I have rarely used the trephine in fractures of the skull. Its use has been adopted by my colleagues at the General Infirmary in Leeds; and will be adopted, I hope, by every surgeon who has once made trial of it." Mr. Hey next informs us, that the instrument was first shown to him by Dr. Cockell of Pontefract; but that there is a saw, formed on the same principle, in Scultetus's *Armamentarium Chirurgicum*. This saws alluded to are very short ones, fixed at the end of a longish straight handle; their edges

are made either straight, or semicircular. The latter construction qualifies the instrument for cutting in a curvilinear direction, which is often proper. The edge of the saw should always be made a little thicker than the rest of the blade, by which means it will work in the groove, which is cut, with more facility. The semicircular saws do not, however, answer so well as the straight; and Mr. Liston declares them to be utterly useless. (*On Practical Surgery*, p. 46.)

Saws made on the principle just described, are also of infinite use in cutting away diseased portions of other bones, besides the skull, exostoses, &c. In necrosis, when a dead part of a bone is quite wedged in the substance of the surrounding new bony matter, Mr. Hey's saws may often be advantageously employed for cutting away the parts which mechanically prevent the detachment of the dead pieces. The saws, invented by Mr. Machejl and Professor Graefe, are also highly ingenious, and particularly merit attention, when there is very little room for the working of the instrument, and the bone to be cut lies deep. They are wheel-like saws, turned by machinery.

Besides trephines of various sizes, and the saws just now noticed, the surgeon should also take care to have in his case of trephining instruments a little brush for occasionally cleansing away the particles of bone from the teeth of the saw, in the progress of the operation; a pair of forceps for extracting the round piece of bone after it has been detached by the saw; a lenticular knife for removing any inequalities, which may present themselves, round the sawn edge of the cranium, after the circular piece has been taken out; a raspatory for scraping the bone, in order to see whether it will bleed, which is a circumstance, deemed by Abernethy in some cases important to be attended to, (see *HEAD INJURIES* OF); a largish common scalpel for dividing the scalp, &c.; and some elevators for raising depressed pieces of bone.

Thy raspatory and the lenticular knife are disapproved of by Mr. Liston; the requisite denudation of the bone to a small extent, he accomplishes with the point of the knife, and the dissecting forceps; the lenticular he does not employ, because it cannot be used without unnecessarily detaching the dura mater. "Any sharp spine in the opening (he says) can be easily removed by the careful employment of the elevator." (*On Practical Surgery*, p. 45.)

The common elevator is now generally used: but several others have been proposed, as, for instance, the tripod elevator; and another invented by J. L. Petit, and afterwards improved by M. Louis.

Before beginning the description of the operation, I think it highly proper to remind the reader of what has been so forcibly dwelt upon in the article *HEAD, INJURIES* OF,—that, generally, the removal of pressure from the brain, which pressure must also actually occasion dangerous symptoms, can form the only true and vindicable reason for employing the trephine, or sawing away any portion of the skull. There are but few exceptions to this remark: it may, indeed, be now and then proper, to saw away the bony edges, around some fungous excrescences, which grow from the dura mater, and make their way outward, by occasioning an absorption of the part of the skull immediately over them. (See *DURA MATER*.) It may also be necessary to saw out a necrosis involving both

tables, if it were the occasion of irritation of the dura mater, and much cerebral disturbance: under other circumstances, it may generally be more prudent to leave the detachment of the dead bone to be completed by the process of exfoliation; though M. Velpeau is inclined to maintain, that a necrosis of both tables of the skull is of itself, whether attended or not with symptoms of compression, a well-founded indication for the trepan: and he relates three cases in support of this view. (See *Atf. Velpeau, de l'Opération du Trepan*, p. 23.) A mere necrosis of the outer table, abstractedly considered, can never be an adequate reason for the application of the trephine. Loose splinters should generally be removed. But though this is the common rule, there are exceptions to it. If the bone were broken into several loose pieces, but not exposed by any wound of the scalp, and the case not accompanied by any urgent symptoms of compression, an operation for the removal of the fragments of bone would, in my opinion, be unadvisable. A very interesting case has been published by Mr. Crampton, proving that, even though such injuries of the bone may be attended with a wound, and depression of some of the fragments into the substance of the brain, the case will not invariably require the immediate extraction of the pieces of bone. In the instance alluded to, Mr. Crampton had scarcely touched with the forceps a large fragment of bone, which was buried in the brain, when the whole body was shaken by a convulsive movement, and the patient (a nephew of Lord Brougham's) moaned deeply. Mr. Crampton desisted from all further attempts to extract the splinters; antiphlogistic treatment was pursued, and, at the end of twenty-two days, the small fragments of bone were removed as they became detached by the process of nature. (See *Ph. Crampton in Dublin Journ. of Med. Science*, vol. ii. p. 42.) I know of some other similar cases; yet, these may be regarded as exceptions to the general maxim. If the depressed portion of bone be denuded by a wound of the scalp, a trial to raise it with the elevator may sometimes be proper, even though urgent symptoms of pressure may not exist. In such a case Sir A. Cooper sanctions the application of the trephine. (*Lectures*, vol. i. p. 343.) Yet, my own experience and reflections would here incline me to abstain from the operation, and to follow the example of Dease, Desault, Abernethy, and Crampton. "In Dublin, (observes the latter distinguished surgeon) we conform in general with the rule of practice, as originally laid down by Mr. Dease (who preceded Desault by many years) namely, in fractures of the skull with depressed bone, whether complicated with wound of the scalp, or otherwise, no attempt should be made to raise the depressed bone, unless very decided symptoms be present of compressed or irritated brain." (*Op. cit.* p. 34.) I have seen many cases, which have terminated very favourably, without the trephine, though the scalp was wounded, and the bone depressed. A boy has just now (July, 1838,) been discharged from University College Hospital, who was brought to it for a wound of the forehead, and considerable depression of the frontal bone, above five weeks ago. The accident was occasioned by the blow of the handle of a pump. As he was perfectly sensible, I recommended bleeding, calomel, cold lotions, and

other antiphlogistic means; and the patient recovered without any serious indisposition, the depression of the bone, however, still continuing.

An argument urged in favour of elevating the bone by an operation, is that, though the patient may not at present labour under bad symptoms, he will become liable to them afterwards, if the bone be left depressed; a consideration upon which Sir Astley Cooper, M. Velpeau and others, lay much stress. It is indeed a truth, that, in a certain number of cases, inconveniences and danger do subsequently come on. But, with this fact before us, the questions may yet be asked, ought we then to trephine in the first instance, without taking the chance of there being any occasion for the operation? Or, ought we to take such chance, and avoid trephining till the inconveniences of the continuance of the depression show themselves? Thus, if a patient were to become subject to epileptic attacks, manifestly dependant upon the depression of a part of the skull, it might be time enough to trephine when the patient became thus afflicted. Professor Dudley has inserted a valuable paper On Injuries of the Head, in the first No. of the *Transylvania Journal of Medicine*. He reports several cases of epilepsy from injuries of the skull, which he cured by trephining; and another instance of this has been published by Dr. D. L. Rogers, of New York. (See *New York Med. and Physical Journ.* vol. v.) A person might meet with a compound and depressed fracture of the skull, yet experience at first no symptoms requiring the trephine; but, in about a week, signs of irritated and compressed brain might come on, and the removal of a portion of the skull become indispensable. The reader will find this observation well exemplified in a case recited by Mr. Crampton, where both tables of the skull, the membranes of the brain, and the brain itself, had been divided with a sabre, and the inner table had been driven in upon the brain, so as to form an acute angle with the outer table. (See *Ph. Crampton, in Dublin Journ. of Med. Science*, vol. ii. p. 37.) The subject of this case after having been discharged, lived irregularly and returned to the hospital with severe headach, paralysis of the right arm and hand, and right side of the face, followed by convulsions, stupor, &c. A small opening was made in the prominent part of the cicatrix, and two drachms of healthy pus were let out; "the pulse immediately rose to 68; he sat up in bed; answered questions rationally, and said he was quite free from pain." (*Crampton, Op. cit.* vol. cit. p. 206.) I once attended, with Mr. Walne of Bloomsbury square, and Mr. Bainbridge of Tooting, a young gentleman, who fractured the frontal bone, and was trephined on account of urgent symptoms, which were thus relieved; but febrile symptoms and attacks like those of epilepsy afterwards came on, and the case ended fatally from abscess in the substance of the brain.

In a case of depressed fracture, unaccompanied at first by any urgent symptoms, suppurating may follow between the skull and dura mater, or even more deeply; still it may be questionable whether trephining would be the most likely means to prevent such mischief, though, undoubtedly, the best calculated to afford relief, if the matter were directly under the skull. Here I should say, that the right treatment consists in antiphlogistic measures; and that we should only proceed to remove

bone, when the symptoms indicate the confinement of matter under it, or injurious effects from the continuance of a depression, which, in the first instance, perhaps, produced no unfavourable symptoms. On the question, however, whether we should trephine for a depressed fracture exposed by a wound, though not attended with urgent symptoms of pressure, I deem it fair to mention, that Sir Benjamin Brodie coincides with Sir Astley Cooper; and lays down the following general rule: that if the depression be exposed, in consequence of a wound of the scalp, let the surgeon apply the trephine, and elevate the depression; but if there be a depression, without a wound of the scalp, in consequence of the accident, let him not make such a wound by an operation. (See *Med. Chir. Trans.* vol. xiv. p. 403.) M. Velpeau is another high authority also in favour of not suffering a depressed fracture to continue. (See *HEAD, INJURIES OF.*) The punctured or stellated fracture, on account of its being invariably accompanied with splintering and depression of the inner table, I join in believing a proper exception to the general rule of not trephining, unless urgent symptoms of pressure exist.

In the records of surgery, innumerable facts may be consulted, where the prudent and judicious employment of the trephine has effected wonderful cures, and been the only thing by which the patients' lives could possibly have been saved. The benefit, which the operation brings about, is also sometimes so sudden and astonishing, that in no instance does the interposition of the surgical art display itself to greater advantage. The immediate restoration of sight by the depression, or extraction of an opaque substance from the eye, is not more beautiful and striking, than the instantaneous communication of the intellectual faculties, and of the powers of speech, of feeling, &c. together with voluntary motion, to a person lying in an apparently lifeless state from an injury of the head. The utility of the trepan is occasionally manifested even in this degree. In the valuable essay of Mr. Abernethy, "On Injuries of the Head," a case may be seen, in which the patient, who had been in a condition almost bereft of animation, rose up and spoke the instant the extravasated blood had been removed from the surface of the brain: and amongst the wounded at the battle of Waterloo, there was a soldier of the 44th regiment, whose case is of equal interest. He had been struck by a musket-ball on the right parietal bone, which was exposed, but had no appearance of being fractured. As however the symptoms of compression were urgent, and the patient was in nearly a lifeless state, I conceived it right to apply the trephine to the part on which the violence had acted. I had not sawn long before the external table came away in the hollow of the trephine, leaving the inner table behind, which was not only splintered, but driven at one point more than half an inch into the membranes and substance of the brain. No sooner were the fragments taken out with a pair of forceps, than the man instantly sat up in his bed, looked around, and began to speak with the utmost rationality. It is a most extraordinary fact, that this patient got up and dressed himself the same day, without leave from the medical officers, and never had a single complaint afterwards. Immediately the operation was finished, the temporal arteries were the day of and some purgative medicines exhibited.

Sir Benjamin Brodie has seen a case, in which there was a fracture with distinct depression of the inner table, while there was a simple fissure, which was scarcely perceptible, and that without the smallest depression of the outer table. He also adverts to the example recorded by Tulp, in which there were extensive fissures of the inner table, although the outer one remained uninjured; and to another, mentioned by Paré, in which, while the outer table was entire, the inner table was broken into splinters, some of which were actually driven into the substance of the brain. In all fractures of the cranium with depression, it is remarked, that the inner table is always broken to a greater extent than the outer one; and the actual depression greater than would appear from the mere inspection of the external fracture. These circumstances are imputed to the greater elasticity of the outer table, and more considerable brittleness of the inner. (See *Med. Chir. Trans.* vol. xiv. p. 330.)

In a case of fungus of the dura mater, with diseased bone, mentioned by Schmucker, the trepan was applied eleven times in less than a month, and the operation used to cause so little indisposition, that the patient hardly ever required to go to bed afterwards; and, on one occasion, actually went to market an hour after its performance. (*Wahrnehmungen*, b. i. p. 456.)

Let not the young surgeon, however, imbibe from a few dazzling examples of success an immoderate solicitude to perform the operation; for it should scarcely ever be undertaken but in the most pressing circumstances, and when symptoms unequivocally show, that a dangerous degree of pressure on the brain exists. I recollect an unfortunate example, in which the late Mr. Ramsden, of St. Bartholomew's Hospital, ventured to saw out a portion of the frontal bone for a mere long-continued pain in the part: the patient was attacked with inflammation of the dura mater, and perished in three or four days. Two analogous cases of the needless use of the trephine, with similarly tragical results, are also mentioned by Sir Benjamin Brodie. (See *Med. Chir. Trans.* vol. xiv. p. 394.) That the removal of bone creates some risk of subsequent ulceration, and sloughing of the dura mater, and protrusion of the brain, is now a fact universally admitted. We may therefore conclude, that the operation is not itself exempt from danger; and it is certain, that it ought never to be resolved on without deep consideration, "*Gravis tamen satis est operatio, ut nunquam, nisi indicationes sufficientes adsint, institui debet.*" (Cullisen, *Syst. Chir. Iodiern.* tom. i. p. 658.)

In cases of injuries of the head, the trepan or trephine, is hardly ever justifiable, except for the purpose of relieving the brain from pressure. Such pressure may be caused by a depressed portion of the cranium, or it may be produced by an extravasation of blood, or the lodgment of matter, betwixt the skull and the dura mater. The chief danger of concussion, when the accident is not directly or soon fatal from the disorganisation and mischief done to the brain, depends upon the consequent inflammation of this organ, and therefore cannot be likely to be benefited by the trephine. If the operation become proper in such a case, it is when an abscess has formed under the cranium, and when the confined matter itself creates bad

symptoms by its pressure on the brain. This state, however, cannot come on till after the inflammation of the brain and its membranes has prevailed a certain time, and it is always accompanied with a detachment of the pericranium and a puffy tumour of the scalp; or if there be a wound of the latter part immediately over the abscess, the lips of the injury suddenly acquire an unfavourable appearance, and lose their vermilion colour. The patient has also had much preceding febrile disorder, pain and tension over the whole head, redness and turgescence of the eyes, and generally more and less delirium. When the matter is forming, there are usually rigors, and as soon as it is formed, the patient falls into a comatose state, and paralytic symptoms show themselves. Here the urgency for the prompt application of the trephine is very great, and the patient's only chance of living is almost essentially connected with the immediate performance of the operation. This important case has been particularly dwelt upon in the writings of Pott.

In the article *HEAD, INJURIES OF*, I have enumerated the most remarkable symptoms of concussion, and compression of the brain; a subject, which every surgeon should study with earnest attention, before he ever presumes to employ the trephine. For sometimes these cases are extremely difficult to be discriminated; sometimes they exist together in the same individual, a complication which is peculiarly embarrassing; and, in every instance, where the symptoms are those of concussion, the operation so far from being indicated, would be a step of all others the most likely to do harm, by increasing the irritation and the risk of inflammation of the brain and its membranes. A fall upon the back, or upon the head, occasions a direct concussion of the brain; and the shock, not being materially weakened by the intervention of any yielding elastic structure, is the more dangerous. When a person has fallen from a certain height, and pitched on his head, his back, the buttocks, the knees, or even the soles of the feet; when he has been instantly deprived of his senses, and then by degrees recovered them and come to himself again: the fact of his having suffered concussion of the brain is clear and indisputable. Concussion has likewise taken place, though in a slighter degree, when the patient has been only stunned by the fall, and experienced a sensation of sparks. But, a multitude of degrees separate this feeble concussion from that, in which the substance of the brain is instantaneously disorganised, so that there is not the possibility of recovery.

The symptoms of concussion of the brain are attended with coma, and the compression of this organ by an extravasation is also accompanied with lethargic heaviness. How then is the surgeon to ascertain, whether the comatose disorder arises from one or the other of these affections?

Here, in order to avoid repetitions, I beg leave to refer to the observations already made in another article. (See *HEAD, INJURIES OF*.) But there is one criterion of such importance, that it may prevent innumerable fatal mistakes, and, indeed, without the continual recollection of it, no man ought to interfere with this dark and abstruse part of surgery. On this account, I shall mention it here, notwithstanding it has been already noticed elsewhere. If the patient has been knocked down and

stunned directly by the blow, and remains in a state of insensibility, these primary symptoms are ascribable to the concussion. On the contrary, when the coma and loss of sense do not take place till an hour or two after the blow, they are to be imputed to an extravasation.

The shock, given to the brain by concussion, must, like every other impulse communicated, continue to diminish, until it ceases altogether. If, at the very time of the blow, the shock has not been forcible enough to produce alarming symptoms, such symptoms will not afterwards come on when their cause is weakened. Hence, the reason why compression can be distinguished from concussion of the brain when there has been an interval of sense between the receipt of the blow, and the occurrence of the bad symptoms. But, the distinction of the symptoms into primary and consecutive, cannot be made when concussion and extravasation exist together.

Having made these few remarks on concussion and compression of the brain, I shall next introduce a few observations on contusions of the head and fractures of the skull, cases on which the most erroneous opinions have been entertained.

Contusions of the head not unfrequently occasion a small kind of tumour, which is soft in the centre, but hard and resisting at the circumference, especially when the violence has been considerable. Now the ease, with which the centre or seat of the extravasated fluid admits of being depressed, while the circumference remains hard and elevated, is extremely apt to give rise to the belief, that a fracture with depression has happened. The true nature of this accident was first clearly explained by J. L. Petit; and, since his time, the proper cautions not to fall into a mistake concerning it, have been laid down by the generality of surgical writers.

Often nothing is more obscure, than the diagnosis of fractures of the cranium: their existence, indeed, can only be made out with certainty, when they can be felt, or seen. Thus a fracture of the skull, attended with a wound of the scalp, and exposure of the bone, shows itself in the form of a fissure more or less wide and extensive, and taking various directions. The accident may also be known by the touch even when the soft parts continue entire, particularly if the fracture is accompanied with splinters, or the edges of the fissure are materially separated. When there are many splinters, entirely detached, a crepitus will likewise serve to explain the nature of the accident; but, unassisted by these symptoms, imparted to him by the sight, the hearing, or the touch, the practitioner cannot at once offer a decided opinion as to whether a fracture exists, or not.

In order to procure more positive information, would it be right and judicious to make several incisions and uncover the bone? But, here the surgeon would be embarrassed in the very commencement of his proceedings; for, how would he be able to judge where the knife should be applied? Why also should he resort to an useless and painful operation, which (to say the best of it) would only render the patient's cure more distant?

The symptoms, indicating compression of the brain, can alone justify an examination of the fracture. These symptoms also must be urgent and alarming; for, when they prevail in a slight degree, bleeding and evacuations promise more

benefit than any operation on the skull; and consequently all examination of the part, supposed to be broken, must be unnecessary.

Even when the cranium has been denuded, so that the sight can convey due information respecting the solution of continuity in the bone, care must be taken not to be deceived by a suture, or by the groove of a vessel. In cases of doubt, a modern surgical author advises us to scrape the outside of the bone; and he tells us, that, if after the removal of the external scale, the fissure yet appear, and a thread of blood be seen at its outer part, no doubt exists of its being a real fissure. As however making this examination can answer no purpose, except with the view to determine the place where the trephine should be applied, I cannot recommend the plan except where the symptoms positively render this information desirable. On the contrary, it appears to me, that all examinations of the bone, made seemingly from mere curiosity, and without any true surgical object, should be deprecated as rash and hurtful.

The danger of fractures of the skull does not depend upon the simple solution of continuity: but is in relation to the degree of concussion and compression of the brain, with which the injury of the bone may be complicated. The pressure, caused by depressed splinters of bone, is less alarming, inasmuch as the cause of the compression is easy of removal. The pressure of extravasated fluid is far more serious, in consequence of the difficulty of ascertaining positively its existence and precise situation.

Its seat is sometimes between the skull and the dura mater, which is detached from the bone. More frequently, it occurs either between the dura mater and tunica arachnoides; in the substance of the brain; or else in the ventricles. The quantity of extravasated fluid is generally less in those extravasations, which are situated between the dura mater and the skull, unless they lie in the course of the middle meningeal artery, where they are frequently copious. Extravasations, formed in the substance of the brain itself, are not only more considerable, but also, as they mostly depend upon concussion, are more alarming, than effusions on the surface of the dura mater. It is indeed extremely difficult, if not impossible, to ascertain the situation of the extravasated fluid. In such cases, the trepan is likewise of no use; while concussion, when so violent as to produce internal extravasation, is perhaps invariably fatal. In extravasations between the dura mater and the skull, which are almost the only cases of the kind, to which surgery can administer relief, when the effused fluid lies under a part of the skull, accessible to the trephine, the extravasated fluid is generally, except in the instance just now specified, small in quantity. The danger, however, is not the less: ten or twelve drops of fluid are sometimes enough to produce a fatal compression. When the extravasation has happened in the substance of the brain, the compression is far more perilous: in short, it may be said to prove, with very few exceptions, certainly mortal.

The lethargy, the degrees of which increase from mere drowsiness into the most perfect coma; and the paralysis of the opposite side of the body to the seat of the extravasation; are the

most common symptoms of this accident. Having explained elsewhere (see HEAD, INJURIES or) some other symptoms, such as stertorous respiration, dilated pupils, &c. which usually indicate pressure on the brain, it is unnecessary here to dwell upon them. The subsequent increase of the coma, and paralytic affections, and the gradual augmentation of their intensity, serve to render these symptoms distinguishable from others, which are suddenly brought on by concussion. But there are instances, as every man of experience knows, where concussion ruptures the blood-vessels and produces an extravasation of blood. In this circumstance, it is obvious, that the symptoms of compression are blended with those of concussion. The symptoms, proceeding from the latter cause, always diminish in proportion to the time, which has elapsed from the moment of the injury; while those of compression succeed, and, on the contrary, increase in intensity, in proportion as the quantity of extravasated fluid becomes more considerable. Notwithstanding these distinctions, however, it must be acknowledged, that there are many cases, in which the surgeon is obliged to remain in doubt, with regard to the particular cause of the symptoms. This indecision is the more embarrassing, because the operation of trephining is necessary in cases of extravasation, but useless in those of concussion. Even when extravasation is known to exist, the practitioner requires more information; for he ought to know the precise situation of the effused fluid. It is true, indeed, that paralysis of one side of the body generally indicates the pressure to be upon the opposite hemisphere of the brain. But, what surgeon would venture to follow the practice advised by Van Swieten, and apply to the suspected side of the head three crowns of the trepan? Possibly, not one of them might fall on the situation of the extravasated fluid. When the skull is broken, the extravasation is almost always on the same side as the fracture. When it is the effect of concussion, or when the breach of continuity in the skull is what is termed a counter-fissure, the effusion is generally on the side of the head most remote from the blow. If the pressure is caused by a detachment of the internal table of the skull, the nature of the case cannot be ascertained before the operation of trephining has been performed on the part of the skull, upon which the violence has acted. When there are two extravasations, one depending upon a fracture, and situated immediately under it, between the dura mater and the skull; the other arising from concussion, and situated at some point directly opposite, either between the dura mater and tunica arachnoides, or within the substance of the brain itself; paralysis may occur on the same side as the fracture; and hence, it may be inferred, that the palsy does not always take place on the side opposite to the extravasation. But, says Richerand, an examination of the body quickly proves, that the case does not deviate from the common rule. The extravasation, produced by concussion, being almost invariably more considerable, than that caused by a fracture, accounts for the extension of the palsy to the same side of the body. Sometimes, the side, which is not paralytic, is affected with convulsions; the pulse is full and hard; and the respiration stertorous; in

short, the symptoms are analogous to those caused by apoplexy.

The following observations and advice fully accord with the doctrines, which I have always inculcated in my writings upon this part of surgery, and they also agree with the practice, which was so successfully adopted by me in the case of the soldier of the 44th regiment, wounded at the battle of Waterloo, as already mentioned: it is therefore with much pleasure that I quote the authority of Sir Benjamin Brodie on a point, about which practitioners have been so much perplexed:—"Blood (says he) is seldom poured out in any considerable quantity between the dura mater and the bone; except in consequence of a laceration of the middle meningeal artery, or one of its principal branches; and it is very rare for this accident to occur, except as a consequence of fracture. If, therefore, we find the patient lying in a state of stupor, and, on examining the head, we discover a fracture with or without depression, extending in the direction of the middle meningeal artery, although the existence of an extravasation on the surface of the dura mater is not thereby reduced to an absolute certainty, it is rendered highly probable, and the surgeon, under these circumstances, would neglect his duty, if he omitted to apply the trephine: and, where no fracture is discoverable, yet, if there is other evidence of the injury having fallen on that part of the cranium, in which the middle meningeal artery is situated, the use of the trephine may be resorted to on speculation, rather than that the patient should be left to die without an attempt being made for his preservation. I cannot, indeed, adduce any particular experience of my own in favour of what is here recommended; but, I conceive, that the instances, which have been recorded, in which the middle meningeal artery has been ruptured without any fracture of the bone; and the known fact, that there is sometimes a fracture of the inner table of the skull, while there is none of the outer table; sufficiently justify such an experiment in desperate cases." (*Méd. Chir. Trans.* vol. xiv. p. 385.)

With the foregoing exception, in which indeed the ground for suspecting the seat of the effused blood is the knowledge of the exact part on which the violence has operated, the plan of depletion, recommended for concussion (see HEAD, INJURIES OF,) is all that can be done, when every thing is uncertain relative to the situation of the extravasation. It is all that can be done in those frequent instances, where the effusion has taken place in the substance of the brain, so that it cannot possibly be voided. The trephine then is indicated only when there is an extravasation between the dura mater and the bone, the fracture being situated at a part of the skull accessible to instruments, and not at the base. We shall not here dwell upon the doubtful example, where the fluid lies between the dura mater and the arachnoides. I believe, that the operation should be limited to a small number of cases, in which not only the existence and situation of the pressure are known, or may be suspected on the ground above explained, but in which the symptoms, arising from this cause, are urgent and dangerous, and the pressure can be removed by no other means.

Desault in the last years of his practice abandoned the operation of the trepan altogether, its ill success at the Hôtel-Dieu having become noto-

rious. Surgeons of the present day trephine with more caution and discrimination, and sometimes with striking success.

When the case is a simple fissure, the trephine ought to be applied upon the solution of continuity, if the symptoms indicate a dangerous degree of pressure on the brain.

When the detached portions of bone are depressed, so as to compress the brain, and cause urgent symptoms, the operation is still requisite, if they cannot be elevated by other means. But Richerand maintains, that a positive indication for trephining is not frequent, either because it is difficult to judge of the existence and situation of extravasations, or because extravasated fluids readily escape through the interspaces of the fragments, when there is a splintered fracture. Such facility is also increased, when one of the portions of broken bone is totally detached, so that it can be removed, leaving an aperture equivalent to what would be produced by the application of the trepan.

When the operation is determined on, the head should be shaved: indeed, this is often done immediately the surgeon is called, in order that he may have a better opportunity of seeing what parts of the scalp have been struck; for it is in such situations, that he has most reason to apprehend fractures of the bone, or extravasations beneath it. If, however, the violence has occasioned a large wound, or laceration of the scalp, the practitioner, knowing where the force has been applied, is frequently content with having a little of the hair shaved off the parts surrounding the injury. All that need be said on this subject is, that it is always better to have enough of the hair taken away, to afford the surgeon an uninterrupted opportunity of examining the scalp freely, and doing whatever may be necessary. The loss of a little hair is of very little consequence, while the concealment of the seat of a depressed fracture, or extravasation may lead to fatal consequences.

When the propriety and necessity of trephining are fully indicated, provided the wound, or laceration of the scalp should not have exposed a sufficient surface of the bone for the application of the crown of the trephine, an adequate dilatation of such wound ought immediately to be made. If, in the situation of the blow, there should only be a contusion, or a bump, unattended with any wound, a division of this part of the scalp is to be made by carrying the knife quite down to the bone. In those cases, in which the swelling, occasioned by the violence, is considerable, and attended with the sensation of a crepitus, as well as in other instances, in which there is only a contusion, under which a fracture and displaced pieces of bone may be felt; the scalp must be divided in the same manner, only with greater caution, lest the point of the knife should insinuate itself through the fracture, and do mischief to the dura mater and brain.

Authors recommend the shape of the incision to be different according to the kind of fracture, and the parts of the head, on which the violence has operated. When the whole extent of the injury can be brought into view, by means of an incision, having the form of the letter 'J', the surgeon should be content with such a division; but if this be not sufficient, he may give it a crucial shape. When the trephine is to be applied to the squamous part of the temporal bone, we are recommended to make the incision as much as possible, in the

shape of the letter V, the branches of which are to be upward, and the angle downward, in order that as little as possible of the temporal muscle may be cut, and that the division of its fibres may be avoided as far as it is in our power.

Having divided the scalp and aponeurosis of the occipito-frontalis, the next object is to reflect the flaps; but no man would be warranted in cutting any part of them away, although such practice is advised by Pott. The purposes of the operation do not require any removal of this kind; and the method would leave a wound, which would be long in healing, and, when healed, never exempt from deformity. In short, the reflected flaps of the scalp are capable of adhering to the parts, on which they are laid, after the operation, and, consequently, ought never to be wantonly cut away.

The scalp being reflected, some authors next advise us to scrape away the pericranium, either with the knife, or raspatory. Perhaps this measure may be considered as one, which does neither much harm, nor much good. The design is to facilitate the application of the trephine to the bone. However, the teeth of a proper instrument, in good order, will not be impeded by the slender periosteum; and scraping this membrane away from parts of the skull, which are not to be removed, may conduce to exfoliations.

Sometimes, the bleeding from branches of the temporal, or occipital artery, is so copious, that the bone cannot be conveniently perforated until the hemorrhage is suppressed. If it be prudent to wait a little, and the case (as it generally does) should be likely to be benefited by the evacuation of blood, it is as well to let the bleeding continue for a certain time. The surgeon may then just direct an assistant to put the end of one of his fingers on the mouth of the vessel, and proceed in the operation. In some cases, the bleeding might be so troublesome, that it would be better to tie the artery.

All parts of the cranium do not admit of being trephined with equal convenience and safety. It has usually been set down by surgical authors, that the trephine cannot be applied below the transverse ridge of the os occipitis. There are some cases, however, which prove that such an operation is practicable, and that we ought not, in urgent circumstances, to be afraid of dividing the trapezius and complexus muscles, in order to be enabled to apply the trephine to the bone. (See *A. C. Hutchinson's Case in Med. Chir. Trans.* vol. ii. p. 104, &c.) Additional instances of similar practice are quoted by M. Velpeau. (*De l'Opér. du Trépan*, p. 139.)

Many writers forbid the application of the trephine to the frontal sinuses, in consequence of the indeterminate depth of these cavities, and the apprehension of incurable fistulae. However, Larrey deviated from this precept in several instances; and his practice confirms the statement of Sir Charles Bell, that, by opening the frontal sinus with a large trephine, and then using a small one, the internal parietes of this cavity may be trephined with perfect safety, and without injuring the dura mater with the saw. (See *Larrey, Mém. de Chirurgie Militaire*, t. ii. p. 136—138. t. iv.)

Written also caution us not to apply the trephine to the posterior inferior angle of the parietal bone, on account of the situation of the lateral sinus under it; nor to its anterior inferior angle, in

consequence of the middle artery of the dura mater lying under it, generally in a groove of the bone, but occasionally in a canal in its very substance. In the latter circumstance, this portion of the parietal bone could not possibly be taken away, without wounding the vessel. However, notwithstanding this advice which has been transmitted from generation to generation, I much question the soundness of the doctrine. We undoubtedly ought to avoid trephining this part of the cranium, when we can prudently do so. But the causes demanding this operation, are always so urgent that the patient's sole chance of existence depends on their quick removal. Hence, were there pressure on the brain, either from a depressed portion of bone, from blood, or matter, and such pressure could not be removed, without trephining the anterior inferior angle of the parietal bone, what operator would be afraid of doing so? Besides the peril hemorrhage has been greatly exaggerated; for, the lodgment of the artery in a bony furrow, or canal, which authors have pointed out as rendering the suppression of the hemorrhage difficult, has no such effect, a little plug of lint or a bit of a small bougie pushed into the orifice of the vessel, so situated, will mostly stop the bleeding with ease.

The foregoing suggestion was made in the early editions of my works, and I now see the safety of the practice has been confirmed. "I have applied the trepan (says Larrey) over the track of the spheno-spinous artery, at the inferior anterior angle of the parietal bone. The artery was divided; but I stopped the hemorrhage almost immediately, by applying an iron probe red hot. (*Mém. de Chir. Militaire*, t. ii. p. 138.) Dr. Dorsey, of the United States, once succeeded in tying this vessel.

Formerly, surgeons were cautioned not to trephine on the temple, because the temporal muscle and middle meningeal artery would thereby be injured. Had there been sufficient reason for this advice, as M. Velpeau observes, it would have been unfortunate, inasmuch as the temporal region is precisely one of those, in which the trepanning or trephining is most frequently useful. Luckily, (he adds) the prohibition has scarcely ever been attended to; and he refers to various works in proof of this statement. (*Velpeau de l'Opér. du Trépan*, p. 134.) In many persons, the bleeding from the middle artery of the dura mater is but trivial, and, when it is more copious, it may easily be stopped. Thus, in addition to cases already mentioned in proof of this observation, I may state, that Béchard and M. P. Dubois experienced no difficulty in checking the hemorrhage. (*Arch. Gén. de Méd.* t. iii. p. 377.)

The occipital protuberance, by reason of its thickness and inequalities, would render the safe application of the trephine difficult. The conflux of the sinuses at that point would also be another objection. Yet, if the case were urgent, M. Velpeau sees no insurmountable obstacle to trephining on the occipital protuberance; and he cites a case, in which Bourrienne expresses regret, that an extravasation of blood, under the occipital protuberance, had not been recognised during the patient's life, as it might have been discharged by trepanning. (*Journ. de Dehorne*, t. iii. p. 246.) It seems to me that, in an urgent case, a surgeon would, at all events, be warranted in trephining over one or both the fossæ for the posterior lobes

of the brain, or even the manner adopted by Mr. A. C. Hutchison below the transverse ridge of the occiput.

Writers, until lately, prohibited us from trephining over any of the sutures, and especially, over the sagittal suture, beneath which the longitudinal sinus is situated. The fear of the dura mater being injured, and of this vessel being wounded, was the reason for the advice. With regard to the sutures in general, the trephine may be applied to them, if circumstances call for it, as well as to any other part; and, as for the sagittal suture, many facts confirm the propriety of not being deterred even by it, though situated immediately over the longitudinal sinus. It is to be remembered, also, that the dura mater, in cases of extravasated blood and pus, beneath the cranium, is detached by the intervention of such fluids from the inner table.

Amatus Lusitanus trepanned on the sutures and on the occipital bone. (*Portul*, t. i. p. 500.); and Thiriot on the squamous suture. (*Journ. de Desault*, t. iv. p. 105.) Morand followed the same practice (*Op. Chir.* part 2. p. 192); and Warner applied the trepan to the lambdoidal suture. (*Obs.* 2.) See also *Velpeau de l'Opér. du Trépan*, p. 126.

By means of a perforation practised over the sagittal suture, Garengot successfully elevated a portion of bone, which pressed upon the longitudinal sinus. The depressed piece of the cranium could not have been so advantageously raised had the trepan been applied in any other situation. But a still stronger argument, in favour of this practice, when the case at all requires it, is the fact, that wounds of the longitudinal sinus, and the hemorrhage resulting from them, are not attended with any serious danger. Sharp mentions his having twice seen a bleeding of this kind. Another instance is also recorded in Warner's Cases. A child received a wound on its forehead: the two parietal bones were fractured, and a portion of each was depressed on the dura mater. The child lived a month, without any operation being performed; but, at the end of this time, Warner applied the trepan. He found a splinter of bone sticking in such a way into the longitudinal sinus, that it could not easily be got out; consequently, he enlarged with a lancet the opening, in which the splinter was entangled. The hemorrhage, which was copious, was easily suppressed by the application of a little dry lint, and the child was relieved, though it died at the end of two months, after suffering a variety of symptoms, which had no connection with the wound of the sinus, the opening of which soon healed. The fourth case, related by Marchetti, also proves, that wounds of the longitudinal sinus are not fatal. Pott and Calisen have recorded other facts, tending to the same conclusion. (See *Syst. Chir. Hodierna*, pars i. p. 659, ed. 1798.)

The following case was communicated to M. Velpeau by M. Champion. "I removed (says the latter) the two upper thirds of the occipital bone, which had been broken in pieces in a boy twelve years old. In taking away one fragment opposite the torcular Herophili, the blood from this point gushed out to the distance of more than two feet, and extinguished the candle. I placed some charpie over the part, and held it there with the little finger of my left hand, and

by the time that all the pieces of bone had been removed, and raised, there was no more bleeding." (See *Velpeau, de l'Opér. du Trépan*, p. 129.) If a vein is so placed, that it will admit of compression, the bleeding from it, however large the vessel may be, may generally be commanded with facility.

Whenever a depressed fracture can be elevated to its proper level, without applying the trephine, and with the mere aid of a pair of forceps, or an elevator, trephining should never be performed, unless there be strong reason to apprehend, that blood or matter, lodged on the surface of the dura mater, contributes to the production of the bad symptoms, and cannot otherwise be discharged.

"In order to gain space for the disentanglement of the depressed bone, and for the efficient application of the elevator, it is in many cases necessary to remove a circular piece of bone. This is generally done, so as to attain the desired object most readily as near as possible to the point, where the force has been applied. In very bad and extensive fractures, large portions may be found entirely detached and loose, but very frequently the depressed portion is not separated. On one side, the bone is cracked and bent down; that part, which has been struck, is generally driven more deeply towards the cavity, and is wedged under the sound portion. By removing part of this, the elevator can be introduced with advantage under the depressed piece. The crown of the trephine is therefore applied, so as to overlap slightly the injured part, and to remove the broken edge." (See *Liston on Practical Surgery*, p. 47.)

The scalp and aponeurosis of the occipito-frontalis, having been divided, if necessary, and the pericranium scraped from the bone, according to the common precepts, the next thing is the application of the crown of the trephine.

The surgeon is first to make a little impression with the point of the centre-pin, for the purpose of marking the place where it will work, when the crown of the trephine is applied in the proper situation; for, where such impression is made, the operator must make a small hole with a perforator, in order to fix the point of the centre-pin, on which the crown of the instrument turns backwards and forward, as on an axis, during the first stage of the operation. However, the generality of centre-pins make a perforation, without need of any particular instrument for the purpose, and, in this respect, are advantageous.

The point of the centre-pin having been fixed, the trephine is to be turned by regular semi-circular motions, alternately to the right and left, which object is effected by steady pronations and supinations of the operator's hand, the pressure being only made in turning the instrument from the left to the right. (*Liston, Op. cit.* p. 47.) The teeth of the saw having made a manifest circular groove in which they can steadily work, the centre-pin becomes useless; and, as it would, if not withdrawn, or removed, certainly injure the dura mater and brain, by reason of its projecting further than any other part of the instrument, it would be an unpardonable blunder to let it remain after a proper circular groove had been formed by the teeth of the saw.

The beginning of the sawing may be executed boldly and quickly; for, the operator runs no hazard of doing mischief. It is necessary occasionally with the view of facilitating the action of the instru-

ment, to clean away the particles of bony matter, with a little brush, usually kept for the purpose in every box of trephining instruments. Were this plan neglected, the action of the cylindrical saw would be very much clogged.

The operator, however, must increase his caution, when the sawing has made greater progress; for, were he to be too bold, he might sometimes lacerate the membranes of the brain with the teeth of the instrument, particularly as the thickness of the cranium is subject to infinite variety, both in different parts of the same head, and in different subjects. Let the surgeon, therefore, never forget to examine frequently, with the point of a quill, or thin end of a probe, whether any part of the circular groove is cut through or nearly so; for, when this is the case, the instrument must only be worked in such a way, as to make pressure upon, and cut, the part of the circle, which yet remains to be divided. In some few cases, it is said, that the surgeon can distinctly feel, when the teeth of the saw reach the diploe, or medullary structure, between the two tables of the cranium; and some writers have rashly directed us to saw with boldness, till the sensation of this occurrence is communicated to our hand and fingers. However, I believe, this possibility of discriminating the arrival of the teeth of the saw at the diploe is so uncommon and so fallacious, that it should never be expected, or relied on. Nor ought the surgeon to saw with incautious force and rapidity, till he sees the teeth of the trephine bloody, which appearance has been set down as another criterion of their having reached the diploe. I have already stated, that a great many skulls have hardly any space between several parts of the two tables. This is well known to be the case in old persons and in children.

A prudent man will always prefer exerting a little force for the purpose of breaking some of the bony connexion, retaining the circular piece of bone, to running any hazard of injuring the dura mater, by sawing too deeply. After a certain time, therefore, it is better to lay down the trephine, and endeavour to elevate the portion of bone, with the aid of a pair of forceps, constructed for the purpose, and kept in most cases of trephining instruments, or else by means of an elevator, which is still more calculated for the purpose.

When the circular piece of bone has been taken out, and the edges of the perforation are unequal and splintered, the irregularities are to be cut off with the fencible knife. When there is extravasated blood underneath the opening that has been formed, it sometimes spontaneously makes its escape, and if it should not do so, the surgeon must remove it himself. If one perforation of the skull should not suffice for letting out the blood, as much more of the cranium ought to be removed with the trephine, as circumstances may require; there being no comparison between the danger of repeating the application of the instrument, and that of leaving a quantity of undischarged, compressing fluid, on the surface of the brain. Certainly many facts on record evince, that the dura mater may be very extensively uncovered without dangerous consequences. Sarrau saw a whole parietal bone exfoliate, in consequence of a blow on the head.* Blegny relates a similar case; and Bayard makes mention of a woman, who had lost the upper part of the os frontis, both the parietal

bones, and a large portion of the os occipitis, all of which had come away at the same time; yet she recovered. Vaugion, however, who seems also to refer to this identical case, describes the exfoliation as not being quite so extensive.

I am of opinion, notwithstanding these facts, that exposing a large part of the dura mater with the trephine is, by no means, an operation exempt from serious danger. And, what I conceive confirms this statement, is my having known instances in which persons, who had been rashly advised to submit to being trephined, for the cure of violent pains in the head, &c. died, in consequence of the operation. I make this observation, well aware of the successful instance of the practice recorded by Schmucker. (*Wahrnehm.* b. i. p. 434.)

However, I perfectly coincide with writers, who direct the removal of as much bone as is necessary, in order to be able to remove the whole of the pressure from the surface of the dura mater.

The application of the trephine, in cases of copious extravasations, must in particular be made several times, when the situation of the fluid does not favour its escape. But, in this circumstance, Sabatier says, that we should not make numerous perforations all along the extent of the extravasation; but only a counter-opening, as is done on the soft parts. This author expresses his surprise at there not being on record many examples of counter-openings made in the cranium, since analogy demonstrates their utility. I cannot help remarking, on this part of the subject, that one very obvious objection to making openings of this kind in the cranium, is the impossibility of knowing, with certainty, whether blood lies under any particular part of the skull; whereas, in abscesses of the soft parts, the surgeon feels the fluctuation of the matter, and knows, that his counter-opening will be made in the cavity containing it. One may sometimes have occasion to make more than one perforation, in order to discharge blood extravasated beneath the skull, when the blow has happened near a suture, to which the dura mater continues adherent; for a single opening, made only on one side of the suture, might only give vent to a part of the extravasation.

When the trephine is applied, on account of a fracture with depression, Sir Benjamin Brodie considers the removal of a small portion of bone as generally sufficient; but, when the case is an extravasation of blood on the surface of the dura mater, he recommends a freer removal of the skull. He was led to adopt this rule by having seen a case, in which, after two triangular portions of bone had been taken away with a straight saw, and a large quantity of blood discharged, to the great relief of the patient, suppuration afterwards took place on the surface of the dura mater, wherever this membrane had been separated by the extravasation from the bone. The matter was hindered by the granulations from escaping by the aperture already made, and though another portion of bone was removed, the practice was too late to save the man's life. (*See Méd. Chir. Trans.* vol. xiv. p. 387.) Whether an extensive removal of the cranium ought to be generally made in anticipation of suppuration of the dura mater in such a case—whether such a measure might not rather tend to make the event more likely to happen—and whether the practice which Sir Benjamin Brodie actually adopted, might not have been the

best, though, in the instances brought forward, unsuccessful — are questions, I think, on which the most judicious surgeons may entertain differences of opinion. As my principles lead me to disapprove of the old custom of trephining for the purpose of preventing inflammation and suppuration of the dura mater, they would incline me to be content with rigorous antiphlogistic treatment, and discharging the confined matter as soon as the ill effects of its pressure began to show themselves.

If we should not find blood lodged under the cranium, but the dura mater should seem elevated, tense, dark-coloured, forming a prominent fluctuating tumour, it may be cautiously opened with a lancet, or bistoury, with the view of letting out any collection of blood underneath. In the article *HEAD, INJURIES OF*, I have stated the result of Mr. Abernethy's experience, in regard to the operation of opening the dura mater. This gentleman found, that the method never effectually discharged all the blood, but only the serous part of it. However the evacuation of any of the compressing fluid must certainly be desirable; and, if the surgeon cannot do more, yet he has fulfilled his professional duty.

Although Sir Benjamin Brodie admits, that wounds of the dura mater are attended with great danger, he approves of the practice here recommended (see *Med. Chir. Trans.* vol. xiv. p. 389), and supports his opinion by reference to an interesting case under the late Mr. Chevalier. This gentleman was called to a child, a year and a half old, which had received a severe blow on the head, and lay insensible and convulsed. There was no wound of the scalp; but the fontanel appeared somewhat elevated. It was therefore exposed by an incision, and raised so as to uncover the subjacent dura mater, beneath which the purple colour of extravasated blood was plainly discernible. A puncture having been made with a lancet, three or four ounces of blood issued out with considerable force; the symptoms were immediately relieved, and the child recovered. (See *Med. Phys. Journ.* vol. viii. p. 505.) An example, furnishing an equally convincing proof of the practice here advised, is also adduced by Sir Benjamin Brodie, from the practice of my friend and neighbour, the late Mr. Ogle.

The utility of trephining is not limited to discharging extravasated blood, or matter, lodged underneath the skull. This operation frequently enables us to elevate depressed portions of bone. The latter object can often be accomplished by merely making one perforation. Sometimes, several perforations are requisite to be made near each other. Authors even state, that it may also become necessary to remove the intervening portions of bone with a pair of cutting forceps. The depressed part may then be easily raised by means of an elevator. Occasionally, indeed, I may say, very often, the best practice is to remove the depressed portion entirely, when its total separation from the rest of the skull can be accomplished by cutting across the base of the depressed piece.

According to some writers, if, after dividing the dura mater, the surface of the brain appears smooth and flabby, with a fluctuation, we may conclude there is an abscess in its substance; and these authors, more enterprising with their pens, it is to be hoped, than with their scalpels, sanction the method of carrying the point of the bistoury to the

depth of an inch, if circumstances render so deep a puncture necessary. "But," says Richerand, "prudence forbids us to go further. Cutting the surface of the brain causes no pain, and it produces less danger than one might apprehend; experience and observation prove (in opposition to phrenological theories), that the essential parts of this organ are situated near its base, and that its surface may be removed without danger or pain." (*Nosogr. Chir.* t. ii. p. 301. ed. 3.)

A case, in which Dupuytren plunged a bistoury to the depth of more than an inch into the brain, and thus let out an ounce and a half of pus, is recorded in a valuable periodical work. (See *Journ. of Foreign Med.* No. 18. p. 298.) Some temporary amendment followed; but the case had a fatal termination.

After the operation of trephining, the divided scalp is to be placed as nearly as possible in its natural situation, and lightly dressed with a pledget of simple ointment, or covered with the water dressing and a piece of oil silk. In applying the dressings, the surgeon should invariably keep in view these objects; namely, to let whatever is put on the wound be as light as possible, not apt to make pressure on the brain, and of a nature which cannot excite irritation. All stimulants are to be strictly prohibited. A bandage, which would only heat the patient, should be avoided; and, if any further covering be required, a thin linen cap should be preferred.

The practitioner should not now conceive, that he has done all that he ought to do. Let him remember the urgent necessity of keeping off, or diminishing, inflammation of the dura mater and brain, which is still to be feared. Let him bleed the patient largely and repeatedly; exhibit calomel, saline purges, clysters, and antimonials; and if the symptoms continue, let him apply a blister to the head. I shall avoid, however, any repetitions on this subject, by referring to *HEAD, INJURIES OF*.

The aperture in the skull becomes closed with granulations, which slowly acquire a hard consistence. While the cicatrix is soft, it should be protected from external injury with a thin piece of horn, or metal. Exfoliations from the margin of the perforation sometimes retard the healing of the wound; but, now that the practice of dressing with drying spirituous applications has been exploded, and the removal of any part of the scalp is condemned by all the best surgeons, these unpleasant consequences are rendered much less frequent, than in former days.

The reproduction of bone to fill up the perforation, made by the trephine, does not usually advance beyond a certain point, and takes place very slowly and only from the margin of the aperture. Even when the soft parts unite by the first intention, the deficiency of bone is never completely obviated (See *NECROSIS*); first, because, as M. Velpeau observes, the pericranium has been destroyed; secondly, because the dura mater (which, however, does not appear to him to be capable of contributing to the process) is for the most part also involved; and thirdly, because the concentric reproduction is hindered by the contact of the soft parts. If the wound heal by the suppurative process, M. Velpeau adverts to the following changes as taking place. Between the 15th and 20th days, a preliminary inflammation begins to detach the sharp

edges of the perforation, which afterwards exfoliate. The osseous texture itself becomes the seat of a very curious healing process, which has been accurately investigated by Baron Larrey. It becomes exceedingly vascular, and its minute vessels, by extending themselves, and producing ossification, may even in time close with an osseous plate the greater portion of the opening in the skull. In the Museum of M. Larrey at the Invalides, M. Velpeau saw various preparations, and one patient in which this process was manifest; and, in proof of the accuracy of this statement, the latter surgeon adverts to instances, in which the perforation is reduced to a mere canal. In University College Museum, there is a skull in which very extensive reproductions of bone have taken place after the operation of trephining, the patient having survived it forty years. That the bone may live and enlarge, without the intervention of the pericranium and dura mater, seems evident to M. Velpeau from the circular, osseous ridge, which sometimes takes place around the perforation, so as either to form a perceptible protuberance under the scalp, or a swelling within the skull. Larrey showed him one example of this; and another specimen is referred to, as being in Dr. Physick's Museum, at Philadelphia. (See *Velpeau, de l'Opér. du Trépan*, p. 262—264.) I will conclude this article with the following extract from Dr. Reese's *American ed. of this Dictionary*.

"It is a high source of gratification to be able to record, that in this country (the United States), the trephine is now much more seldom used than formerly. But a few years ago, on a man being stunned by a blow or a fall, to any considerable extent, almost any neighbouring physician would apply the trephine without hesitation, and the facility with which this operation can be performed, offers no small temptation to the mere operator, especially as there is seldom any risk of life, and always a gain in reputation among the multitude. It is now very generally viewed as it ought to be, as a *dernier resort* in such cases, and the use of it is not countenanced, unless the symptoms of compression by depressed bone, or extravasated blood, are altogether unequivocal; and a consultation with the best surgeons is always premised.

"I have seen scores of persons, who would have formerly been trephined, without even a "trial by jury," recovered from coma, paralysis, and convulsions, justly attributable to compression on the brain, by very large and copious bleedings, aided by cathartics and stimulating frictions and cataplasms to the extremities.

"Still, however, there will be a sufficiency of instances, imperiously requiring the use of the trephine, to render it necessary that every practitioner should be conversant with the instrument, and all the circumstances connected with its use. Indeed, some of the most deplorable cases to which surgical assistance is ever rendered, are occasionally met with among the examples in which the trephine becomes indispensable.

"In the year 1819, I assisted Dr. Henry William Ducachet, then a practitioner in the city of Baltimore, in the performance of this operation on a woman, who had received several blows on the head with an axe, from a brutal husband. We could discover no depression of bone, and yet the coma, stertor, hemiplegia, and other evidences of compression, resisted all our depletion, and, on the

third day after the violence, we determined to apply the trephine, being sustained by judicious counsel in our opinion, that there must be extensive extravasation of blood beneath the cranium. On removing the circular piece of bone, with the largest crown of the instrument, a coagulum was found extending over the left hemisphere of the brain, exterior to the dura mater. This being removed, and only a mitigation of the symptoms following, the obvious distention of the dura mater itself pointed out the existence of still more extended mischief. We therefore divided the dura mater with a probe-pointed bistoury, for the space of half an inch, when coagulated blood to an immense extent forced itself through the opening. After washing out the cavity by warm water thrown in with a syringe, we were delighted to find the entire removal of the symptoms instantaneously result. Our patient spoke for the first time, asked for water, seemed as though awoke from an ordinary sleep, the stertor ceased, the dilatation of the pupil and hemiplegia were removed, and the most sanguine hopes were entertained of her recovery.

"I shall never forget the painful acuteness of our disappointment, when in a few hours we found all these dangerous symptoms return in a still more aggravated form, discovering to us the mortifying truth, that *though the operation had succeeded, yet our patient would die*; for, although we had removed the coagula, we could not stop the bleeding vessel.

"In the post mortem examination, the temporal bone was found fractured, and a spicula of bone had pierced the meningeal artery, which had not ceased to pour out its blood, and hence, coagula were found to fill the whole space of the hemi-cranium, above and below the dura mater. I have preserved the skull in my cabinet of morbid preparations, and the point at which the fracture of the internal table pierced the great artery of the dura mater, is distinctly visible in the depression which marks its course, which is in this case deeper than ordinary. It was exhibited on the trial of the murderer, and was highly important in a medico-legal point of view, since it fully satisfied the court, counsel, and jury, that her death was occasioned by the blows, and that the injury was altogether irreparable. This was clear from the fact, that the only blows which had wounded the scalp were on the top of the head, and on the middle of the os parietale. The fracture and consequent rupture of the vessel was low down in the temple, where no external wound was found, and two inches from the point at which the trephine was applied, guided as it was by the external injury.

"Since that time, I have applied the trephine and Hey's saw for the removal of a large portion of the frontal bone, which had become carious from syphilis, involving nearly the whole forehead. The extensive suppuration which had entered the frontal sinus, and even passed into the cavity of the skull, rendered this operation necessary, in the opinion of the consultation; the man having become idiotic from the disturbance of the cerebrum, and being a burden to himself and family, from frequent epilepsy.

"I applied the crown of the instrument four times, removing all the diseased portion of the bone, and only once entering through the skull, the caries being in the other parts confined to the external table, and the diploe filled with a fetid pus which had not sufficient egress, and by consequence was

involving the bone still more extensively in the specific morbid action. A large number of smaller pieces of the cranium were removed with Hey's saw, and by the forceps. A very considerable quantity of pus was found upon the dura mater, at the point at which the caries had entered the cavity, which was discharged through the opening made by the trephine, and the cavity of the head washed out with warm water. Notwithstanding the specific character of the disease, the almost hopeless extent to which it had progressed, and the extreme emaciation which had been superinduced by neglect and mismanagement, this patient entirely recovered, and has ever since the time of the operation (1822) been actively employed as a mechanic; never having had epilepsy since, nor any intellectual deficiency, although this had become apparent for months before. I saw him when last in Baltimore in perfect health."

The reader may find an account of the operation of trepanning or trephining in every system of surgery; but he should particularly consult the writings of Sharp, Le Dyan, Dionis, Brannath, Pott, Sabatier, Schmucker, Richter, Dease, Abernethy, Desault, Calhoun, Richerand, Sir C. Bell; the *Mém de l'Acad de Chirurgie*; Sir B. C. Brodie, on Injuries of the Brain, in *Med. Chir. Trans.* vol. xiv. A. A. M. L. Felepan, *De l'Opération du Trépan*, &c. 8vo. Paris, 1834; and in *Nouv. Flém. de Méd. Opér.* t. i. J. F. Malgaigne, *Manuel de Méd. Opér.* p. 217. 2mo. Paris, 1837. Ph. Crampton, in *Dublin Journ. of Med. and Chemical Science*, vol. ii.; 8vo. 1832. Professor Dudley, in *Transylvania Journ. of Medicine*, to. i. Dr. David L. Rogers, in *N. Y. Med and Phys. Journ.* vol. v. p. 79. R. Liston, on *Practical Surgery*, . 44. 8vo. Lond. 1837.

TRICHIASIS (derived from *τριχ*, the hair) denotes a faulty inclination of the eyelashes inwards against the globe of the eye. The disease presents itself under two distinct forms: the first is, where the hairs turn inwards, without the natural position and direction of the tarsus being at all changed; the second consists in a morbid inclination of the tarsus inwards (*Entropion*), and consequently of the eyelash towards the eyeball (*Trichiasis*.)

The first form of this disease is said both by Beer and Scarpa to be uncommon, nor has it come under the observation of the latter writer more than once, and, in this instance, only some of the hairs have changed their direction. On this point, however, Mr. Travers is completely at variance with the foregoing authors, as he describes an inversion of the cilia as frequently existing independent of entropion. (*Synopsis*, p. 232.) The second species, or form of trichiasis, or that which consists in a folding inwards of the tarsus and cilia at the same time, is the case which is commonly met with in practice. It may be either complete, affecting the whole of the tarsus; or incomplete, occupying only a certain portion of the edge of the eyelid, most frequently near the external angle of the eye. Sometimes the disease is confined to one eyelid; at other times it affects both; and occasionally the patient is afflicted with it in both eyes.

Some writers, amongst whom is Beer (*Lehr. von den Augenkr.* b. ii. p. 118.), admit a case, which they call *distichiasis*, and which they suppose to be produced by a double and unusual row of hairs. But, according to Scarpa, this third

species is only imaginary, and the reason of this subdivision seems to have arisen from not recollecting what was long ago remarked by Winslow and Albinus, that, although the roots of the cilia appear to be disposed in one line only, they form two, three, and in the upper eyelid even four rows of hairs, unequally situated, and, as it were, confused. Whenever, therefore, in consequence of disease, a certain number of hairs are separated from each other in a contrary direction and disorderly manner, the eyelash will appear to be composed of a new and unusual row of them, while, in fact, there is no change, either with respect to their number, or natural implantation.

It is not an easy matter to determine precisely, what are the causes which sometimes make a few of the hairs deviate from their natural direction, while the tarsus continues in its right position. They are commonly referred to cicatrices in consequence of previous ulceration, whereby the cilia fall off, and those which are growing are hindered from taking their proper direction. There must, however, be other causes sometimes concerned; for, in the case seen by Scarpa, two or three hairs were turned inwards against the eyeball, although there had been no preceding ulceration, nor cicatrices, of any part of the tarsus. Indeed, Scarpa is inclined to believe, that the small ulcers and scars, which are sometimes formed upon the internal margin of the tarsus, are more likely to cause the second form of the disease, or the inversion of the edge of the eyelid, and, consequently, of the cilia towards the globe of the eye. As these ulcers, when neglected, destroy the internal membrane of the eyelids near the tarsus, it necessarily follows, that, in proportion as they heal and diminish, they draw along with them and turn inwards the tarsus and hairs inserted into it. And since they do not always occupy the whole extent of the internal margin of the eyelid, but are sometimes confined to a few lines in the middle, or extremity, near the external angle of the eyelid, so, after the cicatrices are formed, the whole of the hairs are not invariably turned inwards, but only a certain number of them, which correspond to the extent of the ulcers previously situated along the internal edge of the tarsus. Indeed, in every case of imperfect trichiasis from a cicatrix of the inner margin of the eyelid, the tarsus and cilia are every where in their natural situation, except opposite the part, where the ulcers formerly existed. Also, if the eyelid be everted, its internal membrane, near that part of the margin corresponding to the seat of the trichiasis, will be found pale, rigid, and hardened, the inversion of the cartilaginous border and of the cilia being plainly the effect of the contraction of the cicatrized point.

Chronic ophthalmics of long continuance sometimes bring on the complaint, in consequence of the skin of the eyelids being kept for a long time in a state of distension and oedema, terminating in a considerable relaxation of it. And, according to Beer, the too long continued use of emollient poultices may have the same effect. (*Lehre*, &c. b. ii. p. 113.) The cartilaginous margin of the eyelid then loses the proper support of the integuments, inclines towards the eyeball, and afterwards turns inwards,

drawing the eyelashes along with it in the same improper direction. Long-continued puriform discharges from the ciliary glands likewise spoil the shape and consistence of the cartilage of the eyelid, and therefore not unfrequently occasion trichiasis. Scarpa doubts, whether a spasmodic contraction of the orbicularis palpebrarum muscle can ever be a cause of the disease.

The annoyance, which must necessarily result from the hairs perpetually pressing upon the cornea, and white of the eye, as Scarpa observes, may be easily imagined. The evil is rendered still greater by the hairs, which are turned inwards, becoming much longer and thicker, than those which retain their natural direction. And although the trichiasis be confined to one eye, both the eyes usually suffer from the effects of the disease. Indeed, generally, the eye on the sound side cannot be moved without occasioning pain in that which is exposed to the irritation and friction of the infected hairs. In almost all cases, both the eyes are very irritable, and incapable of bearing the light. As, in cases of incomplete trichiasis, the patient retains some little power of opening the eyelids for the purpose of seeing, and that most frequently towards the internal angle of the eye, the head and neck are often inclined in an awkward manner, so that in children a distortion of the neck and shoulders is at last produced, which cannot be rectified without difficulty even after the trichiasis has been cured. Unfortunately, also, children are impatient of the uneasiness arising from the infected hairs, and therefore are continually rubbing the eyelids, whereby all the ill effects of the complaint are much increased.

The cure of the second species of trichiasis, or that which is commonly met with in practice, is accomplished by artificially everting the eyelid, and fixing it permanently in its natural position, together with the eyelashes, which irritate the globe of the eye. This indication is perfectly fulfilled by the excision of a piece of skin close to the edge of the eyelid, of such a breadth and extent that, when the cicatrix is formed, the tarsus and margin of the eyelid may be turned outwards, and sufficiently separated from the eyeball, the cicatrix of the integuments affording a point of support fully adequate to keep the parts in their natural position and direction. Scarpa believes, that few modern surgeons, with the view to the radical cure of this disease, now place any confidence either in plucking out the inverted eyelashes, bending them outwards, and retaining them so by means of adhesive plaster; or in plucking them out, and destroying their roots with caustic: much less in extirpating the edge of the eyelid along with the hairs, or dividing the orbicularis muscle on the internal surface of the eyelid, under an idea that the disease is sometimes produced by a spasmodic contraction of it.

The following is the mode of proceeding recommended by Scarpa. The patient being seated in a chair, if an adult, or, if a child, laid upon a table, with the head raised, and firmly held by an assistant, who must stand behind the patient, the surgeon is to push outward, with the end of a probe, the hairs which irritate the eye. Then, with a pair of dissecting forceps, or the ends of his forefinger and thumb, he should lift up a

fold of the skin of the eyelid, taking great care that the piece, which is taken hold of, corresponds exactly to the middle of the whole extent of the trichiasis; for, sometimes the whole, sometimes a half, and in other instances, only a third of the extent of the tarsus is inverted. The surgeon, with his left hand, must raise the fold of the skin, more or less, according as the relaxation of the integuments, and the inversion of the tarsus, are more or less considerable. The reason of this is evident, viz. the greater the quantity of skin is, which is raised, the greater is the quantity which will be cut away. Supposing the patient to be an adult, as soon as the fold of skin has been raised in a certain degree, the surgeon must request him to open his eye; and if, in this act, the tarsus and eyelashes resume their natural place and direction, the portion of skin already raised will be sufficient for the purpose. When the integuments are elevated, by means of a pair of dissecting forceps, and care is taken to lay hold of the skin precisely at the middle point of the whole extent of the trichiasis, it necessarily follows, that the consequent section of the skin will form an oval, and that the greatest width of the wound will correspond exactly, or nearly so, to the middle of the eyelid, and its narrowest parts to the angles, or commissures of the same.

This contributes very materially to make the cicatrix correspond to the natural fold of the eyelid, and hinder the origin of a disease of an opposite nature to the one about to be remedied, toward the angles of the eye, viz. a turning out of the commissures of the eyelids. See ECTROPION.

Besides this caution, relative to the situation and figure of the fold of the integuments to be cut off, the surgeon must be careful, that the division of the skin be made very near the inverted tarsus. Were this circumstance neglected, the operator might have the mortification of finding, after the wound has been healed, that although the eyelid is shortened, on the whole, from the eyebrow to the place of the recision, yet it is not equally so at the space which is between the edge of the eyelid and the cicatrix of the skin. Hence the tarsus would not be turned outward sufficiently to keep the eyelashes from rubbing against the eye.

The surgeon holding up the fold of skin by means of the forceps, in his left hand, is, with a pair of probe-pointed, sharp-curved scissors, to cut off the whole of the duplicature, being first sure that one of the blades of the instrument is applied close to the edge of the eyelid. If the two eyelids should be affected, the same operation must immediately be done upon both of them, with such cautions, and in such proportion, as the extent of the disease, and the degree of inversion of each eyelid, may require.

Scarpa employed no suture to unite the wound, and considered it sufficient to keep the eyebrow as much downward as possible, if the operation had been done on the upper eyelid, or, if on the lower, to support it against the inferior arch of the orbit, by pressing it from below upwards, so as to keep the edges of the wound from becoming separated. Then the lips of the wound are to be brought exactly together, by means of strips of adhesive plaster, extending from the superior arch of the orbit to the zygoma; and the maintenance of this state of the wound will be still more securely

affected, by placing two compresses, one on the eyebrow, and another on the zygoma, together with a bandage. On the other hand, Langenbeck disapproves of the omission of sutures, by which he finds, that the wound may be both more accurately and expeditiously united. Indeed, he expresses himself generally in favour of sutures, where the wounded part is liable to be disturbed by the continual action of muscles. (*Neue Bibl.* b. i. p. 415, &c. 12mo. Hannover, 1818.) Langenbeck, however, takes care to withdraw the ligatures in about twelve, or at most twenty-four hours, as their longer continuance, would produce suppuration. Beer also particularly insists upon the utility of bringing the edges of the incision together with a suture; and both he and Langenbeck employ forceps, the ends of which have transverse pieces, calculated to take better hold of the slip of skin to be removed. (*Lehre*, &c. b. ii. p. 114.)

On taking off the first dressings, the third day after the operation, the surgeon will find, says Scarpa, that the patient can open his eye with ease, and that the inverted tarsus and eyelashes have resumed their natural position and direction. In the partial, or incomplete trichiasis, or that which only occupies a half, or a third, of the whole length of the tarsus, and in subjects who have had the skin of the eyelids very loose, Scarpa has often found the wound perfectly united on removing the first dressing.

When, however, only a part of the incision has healed, while the rest seems disposed to heal by suppuration and granulation, the surgeon is to cover the wound with a small piece of lint, spread with the unguentum cerussæ; and if the sore should become flabby, it must be occasionally touched with the argenti nitratum, until the cure is finished.

With regard to the first form of this disease, or that in which the eyelashes project against the eyeball, without the natural position of the tarsus being at all altered (a case which is fortunately rare), the accomplishment of a cure is difficult, since neither the pulling out of the hairs, nor burning the situation of their roots, are means at all to be depended upon for producing a complete cure of the disorder; and turning the tarsus out of its natural position would make the patient liable to an irremediable dropping of the tears over the cheek, attended with a chronic thickening of the lining of the eyelid. It has only been in youngish individuals that Beer has ever seen the repeated and careful extraction of the cilia effect a radical cure. (See *Lehre von den Augenkr.* b. ii. p. 121.) In the instance of this form of the disease, which Scarpa met with, only two or three of the eyelashes inclined against the eyeball. He found, on turning the eyelid a little out, opposite to the situation of the faulty hairs, that he could not, indeed, completely put them in their natural position; but he saw that he could thus remove them so far from the cornea, that they would not rub against it, without altering the position of the eyelids so much as to occasion a perpetual discharge of the tears over the cheek. And, as, in the patient alluded to, the skin about the eyelid was very tense, Scarpa made an incision with the back of the lancet, near the tarsus, three lines long, and took away a small piece of skin of the same length, but very little more than one line broad. When the cut healed,

the operation was found to answer as well as the nature of the case would allow, though the cure was not complete.

According to Mr. Guthrie, when chronic inflammation prevails, and there is a commencing, but incomplete general inversion, of the cilia, the cure of the inflammation will restore the conjunctiva to its natural state, and the cilia to their original direction, without any especial means being employed for the cure of the beginning inversion; but, when these changes proceed too slowly, the sulphuric acid, recommended by Helling, of Berlin, and Quadri, of Naples, should be applied, and will always be found effectual. Indeed, in cases where the incurvature of the cartilage is slight, and the contraction of the angles moderate, Mr. Guthrie finds, that such treatment will render another operation unnecessary. Quadri applies the acid as follows: 1st. A small quantity of concentrated sulphuric acid is to be applied, by means of a piece of smooth solid wood, to the centre of the affected part of the lid, and rubbed along on an oval space, a little exceeding in length the part on which the inverted hairs are situated, and from three to four or six lines in width, according to the inveteracy of the disease. The part ought to be wiped dry, after the acid has been applied about ten seconds, in order to prevent any of it from getting into the eye. 2d. The application of the acid is now to be repeated, care being taken that it approach the edge of the eyelid, and touch the parts immediately over the inverted eyelashes; and it is to be continued, or repeated a third, or a fourth time, until the contraction of the parts draws the hair from within outwards, or to their natural situation; then the operation is completed, and the part ought to be again perfectly dried. The attachment of the cilia to the forehead, by means of pieces of silk and adhesive plaster, as practised by Quadri, Mr. Guthrie rejects as inconvenient and unnecessary. (*Operative Surgery of the Eye*, p. 30.) Instead of sulphuric acid, Delpech applied the actual cautery.

Some new methods of performing the operation, for the cure of trichiasis, have been proposed by Mr. Crampton, Mr. Saunders, Dr. Jaeger, Schreger, and Mr. Guthrie. With respect to that of Mr. Saunders, however, its novelty is denied by Graefe, who states that the practice is as old as the time of Ætius.

The following is the account which Mr. Crampton gives of his plan, which he tried in one instance with complete success. "Let the eyelid be well turned outwards by an assistant; let the operator then, with a lancet, divide the broad margin of the tarsus completely through, by two perpendicular incisions, one on each side of the inverted hair, or hairs; let him then, by a transverse section of the conjunctiva of the eyelid, unite the extremities of the perpendicular incisions. The portion of cartilage, contained within the incisions, can then, if inverted, with ease be restored to its original situation, and retained there by small strips of adhesive plaster, or, perhaps what is better, by a suspensorium palpebræ, adapted to the length of the portion of the tarsus, which it is intended to sustain, should one or two hairs be displaced without inversion of the tarsus." (*Essay on the Entropion*, p. 55.)

Mr. Travers informs us, that, in cases of a circumscribed inversion, "produced by cicatrix from

burn, or wound," he has found Mr. Crampton's method an effectual remedy. It is added, that the complete division of the conjunctiva and tarsal cartilage, including the inverted portion, and parallel to its border, with the aid of sticking plaster, sometimes proved sufficient. Mr. Travers also sees no objection to the entire removal of that portion of the tarsal edge, which is incorrigibly inverted from such a cause, especially when combined with a preternatural growth of cilia from the Meibomian border of the tarsus. (*Synopsis*, &c. p. 356.) In one inveterate case, which was not effectually relieved by the frequent extraction of the cilia, cauterising the edge of the tarsus, the excision of a slit of skin, and smearing the eyelid with concentrated sulphuric acid, as proposed by Helling (*Hufeland's Journ.* st. 4. p. 115.), Schreger, with a pair of curved scissors, cut out a triangular piece of the cartilage of the eyelid at the place where the cilia were most troublesome. The great benefit, derived from the operation, then led the same practitioner to suggest the removal of the whole of the inverted edge of the tarsus, towards the inner canthus, where some irritation was yet maintained. The plan, though followed by severe pain, appears to have succeeded. (*Chir. Versuche*, b. ii. p. 253.)

Mr. Saunders entertained a favourable opinion of Mr. Crampton's operation for the cure of the disease in its early stage; but he contended, that such a vicious bending of the tarsus inward was often the consequence of repeated ophthalmia, attended with ulceration of the conjunctiva and inside of the eyelid, so that every endeavour to rectify the wrong position of the tarsus, and restore its original direction, would be fruitless. Hence, he believed that its excision was decidedly indicated; an operation which is said to be followed by no pain nor uneasiness, and which is sure in its effect. No particular shortening of the eyelid ensues; the deformity is materially lessened; and, unless the cornea be already too opaque, perfect vision is re-established. Mr. Saunders directs a piece of thin horn, or a plate of silver, having a curvature corresponding to that of the eyelid, to be introduced under this part, with its concavity towards the eyeball. On this instrument the eyelid is to be stretched. An incision is to be made through the integuments and orbicularis palpebrarum, down to the tarsus, immediately behind the roots of the cilia. The cut should extend from the punctum lachrymale to the external angle. The exterior surface of the tarsus is then to be dissected, until the orbital margin is exposed, when the conjunctiva is to be cut through directly by the side of the tarsus, which must now be disengaged at each extremity. The punctum lachrymale must be left uninjured. The operation is described as being simple, and if any embarrassment arises, it is from the hemorrhage of the ciliary artery, the blood sometimes obscuring the punctum lachrymale, just when the operator is about to divide the tarsus by the side of it. No dressings are required, it being merely necessary to keep the eye covered for a few days. The skin will continue to be elevated, just as the perfect eyelid was; and, though less completely, yet enough to leave the pupil clear, when the eye is moderately directed upward. In all the cases in which Mr. Saunders operated, a fungus grew from the wound. He recommends the excrescence to be destroyed with caustic, or the knife.

Respecting this operation, I shall merely observe that it is more severe than that advised by Scarpa, and even than the method of Schreger, and must leave greater disfigurement. Unless, therefore, the latter methods prove ineffectual, I should consider the practice unjustifiable. Mr. Guthrie has seen three persons on whom this operation had been performed, and on two of them by Mr. Saunders himself; in all, the deformity was considerable, and the relief only partial. (*Operative Surgery of the Eye*, p. 25.) Nor is Schreger's method allowable, except in cases which resist the milder plan, sanctioned by Beer and Scarpa.

Mr. Guthrie recommends the following operation, as adequate to the cure of the worst cases. A small narrow knife, or one blade of a blunt-pointed scissors, is to be introduced close to the external angle, and a perpendicular incision made, from a quarter to half an inch in extent, or of sufficient length to render the eyelid quite free. Another incision is then to be made, in a similar way, at the inner angle, without including the punctum lachrymale. "The length, to which the perpendicular incisions at both angles ought to extend, must now be decided upon by the appearance of the part: they must be continued, if necessary, by repeated touches with the scissors, until that part of the eyelid, containing the tarsal cartilage, is perfectly free, and is evidently not acted upon by the fibres of the orbicularis muscle." The part, included in the incisions, is now to be completely everted, and retained by the forefinger of the operator's left hand against the patient's brow; when, if any lateral attachment be observed, confining the lid, it is to be divided. "On letting the eyeball fall on the eye, the edge of the tarsus and the hairs will frequently appear in the natural situation, in consequence of the relaxation of the angles, which bound them down; but, if the tarsal cartilage has become altered in its curvature, this will be immediately perceived; it will turn inwards at its ciliary edge, and be completely bent at its extremities, more especially at the inner one, where it is more powerfully acted upon by the ciliaris muscle. On desiring the patient to raise the lid, he readily attempts it, but the action of the levator, in such cases of vicious curvature, causes the cartilage to resume its situation; and, on examination, the curve will be observed to be so permanently vicious, for about an eighth of an inch at each extremity, and especially at the inner, that it cannot be induced to resume its actual situation. When this is the case, the cartilage is to be divided exactly at the place, where it is bent in its length, and in a direction at a right angle with the perpendicular incision: the portion thus slit is only connected with the common integuments of the eyelid; and although this incision scarcely exceeds one, and never two-eighths of an inch, at both extremities, and in general is only necessary at the inner, it enables the surgeon to remove the altered curvature of the part." The next proceeding in Mr. Guthrie's operation, consists in cutting away a fold of skin from the part of the eyelid between the incisions. Three or four ligatures are then to be introduced, and the divided parts, from which the fold has been removed, are to be brought together by the ligatures, each of which is to be twisted and fastened to the forehead with several short strips of sticking plaster. The fold of skin should be raised regularly

with the fingers, and as near as possible to the margin of the eyelid. It may then be taken hold of with Beer's forceps, the grasping pieces of which are transverse, slightly curved, and shut with a spring. The skin, thus taken hold of, which need not be large, may now be cut away with a large pair of curved or straight scissors. The ligatures are first inserted at each angle, and when the vicious curvature is considerable, Mr. Guthrie not only passes them through the skin, but takes care to make the *internal one* include, at its lower part, the *outer edge* of the margin of the eyelid. The ligatures, thus placed, are to be equally drawn up on the forehead, until the eyelid is *completely everted*, when they are to be fastened in the manner above specified. In order to prevent union by the first intention, and make the granulating process necessary, the edges are slightly touched with the sulphate of copper. The eye and eyelids are now to be carefully cleansed; a piece of lint, spread with the ung. cetacei, is to be placed upon them; a small compress under the edge of the orbit; and a retaining bandage over the whole. The next morning, the bandage and lint are to be removed, the eye fomented and cleansed, and the dressings replaced. On the second day, great care must be taken, that the ligatures keep the lid sufficiently raised; and, if any union has taken place by adhesion at the angles of the incisions, it must be broken through with the probe. On the third day, the plasters on the forehead should generally be changed. The ligatures themselves must be supported by straps of plaster, placed vertically between them; and the edges of the incisions should be touched again with the sulphate of copper, or separated with a probe. In a few days more, the ligatures cut their way out; and by the time the parts are healed, the eyelid will have resumed its natural situation. (*Operative Surgery of the Eye*, p. 31, &c.) Operations on the same principle, are also recommended by Mr. Guthrie for the lower eyelid.

When a surgeon chooses to try the foregoing operation, he ought to be certain that the carlilage of the tarsus is so altered in its shape, as not to afford much chance of effectual relief from milder plans.

Inversion of the lower eyelid is much less common, than that of the upper one. The late Mr. Saunders never saw this disease arise from the same causes which induce it in the upper eyelid, though he acknowledges the possibility of such a case. However, he met with several instances of the affection, in consequence of encysted tumours, which, as they increased, carried the orbital edge of the tarsus outwards, and, in the same proportion, inclined the ciliary edge towards the globe of the eye.

An inversion of the inferior palpebra is sometimes produced by inflammation and swelling of that part of the conjunctiva which connects the eyelid with the eyeball. In cases of ophthalmia, this membrane often forms between the latter parts a distinct fold, which is situated just on the inside of the orbital edge of the tarsus, and pushes it outward; while the contraction of the orbicular muscle turns the ciliary edge inwards, and inclines it between the swelling of the conjunctiva and the eye. In this particular case, Mr. Saunders assures us, that replacing the eyelid in the early stage of the disease, and maintaining it so, until the ophthalmia has been lessened by proper means, will

be found effectual. But when the conjunctiva is much thickened and indurated, Mr. Saunders recommends cutting such diseased part of it away, and the application of compresses to keep the orbital margin of the tarsus inward. (See also *Travers's Synopsis*, p. 234 and 355.)

Albinus has recorded a species of trichiasis, which originated from the growth and inversion of one of the hairs upon the caruncula lachrymalis. The plan of relief consisted in plucking out the irritating hair; but it is not mentioned, whether it grew again.

J. Scultetus, Trichiasis Admiranda, sive Morbus Pilaris Mirabilis, 12mo. Norib. 1658. *Scarpa* sulle Principali Malattie degli Occhi. *A. Crampton*, Essay on the Entropion, Lond. 1806. *Saunders's* Obs. on several practical Points relative to the Diseases of the Eye, ed. 3. *Nichter's* Anfangsgründe der Wundarzneikunst, b. iii. *G. J. Beer*, Lehre von den Augenkrankheiten, b. ii. p. 111—117. 8vo. Wien, 1817. *Schreyer*, Chirurgische Verträge, b. ii. Neue Methodo the Trichiasis zu Operiren, p. 253. 8vo. Nürnberg. 1818. *B. Travers*, Synopsis of the Diseases of the Eye, p. 232—304, &c. 8vo. Lond. 1820. *Jäger*, Diss. sistens Diagnosin et Curam Radicalem Trichiasis, Distichiasis, necnon Entropion. Viennæ. This method is said by *Mr. Guthrie* to be similar to that proposed by Saunders. *G. J. Guthrie*, Operative Surgery of the Eye, 8vo. Lond. 1823. *Delpech*, Clinique de Chirurgie, t. ii. 4to. 1828; and the Treatises on Dis. of the Eye, by *Lawrence*, *Mackenzie*, and *Middlemore*.

TRISMUS. (from *τριζω*, to gnash the teeth.) The locked jaw. See TETANUS.

TROCIAR, or TROCER, (from the French, *trois-quart*, three-fourths, from its point being always formerly of a triangular form.) An instrument used for discharging serous fluids from different cavities in the body, particularly those of the peritoneum and tunica vaginalis, in cases of ascites and hydrocele. Trocars are also employed for tapping the bladder, dropsical ovaries, &c., and sometimes large chronic abscesses. One, for bronchotomy, was invented by the late Mr. Wood. (See TRACHEOTOMY.)

A trocar consists of a perforator, or stilet, and of a cannula, which is so adapted to the first piece of the instrument, that, when the puncture is made, they both enter the part together, with perfect ease, after which, the stilet being withdrawn, the cannula remains in the wound, and gives a ready passage for the fluid outward.

Such are the uses of a trocar, and the principles on which it should be constructed. It would be unnecessary in this work to detail every little particularity in the instrument: I shall merely observe, that the triangular-pointed, and especially the round pointed trocars seem to retain the greatest share of approbation; for, although those of a flat, lancet-pointed shape enter parts with more ease, their cannulae are not large enough for the ready escape of fluids, which are at all thick, gelatinous, or blended with hydatids and flaky substances.

The trocar for puncturing the bladder from the rectum, should be longer than a common trocar, and of a curved form; but, as Mr. Carque has explained, it should not be passed too high up the rectum, lest the peritoneum be wounded.

Surgeons ought always to have, at least, three trocars; one of full size, another of middling width, and a third of small dimensions. In hydrocele, the latter is often preferable.

TRUSS. (*trousse*, French.) *Brachierium*. A bandage, or apparatus, for keeping a hernia reduced. A truss, which fulfils its intention properly, should compress the neck of the hernial sac, and

the ring, or external opening of the hernia, in such a manner, that a protrusion of any of the contents of the abdomen will be prevented with complete security. Hence, it is the indispensable quality of a good truss, first, to make effectual and equal pressure on the parts indicated, without causing pain or inconvenience to the patient; secondly, not easily to slip out of its right situation, in the varying motions and positions of the body.

Trusses are either of an elastic or non-elastic kind. The latter are composed of leather, fustian, dimity, or similar materials. These cannot be at all depended on, and should, therefore, be entirely banished from surgery. Since (as Mr. Lawrence has remarked) the size of the abdomen varies, according to the different states of the viscera and to the motions of its parietes in respiration, a non-elastic bandage must vary constantly in its degree of tightness, and keep up either too great, or too little pressure. The omentum, or intestine, easily slips out when the opening is not exactly closed, and the patient, who wears such a bandage, must be in a state of constant insecurity. Those who lead an active life, or are obliged to use laborious exertions, will be more particularly exposed to risk. If the patient, after experiencing these defects, endeavours to remedy them by drawing the bandage tighter, he may confine the viscera, but he produces other inconveniences. The increased pressure injures the spermatic cord, and may affect the testicle; the integuments become red, painful, and excoriated; and the bandage must be entirely laid aside until the parts have recovered. Richter has often seen painful tumefaction of the testicle, hydrocele, and even circocele, produced from this cause, and entirely dissipated by the employment of a proper truss. (*Traité des Hernies*, p. 24.) He also saw the pad of a non-elastic bandage, excite, in the region of the abdominal ring, a considerable inflammation, which terminated after a few days in suppuration. The hernia never appeared again after the cure of the abscess. The inflammation had extended to the neck of the sac, and obliterated that part. — (*On Ruptures*, ed. 3. p. 69, 70.) The spring is a very essential part of every elastic truss, and it consists of a flat long piece of steel, which is adapted to the side of the body on which the hernia is situated. It is not a great many years since the spring used to be made of common iron, and Arnaud and Richter express their preference to a mixture of malleable iron and steel, so that the instrument may be moulded by the hand to any particular shape; but, as Mr. Lawrence well observes, a truss, which admits of such management, must be more or less liable to the objections which apply to inelastic bandages, and the only material which possesses the requisite qualities of firmness and elasticity, is well-tempered steel. The front part of the steel spring has an expanded form, and, when the truss is properly applied, ought to be situated over the mouth of the hernial sac. The spring of a truss has commonly been a semicircle, with the posterior end resting on the spine. Camper proposed to carry it round to the anterior superior spine of the ilium on the sound side; a plan of which Scarpa highly approves. Trusses of this form fit with a degree of steadiness which cannot be given to others by tightening the strap. They keep up the rupture better, than even a stronger spring of the common kind. Under the back surface of the anterior end

of the spring is placed the pad, which should be adapted in shape and size to the passage, which is intended to be shut up. The steel spring is usually covered with leather, is lined with soft materials, and, after being put on the patient, is fastened in its situation by means of a strap, which extends from the two ends of the spring, round that side of the body on which the hernia is not situated. Hair-skin, with the fur outwards, is sometimes considered the best covering for preserving the spring from the ill effects of perspiration.

When it is necessary to make strong compression, as in large old ruptures, and in persons who cannot avoid labour and exercise, the elastic spring should be made accordingly thicker and broader. But, an object of the first-rate importance is to make the spring press equally upon every point of the body which it touches. This is what demands the earnest attention both of the surgeon and the instrument-maker, especially as the hips of some individuals are flat and narrow, while those of other persons are broad and prominent. A thick, flexible, metallic wire, accurately applied round the pelvis, will serve to take the measure and proper shape of the spring, which may afterwards be altered a little, if found necessary. The wire, however, should be somewhat longer, on account of the length of the spring.

The springs of trusses, intended for children and persons who do not undergo much labour and exertion, need not be made so strong as those designed for hard-working active people.

The idea that children cannot wear steel trusses, is as erroneous as it is dangerous in its practical consequences; a point, on which Mr. Pott has strongly insisted.

Trusses are sometimes fabricated with a pad moveable on the spring, instead of being riveted to it. This may be inclined upwards, or downwards, according to the form of the abdomen; and it is retained at the desired point by a spring fitting into the teeth of a rack. In others, the plate contains a screw, by which the cushion is pushed further inward, or allowed to recede at pleasure. Although there cannot be a doubt, that some of these inventions possess considerable merit, and are in certain instances superiorly useful, it must be confessed that, in general, their utility is not so much greater than that of common pads, as to make amends for the want of simplicity and the increase of expense. I should be sorry, however, to say any thing that would unfairly discourage all such ingenious endeavours to improve an instrument so difficult to bring to perfection as a truss; especially as I believe there are particular cases, in which pads, with racks, screws, springs, pivots, &c. may be employed with great advantage.

Notwithstanding every care, sometimes even elastic trusses cannot be hindered from slipping away from the part which they are designed to compress. Sometimes they slip downwards, which in fat subjects is generally caused by the projection of the abdomen. Occasionally the fault consists in the instrument becoming displaced in the direction upwards, which mostly happens in thin persons, and is produced by the flatness of the abdomen. In the first case, the displacement is to be prevented by the use of an elastic scapulary; in the second, the slipping of the pad upwards is to be prevented by the employment of a thigh strap.

When a patient is afflicted with a rupture on each side, the two protrusions may be very well kept up by means of a single truss, made with two pads, which are joined together, at the exact distance of the rings from each other, by a piece of steel, applied over the convexity of the symphysis of the pubes, and proportioned in length to the space between the two openings, through which the viscera descend. In such cases, however, it is absolutely necessary to have the spring stronger than if there were only one rupture. The truss should also be put on that side of the body, upon which the hernia most difficult to retain is situated. Some practitioners, however, give the preference to the use of two single trusses, joined together in front and behind with suitable straps.

With respect to the application and use of trusses, the following instructions merit attention.

1. A truss should never be first applied, or changed, except when the patient is in the horizontal posture, and it is known with certainty, that all the contents of the rupture are completely reduced.

2. The first applications of a truss should be made under the superintendency of the surgeon himself; and care should be taken to put on the instrument in such a manner, that the pad will compress the neck of the hernia sac; and, with this view, if the hernia be of the oblique inguinal kind, the chief pressure should be made over the situation of the internal ring, and the course of the inguinal canal; when, on the other hand, the case is a direct inguinal hernia, the pad should make pressure exactly on the abdominal ring. The patient should be made acquainted with the right manner of applying the truss; the principles on which it keeps up the bowels, and affords a chance of a radical cure; the requisite cautions to be observed, &c. When he begins to wear a truss, he should be particularly careful not to be guilty of imprudent exertions, and he ought to observe most attentively, that the instrument does not slip from its proper situation. It will also be necessary for him to pay attention to the instrument being neither too tight, nor too loose.

3. The patient ought to be provided with at least two trusses, which fit him well, so that if one stand in need of repair, he may always be provided with one that will answer. In order to save the truss, especially in fat persons who perspire a great deal, it is a good plan to lay a soft piece of calico under the pad.

4. An uneasiness about the ring, which always gives rise to a suspicion that a portion of intestine, or omentum, is protruded, makes it proper to take off the truss, carefully examine the parts, and reduce them if they have descended.

5. When the skin is excoriated by the truss, the part may be cured by sprinkling upon it the powder of acetate of lead, Fullers' earth, lapis calaminaris, &c., or bathing the part with an astringent lotion. It will also be right to protect the excoriated place with a piece of linen put under the truss.

6. When the pressure of the truss excites pain and swelling of the spermatic cord and testicle, either the thigh-strap must be relaxed, or the lower part of the pad made less prominent. And when strong pressure is absolutely necessary to keep the hernia reduced, the pad should have an excavation in it over the spermatic cord. Whoever wears a

truss should be careful to employ it day and night without interruption, so that there may be no opportunity for the hernia to protrude again. If, under the employment of a truss, the rupture once descends again, either a strangulation happens from the narrowness of the neck of the sac; or, at all events, the hope of a radical cure, which may have been entertained for years and months, is destroyed in a moment; for experience has put it beyond all doubt, that, by the continual unremitting use of a truss, and the steady retention of the contents of the hernia, the neck of the hernial sac, and the ring, may be gradually lessened in diameter, until they are entirely closed, and a radical cure of the rupture effected. This is more frequently observed in young subjects, seldom in adults, and scarcely ever in persons of advanced years. But trusses must be worn a long while; nor should the patient venture to lay aside their use till after many cautious attempts; beginning the experiment at first only in the night-time, and not making it in the day till after a considerable period from the time when he first thinks himself safe. The longer and more attentively a truss is worn, the greater is the hope of a radical cure. (*Callisen, Syst. Chir. Hod. t. ii.*)

England's truss for navel ruptures was preferred by Hey. In the article HERNIA, an account is given of the truss for umbilical hernia, invented by Mr. Harrison, of Leeds. There may also be found additional observations on the place, against which the pressure of the pads of trusses should be directed.

The following remarks are contained in the American edition of this work.

"Our profession is very largely indebted to Dr. Amos G. Hull, of New-York, for the valuable service he has rendered the cause of humanity, as well as the science of surgery, by the indefatigable labours and persevering ingenuity which he has devoted to this interesting department of chirurgery. After experiencing in his own practice the defects of the various kinds of trusses ordinarily employed, and suffering the inconveniences of which surgeons and patients have so long complained, he was induced to attempt the construction of an instrument, which should fulfil the surgical indications in the treatment of reducible hernia; an object which seemed to have been overlooked by previous inventors, and to accomplish which, a knowledge of the anatomy of the parts, and the mechanical operation of the truss was alike indispensable.

"Dr. Hull brought to this subject a mechanical genius of more than ordinary acuteness, and, at the same time, an intimate and accurate knowledge of the intricate subject of hernia itself, and succeeded in constructing an instrument which is not only applicable to every species of rupture to which a truss is adapted; but, in recent cases, and young children, is fully adequate to effect a radical cure, as proved by experience and attested by the leading surgeons of the present day.

"Dr. Hull claims for himself the merit of accomplishing the true indications in the surgical treatment of reducible hernia, by the four following distinctive peculiarities embraced in his truss, viz.

"1st. The *concave* internal surface of the *rupture pad*, from its pressure being greatest at the *circumference*, tends constantly to approximate the hernial parietes affording them rest and mechanical support.

"2d. The combined hinge and pivot mode of connection between the *spring* and *pad*, by means

TUMOUR.

of a *tension and mortice*, so constructed, as to preserve a *double hinge and limited joint* acting in every direction, thereby securing the uniform pressure of the spring on the pad, and sustaining the same nice co-operation of the pad and rupture opening, as well under the varied ordinary muscular actions as when the body is in a recumbent posture.

"3d. The graduating power and fixture of the pad to the spring, rendering, as will be readily perceived, the condition of the pad perfectly controllable, even to nameless minuteness. Also resulting from this mechanism is the advantage of accommodating a large truss to a small person; hence the facility of supplying, without disappointment, persons at a distance.

"4th. The double inguinal truss being simply the addition of another pad attached to a short elastic metallic plate: this plate with its pad move on the main spring by the same power of adjustment and fixture as the first pad, the pressure of the pads being graduated at pleasure by an intervening cork wedge.

"In the article *HERNIA* I have hinted at the importance of a *concave rupture pad*, instead of a convex one, so universal, and once thought indispensable. It is no marvel that so few radical cures were ever known by the truss, when the *convex* pad of the instrument was fitted to the mouth of the rupture, thus enlarging the hernial opening. By this instrument, the elevated circular margin of the concave pad is made to approximate the sides of the hernial opening, closes the aperture, and hence results in a permanent cure of the disease. I have known many instances of radical cures by this instrument, and, in some of them, the truss has been laid aside for several years without the smallest return of the disease. It is to the interest of the profession universally to become acquainted with this instrument, and to profit by its superiority."—*Reese*.

TUMOUR. A swelling, arising (to use the language of Abernethy) "from some new production, which made no part of the original composition of the body." In the present article, it will not be necessary for me to travel over the whole of this extensive subject, because numerous forms of disease ranking as tumours, according to the foregoing definition, have been described in other articles of this work. (See *CANCER*; *EXOSTOSIS*; *NÆVUS*; *FUNGUS HÆMATODES*; *MAMMA*, *DISEASES OF THE*; *TESTICLE*, *DISEASES OF THE*, &c. &c.)

In this place I mean to notice only some parts of the subject, and certain questions, which have not yet been particularly entered into in other articles. In considering all the various tumours and indurations which occur in inflammation and disease, we have reason to suspect, that the processes by which they are formed, must be attended with considerable divergity. Yet Dr. Armstrong believes, that the general principles of morbid changes of structure may admit of being reduced to a small number. Thus, says he, if we take the acknowledged products of inflammation, and to them add *tubercle*, *scirrhus*, *fungus*, and *melanosis*, we have at once a bird's-eye view of the most important changes which occur in the solids. (See *Morbid Anat. of the Bowels*, &c. p. 1.) Though there is some truth in this observation, it is far from being accurate to bring within its scope a multitude of diseases which are classed as tumours: it is to have proceeded perhaps from an undue desire to generalise. Mr. Abernethy

thinks, that the manner in which tumours are formed is best illustrated by those, which hang pendulous from the membranous lining of different cavities. This gentleman adverts to an example noticed by Mr. Hunter, in which, on the cavity of the abdomen being opened, there appeared lying upon the peritoneum a small portion of red blood recently coagulated. This, on examination, was found to be connected with the surface, upon which it had been deposited, by means of an attachment, half an inch long; and this neck had been formed before the coagulum had lost its red colour. (See *Trans. for the Improvement of Med. and Chir. Knowledge*, vol. i. p. 231.) Mr. Abernethy observes, that if vessels had shot through the slender neck, and organised the clot of blood this would then have become a living part: it might have grown to an indefinite magnitude, and its nature and progress would probably have depended on the organisation which it had assumed. He mentions his possession of a pendulous tumour, found growing from the surface of the peritoneum, and which was undoubtedly formed in the same manner as the tumour noticed by Mr. Hunter, viz. by vessels shooting into a piece of extravasated blood, or lymph, and rendering it a living organised substance. Tumours, in every situation, and of every description, are probably formed in the same way. The coagulating lymph being effused, either accidentally or in consequence of disease, is afterwards converted into a living part by the growth of the adjacent vessels, if not the nerves, into it. Mr. Abernethy remarks, that when the deposited substance has its attachment by a single thread, all its vascular supply must proceed through that part; but, in other cases, the vessels shoot into it irregularly at various parts of its surface. Thus, an unorganised concrete becomes a living tumour, which has at first no perceptible peculiarity as to its nature. Although its supply of blood is furnished by the vessels of the surrounding parts, it seems to live and grow by its own independent powers, while its future structure seems to depend on the operation of its own vessels. Mr. Abernethy conceives, that the altered structure of an enlarged gland affords no contradiction to the above account, as, in this latter case, the substance of the gland is the matrix, in which the matter forming the tumour, or enlargement, is deposited.

The structure of a tumour, Mr. Abernethy observes, is sometimes like that of the parts near which it grows. Such as are pendulous in joints are cartilaginous, or osseous. Fatty tumours frequently form in the midst of the adipose substance, and he has seen some tumours growing from the palate, which had a slender attachment, and resembled the palate in structure. However, this resemblance of the structure of a tumour to that of the neighbouring parts, is not always observable. I had in my own possession a completely cartilaginous tumour, which I found in the midst of the fat near the kidneys. The pendulous portion of fat, growing from the peritoneum, and mentioned by Mr. Abernethy, serves as another instance of the fact; and one might add, that every polypus, which we meet with, bears no resemblance in structure to the neighbouring parts. He had seen bony tumours which were unconnected with bone, or the periosteum; and he observes, that the structure of a tumour is, in general, unlike that of the part in which it is produced.

When the coagulable part of the blood is effused, and the absorbents do not take it away, the surrounding blood-vessels are supposed to grow into it, and convert it into a vascular tumour. The effusion of the coagulable part of the blood may be the effect of accident, or of a common inflammatory process, or it may be the consequence of some diseased action of the surrounding vessels, which (diseased action) may influence the organisation and growth of the tumour.

In the former cases, the parts surrounding the tumour may be considered simply as the sources, from which it derives its nutriment, whilst it grows apparently by its own inherent powers, and its organisation depends upon actions begun and existing in itself. If such a tumour be removed, the surrounding parts being sound, soon heal, and a complete cure ensues. But if a tumour be removed, whose existence depends on the disease of the surrounding parts, which are still left, and this disease be not altered by the stimulus of the operation, no benefit is obtained. These parts again produce a diseased substance, which has generally the appearance of fungus, and, in consequence of being irritated by the injury of the operation, the disease is in general increased by the means, which were designed for its cure. (*Abernethy's Surg. Obs.* 1804.) This gentleman suspects, that the irritation of the tumour itself, when once the swelling has been produced, keeps up an increased action in the surrounding vessels, so as to become a sufficient cause of the disease continuing to grow larger. As the tumour becomes of greater magnitude, it condenses the surrounding cellular substance, and thus makes for itself a sort of capsule. The close, or loose manner, in which tumours become connected with the surrounding parts, seems to depend very much on the degree of irritation and inflammation excited in the circumjacent parts. When a tumour has been at all tender, painful, and inflamed, it is generally found intimately adherent to all the neighbouring parts. Mr. Abernethy also believes, that the increased irritation which a tumour creates when it has exceeded a certain size, may explain why some tumours, which are at first slow in their progress, afterwards begin to grow with great rapidity.

It appears, then, from the preceding observations, that a tumour is a new growth, or the deposit of an adventitious substance upon, amongst, or within, the textures of the body; the addition being in the latter case made to them in the way of a molecular deposit, whereby these textures or organs acquire increased magnitude, so as themselves at once to constitute swellings, and undergo changes or obliteration of original structure. As an illustration, fungus hæmatodes, or medullary cancer, may be cited, which is a new growth, or deposit, met with in three distinct forms; sometimes as a new product enclosed in a cyst; sometimes as a new formation unprovided with any cyst; and, in other instances, as an infiltration in the substance of an organ. But whoever wishes to pursue this part of the inquiry further, should carefully study *Carswell's Illustrations of the Elementary Forms of Disease*, in which it is most ably considered.

The process by which tumours are formed, has sometimes been thought to be attended with an increased action of the vessels which supply them with blood. It has been compared to the process

which forms all the thickenings and indurations, met with, under various circumstances, in different parts of the human body; and has often been referred to chronic inflammation. This subject of chronic or passive inflammation is one about which so far as particular forms of it are concerned, very little certain, is known; and even the name itself has commonly been admitted only on the supposition, that some kind of increased action exists in the vessels, though of a slower and less evident kind than what prevails in acute inflammation. According to Dr. Wilson Philip, the difference between what is called active and passive inflammation seems to depend upon "the degree in which the arteries, supplying the *vis à tergo* to the debilitated vessels, are excited."—(*Laws of the Vital Functions*, p. 282. edit. 2.) If this position be satisfactorily established, one important step will be made to a knowledge of the differences between acute and chronic inflammation, but much would yet remain for explanation, before our ideas of the latter process would be at all complete.

On this part of the inquiry, different pathologists entertain very different views. Three explanations have been offered of the mode in which tumours originate and grow. "First, the effusion of blood and its coagulation, and the subsequent organisation of the coagulum; secondly, the effusion and organisation of coagulating lymph; thirdly, chronic inflammation." (*Lawrence, Med. Chir. Trans.* vol. xvii. p. 6.) According to these explanations it seems to Mr. Lawrence, that tumours ought to pass through successive stages, and to present different appearances at different periods of their development. For instance, we ought to find them at first, as masses of coagulated blood, or coagulating lymph, and then to observe various degrees of transition from those substances to the textures which characterise the perfect growth. But, says he, observation discloses nothing of this kind: tumours, in their earliest state and smallest size, have their peculiar structure as well marked as in their subsequent progress and full development. An adipous tumour, not exceeding the bulk of a pea, differs only in size from one as large as the head. Effusions of blood into the cellular texture from external violence are of daily occurrence: if such extravasations could become organised, and then form tumours, it appears to Mr. Lawrence, that the latter should prevail almost universally. "We see, however, that the blood, thus poured out, either disappears by absorption, or irritates the surrounding parts, and causes suppuration, by which it is expelled." The explanation of the origin of tumours from the organisation of effused blood, seems to Mr. Lawrence to have been suggested by the statements of Mr. Hunter, respecting the production of vessels in coagulated blood, the agency of this process in effecting the union of wounds, and its occurrence in effusions of blood into serous cavities. Mr. Lawrence has never seen any satisfactory proof of blood becoming organised, when effused in wounds, bruises, or into serous cavities, or when deposited in aneurismal sacs. Nothing, he observes, is more frequent, than the interstitial effusion of lymph, in consequence of inflammation: "the substance thus poured out, is not formed into tumours; it is absorbed as the inflammation subsides, or its partial organisation causes the enlarge-

ment and condensation of the affected structure. None of the phenomena, usually considered as characteristic of inflammation, are observed to precede the formation of tumours. These growths occur insensibly, and often arrive at considerable size before persons are aware of their existence. If the preceding views, respecting the origin and growth of tumours, were correct, the attempts to check their production and increase by leeches, cold applications, and the antiphlogistic treatment generally, would be rational; we find, however, that such means exert no influence over accidental productions, although they may be employed with advantage in some of the swellings caused by changes of structure; and this marked difference, in the effects of treatment, is a further reason against confounding together the two kinds of disease." (Lawrence, vol. cit. p. 8.)

It would appear, however, that coagula of blood and fibrine are capable of becoming organised under particular circumstances, though, perhaps never, or very rarely, under those adverted to by Mr. Lawrence. Even in the production of some kinds of tumours and new formations, little doubt, I think, can be entertained, that the organisation of these substances, and especially of coagulable lymph, or fibrine, is an essential part of the process. Thus Dr. Carswell, who adopts the expression *analogous tissues*, to signify all *solid, morbid products which resemble the natural elementary tissues* of the body, remarks, that they present two important differences in regard to their origin. "The plastic element of the blood, the spontaneously coagulable part of this fluid, or the fibrine, is by far the most frequent source, and furnishes the materials for the formation of the most perfect examples of the analogous tissues. It is to those which have this origin, that the term *analogous, accidental, adventitious, or pseudo-formations*, is correctly applied. Another and entirely different origin of many of these tissues, is a change taking place in the primary or existing elementary tissues, and even in organs, by means of which they are converted into tissues of a different kind, as, for example, when cartilage is converted into bone, or cellular into serous or fibrous tissue. The analogous tissues which have this mode of origin, are, in order to distinguish them from the former, called *analogous transformations*." The analogous tissues are subdivided by Dr. Carswell; for he observes, that "although originating in the plastic element of the blood, they may be formed out of this substance, whether it be separated from the blood, and effused on the surface of organs in the state of coagulable lymph, in consequence of inflammation; or whether it be separated from this fluid, which had ceased to circulate in the vessels, or had escaped from them in consequence of mere physical causes. The evidence (says this distinguished pathologist) in support of the doctrine, which maintains that analogous formations may originate in the fibrine of the blood, is derived from the changes which are observed to take place in the blood which has ceased to circulate in the heart or blood-vessels, or which has been effused into the substance of an organ. The cessation of the circulation, which precedes these changes in the blood, may be effected by the operation of mechanical, physical, and vital agents, which act either on the blood itself, or on the vessels in which it is contained. The most obvious ex-

amples of the operation of the first kind of agents, are those in which the circulation is at once arrested either in an artery, or a vein, or both, by the application of a ligature; or those in which the blood stagnates in the veins, for example, of the inferior extremities, from a mechanical obstacle to its return situated in a remote part, or in the heart. The first change, which the blood is observed to undergo in these circumstances, is coagulation, the extent of which in an artery, is almost always determined by the situation of the first branch of considerable size sent off from the obstructed vessel between the ligature and heart, but which, in the veins, varies with the situation of the obstacle, and the greater or less facilities afforded for the development of a collateral circulation. Whatever may be the extent of the coagulation, the subsequent changes which take place in the blood are as follow: The coagulum acquires gradually an increase of density, which is accompanied by the removal of the red colouring matter of the blood. The fibrine becomes thus more and more apparent, and is recognised by its pale straw colour, and more especially by the manifestation of its plastic properties, whereby it assumes, almost from the commencement, a laminated or fibriform arrangement. In this, the early stage of what may be called the process of organisation of the fibrine, there is one circumstance, which is peculiarly interesting, not only because it enables us to explain the origin and mode of formation of some analogous tissues, but because it shows, that the vital endowments, or plastic properties of fibrine, under the circumstances in which we are now considering it, are of the same kind as those of coagulable lymph, however much they may vary in degree. The circumstance to which I allude, is, the tendency of the fibrine, from the commencement to escape towards, and to accumulate at, the circumference of the coagulum, or to place itself in contact with the living tissues, which surround the coagulum. It is not only in a blood-vessel that this is observed; it is seen to take place in the cavity of the heart in the formation of what are called polypi, whatever may be their mode of attachment, as well when they occupy the greater part of one of the cavities of this organ, as when they are small, and connected only by a narrow pedicle; and sometimes in large serous cavities in the case of hemorrhage, when the patient has survived that accident for a certain length of time." (See Carswell's *Illustrations of the Elementary Forms of Disease, Fasc. on Analogous Tissues*.)

Although, both when the circulation has been arrested by a mechanical cause in a vessel quite free from inflammation, and the only appreciable organisable product is the fibrine of the coagulum; and also when the circulation has been arrested by a ligature, or by inflammation of the vessel, and the organisable product occurs not only in the form of fibrine, but also in that of coagulable, or plastic lymph, Dr. Carswell has repeatedly satisfied himself of the vascular organisation of the fibrine, he has never been able to detect the primary and independent formation of blood-vessels in this substance. On the contrary, he has always found the vessels, which it contained, existing in the form of capillaries, derived from the collateral branches of the obstructed, or obliterated vessel. According to Dr. Carswell, the conversion of the

fibrine into fibrous, cartilaginous, and osseous formations, is sometimes observed to take place in aneurisms of long standing, the outer layers of that substance lying nearest to the inner surface of the sac. This remark deserves attention, as it disagrees with the statements of some of the most eminent writers on diseases of the blood-vessels. It is well known that John Hunter promulgated the doctrine of the organisable nature of a coagulum of blood; and in the Museum of the Royal College of Surgeons in London are preparations put up by his own hand in proof of the accuracy of this view. There clots of blood are seen on the surface of a stump, and within the tunic vaginalis, with an appearance of injected vessels actually penetrating the coagula. I know that some able men in the profession still look upon these preparations as proofs of what they are designed to exemplify; but others deem them insufficient, believing that the coagula are entangled and surrounded with a plastic lymph, effused in consequence of inflammation, into which last substance the new vessels have extended themselves, and not directly into the clot of blood itself. Certain it is, that the interposition of coagula between the sides of a wound are unfavourable to union by the first intention.

In a work of considerable merit, Dr. Baron, of Gloucester, offers many considerations against the correctness of the ordinary doctrines, respecting the formation of tubercles and tumours. By *tubercles*, he means disorganisations composed of one cyst, "whatever be its magnitude or the nature of its contents," and by *tumours*, he would understand "morbid structures, that appear to be composed of more than one tubercle." (*On Tuberculated Accretions of Serous Membranes*, &c. p. 213.) From certain appearances, traced in dissections, Dr. Baron infers, that all tubercles, wherever situated, and of whatever substance composed, were at their commencement small vesicular bodies, with fluid contents; hydatids, as he endeavours to prove. "It is impossible to say, how minute they may have been at their origin, nor how large they may grow, before their transformations begin; nor are we acquainted with the circumstances which occasion such transformations." To these changes in hydatids (according to this writer), certain tubercles owe their existence, and "on the size, relative position, and structure of the tubercles, which are so formed, depend the characters of many of the most formidable disorganisations to which the human body is exposed." — (P. 215.) A single hydatid when it is transformed (says Dr. Baron) will give rise to one tubercle. "It may be pendulous, or imbedded in any soft part, or it may be found between the layers of membranes, and wherever the textures are of such a nature as to admit of its growth. It may be so small as to be scarcely visible, or it may acquire a very great magnitude. Single tubercles are often seen in a viscus, while all the rest of the organ is free from disease, and its functions are performed in an uninterrupted manner. But it is evident, that the same state of the system (whatever that may be), which calls one tubercle into existence, may generate an indefinite number. They may be diffused through the whole of a viscus, leaving nothing of its original texture, or they may occupy any proportion of it, or extend to the con-

tiguous parts, and involve them in the same form of disease." — (P. 216.) When hydatids growing in clusters, and hanging within cavities, become changed into tubercles, Dr. Baron conceives, that the morbid appearances must, of course, correspond, in some degree, with the original distribution of the parts. He has seen tubercles attached in this form to the choroid plexus, to the valves of the heart, to the fimbriated extremities of the Fallopian tubes, and to the omentum, and convolutions of the bowels. In the latter instance, they were very minute, the largest not being bigger than the head of a pin, and their number defied all calculation.

"Other varieties in the arrangement of the elementary parts of morbid growths, will of course, cause corresponding varieties in their appearance. Thus, when hydatids are enclosed, the one within the other, and are transmuted into solid substances, a section of these substances will exhibit a series of concentric laminae."

Another variety, pointed out by Dr. Baron, is "when an immense number of very small tubercles are generated in juxtaposition, and unite together. Wherever such an event occurs, the original texture of the part is entirely lost, and a mass of varying degrees of density and firmness formed. In the earlier stages of its growth, a granulated appearance may be distinctly traced; but in process of time this disappears, the consolidation becomes more complete, and substances of a gristly, or cartilaginous, or scirrhus, texture may be found. I have traced (says Dr. Baron) the whole of these gradations in the liver, the lungs, the pleura, the omentum, the peritoneum, and in tumours in other parts." — (P. 219.)

"Sometimes, small hydatids grow from the outer or inner surface of large ones, or float within them. I have seen (says Dr. Baron), from a source of this kind, the uterus and its appendages converted into an enormous mis-shapen mass, tubercles, of the size of the fist, growing from it, while these again were surmounted by smaller ones in many gradations. Some had glairy contents, others were in a state of scirrhus, and others were but little changed, having thin delicate cysts, and containing a transparent fluid.

"But perhaps (remarks Dr. Baron) the most important variety of all, is when tubercles, originally distinct from each other, approximate as they increase in size, ultimately unite, and form tumours, which have received different designations, according to the predominant character of their contents and internal structure. It was chiefly to elucidate this part of the subject, that I made the distinction between the words *tumour* and *tubercle*," &c. — (P. 219.) By thus adverting to the primitive arrangement, number, size, &c. of hydatids, and their subsequent mutations, Dr. Baron tries to account for the varieties of encysted and sarcomatous tumours, fungus hematodes, tuberculated sarcoma, scirrhus swellings, &c. &c. The late Dr. Adams, as is well known, referred cancer to the living state, growth, and multiplication of the hydatid. (*On the Cancerous Breast*, p. 77.) In order to account for the various appearances of the disease, he divided hydatids into a number of species, as *lymphatica*, *cruenta*, and *carcinomatosa*, and suspects, that there may be others. These, he affirms, are lodged in dif-

ferent cavities, or enclosed in a fungus, which is occasioned by any individual, or numbers, stimulating the surrounding parts to generate it, for the purpose of dividing the dead from the living. This fungus is a nidus, formed altogether for the protection of another generation; by means of it, the living families are separated from the dead, and their preservation is secured. They die, he says, without otherwise affecting the body, in which they existed, but by their local stimulus; and he declares, that his object is to prove the *animalcular existence* of carcinoma. Now, according to Dr. Baron, this main position is the fundamental error of Dr. Adam's book; for, "in no rational, nor legitimate, point of view may cancer be said to have an *animalcular existence*; because admitting, for the sake of argument, that hydatids are animalcules, it has, I trust, been shown (says Dr. Baron), that it is to the loss of the hydatidial character altogether, and the transformations of these bodies that the morbid appearances in this, and many other diseases, are to be referred." — (P. 276.)

Although I consider the evidence and remarks, which Dr. Baron has adduced, in support of his opinions, in many respects interesting, the facts brought forward do not appear to me to justify the conclusion, that the formation of tubercles and tumours originally depends upon hydatids and their transformation. That hydatids are sometimes found within diseased structures, and that cells, cysts, granulated and tuberculated appearances, are often noticed in tumours of different kinds, are facts universally received. But, the presence of hydatids in the *unchanged* state is only an occasional circumstance; whereas, if they were generally a cause of tumours by undergoing some unexplained transformation, it is impossible to suppose, that some of them, at least, would not be more commonly found in a distinct, unaltered form within, or around all swellings, imagined to proceed from clusters of them. As the growth of tumours formed on these principles, could not, I imagine, be accounted for, without supposing a continual multiplication and transformation of hydatids, either within, or around the swellings, one would expect that some visible hydatids, previously to their transfiguration, would certainly be apparent on minutely examining the interior and the circumference of the diseased structure. Yet I am not aware, that such fact has been proved to be generally the case, either with the aid of the scalpel or the microscope. The observation of cavities, cells, and tuberculated appearances, in some kinds of tumours, is no proof that such modifications of structure are transformed hydatids. Besides, if my limits would allow me to consider this topic further, many reasons might be urged against the hydatid doctrine, arising from the consideration of the changes evident in the blood-vessels, supplying parts in which a considerable tumour is situated. Thus, we often see the trunks of the arteries, running towards such parts, doubled in size, (as is noticed with respect to the carotid, in the natural growth of the stag's horn), and indicating, at least, that the formation and increase of swellings are effected through the medium of the blood-vessels. The sudden effect of tying the arteries, by which it is supplied with blood, would also be difficult to explain, if the growth of the swelling

really depended upon some undefined transformation of hydatids.

It seems to be generally admitted, that the growth of tumours may often be retarded, and that sometimes they may even be diminished, by means of topical bleeding with leeches, and keeping the parts in a continually cool state, by the incessant application of cold sedative washes. Afterwards, when the increased action of the vessels seems checked, and the tumour ceases to enlarge, discutients are indicated, such as frictions with mercurial ointment, pressure, electricity, rubefacient plasters, solutions of salts, blisters, and issues. Few sarcomatous or encysted tumours, however, are ever completely removed by these local means. The swelling, on the contrary, generally increases, notwithstanding them; and the irritation of the disease by stimulants is not altogether unattended with danger of the affection becoming changed by them into very malignant and dangerous cases, sometimes to all appearances cancerous. The most advisable plan is to recommend the removal of sarcomatous tumours with the knife, while they are small, and in an incipient state; for, thus they are got rid of by an operation, which is certainly trivial, compared with what might afterwards become requisite, if the disease were allowed to proceed and attain an enormous magnitude.

TUMOURS, SARCOMATOUS. These have been so named from their firm, fleshy feel. They are of many kinds, some of which are simple, while others are complicated with a malignant tendency. Mr. Abernethy attempted to form a classification of them, and proposed names for them, deduced from the structure which they exhibit on dissection. Under the title of *Common Vascular*, or *Organised Sarcoma*, he includes all those tumours which appear to be composed of the gelatinous part of the blood, rendered more or less vascular by the growth of vessels through it. The vessels which pervade this substance are, in different instances, either larger or smaller, and more or less numerous, being distributed in their usual arborescent manner, without any describable peculiarity of arrangement. The structure under consideration is met with not only in distinct tumours, but also in the testis, mamma, and absorbent glands. When a common vascular, or organised sarcoma, has attained a certain magnitude, the veins of the skin seem remarkably large, and their winding course under the integuments excites notice. This kind of sarcoma is not at all tender, so that it may be freely handled and also electrified, without giving pain. The tumour sometimes grows to such a size, that the skin bursts, the substance of the swelling sloughs out, and the disease is got rid of. However, this mode of cure is attended with local effects of so formidable a nature, and so much fever, &c., that the removal of the disease with the knife is to be preferred.

The second kind of tumour, noticed in Abernethy's classification, is the *Adipose Sarcoma*. Every one in the habit of observing surgical disease, must know, that fatty tumours are exceedingly common. Mr. Abernethy believes that these swellings are formed in the same manner as others; viz., in the first instance, they were coagulable lymph, rendered vascular by the growth of vessels into it; and that their future structure depended on the particular power and action of

the vessels. According to Sir Astley Cooper, "they are not composed of fatty matter only; but the adipose membrane is increased, and their structure is similar, only somewhat more compact, to that of the fatty membrane in other parts of the body." (*Med. Chir. Trans.* vol. xi. p. 440.) This fact is very much against the doctrine, which ascribes the origin of tumours to hydatids and their transformation. Adipose tumours always have a thin capsule, formed by the simple condensation of the surrounding cellular substance. It adheres very slightly to the swellings, and, chiefly by means of vessels, which pass through this membranous covering in order to enter the tumour. The vessels are so small, and the connection so slight, that, in removing the tumour, no dissection is requisite, as the operator may easily put his fingers between the swelling and its capsule, so as to break the little vascular connections, and entirely detach the disease. Some individuals seem to have a disposition to the formation of fatty tumours upon various parts of their bodies; a memorable example of which is recorded in the *Revue Médicale*. The patient was a young woman, aged 18, whose constitution was not in any way remarkable. Although very lean, and of the middle stature, she weighed 169 French pounds. Between her shoulders were two tumours, eight inches long, and three broad. A third, of less size, was situated near the right armpit. A fourth arose from the inferior angle of the shoulder-blade, and was 15 inches long, and six broad. A fifth, lower down, was six inches long, and five broad. The sixth, which was larger than a man's head, was situated upon the right hip. The seventh, a small one, was below the right trochanter major. The eighth, a prodigious one, arose from the left hypocondrium, and hung down as low as the middle of the calf of the leg, being two feet long, and three feet one inch in circumference at its base. All these tumours were of a fatty nature, soft, uneven, and quite unconnected with internal organs, or the muscles. (*See Quarterly Journ. of Foreign Medicine.* vol. iv. p. 618.)

As the substance of adipose tumours is never furnished with very large blood-vessels, the fear of hemorrhage, which frequently deters surgeons from operating, is quite unfounded. It is an undoubted fact, that there is no species of tumour, that can be removed with so much celerity, with such apparent dexterity, or with such complete security against future consequences, as those of an adipose nature. However, now and then, when the tumour has been previously in an inflammatory state, the capsule becomes thickened, and intimately adherent to the surface of the swelling, so that the separation of the disease is more difficult, and requires the knife to be more freely employed. The tumour also sometimes becomes, after inflammation, closely adherent to the contiguous parts. Adipose tumours often acquire an enormous magnitude. Indeed, there can be no doubt of the fact stated by Sir Astley Cooper, that they acquire a greater magnitude, than any other swelling ever reaches. Mr. Abernethy relates an example of one, removed by Mr. Cline, which weighed between 14 lbs. and 15 lbs., and which I saw myself previously to the operation. Sir Astley Cooper also mentions the successful extirpation of several adipose tumours of immense

size: one weighing 14 lbs. 10 oz., removed by himself; and another weighing 22 lbs., removed from a lady's thigh by Mr. Cpeland. But, a still more remarkable case is one, in which Sir Astley Cooper removed a fatty swelling, which weighed, independently of the blood in it, 37 lb. 10 oz., and was situated on the abdomen of a man, aged 57. (*See Med. Chir. Trans.* vol. xi. p. 440.) In the case, above quoted from the *Revue Médicale*, and recorded by M. Dagorn, of Morlaix, the largest of the swellings weighed, after its removal, 46 French pounds. (*See Quarterly Journ. of Foreign Med.* vol. iv. p. 618.) Although, when adipose swellings attain an enormous bulk, the immense size of the wound, requisite for their removal, must be dangerous, and is a strong argument in favour of having recourse to the operation at an earlier period; yet it is equally true, that large fatty swellings may be taken out, with a greater prospect of success, than any other kind of tumour of equal size.

The next species of sarcoma, noticed in Abernethy's classification, is what he names *pancreatic*, from the resemblance of its structure to that of the pancreas. This kind of disease is occasionally formed in the cellular substance; but more frequently, in the female breast, on that side of the nipple which is next to the arm. Mr. Lawrence has seen many instances of tumours of this kind situated close to the parotid gland, and near the angle of the jaw; and one close to the submaxillary gland. Abernethy likewise mentions one example situated on the mylohyoides. (*See Lawrence, in Med. Chir. Trans.* vol. xvii. p. 18.)

When a pancreatic sarcoma is indolent, and increases slowly, the surrounding parts and the glands in the axilla, are not affected. But some of these swellings deviate from their common character, and become of a very irritable nature, occasioning severe and lancinating pain, and producing an inflammatory state of the skin covering them, so that it becomes adherent to their surface. The absorbents leading to the axilla are also irritated, and the glands enlarged. Pancreatic sarcoma does not grow to a very large size; but, when its progress is unrestrained, the pain, attendant on the disease, becomes lancinating, and so severe, as to make the patients feverish, and lose their health and strength. Mr. Abernethy remarks, that, when the axillary glands become affected, one generally swells at first, and is extremely tender and painful, but, afterwards the pain abates, and the part remains indurated. Another is then affected, and runs through the same course.

To another species of sarcoma, Mr. Abernethy applies the epithet *mammary*, from the resemblance which this gentleman conceives its appearance bears to that of the mammary gland. This kind of disease, Mr. Abernethy says, he has not often seen. In the example which he met with, the tumour was about as large as an orange, and situated on a woman's thigh. The swelling was removed by an operation; but the wound afterwards degenerated into a malignant ulcer, attended with considerable induration of the surrounding parts, and the woman died of the disease in two months. Mr. Abernethy conceives, that the whole of the morbid part had been cut away, but, that the contiguous parts had a disposition to disease, which was irritated by the operation; and that, if the nature of the case could have been known beforehand, it

would have been right to have made a freer removal of the substance surrounding the tumour.

Mr. Abernethy places the mammary sarcoma between those sarcomatous swellings which are attended with no malignity, and the following ones which have this quality in a very destructive degree.

The *tuberculated sarcoma* is composed of a great many small, firm, roundish tumours of different sizes and colours, connected together by cellular substance. Some of the tubercles are as large as a pea; others equal a horsebean in size; most of them are of a brownish red colour; but some are yellowish. Mr. Abernethy met with this species of sarcoma chiefly in the lymphatic glands of the neck. The disease proceeds to ulceration; becomes a painful and incurable sore; and ultimately occasions death.

Another kind of sarcoma, mentioned in Mr. Abernethy's classification of tumours, is distinguished by the epithet *medullary*, from its having the appearance of the medullary matter of the brain. It appears to be an exceedingly malignant disease; communicates to the lymphatic glands a similar distemper; ulcerates and sloughs, and at last proves fatal. It is treated of in other parts of this book. (See CANCER, FUNGUS HÆMATODES, MAMMA, and TESTICLE, DISEASES OF.)

Mr. Abernethy includes also in his classification, *carcinomatous sarcoma*. (See CANCER.)

This last term is not consistent with other names adopted in the classification, which are taken from anatomical comparisons. Abernethy's arrangement omits, likewise, various new growths, which, according to his own principles, are tumours, and ought to have been included, as, for instance, those now frequently called morbid erectile tumours. (See ANEURISM by ANASTOMOSIS, and NÆVI.) Mr. Lawrence has published a description of a tumour which occurs in that kind of cellular tissue which does not contain fat, and which he proposes to name the *cellular tumour*. Like the adipous tumour, it is not attended with pain, may attain a considerable size, and becomes troublesome or dangerous only in consequence of its bulk. A case is detailed, in which such a tumour occupied the labium pudendi and buttock. Between this cellular tumour, and the enormous swellings, in which the male organs of generation are sometimes involved, it seems to Mr. Lawrence, that there is this distinction, that while the former are new productions, rising and increasing insensibly, without local or general disturbance or pain, the latter are mere enlargements of the cellular and cutaneous tissues, resulting from interstitial deposition, consequent on repeated attacks, or a long continuance of more or less violent inflammation, attended with the usual symptoms of it in the part, and in the constitution. (See *Med. Chir. Trans.* vol. xvii. p. 17.) All hypertrophies of the scrotum would not, however, agree with this description. (See SCROTUM.)

Dr. Warren, of the United States, in a work replete with valuable information, prefers the classification of tumours, founded upon the different textures in which they form and grow. I apprehend, however, that this classification will not be found to answer: indeed, Dr. Warren acknowledges certain objections to it; namely, that it is often difficult to ascertain in which texture any given tumour originates, and that the proposed it refers to the same general head,

without distinction, malignant tumours, and those free from this character. A third objection, noticed by a critical writer, and perhaps a still more serious one, is the fact, that many tumours consist of morbid products, which affect several tissues indiscriminately, and sometimes simultaneously in the same subject; such, for instance, as the medullary sarcoma, or fungus, which generally affects, not only several different tissues, but several different organs at the same time. But, our knowledge of tumours is still so imperfect, that probably, it will be long before a classification of them can be established, even with few defects or inconsistencies. (See *Edinb. Med. Journ.* Oct. 1837. p. 491.)

Besides many operations, which have of late years been performed, and are remarkable, on account of the great size of the swellings removed, others, still more interesting, claim attention, on account of the nature and situation of the parts extirpated. On the excision of the thyroid gland, I need not here dwell, as it is elsewhere noticed (see THYROID GLAND); but, I feel called upon to mention some other very bold operations, the particulars of which are full of instruction. The first is that, performed by Mr. Goodlad, of Bury, in Lancashire. The case was an immense tumour, situated on the left side of the face and neck, and the base of which was about twenty-eight inches in circumference. The disease extended from the external canthus of the eye above to within three quarters of an inch of the clavicle below, and some idea of the depth of its attachments may be conceived, when it is known, that the whole parotid gland was involved in it. For the purpose of obviating all danger of hemorrhage, Mr. Goodlad began with tying the carotid artery. The nature of the operation will be best understood by adverting to the appearances afterwards presented by the wound. "The whole sterno-mastoid muscle was exposed, and its fibres dissected clean, except about half an inch from its insertion into the clavicle. The wound extended backwards from behind the mastoid process to the trachea anteriorly, but became narrower in the direction of the muscle at the lower part of the neck. The submaxillary gland was exposed, and about one-fifth of its substance not appearing healthy, was removed. The digastric, and the greater portion of the mylo-hyoideus, were exposed. The ramus of the jaw was only covered by periosteum, except where covered by the masseter muscle, part of which, not appearing healthy, was dissected away. The whole of the condyloid process of that bone was laid bare in the same manner, and behind it the pterygoid muscles were also exposed. The membrane of the cheek was only covered by a cellular substance, which did not appear healthy; but sufficient skin was saved to cover the zygoma. The parotid gland was entirely removed." This enormous wound healed in ten weeks; but unfortunately the cure was not permanent; the disease returned, and, fifteen months after the operation, the poor woman died. (See *Med. Chir. Trans.* vol. vii. p. 112, &c. vol. viii. p. 582.)

Respecting the foregoing severe operation, many surgeons may doubt the propriety of tying the carotid artery, as a preparatory step, and, indeed, it is positively condemned in an anonymous note attached to the above case; simple temporary pressure on the exposed vessel being represented as preferable. Perhaps, however, Mr.

Goodlad's method was on* the whole the best, because the application of the ligature to the carotid not only removed the dangers of hemorrhage during the operation, but obviated them afterwards, and lessened the necessity for a prodigious number of ligatures.

Nay, the hemorrhage is so profuse from the main branches of the external carotid, and mere pressure so uncertain of always commanding the flow of blood, that the patient may actually die from sudden loss of blood, as nearly happened in another interesting case of removal of a large tumour involving the parotid gland, and connected with the transverse process of the atlas, the basis of the skull, the meatus auditorius, mastoid process, and angle of the jaw. The operator, Mr. Carmichael, in order to complete the dissection, was obliged to divide the trunk of the facial artery: "Instantly (says he) an alarming gush of blood, which evidently came from a large vessel, followed the division; and the danger appeared the more imminent as the pressure, which Mr. Todd applied, with all the force he could exert upon the carotid trunk was actually incapable of repressing the torrent. There was not a moment to be lost. Mr. Colles plunged a dry sponge to the bottom of the wound, and firmly pressed on the bleeding vessel, while I made a horizontal section of the tumour, till I arrived at the cavities occupied by the sponge, with the view of exposing as quickly as possible the mouth of the bleeding vessel. This was accomplished in sufficient time to save the patient's life." Mr. Carmichael, at the conclusion of the history, remarks that, if he were called upon to perform such an operation again, he would, in the first instance, pass a ligature under the carotid trunk, which might be tightened, or not, as occasion should require. The case here spoken of, had a successful termination. One remarkable consequence was a paralysis of one side of the face, brought on by the division of the trunk of the portio dura in the operation. (See *Trans. of the King's and Queen's College of Physicians*, vol. ii. p. 101. 8vo. Dublin, 1818.)

The next instance which I shall notice, of the removal of an enormously enlarged parotid gland, is that recorded by Klein, of Stuttgart. The patient was a woman of seventy, and the swelling extended from the ear to the shoulder. In the operation, all the branches of the facial nerve were divided; a piece of the masseter was left hanging; the external carotid artery and par vagum were left quite bare; the dissected sterno-mastoid lay on one side; and the temporal, external maxillary, and auricular arteries, were of course divided, along with several arteries of the neck; yet, the largest of these being tied, the bleeding was very inconsiderable. The event was so successful, that in less than three weeks, the wound entirely healed.

The same distinguished surgeon also removed a fatty tumour, extending from the buttock to the ham, and measuring three feet one inch in length, and two feet six inches in circumference. Klein undertook its removal, on the supposition, that it was an encysted tumour lying above the fascia lata; but, it turned out to be a steatoma coming from beneath it, and reaching to the thigh-bone, and in every direction amongst the muscles, nerves and blood-vessels of the thigh. At length, partly with the fingers, and partly with the knife, the

fatty mass was separated from all its important connections. Several vessels were tied, and amongst them the profunda femoris. However, not more than a pound of blood was lost. The tumour, after its removal, weighed twenty-seven pounds and three quarters. The patient, a woman 44 years of age, went on very well for eight days; but, on the ninth, she was constantly complaining of uneasiness in the foot of the affected limb; her pulse became weak and intermitting; and she sunk in the most unexpected manner. (See *Journ. für Chirurgie Herausgegeben von D. J. Graefe und D. P. F. Walther*, b. i. p. 106, &c., 8vo. Berlin, 1820; or *Quarterly Journal of Foreign Medicine*, &c., vol. ii. p. 373, &c.)

In the autumn of 1823, M. Bécclard is stated to have removed the whole of the parotid gland, which is described as being in a truly scirrhus state: the disease, however, returned, and the patient ultimately died of it. Two curved incisions were made, so as completely to encircle the tumour. The portion of it, situated on the masseter, was first detached. Then an endeavour was made to separate the tumour from below upwards; but a continuation of it was found reaching a great depth backwards, and under the pterygoideus internus. In order to avoid a hemorrhage, which it would have been difficult to stop in the operation, M. Bécclard now determined to cut into the substance of the swelling, at the point, where the deep production went off from it, and dissecting from below upwards, he removed the mass; and, together with it the lower half of the cartilage of the meatus auditorius externus, which participated in the disease. Numerous arteries being now tied, Bécclard proceeded to the extirpation of the remainder of the tumour. A part of the front and inner surface of the mastoid muscle, found diseased, was cut away. Nearly the whole of the elongation behind the jaw had been cautiously dissected out, when a large jet of arterial blood indicated, that either the external carotid, or one of its branches close to its origin, was divided. M. Bécclard placed his left forefinger on the point, from which the blood issued, and a double ligature was applied, one portion of it above, the other below, the lateral opening in the carotid. The artery was now held forwards, and a little raised, while the rest of the parotid was dissected out. Only one small continuation of the tumour, situated just in front of the cervical vertebræ, was left, on account of its nearness to the internal jugular vein; and it was tied. In the wound, the masseter was seen cleanly dissected. The branches of the seventh pair of nerves had been removed with the tumour; the labial artery, denuded, but not wounded, was seen pulsating in front of the lower part of the masseter. The posterior part of the wound exhibited the mastoid process and the sterno-cleido-mastoid muscle. Internally, the styloid process, the external carotid, tied with two ligatures, the stylo-hyoideus, digastricus, and, rather lower down, the small part of the tumour that was tied, formed the bottom of the wound, which opened into the meatus auditorius externus. The following inferences were deduced by Bécclard from the case: First, The reality of scirrhus of the salivary glands is confirmed. Secondly, The possibility of removing the parotid demonstrated. Thirdly, Hemorrhage from a wound of the carotid in the operation may be stopped by ligature; but

the attempt to remove by the first incisions that portion of the disease which is wedged behind the jaw, is dangerous, as opening the carotid might then prove fatal; whereas, if the largest portion of the tumour be first removed, and then the rest cautiously and slowly, the carotid, if now wounded, may be more easily secured, because the mass which lay over it has been taken away. Fourthly, The erysipelas and delirium, by which the patient was afterwards attacked, are common after operations on the face, and the return of cancerous disease but too frequent, even when completely extirpated. Fifthly, The paralysis of the muscles of the face, which took place, is explained by the division of the branches of the seventh pair of nerves. (See *Archives Gén. de Méd.* Janvier, 1824.)

Dr. Warren, of the United States, relates an interesting, but formidable case, in which he removed a glandular tumour from the neck, situated so closely to the vessels and nerves, that it was difficult to distinguish them. The jugular vein was obliterated, the carotid artery diminished in size, and the pneumogastric nerve so closely mixed with it, that, though separated from, it was not wholly cleared of the tumour; while the sublingual nerve required to be divided, and the pharynx was opened, yet the patient recovered from the immediate effects of the operation. After an interval of some months, however, ulceration took place, and destroyed the patient, about one year from the date of the operation. (See *Warren, on Tumours, &c.* 8vo. Boston, 1837.)

Of the coolness and resource of Dr. Warren in an operation (observes a writer in the *Ed. Med. and Surg. Journ.* No. 133. p. 502.), the case now mentioned may be conceived to be a sufficiently satisfactory specimen. In another, immediately following, these qualities were still more evident. Of the tumour, for which the operation, here alluded to, was undertaken, he calculated the relations to be of the following intricate kind: "Taking its origin in the lymphatic glands, behind the posterior edge of the sterno-mastoid muscle, it had extended backwards, under the trapezius, to the spine; and forwards, under the mastoid, to the pharynx. That it adhered to the splenius and complexus, and trachelo-mastoideus, and involved the digastricus and all the styloid muscles. Of the blood-vessels, that it involved the external carotid artery, with its eight branches, excepting, possibly, the superior thyroid. Of the veins, the internal jugular, all the external jugulars, and the accompanying branches of the arteries. Of the nerves, the three or four superior cervical, the par vagum, sublingual, and its descending branch, the glossopharyngeal, laryngeal, and, probably, the gustatory and great sympathetic. Of the glands, the parotid and submaxillary. Of the canals and passages, the larynx, pharynx, the auditory passage, and, possibly, the œsophagus." The following is Dr. Warren's account of the operation: "My wish was to have secured the carotid artery first; but, perceiving the depth of this vessel from the rising of the hard tumour on the outside, and the trachea on the inner side, an incision was made from the spine to the angle of the jaw, to meet another incision from the last point downwards, in the direction of the anterior line of the sterno-mastoid muscle. The last incision extended down the neck nearly to the clavicle. The flap thus formed

was elevated by a dissection, laborious from the close adhesion of the integuments to the tumour. This flap being turned down, exposed the posterior half of the tumour, a hard, knotted, bloody surface, extending from the spine nearly to the trachea, and showing the mastoid muscle firmly imbedded in the scirrhus substance. Next, having dissected the mastoid from its inferior adhesion to the scirrhus, the carotid was exposed and tied. The superior flap of integuments was then raised, and I attempted to disengage the mastoid muscle from the furrow it occupied in the tumour, in order to pursue the dissection under it. This was found impossible. The alternative then presented of cutting across this muscle, and dividing with it the accessory nerve (the consequence of which last I was unacquainted with) or else dividing the tumour through its middle part, behind the mastoid. The latter course was adopted. The scirrhus mass was cloven in two. The posterior half was dissected out; and it then remained to separate and disengage the anterior part from the posterior face of the sterno-mastoid, from the digastric, the nerves and bones; including the parotid and submaxillary glands. The mass of the tumour was then happily removed from the parts just mentioned. Some portions, adhering to the fore-part of the bodies of the vertebrae, and to their transverse processes, could not be wholly dissected without exhausting the patient's strength. The operation was therefore concluded by the application of the actual cautery. In the latter part of the operation, the patient was seized occasionally with a spasmodic cough, produced apparently by the division of some of the inferior branches of the accessory nerve. The internal jugular was buried in the tumour; and, in order to raise the lower edge of the mass, it was necessary to divide and tie this vessel. To accomplish this with safety, it was compressed between the tumour and the clavicle, and then divided and tied. A few bubbles of air entered the open mouth of this vessel, but were arrested by the finger below, and forced back again. The principal branches of the first and second cervical nerves were seen and divided." The final result is not stated; but we are informed, that eight days after the operation, the symptomatic fever had abated, and soon after this Dr. Warren heard that the patient was recovering. (See *Warren on Tumours*, p. 178—182.)

In the removal of a tumour from the neck, Dr. A. H. Stevens, Professor of Surgery in the University of New York, had occasion also to tie the internal jugular vein at an earlier period than Dr. Warren. "A man of middle age (he states) came under my care in the New York Hospital, during the last winter (1830), with an extensive flattened tumour under the sterno-mastoid muscle, formed of the chain of lymphatic glands, which accompanies the great vessels on the left side of the neck, in a state of great enlargement. It had been the subject of a previous unsuccessful operation, and was then alarmingly obstructing the powers of deglutition and respiration. In the course of my operation for the removal of this tumour, after it had been detached, except at its inner and posterior edge, I drew the tumour outwards and forwards, and divided a vein of considerable size passing horizontally outwards, near its junction with the internal jugular. Half an ounce of venous blood escaped, and in an instant

TUMOUR

Afterward, a peculiar sound was heard, like that occasioned by drawing into a syringe the last portions of water from a basin. It was a moment of intense anxiety; for the fate of Dupuytren's patient was fresh in my recollection. I immediately placed my finger on the aperture in the vessel, seized the pulse with the other hand, and watched the patient's countenance. All seemed well, &c. After a moment's deliberation, I determined to pass a ligature around the internal jugular, below and above the junction of the wounded branch. It was accordingly separated from the par vagum and carotid with the blunt point of an eyed probe, armed with a double ligature, and one of the ligatures was secured below, the other above, the wounded vessel. The operation, of which little remained to be done, was then completed. The man suffered from cough and difficult respiration between the fourth and seventh days after the operation, for which he was twice bled, and saline purgatives administered. The ligatures came away on the fourteenth day, and the case went on without any peculiarities.

"If the par vagum can be divided on one side, without endangering life—a question, I believe, not yet settled by positive experiment—the proposition will be established, that many tumours on the side of the neck (the removal of which is now deemed impracticable) may be successfully extirpated." (*Reese's Amer. ed. of this Dictionary; Supplementary Appendix.*)

I suspect, that many accounts published of the removal of the whole parotid gland did not truly relate to this body itself, certain portions of which seem to be beyond the reach of the knife in the living subject; for who could cut out the portions of it between the articulation of the lower jaw and the pterygoid processes? Such accounts, I think, refer to the taking away of tumours, which have grown, and more or less displaced, or produced, absorption of the parotid. I find in Liston's *Practical Surgery* several good remarks on tumours formed over the parotid, and behind the ramus and angle of the jaw. "These (says he), whether enlargements of the lymphatic glands, or adventitious formations, are bound down by a strong, condensed, cellular sheath, or fascia, and also by the fibres of the platysma myoides, which pass upon the side of the face. Their growth and prominence externally is equally extensive among the deep-seated parts. The parotid gland is displaced and absorbed; the diseased mass is imbedded in its substance, and ultimately occupies its place. The vascular supply is abundant, and the nerves become intimately attached to the posterior surface of the condensed cellular cyst. The tumour is firmly fixed in all ways by its strong investments, firm adhesions, and by its being, as it were, dovetailed by its processes between the bones. I have sometimes, after the removal of tumours of long standing in this situation, found exposed the whole cavity betwixt the mastoid process and the ramus of the jaw, the styloid and pterygoid processes, muscles, &c. The interference with these growths (parotid tumours, as they are called, though the parotid gland itself is not very subject to disease) requires no small degree of consideration. If there be reason to suspect, that the disease is of a malignant nature, and not strongly limited by a cellular cyst, no interference is admissible. If, on the contrary, it be at all

moveable, has advanced slowly, possesses a smooth surface, and is firm (neither of stony hardness, nor pulpy) then the operation may be contemplated. A very free division of the superimposed parts is essential to the success of the proceeding. For this object, a perpendicular incision is first made, and others added, so as to form two or more flaps. The incisions must penetrate to the substance of the tumour, and divide its immediate investments; it being a more easy matter to turn a diseased part out of its cellular cyst, than to dissect that out of the parts to which it adheres, and from whence it draws its supplies.

"The dissection should now be carried deeply to the lower boundary of the disease, where the vessels are known to enter. These will be at once divided and compressed, or tied, if it be thought worth while, and the vessels be very large; for the fingers of the assistant are in the way of the further and, perhaps, more delicate dissection. This is pursued much more safely and satisfactorily, thus; and it will be found always much better to meet the danger at once, than to be obliged to tie one vessel after another, and perhaps the various branches over and over again, instead of the trunk. Much less blood will be lost; the time occupied in the operation will be abridged; and the pain and suffering very much diminished. The utmost care must be taken to avoid the branches of the cervical nerves, and those of the portio dura, by dissecting the posterior aspect of the tumour carefully, and in the direction of their course, the edge and point of the knife being constantly turned towards the part to be removed; but in some cases of this kind, the division of part of the pes usquevagus is quite unavoidable; and we have sometimes to decide between leaving part of the tumour, and causing a temporary paralysis of part of the face." (*See Liston's Practical Surgery, p. 275.*)

In the section on *Erectile Tumours*, contained in Dr. Warren's work, several interesting remarks may be found, which, had I been acquainted with earlier, I should have noticed in the articles *ANEURISM* and *NAVUS*. He gives an instance of aneurism by anastomosis, situated near the internal angle of a young woman's right eye, where the anastomosis of the facial, ophthalmic, and frontal arteries takes place, and where the disease produced a pulsating tumour as large as a hazel-nut. The anastomosing branch of the ophthalmic artery was first tied, the facial artery divided, the tumour emptied, and a compress applied over the artery and sac. On division of the facial artery, the pulsation ceased; but there was a return of slight pulsation on the third day. In a fortnight, the tumour pulsated as strongly as it did before the operation, and the carotids throbbed violently, especially the right one. After the trial of some general remedies and low diet for two months, without benefit, Dr. Warren tied the right carotid artery. The pulsations on that side were immediately relieved, those of the left gradually abated, and the operation led to a complete cure.

In the foregoing case, considerable perplexity was occasioned by the pulsations being almost as powerful and distressing on the left side of the head as on the right, so that it could not be foretold, whether tying the right carotid alone would have been followed by their cessation, or the left carotid might not also have required the applica-

tion of a ligature to it. The result seems to Dr. Warren to prove, that the pulsations were sympathetic. In this example, it likewise merits notice, that the interruption of the current through the small arteries was not adequate to stop the pulsations of the tumour, nor to check its growth, which could only be accomplished by putting a stop to the stream of blood in the large trunk. From this, however, Dr. Warren does not deem the inference warrantable, that it is necessary, in every instance of aneurism by anastomosis, to tie the arterial trunk from which the nutrient vessels of the tumour proceed. Such trunk might also be tied, and yet the disease not invariably be cured; an example of which Dr. Warren met with in his own practice. The reason of the difference seems to be, that, in some instances, a cure will not be affected, unless the vessels immediately entering the tumour are secured, and also the large trunk from which they are derived. The first proceeding is rendered indispensable by the free anastomosis of the small vessels of the head and face; and the second by the necessity of excluding the tumour and its nutrient arteries from the constant impulse of the heart, and the influx of blood, until adhesion has been completed. (See *Warren, on Tumours*, &c. 8vo. Boston, 1837.)

With respect to the disputed question, what is the structure of these erectile tumours? I may refer to a very interesting case and observations, recently published by Mr. T. B. Curling. (See *Lond. Med. Gaz.* for Aug. 1838.) From his examination of a large tumour of this kind with a microscope, he found the arteries terminating by direct continuity of tube in the veins, and not in cells, as has been sometimes represented. The erectile tissue, which is one of the analogous tissues of Carswell and other pathologists, is described by the latter as presenting varieties similar to those observed in the natural erectile tissues, sometimes consisting of a spongy or cellular structure, intercepted by fibrous tissue; but, at other times, and most frequently, consisting of an almost inextricable network of arteries and veins, sometimes the one, sometimes the other, of these sets of vessels predominating. In one case, which Dr. Carswell had an opportunity of examining after death, in an infant, the tumours were formed of the dilated extremities of the vessels, some of which were bulbous, sacculated and distended with fluid, or coagulated blood. One of them burst, and occasioned fatal hemorrhage. (See *Carswell's Illustrations of the Elementary Forms of Disease; Fasc. on Analogous Tissues.*)

In the article, MAMMA, DISEASES OF, I have noticed the little agonising swelling, called the *painful subcutaneous tubercle*, which both Sir Astley Cooper and Baron Dupuytren concur in describing as a fibro-cellular, or fibro-cartilaginous tumour, invested by a cyst, situated almost always under the integuments of the limbs, presenting nearly a round shape, and scarcely ever exceeding the size of a pea. According to Dupuytren, it finally undergoes the kind of softening peculiar to cancer; a remark, however, which I do not find agree with the statements of other pathologists, and the correctness of which I have not seen exemplified in practice. Several writers describe the *painful subcutaneous tubercle* as formed in the sheath of nerves, or in the track of them. Thus, M. Anjoine Petit, in his discourse on pain,

remarks that, on dissection, a white tubercle is met with, covered by a fibrous membrane, commonly adherent to the skin, but loose in the cellular tissue, where it appears to be connected only with filaments of nerves, of which it is the termination. The greater number of swellings of this kind on which he had operated, were in the legs, only one having been situated on the arm. Cheselden had twice met with a little tumour of about the size of a pea, under the skin covering the tibia, attended with excessive pain, and remarkably hard. The disease was cured by extirpation. (*Anat.* ed. 10. p. 136.) The same disease had been frequently seen by Camper, who represents it as situated within the tunic of the nerves. (*Demonstr. Anat. Pathol.* lib. i. p. 11.) Chaussier also describes this sort of swelling as most frequent in the lower extremities, though he had seen it on the back, and as placed in the course of a nerve, and connected with its filaments. In Mr. Liston's museum, there is indeed a specimen, which corresponds to these accounts. On the other hand, Sir Astley Cooper and Baron Dupuytren concur in the statement, that these painful subcutaneous tubercles are not thus directly connected with the nerves. "I have (says the latter) dissected many in the dead subject with the most minute care; and in order to learn their nature more certainly, I have, in extirpating them, removed, at the same time, a considerable quantity of cellular tissue, but never found the smallest nervous filament adhering to their surface. Their texture is evidently fibro-cellular, rather albuminous, and, in time, they become scirrhous." Amongst other particulars he mentions, that, though they are mostly situated in the subcutaneous, or subaponeurotic cellular tissue, they are sometimes noticed elsewhere; and he had seen them in the breast, scrotum, back, and face. There are rarely more than one in the same individual. I have now (1838) a male patient at the Bloomsbury Dispensary, who has a painful tubercle of this description close to the nipple. Dupuytren represents this kind of little tumour as being more common in women than men, and between the ages of 35 and 60, than at an earlier period of life. In order to prove further that the swelling is not a disease of a nerve, he relates a case, in which a surgeon divided the infra-orbital nerve for a supposed neuralgic affection of the face; but, instead of being cured by this measure, the disorder became much worse. Dupuytren detected a painful subcutaneous tubercle in the cheek, removed it by excision, and the patient was immediately cured. "It is manifest (says he) that if the tubercle had been formed of the nervous filaments of this branch of the fifth pair, or had been specially applied to it, the division of the nerve would instantly have put a stop to the pain; on the contrary, it continued, grew more severe, and only terminated with the existence of the tumour." In another case, related by Dupuytren, the tubercle did not become painful till after a lapse of seventeen years. He asks, could this have happened had it been formed in the track or substance of a nerve? In another instance, the tubercle was only painful when pressed, and the pain did not extend towards the fingers, but the trunk. He gives an instance, in which one was occasioned on a shoemaker's finger, by the prick of an awl. (See *Dupuytren, Clin. Chir.*, l. i. art. 18.)

TUMOURS, ENCYSTED. These, which are com-

menly named wens, consist of a cyst, which is filled with different substances. When the contained matter is fatty, the swelling is termed a *steatoma*; when somewhat like honey, *meliceris*; when like pap, *atheroma*. These are the three species into which writers usually divide encysted tumours. However, some of these swellings do not conform to either of the above distinctions, as their contents are subject to very great variety indeed, and are occasionally of an earthy, bony, or horny nature. Some encysted tumours of the latter description occasionally burst, and assume the appearance of horns, by the gradual projection of the matter secreted within their cysts. (See *Sir Everard Home's Obs. on the Growth of Horny Excrecences, in Phil. Trans. for 1701.*) In the year (1824) I attended with Mr. Drew, of Gower-street, a medical gentleman, from whose nates I removed a swelling of this nature, which had become very troublesome, in consequence of its pressure making the parts around its base inflame. It had been cut off many years ago by another surgeon, but grew again. At present (1838), there is no appearance of its reproduction, against which I guarded by carrying the incisions very deeply. I saw an excrecence of this kind removed some years ago from the scrotum of a man in St. Bartholomew's Hospital. Sir James Earle performed the operation; and, if I am not mistaken, the preparation of the disease is now in the museum of that Institution. But, still more remarkable specimens of such excrecences are preserved in the Anatomical Museum of St. Thomas's Hospital; one in particular, which resembles a ram's horn in shape, and was removed from a gardener's head, by Dr. Roots, of Kingston. A further account of the case is given in Rees's *Cyclopædia*, article *Horny Excrecence*.

I suppose every body in London has seen in the British Museum the horn deposited there as a curiosity, and which, with another of the same size, grew upon the head of a human subject. What is equally curious, hairs are not unfrequently found growing in the cavities of encysted tumours. (*Delpsch, Précis des Mal. Chir.*, t. iii. p. 412.); and even teeth, more or less perfectly formed, have been strangely met with in the same situations. An interesting specimen of the latter occurrence, in a double encysted tumour in the orbit, was published some time ago by my friend Mr. Barnes, of Exeter. (See *Med. Chir. Trans.* vol. iv. p. 316.)

It is observed by Sir Astley Cooper, that it is when encysted tumours are situated upon the temple, and near the eyebrows, and other hairy parts, that they sometimes contain hairs: these "have no bulbs, nor canal, and differ therefore from those, which are produced on surfaces of the body, which naturally form hair." In sheep, the cysts sometimes contain wool. (*Surgical Essays*, part ii. p. 233.) The manner in which these horny excrecences are produced, is stated to be as follows: "The horn begins to grow from the open surface of the cyst; at first it is soft, but soon acquires considerable hardness; at first, it is pliant, but after a few weeks, it assumes the character of horn." (Vol. cit. p. 235.; see also *Home, in Phil. Trans. for 1791.*)

Encysted tumours are generally of a roundish shape, and more elastic than the generality of fleshy swellings. However, the latter circumstance depends very much upon the nature of their contents, and the thickness of their cysts. So far as

my observation extends, encysted tumours form more frequently on the head, than any other part; but, they are very frequently met with in all situations under the integuments, and sometimes in deeper places. Encysted tumours are likewise often seen on the eyelids. They are in general nearly globular, and, when seated on the head, feel very firm, but upon the face, they are attended with a fluctuation, more or less obscure. The skin covering them, is generally uninfamed; but it is now and then streaked with blood-vessels, which are larger than those of the surrounding integuments. "In the centre of the tumour on the skin, it often happens, that in its early state, a black, or dark-coloured spot may be seen, which sometimes continues through the whole course of the disease. In general, they are unattended with pain, are never in themselves dangerous, and only require removal from the parts in which they occur, on account of the unseemly appearance they produce. They move readily within the cellular membrane, if they are free from inflammation, but the skin in general does not easily move over them." (*Sir A. Cooper, Surgical Essays*, part ii. p. 230.) The greatest number of encysted tumours, which this experienced surgeon has met with in the same individual, was sixteen, situated upon the head; and he has seen nine in another patient, as many as which number on one person I have seen myself. Four, five, and six, as Sir Astley remarks, are not uncommon. The largest which he has ever seen, was equal in size to an ordinary cocoa nut, and grew upon the head; but in general, they are not more than one or two inches in diameter. He considers them in some degree hereditary, as he has often heard a patient observe, "I have several swellings upon my head, and my father (or my mother) had several." They also frequently occur in several of the same family. (P. 231.)

According to Sir Astley Cooper, when encysted tumours are dissected, some part of their surface is found firmly adhering to the skin, while other parts are connected to it merely by the cellular membrane. The cyst itself is embedded more or less deeply in the cellular membrane, and its thickness is different in different parts of the body. On the face, or near the outer canthus, the cyst is very thin; but on the back it is much thicker, and, on the head, it is so thick and firm, that it retains its form after the discharge of its contents, and is so elastic, that after being compressed, it readily expands again to its former size. Within the cyst Sir Astley Cooper remarks, there is a lining of cuticle, which adheres to its interior, and several desquamations, of the same substance, are formed within the first lining. If the vessels of the cyst are injected, they are found to be numerous, but of small size. The cysts are occasionally met with in an ossified state. (*Surgical Essays*, part ii. p. 232, 233.) The investigations of Sir Astley Cooper prove, that many encysted tumours arise from the enlargement of the follicles, or glandular pores, in consequence of the obstruction of their orifice. (P. 236.) This view furnishes another consideration against the view taken of the formation of tumours by Dr. Baron.

Sir Astley Cooper was so obliging as to present me with two preparations, in which this origin of two superficial encysted swellings is very manifest. These specimens I have placed in University College Museum. I have also to thank him for his

kindness in showing me two cases, in which the fact of there being an opening in the skin, communicating with the cavity of the swelling, and giving occasional exit to its contents, was completely evident. I frequently meet a surgeon, who has had for some years an encysted tumour on the cheek, and in whom the small black point on the centre is very conspicuous. Of course, it is not intended that this doctrine, concerning the origin of an encysted tumour, should extend to the formation of cysts in general, which often present themselves, not only with great diversity of structure, but under circumstances, in which their beginning could not possibly be accounted for by the obstruction of the orifices of any sebaceous follicles.

As all Sir A. Cooper's opinions on surgical questions are deservedly valuable, I subjoin the advice, which he has given, founded upon the preceding doctrine. If the follicle can be seen only as a black spot, filled with hardened sebaceous matter, he recommends a probe to be passed into it, and the sebaceous matter to be pressed out of the tumour, which is done with little inconvenience. But, if the contents cannot be pressed out without such violence, as would create inflammation, he says, that the best plan is to make the opening larger. Other surgeons have tried to cure encysted tumours by pricking them with needles, and squeezing out their contents; by opening them more freely, and filling them with lint, or charpie (*Delpsch, Clinique de Chirurgie*, t. ii. 1828.); or by applying stimulating and discutient applications to them. However, some of these plans mostly fail, and the others have been known occasionally to convert the case into a terrible disease, in which a frightful fungus shoots out from the inside of the cyst, attended with immense pain and irritation, and even proving fatal. (See *Abernethy's Surgical Observations*, 1804. p. 94.) Similar dangerous fungous diseases may also arise, whenever the surgeon, in cutting out encysted tumours, leaves any part of the cyst behind.

The most advisable method, I believe, is to have recourse to the knife, before an encysted tumour has attained any considerable size. However, if it be large at the time of the operation being done, a portion of the skin must be taken away with the swelling, in the manner described in the article MAMMA, REMOVAL OF. The chief piece of dexterity in the operation consists in detaching all the outside of the cyst from its surrounding connections, without wounding it. Thus, the operator takes the part out in an entire state, and is sure, that none of the cyst remains behind. When the cyst is opened, some of the contents escape, it collapses, and the dissection is rendered more tedious and difficult.

Sir Astley Cooper believes, that the best manner of performing the operation is to make an incision in the swelling, and then to press the sides of the skin together, by which means the cyst may be easily detached and removed. If the attempt be made to extract the tumour whole, "the dissection is most tedious, and, before it is completed, the cyst is either cut, or burst. So many incisions and so much pain may be readily prevented by opening it freely by one incision, raising its edge between the fore-finger, and dissecting it from its adhesions to the surrounding membrane. (*Surgical Essays*, part ii. p. 240.) When the swelling is in the scalp, Sir Astley directs an incision to be made through

its centre, from one side to the other, when its contents, which in this situation are very solid, are immediately discharged in a mass of the same shape as the tumour. The cyst being raised with a tenaculum, may then be easily separated. When the foregoing difficulties are likely to be encountered, one writer suggests the plan of first opening the cyst, washing out its contents, and then injecting into it a thin mixture of sulphate of lime, which will immediately harden, and facilitate the excision of the cyst. (*M'Ghie, in Ed. Med. Journ.* No. lxxvi.) This proposal, though ingenious, is not likely to be adopted, because the operation, which is generally easy enough without it, would thus be rendered long and complex.

With respect to encysted tumours of the eyelids, the atheroma and meliceris are said by Beer to form only upon the upper eyelid, on the side towards the temple, while he has always found the steatoma to be seated either in the vicinity of one of the eyelids, or sometimes over the lachrymal sac. The atheroma and meliceris, he says, usually lie in the loose cellular substance directly under the skin of the eyelid, though sometimes more deeply under the orbicularis muscle, or even quite underneath the levator palpebræ superioris, upon the convex surface of the tarsal cartilage, to which the swelling is then generally so firmly adherent, that it is impossible to remove this part of the cyst. Encysted tumours of the upper eyelid are commonly so moveable that they may sometimes be pushed above the superciliary ridge of the os frontis: which is regarded by Beer as a very favourable circumstance in regard to an operation. Though the atheroma and meliceris of the upper eyelid occasionally become as large as a pigeon's egg, Beer has never known a steatoma, in the vicinity of the eyelids, exceed the size of a hazel nut. Encysted tumours of the upper eyelid itself sometimes appear moveable, though they may be at the same time closely adherent to the cartilage. Hence, Beer recommends moving the tumour about for a few days previous to the operation, and trying to push it above the superciliary ridge; and, if this cannot be done, the circumstance will prove, that the swelling is connected with the cartilage, or, at least, is under the orbicular muscle, and the mode of operating regulated accordingly. With the yellow pappy substance, found in the cysts of atheromatous tumours of the eyelids, fine short hairs, scarcely one line in length, are frequently blended. Sometimes, as Beer remarks, the whole inside of the cyst is covered with these little short hairs, which may all be washed out, and are destitute of bulbs; a fact also noticed by Sir Astley Cooper. In tumours of the meliceris kind, formed upon the eyelid, Beer never met with hairs. (*Lehre von den Augenker.* b. ii. p. 607—609.) He remarks, that, when encysted swellings of the eyelid are let alone, he has never known them produce any injury to the eye itself, except in the hindrance to the opening of it, when they are large. On the other hand, if they be unskillfully removed, or rashly attacked with caustic, various ill consequences may ensue; as, for instance, fistulæ of the lachrymal gland, entropium from a shrinking of the tarsal cartilage, ectropium from destruction of the skin, and the hare-eye from an actual shortening of the upper eyelid. In consequence of the inflammation, caused by escharotics, Beer has more than once found the integuments so adherent to the tumour, that, in the operation, the

removal of a considerable piece of them was unavoidable. But, says he, when swellings of this nature are properly treated, in good time, they may be removed, without leaving any vestige behind, excepting a trivial scar. He joins all the best modern surgeons in considering the entire removal of the sac, and the reunion of the wound by the first intention, as the safest and most effectual method of curing encysted tumours of the eyelids. He admits, however, that the hinder portion of the cysts of some swellings of this nature upon the upper eyelid cannot be dissected out, because it is so closely adherent to the cartilage, that its excision would injure the latter part too much, and produce either an incurable entropion, or an irremediable shortening of the eyelid. But, steatomatous tumours, near the eyelids, may almost always be completely dissected out, the only exceptions being cases in which the swellings happen to be situated between the lachrymal sac and the orbicular muscle, and so intimately connected with the first of these parts, that the back portion of the cyst could not be cut away, without permanently destroying the functions of the excreting parts of the lachrymal organs. However, when the swelling is not too strongly attached to the cartilage of the eyelid, Beer sanctions the removal of the whole of the cyst. He particularly insists upon the utility of moving the tumour a good deal about daily, for a few days before the operation, so as to loosen its connections, and enable the surgeon to push it over the edge of the orbit, where it may be steadily fixed during its removal. (B. ii. p. 612.) Excepting a few instances, in which the skin was diseased, and firmly adherent to the cyst, Beer has never found it necessary, in the excision of encysted swellings of the eyelids, to remove any portion of the integuments; and he has cut away some tumours of this kind, which were as large as a pigeon's or hen's egg. The incision, through the skin, should be longer than the tumour, so as to facilitate the extraction of the distended cyst. (B. ii. p. 613.) When it is not advisable, for reasons above stated, to attempt to dissect out every particle of the cyst, Beer fills the cavity with lint, lets the wound suppurate, and, if this plan be not sufficient, he applies stimulants and caustic. It is noticed by Sir Astley Cooper, that encysted tumours, at the outer canthus, are often difficult of removal on account of their extending into the orbit, and being adherent to the periosteum. (*Surgical Essays*, part ii. p. 241.) Scarpa strongly recommended making the incision for the extraction of encysted swellings on the inside of the eyelids. But, as Mr. Travers correctly remarks, the swellings are often situated superficially, and loosely connected with the tarsus; in which case, the operation should be done on the outside of the eyelid. The latter writer admits, however, that the cyst is often formed betwixt the cartilage and the ligamentary membrane, which covers it; and, in his opinion, it is only when an intricate adhesion subsists, and the appearance of a white circumscribed indentation is seen upon the everted tarsus, that the excision should be performed on the inside of the eyelid, by dividing the cartilage. (*Synopsis of the Diseases of the Eye*, p. 357.)

I shall conclude the subject of tumours with a few observations, delivered by Sir Astley Cooper, and Professor Langenbeck. "The removal of

encysted tumours (the first gentleman observes) is not entirely unattended with danger. I have seen three instances of severe erysipelatous inflammation succeed the operation of removing these swellings upon the head, and, I believe, it is owing to the tendon of the occipito-frontalis being wounded in the attempt to dissect them out whole." (*Surgical Essays*, part ii. p. 241.) I have witnessed several fatal cases of the same kind.

In the extirpation of tumours about the neck, Langenbeck adopts the following rules: he makes a free division of the integuments, and dissects the muscles from the tumour, which lie over it, but he avoids cutting through, or injuring them; in this manner, the swelling is rendered more moveable. By the situation of the muscles, he is then enabled to know the place of the chief blood-vessels; and, on this account, he particularly advises young surgeons to study myology with the greatest care. It is indeed an important advantage after a muscle has been exposed, to know what vessels lie at its edges, or underneath it. Thus, the sartorius is a sure guide to the crural artery, and the sterno-cleido-mastoideus to the carotid. A surgeon who knows correctly the anatomy of the parts, will not be in danger of wounding unintentionally any large vessel. When the surface of the tumour has been cleared, but the base of it is yet firmly attached, Langenbeck commences the separation on the side which presents the least risk, that is, where the least considerable blood-vessels are, and thence he proceeds, by degrees, towards the most hazardous side. In favour of this method, he offers the following considerations: if, by chance, an artery, requiring a ligature, should be cut, it can now be more easily secured, as the base of the tumour is already partly detached. The loosened swelling may also be drawn away from the large vessels with the hand, or a tenniculum. Langenbeck never introduces the knife deeply, when there are large blood-vessels there, but pulls the swelling outward, and then divides the cellular tissue, thus stretched, which is situated upon the already exposed portion of the tumour. In this manner, the swelling can always be drawn more and more away from the vessels, until, at last, there is no danger of wounding them. By attending to these principles, Langenbeck has succeeded in removing many very large tumours from the neck, where nearly all the muscles of that part were exposed by the dissection, and the carotid denuded. After one of these operations, not only the styloid process could be felt, but all the muscles originating from it could be distinctly seen. (*Bibl. für die Chir.* b. ii. p. 312, &c. 12mo. Göttingen, 1808.)

See the articles Cancer, Exostosis, Fungus, Hematodes, Jaw, Mamma, Testis, &c. C. G. Stenzel, *De Steatomatibus in Principio Aortæ repertis et Cysticis in Genere excrecentibus*. Wittenb. 1723. J. J. Plenck, *Novum Systema Tumorum, quo hi morbi in sua genera et species rediguntur*. Pars prior. 12mo. Viennæ, 1767. Wm. Ogle, *Letter concerning the Cure of encysted and other kinds of Tumours without the Knife*, 8vo. Lond. 1754. Abernethy's *Surgical Works*. Ph. Tr. Walther, *über die angeborenen Fetthautgeschwulsten und andere Bildungsfehler*. fol. Landshut, 1814. J. P. Weidmann, *Annotatio de Steatomatibus*, 4to. Maguntiaci, 1817. W. Hey, *Practical Obs. in Surgery*, p. 517. ed. 2. 8vo. Lond. 1810. Allan Burns, *Surgical Anatomy of the Head and Neck*, 8vo. Edin. 1811. This work contains much valuable information, respecting the extirpation of swellings about the neck. Schreger, *Chirurgische Versuche*, b. i. p. 297; Ueber Lipoma und Extripsio derselben. 8vo. Nürnberg, 1811. John Baron, *An Inquiry, illustrating the Nature of Tuberculated Accretions of Serous Mem-*

branes, and the Origin of Tubercles and Tumours in different Textures of the Body, 8vo. Lond. 1819. Also Illustrations of the Inquiry, &c. 8vo. Lond. 1822. *Sir Astley Cooper*, Surgical Essays, part ii.; and *Med. Chir. Trans.* vol. ii. *C. J. M. Langenbeck*, *Bibl. für die Chir.* b. ii. p. 312. Gött. 1808. Also Geschichte einer grösssen Speckgeschwulst welcher mit dem Unterleiste so fest zusammenhing, dass die Trennung mit der Säge verichtet werden musste: Neue *Bibl.* b. i. p. 265. 12mo. Hanover, 1817. *B. H. Jacobsen*, De Tumoribus Cysticis, 4to. Juno, 1792. *C. G. Ludwig*, *Monita de excisendis Tumoribus Tunica inclusis.* 4to. Lips. 1758. *R. Liston*, Cases of large Tumours in the Scrotum and Labium, removed by Operation: see *Edin. Med. Journ.* No. 77. *Armstrong's* Morbid Anatomy of the Bowels, Liver, &c. 4to. 1828. *B. Travers*, On the Local Diseases termed Malignant; in *Med. Chir. Trans.* vol. xv. *John C. Warren*, Surgical Obs. on Tumours, with Cases and Operations, 8vo. Boston, 1837. *Robert Liston*, Elements of Surgery, and, On Practical Surgery, 8vo. Lond. 1837.

TYMPANUM. For an account of its diseases, see *EAR*.

ULGERATION, is the process, by which sores, or ulcers, are produced in animal bodies. In this operation, the lymphatics are commonly believed to be at least as active as the blood-vessels; an ulcer being, according to the doctrines most prevalent, a chasm formed in some surface of the body by the removal of parts back into the system by the action of the former vessels. At first, it may be difficult to conceive how a part of the body can be removed by itself: but it seemed to John Hunter, that there was not more difficulty in conceiving this, than how the body could form itself. Both facts seemed to him equally well confirmed. When it becomes necessary that some whole living parts should be removed, it is evident, says he, that nature, in order to effect this object, must not only confer a new activity on the absorbents, but must throw the part to be absorbed into a state which yields to this operation. The absorption of whole parts in disease he refers to five causes:—pressure; irritation of stimulating substances; weakness; inutilty of parts; death of them. (*Hunter, on Inflammation*, &c. p. 442—446.)

Ulceration takes place more readily in the skin, mucous, cellular, and adipous tissues, than in muscles, tendons, ligaments, nerves, and blood-vessels. Hence in the progress of pus to the surface of the body, in consequence of the intervention of textures backward to ulcerate, ulceration often takes a circuitous course for the purpose of bringing the matter to the skin. (*Hunter*, p. 447—449.) Parts, at a considerable distance from the source of the circulation, are generally more disposed to ulcerate, than others situated nearer to the heart: hence, one reason of the greater number of ulcers on the lower, than the upper extremities. Here, however, another cause is likewise concerned, namely, the retardation and stagnant state to which the blood in the veins of the lower extremity is so frequently subjected. In this instance, as a great pathologist observes, probably ulceration does not take place till the venous blood, accumulated largely in the capillary vessels, excites by its presence an irritation, like that resulting from the presence of a foreign body. (See *Précis d'Anat. Pathol.* t. i. p. 190.) This cause has long been recognised by the practical surgeon, who daily sees instances of its operation in those ulcers denominated *varicose*.

New-formed parts, such as cicatrices, callus, and all adventitious productions, substances, and growths, are not fit to be absorbed. Thus, in Lord

to suffer from great privations, fatigue, the scurvy, &c., it was remarked, that such men as had formerly had ulcers and broken bones, became again disabled by their old sores breaking out afresh, and the provisional callus of their old fractures being removed. The adventitious matter is even more prone to be absorbed, than that which is a substitute for the old. Mr. Hunter explained this circumstance on the principle of weakness.

Mr. Aston Key adverts to three modes in which texture seems to modify the nature and course of this process: First, as it occurs in highly vascular structures; Secondly, in parts possessing a somewhat lower degree of vascularity; and, Thirdly, as it is observed to take place in parts endowed with the least degree of organisation. "The remarkable disposition to ulceration (says he) in those textures, that are well supplied with blood, must be obvious, if not familiar, to us all. In the mucous membranes it is especially observable. These parts abound in vessels of large size, and are liable, under moderate degrees of inflammation, to pass into the ulcerative state; the mucous lining of the intestine, holding a first rank among vascular structures, quickly ulcerates under some forms of muco-enteritis; that of the trachea, being somewhat less vascular, is less prone to ulceration. The lining membrane of the mouth speedily exhibits an apithous surface, or even a deeper extent of ulceration, from trivial causes of inflammation; and the gums, disposed as they are to ulcerate, have this disposition still further increased, when they become spongy and more vascular." (See *Med. Chir. Trans.* vol. xviii. p. 209.)

When ulceration takes place, in consequence of the death of an external part, it occurs first on the outer edge, between the dead and living substance.

A tumour, when it makes equal pressure in every direction around, will only make its way in an external course, because what Mr. Hunter termed interstitial absorption happens in no other direction. (P. 449.)

The parts, situated between an abscess, or any extraneous substance, and the nearest surface, are those which are most susceptible of ulceration. This is one of the most curious phenomena connected with the process under consideration. It shows that there is a principle in the human body, by which parts are always prone to free themselves from disease. Slight pressure from without will often produce a thickening of parts, and hence Mr. Hunter remarks, there even appears to be a corresponding backwardness to admit disease. (P. 449.) Both these facts, he observes, are shown in the case of fistula lachrymalis; for, though the matter is nearest the cavity of the nose, still it makes its way externally, by means of ulceration, while the Schneiderian membrane even becomes thickened, so as to become a barrier against the progress of the disease inward. (P. 451.)

Not unfrequently, matter forms behind the sternum, close to the pleura and pericardium, which membranes are extremely thin. From the proximity of these membranes, it might be expected, that the matter would generally open into the pleura, and, by discharging itself into the cavity of the chest, destroy life. Instead of this result, however, the pleura undergoes no other alteration, than that of becoming thickened; and while it is

acquiring this addition of substance, the process of absorption is going on in the inner part of the sternum, an aperture is formed through it, and the matter is voided externally. (See SUPPURATION.) The same fact is exemplified in abscesses between the peritoneum and abdominal muscles. Abscesses of the liver, however, generally burst into the stomach or bowels, which are nearer to them than the skin, and afford also a passage for their evacuation. (See *Sir Astley Cooper's Lectures*, vol. i. p. 132.) Thus, we find that an abscess, though close to a serous cavity, will not generally make its way into it by ulceration, because every serous cavity constitutes a shut sac, but if the pus be near a cavity lined by a mucous membrane, it may take this course, because in this direction there is always an outlet.

There is one difference between the advancement of an encysted tumour to the surface of the body, and the progress of an abscess in the same direction, viz. that the former does not excite ulceration of the cyst, but an interstitial absorption of the sound parts, between the cyst and skin, till the cyst and external skin come into contact, at which period inflammation takes place, and absorption becomes accelerated into ulceration. In an abscess, the progressive ulceration begins in the cyst, at the same time that the interstitial absorption in the sound part covering the matter is going on. (P. 452—457.)

The action of progressive absorption is to remove surfaces contiguous to irritating causes, which Mr. Hunter referred to pressure, irritation, and weakness. In cases of tumours, pressure becomes a cause. The buttocks and hips of persons, who lie long on their backs, often ulcerate. The heels of many patients, with fractures, who lie for a great while in the same position, frequently ulcerate. In the latter instances, Mr. Hunter conceives, that ulceration is a substitute for mortification, and is, at the same time, a proof of a certain degree of strength; for, if the patient's constitution were very weak, the same parts would mortify. (P. 453.) That pressure is a frequent cause of ulceration, is also evinced by the occasional effects of chains on prisoners, and harness on horses. That irritating substances produce ulceration, needs no illustration.

Whatever may be the lesion preceding ulceration, it must not be forgotten, as (M. Andral observes) that "its production, though the work of acute, or chronic stimulation, does not depend upon such stimulation alone, for by varying the degrees of the latter, a texture cannot always be made to ulcerate at option. The causes of ulceration are special conditions, which consist neither in the intensity, nor in the duration of the irritation, by which the process is constantly either preceded or accompanied. Frequently an extensive ulceration originates from a very slight, transient, and scarcely appreciable irritation; while in other instances, a most intense stimulation, such as is produced by the passage of concentrated acid into the stomach, or a stimulation of very long continuance, such as exists in the digestive tube of a person afflicted with a diarrhoea of long standing, does not give rise to any ulceration. There are moreover cases, in which ulceration cannot be regarded as the simple result of a local affection; and, like many other lesions of the circulation, nutrition, or secretion, it is only one of the modes

in which a general morbid state of the system is manifested, the existence of which is revealed by local lesions of the most different kinds, in respect to their seat and apparent nature. Thus, at the same time that, in scorbutic individuals, the blood has lost the power of coagulating, and hemorrhages are taking place from many parts, the skin and often the mucous membrane of the mouth are observed to be attacked with numerous ulcers. While also in scrofulous persons, the whole of the functions of nutrition and secretion are so remarkably altered, the skin, mucous membranes, and even the bones are invaded by ulceration. Who is not aware, that ulcers likewise form in many parts of the body from the abuse of mercury, which, on other occasions, is seen to cure them?" (See *Andral Précis d'Anat. Pathol.* t. i. p. 193.)

Progressive absorption may occur either with, or without suppuration. We have instances of the latter in cases of extraneous bodies, which travel about the body, without producing irritation enough to give rise to the secretion of pus. In the progress of aneurisms of the aorta, and of fungous tumours of the dura mater to the surface, the same fact is also illustrated. (P. 456.)

Absorption with suppuration, in other words, ulceration, either happens in consequence of suppuration already begun, in which event the pus acts as pressure; or else absorption attacks external surfaces from particular irritations, or weakness, in which case, suppuration must follow. (P. 456.)

The production of ulceration requires much greater pressure from without, than from within. The process is always disposed to take place more quickly, when the cause is near the surface of the body; and its progress becomes accelerated, in proportion as it arrives near the skin.

The adhesive inflammation precedes the suppurative, and prevents the pus from becoming diffused, as soon as it is secreted; and when the cyst afterwards ulcerates, in order to let the matter approach the skin, the adhesive inflammation still continues to go before the ulcerative process, and thus prevents the matter from insinuating itself into the interstices of the cellular substance. (P. 457.)

The pain of ulceration is, in some degree, proportioned to its quickness. When ulceration begins on a surface, or takes place for the purpose of bringing matter to the skin, the pain is always considerable. When ulceration takes place, in order to separate a dead part, as in sloughing, exfoliations, &c., there is seldom any great degree of pain. (P. 459.)

The ulcerating sore always exhibits little cavities, while the edge of the skin is scalloped, and thin, at the same time, turning a little out, and overhanging, more or less, the ulcerated surface. The face of the sore appears foul, and the discharge is very thin. When ulceration stops, the edges of the skin become regular, smooth, a little rounded, or turned in, and of a purple colour, covered with a semi-transparent white. (*Hunter, on Inflammation, &c.* p. 460.)

The Hunterian doctrine relative to the nature of ulceration, as noticed in the foregoing columns, does not at the present time command universal belief. Thus, M. Andral, after mentioning the common definition of ulceration, observes, that we are completely ignorant of its mechanism, the

lesions (or disorders) which precede it, being all that we can detect; as, for instance, what he terms hyperæmia, without alteration of nutrition or secretion; various affections of nutrition, morbid secretions, and gangrene. All those pathologists, who differ from Hunter respecting the functions of the lymphatics generally, cannot of course join in the views of the nature of ulceration, as hitherto most usually entertained in this country. Mr. Aston Key notices certain circumstances, which appear to him "to throw some doubt on the received opinion, that the absorbents perform the office of removing parts that are under the influence of ulceration, and to refer some share, if not the whole, of this action to the veins. It is by no means satisfactorily ascertained, what part the veins and absorbents respectively take in healthy, or nutritive absorption. In the absorption, produced by disease, the nature of the process is still less definitely understood; and it yet remains a problem for the physiologist to solve, whether the veins are not mainly engaged, or at least assist, the absorbents in the process of ulceration." Mr. Key, in corroboration of this suspicion, adverts to the fact, that all structures, previously to being removed by ulceration, become unusually vascular; as if a more complete development of the sanguineous tissue were essential to this mode of absorption. He is of opinion, likewise, that this view receives strong confirmation from the peculiar circumstances attending the ulceration of cartilage. Various observations and experiments are referred to by Mr. Key, in support of the doctrine, "that the functions of the absorbents is confined to nutrition, to the removal of interstitial fluids, and to the preservation of the form of the body during growth, or as Mr. Hunter termed it, modelling absorption; and that progressive absorption, or ulceration, is effected through the agency of the extreme branches of the venous system."

I have already cited the enumeration by M. Andral of hyperæmia, or of great vascular turgescence, amongst the causes of ulceration: Mr. Key informs us, that Sir Astley Cooper has in his collection an ulcer of the leg very successfully injected "in which the veins are developed in a remarkable manner. They are numerous and large, and surround the margin of the ulcer. There is also in his collection another ulcer, in which the absorbents of the leg have been injected; but they appear to be neither increased in size, nor in number. The absorbents, that, in a sound state of the limb, took their course through the site of the ulcer, are cut through by the disease, and each absorbent can be seen to terminate in a vascular granulation." (See *Key, in Med. Chir. Trans.* vol. xvii. p. 212.)

The following extract from Mr. Key's paper contains additional arguments in support of the view taken by him of the nature of the process of ulceration:—"The fibrous textures of the body (he observes) present a remarkable indisposition to ulceration; the length of time, required for the separation of a dead portion of tendon, or for the pointing of a superficial abscess, sufficiently evince this. The long resistance, which the intervertebral cartilage offers to the absorbent action caused by the pressure of an aneurismal sac, affords another example. The bones and the intervening ligaments of the spinal column are frequently eroded to a considerable extent, while the

fibro-cartilaginous structure often exhibits not any signs of incipient ulceration. In ligamentous fibre, the process appears to be accompanied with some peculiar circumstances. The ligament, instead of preserving its usual form and size, becomes distended, and feels pulpy. When cut into, the fibres are found to be separated from each other by a vascular structure, which, upon being injected, has a villous appearance. This interstitial vascular mass is the reticular membrane, that, in the healthy structure, unites the ligamentous fibres. Under inflammation, it becomes highly vascular, and assumes the appearance alluded to, while the fibres of the ligament retain their natural glistening appearance, until, in the progress of the disease, they at length become softened and pulpy, previously to their undergoing absorption. It is not improbable, that the ligamentous fibres themselves are passive in the ulcerative process, which, there is some reason for believing, is performed entirely by the vascular tissue that surrounds them.

"The most striking illustration of this passive condition of parts, that are undergoing the absorbing process, is afforded in the attempt made by nature, to remove a cylindrical bone, rendered necrotic by inflammation. In making a section of a limb in this state, the first circumstance, that arrests the attention, is the smooth and polished condition of that portion of the dead bone, which has been exposed to the atmosphere, while the other parts of its surface and its extremities present a number of holes, or indentations, as if worm-eaten. When the sequestrum is removed from its case of new bone, and the interior of the latter is exposed to view, a number of flocculent bodies are seen attached to a membrane, that supplies the newly formed bone. When injected, these are shown to be highly vascular, and are seen to fill the indentations in the dead bone. If the latter be carefully taken out of its case of new bone, these vascular elongations will be found to have a slight attachment to those parts of the dead bone, in which they are imbedded.

"It is by means of this organisation, that large cylindrical bones, when deprived of vitality, are found, in the course of time, to have undergone extensive absorption. The dead bone, having no power of self-removal, the surrounding living parts are called upon to perform the office of removing the useless and offending mass. For this purpose, the inner layer of the new structure, which is to supply the place of the old, is furnished with an organisation capable of its removal; it becomes extremely vascular, resembling those structures, namely the villous, which are known to possess in a remarkable degree the ulcerative disposition. The removal of dead bone, under these circumstances, has been attributed to a solvent power in the fluids effused. Were this the cause of the gradual disappearance of the bone, its surface would be more uniformly dissolved, and would not present that worm-eaten appearance in those parts, to which the projections of the membrane are most closely applied. 'In a manner, analogous in many respects to the process of removing dead bone, does nature achieve the task of absorbing the cartilaginous structure covering the articular extremities of bones.'" (See *Med. Chir. Trans.* vol. xviii. p. 214.) Mr. Key's description of the process of ulceration in cartilage having been already noticed in another article (see *JOINTS, DISEASES OF*) it is not

necessary here to repeat it further, than to observe, that cartilage being, according to Mr. Key, indisposed to ulceration from the low degree of its organisation, is acted upon by the newly organised synovial surface, which is rendered highly vascular, and, by means of its villous processes, forms, in the scrofulous kind of ulceration, a groove in the edge of the cartilage, thus commencing the work of destruction. When suppuration follows acute inflammation from a wound of the synovial membrane, the surface of the latter part becomes highly vascular, and in most parts covered with a new deposit of adhesive matter, which adheres firmly to it. The new surface is irregular, wanting the polish of the original membrane, and appears in many parts villous, or furnished with vascular fringed projections. In a joint, thus far advanced in disease, the only mode of reparation, consists in the production of ankylosis. To this end, the removal of the cartilage is an essential step; which seems to Mr. Key, to be accomplished through the intervention of the newly organised surface of the inflamed synovial membrane. "The cartilage, under these circumstances; is not only eroded at the edge where the synovial membrane is reflected from it, but grooves and indentations may be traced in various parts of it."

In another paper, of later date, Mr. Key makes some change in the theory, adopted by him, respecting the process of ulceration; which, he regards, in its strict signification, "not as an absorbent action, but as a process of degeneration, or a softening of tissue, analogous to that action, by which the medullary part of the brain, and scrofulous tubercles become converted into a purulent mass." (*Op. cit.* vol. xix. p. 135.) And again, "it is a degeneration of tissue; a change in the affinities existing between its component parts, by which it becomes changed from a solid organised texture to a fluid inorganic mass. It differs from gangrene in being a vital action; while gangrene, by at once producing death in a part, prevents any such change taking place. In gangrene, the supply of blood to the part altogether ceases, while the integrity of tissue is preserved: under ulceration, the circulation in the vessels continues during the action, and the part still belongs to the living mass, and remains under the influence of vital action, until its separation is completed." (P. 137.)

Mr. Key, after expressing his belief, that there is a want of proof, that absorption is in any way concerned in the formation of an ulcer, and that ulceration is a work of disintegration, or degeneration of tissue, introduces the following argument in support of the view, which he himself entertains:—"The supposition, that nature carries into the circulating system noxious matters and poisoned tissues, which can be more effectually and more safely got rid of by other means, is carrying analogy beyond the bounds of probability; but, if the formation of an ulcer be an act of absorption, the parts, that are removed in the formation of a chancre, are so disposed of: the absorbents, in forming a chancre, carry into the system tissues tainted by the venereal poison, and must therefore in every instance contaminate the whole mass of circulating fluids. That an action, so deleterious to the system, should uniformly accompany the formation of every venereal sore, is highly improbable; and, if it were so, a bubo ought to be one of the earliest accompaniments of

chancre. But, during the ulcerative stage of chancre, the glands in the groin usually remain free from infection: it is when the ulcerative stage is at an end, that the gland enlarges and bubo forms. In other words, when the absorbents are most actively engaged in producing the ulcer, and in carrying the poisoned mass into the gland, the latter exhibits no sign of irritation; but when the absorbents are inactive, the gland begins to enlarge. It is a fact, which every surgeon can bring to his mind, that, during the most active stage of phagedænic venereal sores on the penis, a gland rarely enlarges; and that bubo is only to be apprehended during the granulating stage of chancre.

"Ulcers of all kinds, if closely watched in their formation, clearly exhibit the breaking up of the tissue, and its gradual conversion into pus. In the earliest stage of an ulcer, before the vesicle has burst, or the skin given way, the extent of substance lost is always compensated for by the amount of fluid formed. In its progress, when rapid, and when a large portion of structure is quickly destroyed by ulceration, a corresponding quantity of pus may be always seen to occupy its place; and when the action is more chronic, as in fibrous structures, the debris of the tissue can be seen mixed with the purulent fluid." Mr. Key further maintains, that observation of the process by which a dead is separated from a living part, will prove, that this, like others that have been improperly attributed to absorption, is an act, in which the absorbents do not take a part. (*See Med. Chir. Trans.* vol. xix. p. 139 -142.)

The late Mr. Wallace, of Dublin, is another writer, to whom the Hunterian theory of ulceration seemed to be erroneous. The process, as well as that of mortification, appeared to Mr. Wallace to consist of two distinct, though connected actions: "one, by which the substance, about to undergo ulceration, or to be removed by the process of mortification, is converted into an apparently new texture; and the other, a process, by which this texture, when so altered, is afterwards separated from its connection with the living structure. In ulceration (says he), the removal of the altered texture is accomplished by a further change of this texture into a liquid; while, in the process of sloughing, the slough, or altered texture, is thrown off in a more or less solid mass. In fact, the preparatory stage, as it were, or the stage of the conversion of the texture, which is to be removed into a new kind of substance, is essentially the same in the process of sloughing, as in the process of ulceration. It is only in the mode, in which the altered structure is thrown off, and, in the relative quantity of this altered structure, that any difference seems to exist between these processes. When the altered structure is formed in comparatively large masses, and is separated in thick and visible portions, more or less solid, the process is named sloughing, or mortification, and the portion thrown off, is named a slough; but, on the other hand, if the portion, which has been changed in its structure, preparatory to its separation from the body, forms only a very thin stratum, often almost imperceptible on the diseased surface; and, if it be liquified, as it were, as fast as the change of texture occurs, the whole process is called ulceration; the surface, from which the substance has been separated, is named an ulcer; and the separated sub-

stance is mixed in a fluid form with those exhalations, or secretions, from the orifices of opened vessels, which are called sanies, sordes, pus, &c."

"It may probably be said, in opposition to the preceding account of the actions, which compose ulceration, that the stratum of morbid texture, which it has been affirmed always covers the surface of ulcers, is not to be observed. To this (says Mr. Wallace), I reply, that, with the assistance of a magnifying glass of moderate powers, we may always detect, upon an ulcerating surface, a stratum of matter more or less solid, and sometimes semi-transparent, formed by the original texture in progress to liquefaction. This stratum may be easily distinguished from the lymph, which covers the surface of ulcers, after the process of ulceration has ceased, and that of reparation has commenced. Moreover the frequency, with which the processes of ulceration and sloughing are united, the quick and reciprocal succession, or alternation of these processes, and also the occasional occurrence of certain states, which bear as much resemblance to sloughing as to ulceration, not only demonstrate clearly and decidedly the close relation of ulceration and sloughing, but also afford examples of surfaces, covered by strata of sloughy substance of every degree of thickness, and consequently the gradual transition from the state of ulceration to the state of sloughing." (On the Venereal Disease, p. 48.)

The conversion of the sloughing matter into a liquid, which forms the peculiar character of ulceration, seems to Mr. Wallace to be in some measure a vital process; and therefore, whenever the process of destruction extends very rapidly, there is not time, before the part is entirely deprived of life, for the completion of the process of liquefaction. Under these circumstances, he conceives, sloughing necessarily takes place: for the process of softening, or ulceration, cannot occur, unless where the sloughing matter is in contact with parts possessing full powers of life, and where, as we may suppose, its vital action still exists in sufficient force to produce, or support this process. Were Mr. Hunter's opinions of the process of ulceration correct—which opinions imply absorption—Mr. Wallace argues with Mr. Key, that, in cases of chancre, contamination of the system would always follow ulceration; which is not the case: and that, not only may a chancre exist without absorption, and therefore without contamination of the system, but that, so long as the process of ulceration continues, it is extremely probable, that no absorption can take place from the ulcerating surface, and that such surface must have become a granulating one, before it acquires the power of absorbing. This view leads Mr. Wallace to offer some practical inferences respecting the character of glandular swellings in the groin, deduced from the consideration of the stage of chancre, in which they form; those of early appearance seeming to him to be more likely to be the effect of irritation, than of the absorption of the virus. (P. 51—53.)

The foregoing gentlemen are not the only disbelievers in the Hunterian theory of ulceration: Mr. [redacted] Earle, Mr. Samuel Gaskell, of Manchester, whose excellent Dissertation on the Nature of Suppuration and Ulceration, has just obtained the Jacksonian prize; and perhaps the greater number of the continental pathologists, adopt a doctrine entirely different from that of Hunter. Mr. W. J. [redacted] appears to regard the process of ulceration

only as a modification of mortification: instead of the death of a large piece taking place at once, (he observes), a minute portion may die first, and the death of numerous other minute portions may happen in succession, with more or less rapidity. This is the most frequent variation of the mode, in which mortification occurs; and constitutes the disease, which is commonly known by the term, *ulceration*. (See *London Med. Gaz.* for 1835, vol. xvi. p. 254.) Sloughing phagedæna, he regards as a process, in which there is a successive death both of minute and of tolerably large portions, chiefly of skin and cellular tissue; although no texture appears to be exempted.

So far as I am able to judge, the dissertation of Mr. Samuel Gaskell, illustrated as it is by a series of beautifully executed preparations, is one of the best documents, which have yet been composed against the Hunterian theory of suppuration and ulceration: and I hope, that so meritorious a paper, which I had the pleasure of reading as one of the Jacksonian Committee, will shortly be submitted to the judgment of the profession.

ULCERS. Surgeons usually define an ulcer to be a solution of continuity in any of the soft parts of the body, attended with a secretion of pus, or some kind of discharge. "A granulating surface, secreting matter," has been proposed as a definition. (Sir A. Cooper, *Lectures*, &c. vol. i. p. 182.) which is very applicable when ulcers have formed granulations, but cannot include cases, in which the effects of ulceration are extending, and the granulating process has not yet commenced.

Here, it will be unnecessary to speak of several kinds of sores, treated of in other articles. (See CANCER, CANCRUM ORIS, CHILBLAIN, FISTULA, HOSPITAL GANGRENE, LUPUS, OZENA, SCROFULA, SINUS, and VENEREAL DISEASE.)

Ulcers are divided into *local* and *constitutional*. However, it is only within certain limits, that this distinction is well founded; for, an ulcer, which is at first completely local, may in time affect the system, so as to become constitutional; and ulcers, which derive their origin from some general affection of the system, may remain after the removal of the constitutional disorder by which they were originally produced. (See *Thomson, on Inflammation*, p. 427.)

"Ulcers (says Dr. Thomson) have usually been distinguished from each other by the causes by which they are induced, by the symptoms which they exhibit, and by the parts of the body in which they occur. The want of a disposition to heal in a suppurating surface may depend upon some specific action in the cause from which it proceeds, upon something peculiar in the constitution of the patient in whom it exists, or merely upon an improper mode of management: and, hence, the distinction, that has long been made of ill-conditioned sores, or ulcers, into those which are *specific* in their nature, and into those which are *simple*."

"Specific sores, or ulcers, may be occasioned by specific poisons, or by particular diatheses. The sores, or ulcers, which arise from specific poisons, may be either *local*, that is, confined, like a primary syphilitic ulcer, to one spot; or *constitutional*, that is, liable to occur in any part, texture, or organ, such as secondary syphilitic ulcers. Of diatheses, predisposing to ulcers, we have ex-

amples in the scrofulous, scorbutic, and arthritic diatheses, and also in the syphilitic diathesis, or that which arises not unfrequently in those, who have had syphilis, from the too free and injudicious use of mercury.

"Every ulcer, strictly speaking, is of a local nature; but, there are ulcers, which, though necessarily local in their appearance, are connected with, or dependent upon, diseases, which affect the general system. These ulcers ought to be regarded as modifications of, or forms in which the diseases appear, with which they are connected. Considered in this light, it is obvious, that specific ulcers can be treated of with propriety, only under the head of the diseases, to which they respectively belong.

"We call those ulcers *simple*, which do not appear to proceed from any specific disease, or morbid diathesis existing in the constitution of those, in whom they take place. They are usually solitary occurrences, and the consequences of accidental injuries, and improper modes of management. They may occur in every part of the body, but they appear most frequently upon the lower extremities."

Professor Thomson afterwards remarks, that "the appearances, which different ulcers exhibit, seem, at first view, to afford an excellent foundation for distinctions among them; and so they undoubtedly do in many respects."

"But (says he) it is to be regretted, that the characters, upon which the distinctions of ulcers, as well as of many other local diseases, are founded, are neither very uniform in their appearance, nor very easily distinguishable from one another. Not only are the local appearances, which present themselves in simple ulcers, liable to great variations in the different stages of the same individual affection, but they are often apparently the same with, or at least not easily distinguishable from, those which occur in specific diseases, and which require, for their cure, peculiar modes of treatment. It is this circumstance, which renders it so necessary for us, in endeavouring to distinguish and to cure ulcers, to avail ourselves of all the information, which we can procure from the history of the ulcer, from the nature of the exciting cause, by which it has been induced, and from the effects of the remedies, which have been employed, as well as from the particular appearances, which the ulcer itself exhibits."

In noticing another ground of distinction among ulcers, or that derived from the parts in which they occur, Dr. Thomson observes, that "every texture and organ of the body possesses physical and vital qualities peculiar to itself; and these qualities must necessarily modify the appearances, which each texture and organ respectively exhibits in the state of disease. Specific diseases render some parts more liable, than others, to attacks of ulceration. Thus secondary syphilis appears most frequently in the throat; scurvy in the gums; cancer in the lower lip; and lupous and scrofulous ulcerations in the upper lip, or in the nose. Cancer seldom or never appears primarily in the upper lip; but syphilis, when it attacks this part, puts on many of the appearances of cancer;" a fact, which Dr. Thomson says, he first learned from Mr. Pearson. (*On Inflammation*, p. 427—430.)

In the treatise published by Sir Everard Home, ulcers are divided into six principal kinds, viz.

1. Ulcers in parts, which have sufficient strength to carry on the actions necessary for their recovery.

2. Ulcers in parts, which are too weak for that purpose.

3. Ulcers in parts, whose actions are too violent to form healthy granulations, whether this arise from the state of the parts, or of the constitution.

4. Ulcers in parts, whose actions are too indolent, whether this arise from the state of the parts, or of the constitution.

5. Ulcers in parts, which have acquired some specific action, either from a diseased state of the parts, or of the constitution.

6. Ulcers in parts, which are prevented from healing by a varicose state of the superficial veins of the upper part of the limb.

Although I have chosen, in the subsequent columns, to adopt this nomenclature, in order to be able more conveniently to notice many of the observations of Sir Everard Home, I am perfectly aware of its being on some accounts objectionable, but, especially, because it assumes hypotheses, the truth of which can never be established, nor proved. This is one of the considerations, which induced Professor Thomson to prefer the old names. *Op. cit.* p. 435—438.)

The classification of *local* and *constitutional* ulcers, *specific* ulcers, *healthy* ulcers, *indolent*, *inflamed*, *sloughing* and *cachectic*, will also comprehend every description of sore. (See *Mayo's Human Pathology*, p. 260.) An arrangement, nearly like this, is what I usually follow in my lectures at University College.

OF ULCERS IN PARTS, WHICH HAVE SUFFICIENT STRENGTH TO CARRY ON THE ACTIONS NECESSARY FOR THEIR RECOVERY:—SIMPLE, OR HEALTHY ULCERS.

In this species of ulcer, the pus is of a white colour, thick consistence, and readily separates from the surface of the sore, and when diluted, and examined in a microscope, is found to be made up of small globules, swimming in a transparent fluid. The granulations are small, florid, and pointed at the top. As soon as they have risen to the level of the surrounding skin, those, next to the old skin, become smooth, and are covered with a thin, semi-transparent film, which afterwards becomes opaque, and forms cuticle.

In the treatment; it is only necessary to keep the surface clean, and the part quiet; and if it be the leg, in a somewhat elevated position, to promote the free return of the venous blood through the limb. Great benefit may be produced by the application of dry lint, for the purpose of absorbing and retaining the matter, which serves as a soft covering for the granulations, and by putting over the lint a pledget of any simple ointment, in order to hinder the matter from evaporating; by which means the dressings will be prevented from becoming adherent, and may be easily taken off, as often as requisite.

Although healthy ulcers require no medicated application, the dressings must be such as do not disagree with the granulations, or with the surrounding skin.

In some patients, a roller, applied with mode-

rate tightness, with the view of retaining the dressings, will cause uneasiness, and make the ulcer lose its healthy appearance. Sir E. Home met with several cases of this kind, in which the proper appearance of the sore returned as soon as the bandage had been discontinued.

In some patients, ointment irritates and inflames the neighbouring skin; and certain superficial ulcers will not heal, while kept in a moist state, and unexposed to the air; but heal, when allowed to become dry and covered with a scab.

These peculiarities are referred by the preceding author to constitutional causes, and not disease; for, the ulcers heal as soon as the particular things, which disagree with them, are discontinued. These peculiarities in certain healthy sores may also attend others of a different description, and should always be discriminated from the effects of disease.

1. Applications in the form of vapour, and fomentations, should never be employed, as they render the texture of the granulations looser, and diminish the disposition to form skin.

2. With respect to fluid applications, Sir E. Home condemns poultices, as well as fomentations. In University College Hospital, however, the simple water-dressing is the usual application for common healthy ulcers, and, when the granulations require to be repressed, or stimulated, the red-wash, consisting of a solution of two or three grains of sulphate of zinc, coloured with a few drops of tincture of lavender, is employed by means of lint, which is kept from becoming dry by being covered with a piece of oiled silk. In some cases, nitrate of silver is used, and a roller.

3. In regard to ointments, their only use, like that of oiled silk, in cases of healthy ulcers, is to keep the matter from evaporating. The most simple are the best for the purpose; particularly that composed of white wax and olive oil.

Ointments sometimes disagree with the skin, even when recent, and free from all rancidity. But when they have acquired the latter quality, they are sure to create a great degree of irritation.

4. With respect to applications in the form of powder, Sir E. Home remarks, that when it is desirable to form a scab on the ulcer, any inert powder may be sprinkled on the sore; but he prefers dry lint. Nothing should touch the powder, or lint; and, to prevent this circumstance, Sir E. Home recommends applying little bolsters on both sides of the sore, and over them a roller, which will go from one bolster to the other, in the manner of a bridge.

For healthy ulcers, dry lint, covered with a pledget, or else the water-dressing, covered with oiled silk, may be regarded as being upon the whole the most eligible application. When the sore does not secrete pus enough in twenty-four hours to moisten the lint, the dressings are to be changed only every other day.

When a moderately tight bandage is not forbidden by constitutional peculiarities, it is useful, both in supporting the muscles and skin, which are often in a flabby state from the unexercised state of the limb, and in defending the newly-formed

of the co. ulcers are small, and free from inflammation, the discharge is little, and the parts not liable to much motion, or friction, Mr. Higgin-

bottom applies the nitrate of silver to the sore, and also very lightly over the surrounding skin: he then covers the part with gold-beater's skin, and directs it to be exposed to the air. On the following day, he makes an incision with a lancet, in the centre of the eschar, and discharges the fluid under it. The sore is then left to heal under the eschar. (See Higginbottom, on Nitrate of Silver, p. 112. ed. 2.)

ULCERS IN PARTS, WHICH ARE TOO WEAK TO CARRY ON THE ACTIONS NECESSARY FOR THEIR RECOVERY.

This is the second of the classes, into which Sir Everard Home divided ulcers in general.

The granulations of these sores are larger, more round on their external surface, and of a less compact texture than those formed on ulcers in healthy parts, and present a semi-transparent appearance. When they have filled up the cavity of an ulcer to a level with the surface of the body, they do not readily form skin, but, rising up in a still higher manner, often lose altogether the power of producing that texture. When the parts are still weaker, the granulations sometimes continue gradually to fill up the hollow of the ulcer, and then, all on a sudden, are suddenly absorbed, so as to leave the sore as deep as it was before.

Ulcers may be weak from the first, or become so in the progress of the case. Even granulations of the most healthy kind, if they are not covered by skin in a certain time, gradually lose their primitive strength.

Sores on the legs are greatly under the influence of all natural peculiarities of the constitution, and every thing which affects the health. When the constitution becomes in the least weaker or stronger, the appearance of the granulations is changed accordingly; and this effect of constitutional weakness, or strength, on ulcers, is greater in proportion as the sores are further from the source of the circulation.

While the constitution is undergoing any kind of disturbance, the healing of an ulcer is retarded, or suspended. Mental anxiety frequently interrupts cicatrization.

Such effects of internal or constitutional circumstances on ulcers are greater in weak and delicate persons, than in the strong and robust. Change of weather has considerable influence over the healing of sores. Sir E. Home mentions, in proof of this fact, that when there were several hundreds of ulcers in the Naval Hospital at Plymouth, in 1778, every time the weather changed from a dry to a moist state, the ulcers universally assumed an unhealthy appearance; but put on a better aspect when the weather became dry again.

In the treatment of this kind of ulcer, tonics are to be exhibited, particularly bark, quinine, and steel medicines, and every thing which disagrees with the constitution is to be avoided. Wine and cordial medicines are also usually prescribed. Porter, however, is deemed better than wine, for working people.

Sir E. Home considers, that the first object, in the local part of the treatment is to keep the granulations from rising above the edge of the surrounding skin. It is far better practice to prevent the granulations from ever becoming too high by the employment of proper applications, than follow the common plan of destroying the high gra-

granulations with escharotics, after they have risen to an improper height. There cannot be the smallest doubt, that if the granulations could always be prevented from rising up too much, the patient would suffer a great deal less pain.

Instead of applying to the surface of the ulcers, now under consideration, nitrate of silver, sulphate of copper, or red precipitate, Sir E. Home prefers mixing these escharotics with other substances, so as to render them only strong stimulants, and using them in this latter form. He conceives, that, when the high granulations are destroyed with escharotics, the disposition of the surface underneath to reproduce them is increased, but, that this is not the case, when the luxuriant parts are only stimulated, so as to become absorbed. He believes, that when animal substances grow with great rapidity, they are, like vegetable ones, weaker, than when produced in a slower manner. Hence, he is of opinion, that the growth of granulations ought to be checked in the early stage of their formation, by some resistance, which they are just able to overcome; under which circumstances they derive strength from the limited increase of action, which they are obliged to undergo. On the same principle, the pressure of tight bandages seems to him advantageous; and ulcers, which heal while the patient is walking about, are not so apt to break out again as others, healed while the parts are in a state of perfect rest.

In the treatment of these ulcers, when the granulations have been reduced to a proper height, but do not form a thin, semi-transparent pellicle upon their surface, they are to be considered as weak parts, and treated accordingly. In this circumstance, when no particularity of constitution forbids, Sir E. Home recommends pressure, made with a thin piece of lead over the dressings, and supported with a tight bandage.

Amongst the impediments to the healing process, Sir A. Cooper notices the *languid state of a sore*, denoted by the glassy, semi-transparent appearance of the granulations, already described. The dressings enumerated by him for the improvement of an ulcer in this condition, are, the ung. hydr. nitrico-oxydi, which, however, is said to produce a thickening of the cuticle at the edge of the sore, preventing the growth of the granulations at that part, and requiring the application of the ung. hydr. fort. for its correction; a lotion of the sulphate of zinc, two grains to one ounce of water; a solution of the sulphate of copper, one grain to an ounce of water; and a solution of one grain of oxy muriate of mercury in an ounce of lime-water. A roller is to be applied, the diet is to be nutritious, and the patient to take exercise. (*Lectures*, vol. i. p. 187.) No ulcer receives more benefit than this, from the plan of keeping the leg moderately elevated on an inclined plane, so as to render the return of the venous blood free and quick.

OF APPLICATIONS TO ULCERS ATTENDED WITH WEAKNESS.

Although, strictly, we have no topical applications, which can directly communicate strength to granulations, there are certainly some which prevent the granulations from exhausting themselves by luxuriant growth, and stimulate them to draw more blood from the arteries; which effects,

as Sir E. Home remarks, render such granulations stronger.

1. This gentleman condemns, as applications to weak ulcers, all relaxing fomentations commonly employed; and recommends, instead of them, the use of spirits of wine, and the decoction of poppies, in equal proportions, but not to be applied hot.

2. With regard to moist applications, the same gentleman expresses his disapprobation of poultices; and mentions a weak solution of the nitrate of silver as the most eligible application.

3. On the subject of powdered substances, as applications to weak ulcers, Sir E. Home says, he has often tried bark, and the lapis calaminaris, without perceiving that the former had any power of strengthening granulations, or the latter any virtue in disposing them to form new skin; properties commonly imputed to these applications.

Sir E. Home entertains no better opinion of plaster of Paris, or powdered chalk, employed with the view of promoting the formation of skin. Powdered carbon, he speaks of as being more adapted to irritable, than weak ulcers. He praises powdered rhubarb, as particularly applicable to the latter kind of ulcer, because it represses the luxuriant growth of the granulations, renders them small and compact, and disposes them to form skin. When, however, the granulations have risen above the level of the skin, it is not powerful enough to reduce them. When the rhubarb is too stimulating, it is to be mixed with a fourth part of crude opium, in powder.

A piece of lint, a little less than the sore, is to be put over the powder, and covered with a pledget of simple ointment.

4. Ointments, according to Sir E. Home frequently disagree with weak ulcers. When other applications fail, however, greasy ones may be tried, and the above gentleman gives a preference to the ung. hydrarg. nitrat. mixed with hog's lard, in the proportion of one to five, or else to common cerate, blended with a small quantity of the red precipitate of mercury.

OF ULCERS IN PARTS, WHOSE ACTIONS ARE TOO VIOLENT TO FORM HEALTHY GRANULATIONS, EITHER FROM THE STATE OF THE PARTS, OR THE CONSTITUTION: — IRRITABLE, GANGRENOUS, OR SLOUGHING ULCERS.

There are three states of the constitution influencing the nature of ulcers: an irritable state, in which all the actions of the animal economy are more rapid than in health; an indolent state, in which they are unusually languid; and, lastly, a diseased state, by which they are affected.

An irritable and an indolent ulcer cannot in general be distinguished from each other by mere appearances, though they may be so in a few instances. Sir E. Home states, that the disposition of an ulcer, like the disposition of a constitution, can only be accurately ascertained by determining the actions, which arise from the different impressions made upon it. The following appearances, he says, at once show the ulcer to be of an irritable kind:—The margin of the surrounding skin being jagged, and terminating in an edge, which is sharp and undermined. The bottom of the ulcer being made up of concavities of different sizes. There being no distinct appearance of granulations, but a whitish spongy substance, covered

with a thin ichorous discharge. Every thing that touches the surface gives pain, and very commonly makes it bleed. The discharge is altered from common pus to a thin fluid, in proportion to the degree of irritability communicated to the sore by constitutional causes. In general, the pain of an irritable sore gradually becomes less. When it is not constant, but comes on in paroxysms, chiefly in the evening, or night-time, with great violence, convulsive motions of the limb are apt to occur, and extend to various other parts.

When these signs of an irritable ulcer are absent, we must form a judgment of the nature of the sore, from the history of the case, the effects of various applications, &c. When this history cannot be obtained, Sir E. Home recommends the treatment to begin on the supposition of the ulcer being of an irritable nature.

The gangrenous, or sloughing ulcer is frequently only one stage of the irritable one, and is therefore frequently met with in persons, whose constitutions have been hurt by intemperance. It occurs, also, as Sir A. Cooper has related, amongst persons emaciated and reduced by extreme want. The surface of the sore is dry, its edges have a livid appearance, with small vesicles on them, and the patient suffers much from irritative fever.

When an ulcer occurs just over the malleolus externus, it is generally of an irritable kind, in consequence of the nature of the part on which it is situated, quite independently of any constitutional or local disposition to irritability. Sir E. Home conceives, that the periosteum, which here lies immediately under the skin, becomes the seat of the ulcer, is the cause of its being very difficult to heal, and gives it the irritable appearance. The fact, that sores, situated on the ligament of the patella, and over the periosteum of the anterior surface of the tibia, assume a similar appearance, and are equally difficult to heal, made him more confirmed in this view.

As internal medicines, Sir A. Cooper praises calomel and opium; one grain and a half of the former, and one of the latter, morning and evening. By some practitioners, the compound decoction of sarsaparilla seems also to be regarded as a good medicine for lessening constitutional irritability. (*Lectures*, 8c. vol. i. p. 195.)

In treating ulcers in general, the surgeon will find it advantageous to be acquainted with the effects of many external applications; for few cases will continue to heal beyond a certain time, without some alteration in the treatment. The necessity of changing the applications, after they have been continued for a certain time, is strikingly illustrated by the fact, that leaving off a powerful application and employing one, which at first would have no effect, often does a great deal of service. When the change is made to a medicine of powers equal to those of the previous one, the benefit will be more lasting, than in the preceding circumstance.

OF APPLICATIONS TO IRRITABLE ULCERS.

1. Sir E. Home recommends applications in the form of vapour, as allaying irritation, and soothing pain. The steam of warm water is productive of benefit in this way. Its good effects being sometimes increased, when the water contains a proportion of camphorated spirit. Sir E. Home speaks also in favour of fomentations, containing opium; such

as the tincture of opium sprinkled on flannel, wrung out of warm water; or the application of flannels, wet with a warm solution of the extract of opium, or with a decoction of poppy-heads. A decoction of chamomile flowers, the tops of worm-wood, or hemlock leaves may also be employed for the same purpose. He refers, however, to particular irritable ulcers, which are rendered more painful by warm applications; and he states, that the sores alluded to are generally attended with a mottled purple discolouration of the limb, for some way from them, and a coldness of the lower part of the leg, and that they are often disposed to mortify; which event is promoted by warmth.

2. As for moist applications, the poultice made of linseed meal is the most simple, and most easily made; and, as it does not require any addition of oil, is to be preferred, when this disagrees with the sore.

Sir E. Home does not say much in favour of the use of liquor plumbi acetatis diluted in poultices; for, though he allows, that it often answers very well, he adds, that it also frequently disagrees with the ulcer, and, if long used, is apt to bring on the lead-colic. The decoction of poppy-heads is sometimes used in making poultices for irritable ulcers.

The carrot-poultice is also found to agree with many sores of this description.

If poultices be employed, their use is to be continued so long as the granulations are small, and the ulcer is rapidly diminishing in size, and even till cicatrization is complete. When the granulations become large, and loose in their texture, poultices should be discontinued.

When the weight of poultices prohibits their use, Sir E. Home advises the trial of lint, dipped in one of the following lotions, and covered with a pledget of some simple ointment; a solution of the extract of opium; a decoction of poppies; the tincture of opium; a decoction of cicuta; the liquor plumbi acetatis dilutus; or a weak solution of the argemum nitratum.

3. On account of the weight of the poultice, the tepid water-dressing, covered with a piece of oil-silk, is frequently to be preferred.

4. Powdered applications are generally too stimulating for irritable ulcers. Carbon has been found useful; so has powdered extract of opium, mixed with an equal quantity of carbon, or linseed flour. However, opium occasionally affects the constitution, in consequence of absorption, and it has been known to excite violent inflammation, ending in mortification.

5. Ointments are not often proper applications for irritable ulcers, as they are generally more or less, rancid, and mostly disagree with the skin. According to Sir Astley Cooper, however, the following ointment agrees well with such cases; R Ung. cetacei, ung. hydr. nit. aa ʒ ss. Pulv. opii. ʒj. M. (*Lectures*, vol. i. p. 194.)

6. The pressure of bandages is generally hurtful to irritable sores, though a slight degree of it proves serviceable to certain ulcers, which are somewhat less irritable, and arise from weakness.

When an ulcer is gangrenous or sloughing, or phagedenic, one of the best applications is the nitric acid lotion (50 drops of the acid to a quart of water.) Lint is to be dipped in it, laid over the sore, and then covered with a piece of oiled silk, so as to keep it wet several hours, the recumbent posture being

observed. (Sir A. Cooper, *Lectures*, &c. vol. i, p. 191.) This gentleman also gives internally, three times a day, twenty drops of the tincture of opium, and 10 gr. of carbonate of ammonia, with an ounce and a half of camphor mixture, and a little of the compound tinct. of cardamom seeds. Here, the exhibition of acetate or muriate of morphia is advantageous.

In University College Hospital, many ulcers of the latter kinds are dressed with lint dipped in the undiluted nitrous acid, which destroys the old surface, and leads to the production of a new one, in which the granulating process often goes on favourably.

I have had no experience of Mr. Higginbottom's plan for inflamed ulcers: after clearing out the bowels with calomel and a purging draught, he applies the nitrate of silver to the inflamed and ulcerated surfaces. He then covers the sore with lint, and every part of the inflamed surface, with the following ointment, spread on linen, which is covered with a roller: *Re Empl. Plumbi lbij olei oliv. lbj cretae pptt ʒ xviii Aceti Destillat. lbj.* The acid and chalk are well mixed in a mortar, and the lead plaster and olive oil, having been slowly mixed together, are then to be added, and the whole stirred together till cool. (*On Nitrate of Silver*, p. 118.)

So important is position in these cases, that, unless the leg be kept quiet, and in a position favourable to the return of the venous blood from it, very frequently all other means prove unavailing.

OF ULCERS IN PARTS, WHOSE ACTIONS ARE TOO INDOLENT TO FORM HEALTHY GRANULATIONS, WHETHER THIS INDOLENCE ARISES FROM THE STATE OF THE PARTS, OR OF THE CONSTITUTION:—THE CALLOUS ULCERS OF SEVERAL WRITERS.

The indolent ulcer forms in its appearance a complete contrast to the irritable one. The edges of the surrounding skin are thick, prominent, smooth, and rounded: the surface of the granulations is smooth and glossy. The pus, instead of being of a perfect kind, is thin and watery, being composed of a mixture of pus, and coagulating lymph. The lymph consists of flakes, which cannot be easily separated from the surface of the sore. The bottom of the ulcer forms quite a level, or nearly so; and, as Sir E. Home very accurately remarks, the general aspect conveys an idea, that a portion of the skin and parts underneath it has been removed, without the exposed surface having begun any new action to fill up the cavity.

When, however, the indolence of the ulcer is not so strongly marked, the sore does not correspond to the preceding description, but resembles in appearance the ulcer, which possesses an inferior degree of irritability, and can only be discriminated from it by receiving benefit from soothing applications.

The circumstance of certain indolent sores presenting the appearance of irritable ones, is, in some degree, explained by ulcers always being influenced by changes in the constitution, and accidental circumstances affecting the parts.

Most of the ulcers, seen in the London hospitals, are of the indolent kind. This indolent disposition may proceed altogether from their long existence; and hence, Sir E. Home justly observes, it is immaterial whether at first the sore were healthy, weak, or irritable; for, if not cured within a certain

time, it becomes indolent, with the exception of a few of the irritable kind, which never change their nature.

Indolent sores do form granulations; but these, every now and then, are all on a sudden absorbed, and, in the course of four and twenty hours, the sore becomes as much increased in size, as it had been diminished in as many days, or weeks. This absorption of the granulations arises principally from their not being of a healthy kind; but the event is promoted by changes in the weather, anxiety, fatigue, &c.

The object in the treatment of indolent ulcers is not simply to produce a cure, but to render such cure as permanent as possible. This can only be accomplished by altering the disposition of the granulations, and rendering them strong enough to stand their ground after the ulcer is filled up.

When an ulcer, that has existed six months, is dressed with poultices for a week, the granulations, at the end of this time, will partly have filled up the hollow of the sore, but they will present a large, loose, and glossy appearance. Should the poultice be now discontinued, and some proper stimulating application used for another week, the granulations will be found, at the expiration of this time, to have become smaller, more compact, redder, and free from the glossy appearance. The ulcer, when healed by the latter application, will not be so likely to break out again, as when healed with large, loose, flabby, glossy granulations.

APPLICATIONS TO INDOLENT ULCERS.

1. Medicines in the form of vapour cannot heal indolent sores, so as to accomplish a lasting cure. It is only when they assume a foul appearance, and are in a temporary state of irritation, that such applications can be advantageously employed. In general, patients, on their first admission into hospitals with sore legs, have their ulcers in a temporary state of irritation from neglect, exercise, excesses, &c. Hence, it is commonly found advantageous, for the first few days, or a week, to have recourse to poultices and fomentations.

Sir E. Home describes a species of indolent ulcers, which occur in patients of debilitated constitutions, which put on a sphacelated appearance, without any apparent cause, even after they have made some progress towards a cure, and in this way spread to a very large size. Some of these ulcers, if judged of from their appearances, would be ranked as irritable ones; but, as soothing applications do not agree with them, they are not to be classed with the latter kind of sores. They are said to occur particularly in seamen, and soldiers, who have been long at sea; and have been termed *scorbutic* ulcers. Sir E. Home represents them, however, as not being necessarily connected with the scurvy, and being often met with in patients, who have not been on the sea. He states, that they are not of necessity joined with any specific disease; but are common to all kinds of patients, whose constitutions have been impaired, either by salt provisions, warm climates, or drinking.

From some trials, first made by Dr. Harness, and afterwards by Sir E. Home, it appears, that these particular ulcers, when in a sphacelated state, are benefited by employing the gastric juice of ruminating animals, as an external application. It makes the sloughs fall off, and the sore assume

a better appearance. Some pain follows its first application; and it is to be regarded as a stimulating dressing.

When indolent ulcers are not attended with certain peculiarities, a solution of nitrate of silver is one of the best of the watery applications. It stimulates the granulations, and makes them put on a more healthy appearance, and its strength may be increased according to circumstances. An ulcer, which at first cannot bear this solution above a certain strength, without pain, and without the granulations being absorbed, becomes able, after the application has been used, about ten days, or a fortnight, to bear it twice as strong, without such effects being produced; a proof of the granulations having acquired strength.

A scruple of nitrous acid, mixed with eight ounces of water, was considered by Sir Everard Home as a very useful medicine for external use. The strength must be increased or diminished, according to circumstances. The first application of diluted nitrous acid gives a good deal of pain, which lasts about half an hour, and then goes off. When an indolent ulcer heals with this lotion, the process of skinning seemed to Sir E. Home to be accomplished with more rapidity than when other applications are employed; and the new skin to be more completely formed. The acid coagulates the pus as soon as it is secreted.

The same practitioner states, that several patients, whose ulcers were dressed with diluted nitrous acid, were allowed to walk about, without finding the progress of the cure retarded, although no bandage to support the limb was made use of. He also found, that in ulcers of the leg, attended with an exposure of a piece of bone, which retards the cure, because it does not exfoliate, and come away, the application of diluted nitrous acid to the bone removes the earthy part, and excites the absorbents to act upon the remaining animal portion.

2. The only application, in the form of powder, adapted to indolent ulcers, is, according to Sir E. Home, the red precipitate. It may be occasionally used for ulcers of the most indolent kind.

3. Ointments are described by him, as good applications for indolent sores.

Such ulcers should not be too frequently dressed; for, if they are so, and the dressings are stimulating, the practice will do harm. Changing the dressings once in twenty-four hours is generally deemed sufficient, unless the quantity of matter be very copious; which seldom happens.

One part of the unguentum hydrargyri nitratis, mixed with three of hog's lard, forms an excellent application. Its strength, however, must be gradually increased. The unguentum hydrargyri nitratis has the effect of quickly removing the thickness of the edges of indolent ulcers, and the surrounding dark red colour of the skin. It seems also to have great power in making the granulations become small and healthy, and, of course, the ulcer less likely to break out again. With some ulcers, however, this ointment is found to disagree.

The ceratum resinosum and the unguentum elemi, mixed with the balsam of turpentine, or that of copaiba, are other common applications to indolent sores. Sir E. Home states, that the resins and turpentine are not so powerful as the acids and metallic salts in giving the granulations a healthy appearance, and a disposition to resist absorption. Some cases, attended with much indolent

thickening, are improved by camphorated tinctments.

In numerous cases, the applications, whatever they are, soon lose their effect, and others should then be substituted for them. The past and present states of the sore are always to be considered. Although the ulcer may be in its nature indolent, it is liable to temporary changes, from constitutional causes; and hence, a temporary alteration in the treatment becomes proper.

4. Bandages are of essential service in healing many kinds of ulcers; but their efficacy is so conspicuous in many examples of indolent sores, that they are sometimes considered the principal means of cure. Among modern advocates for rollers, the late Mr. Whateley was one of the most zealous. While this gentleman acknowledged that the efficacy of pressure in counteracting the effects of the dependent posture was known to Wiseman, who recommended the use of the laced stocking for this purpose, he conceived, that the effects of pressure, in the cure of ulcers on the extremities, previously to the appearance of Dr. Underwood's treatise, had not been duly insisted upon by surgical writers. However, he confessed, that there always had been practitioners, who were acquainted with the importance of this mode of treatment, and adopted it in their practice. He criticised the work of Sir Everard Home, for not having duly explained the good effect of pressure in the cure of ulcers. Indeed, says Mr. Whateley, it is stated in that book, not only that no benefit is derived from compression in several species of these ulcers, but that many ulcers are rendered worse, more painful, and more unhealthy in their appearance by its use: truths which it would be impossible for Mr. Whateley to refute. They are, I conceive, admitted by himself, when he observes, that there are certain conditions of an ulcer, which will not bear compression. Whether Sir Everard Home has not given a sufficiently favourable account of the effects of pressure in the cure of ulcers of the leg, I will not presume to determine: perhaps, he may not have insisted so much upon this treatment as it deserves; but I can find no fault with him for speaking of it as frequently injurious, because the fact is notorious.

In the cases published in Mr. Whateley's essay, *very little variety of dressing was used*; pressure being the principal means of cure, with some exceptions particularly specified in the work.

"I cannot doubt (says Mr. Whateley) that the practice here recommended must, in the end, prevail, notwithstanding it has this great obstacle to contend with, that surgeons must condescend, for the most part, to apply the bandages with their own hands. The clumsy and ineffectual manner, in which this business is too frequently done, can never be expected to produce the desired effect. I am certain, that if the necessary pains be taken, according to the directions here laid down, such effects will uniformly follow as must convince the unprejudiced mind, that to have recourse to the operation of tying varicose veins, and the application of a great variety of remedies, can be very rarely, most probably, never, necessary."

With respect to Mr. Baynton's mode of treatment, while Mr. Whateley regards it as a confirmation of the principles insisted upon in his own

tract, he considers the plan of making the pressure with adhesive plaster inconvenient, and, on several accounts objectionable. In every case, related by Mr. Baynton, he is sure, that the proper application of compresses and flannel rollers, would have produced similar good effects. The instances of success by this method, after the supposed failure by the roller, he attributes to the pressure made by the plasters, having been applied with Mr. Baynton's own hands, whereas that with the roller was probably so made, that the effect intended by it, could not possibly be obtained. No surgeon, he observes, who will not be at the trouble of applying the roller, and compresses himself, can be a judge of what may be effected by the proper management of them.

The following is the calamine cerate, which Mr. Whateley has usually employed:—

R. Axung. Porcin. depur. lib. iij.

Empl. Plumbi. lib. iss.

Lap. Calam. præp. lib. j. M.

"To this formula, (says Mr. Whateley,) I shall add another for making a cerate, which nearly resembles the unguentum tripharmacum of the old Dispensatory, but being less oily, it makes a much more adhesive plaster. It should be spread on rag, or silk, as an external covering to the dressing on lint, where a tow plaster cannot be conveniently used; as in wounds of the face or hands, a bubo, or any other sore, where an external plaster cannot be readily retained in its situation by a bandage. This plaster is likewise so mild, that it never irritates the skin. I have found it also a very useful plaster in fractures. The following is the formula:—

R. Empl. Plumbi. lib. j.

Axung. Porcin depur. unc. vj.

Aceti unc. iv. M."

With respect to the proper method of applying the roller and compresses, Mr. Whateley offers the following remarks:—

"The best width for a flannel roller, designed for those who have slender legs, is three inches: but for those whose legs are of a large size, they should always be three inches and a half in width. They must therefore be at first torn a little wider, that they may be of their proper width when repeatedly washed. It will likewise be found, that rollers made of fine, soft, and open flannel, will answer much better, than those made of coarse hard flannel.

"For those who have full-sized legs, the length of six yards is but just sufficient to answer all the purposes intended by a roller; but in those who have very small legs, five yards is a sufficient length. Care should be taken, that the rollers be washed in very hot water, and they should be hung up to dry immediately on being washed. If these precautions be not attended to, repeated washing of them will, in some kinds of flannel, make them as narrow as tape, by which they will be rendered almost useless.

"In applying a roller, the first circle should be made round the lowest part of the ankle, as near as possible to the heel; the second should be formed from thence round the foot; the third should be passed again round to the foot quite to the toes. The roller should then be passed from the foot round the ankle and instep a second time, to make the fourth circle. In doing this, it should be brought nearer (but not over) the point of the

heel, than it was at the first time of going round this part. The fifth circle should pass over the ankle again, and not more than half an inch higher up the leg than the fourth circle. The sixth, seventh, eighth, and ninth circles should ascend spirally along the small of the leg, at the exact distance of three fourths of an inch from each other. Having proceeded thus far up the leg, we may begin to increase the distances of the circles from each other: they may succeed each other upward to the knee, at the distance of from one to two inches, according to the size and shape of the leg. At that part where the calf of the leg commences, it is generally necessary to let the upper edge of the roller be once, twice, or thrice, turned downwards for about half the circumference of the leg, in order to make the roller lie smooth between the middle of the calf and the small of the leg. When the roller has been thus applied as far as the knee, there will be a portion of it to spare, of perhaps a yard in length; this remainder should be brought down by spiral windings, at greater distances from each other, than those which were made in the ascent of the roller. The windings should in general be completed in the small of the leg, where the roller should be pinned.

"In many cases, it is necessary to apply the roller over the heel. It should be brought as low as possible round the ankle; as in the former description. From thence, the second circle of the roller should pass from the instep over one side of the heel, and be brought over the other side of the heel to the instep again. The third circle should be passed round the ankle a second time, but still nearer to the heel than the first circle was. The roller should after this be brought back to the foot, and passed round it to make the fourth circle. A fifth circle should be again made (though it is not in all cases absolutely necessary) round the foot to the toes. To make the sixth circle, the roller should be brought back, and passed round the ankle again. The seventh, eighth, ninth, tenth, and eleventh circles should ascend spirally at the exact distance of three fourths of an inch from each other; these distances commencing at the sixth circle. The roller should then be carried to the knee and be brought down again to the small of the leg, as described in the former instruction.

"In applying the compresses, it is necessary in every instance to put them on one by one, and not all in a mass, though they be of a proper size and number. They should be crossed in different directions; the largest of them should in no case be longer than just to meet on the opposite side of the leg, to which they are applied. I have in many instances seen the compresses applied by the patients of such a length as to go round the leg like a roller, and be fastened together with pins. This method generally wrinkles and blisters the skin, and by no means answers the purpose of making a compression on the part where it is most wanted. I never suffer a pin to be used in the compresses. If the same compresses in any case be applied two days together, they should always be turned on the contrary side at each re-application, in order to prevent wrinkles on the skin." (See *Practical Obs. on the Cure of Wounds and Ulcers on the Legs, without Rest*; by T. Whateley; 1799.)

5. I shall next introduce an account of Mr.

Baynton's plan of curing old ulcers of the leg, by means of adhesive plaster. Were I to say, that any particular method of dressing such sores is entitled to superior praise, I should certainly decide in favour of this gentleman's practice. I have seen it most successful myself, and I hear it highly spoken of by numerous professional friends, in whose unprejudiced judgment I place much reliance.

Mr. Baynton acquaints us, that the means proposed by him, will be found, in most instances, sufficient to accomplish cures in the worst cases, without pain or confinement. After having been repeatedly disappointed in the cure of old ulcers, he determined to bring their edges nearer together, by means of slips of adhesive plaster. To this, he was chiefly led, from having frequently observed, that the probability of an ulcer continuing sound, depended much on the size of the cicatrix, which remained after the cure appeared to be accomplished; and from well knowing, that the true skin was a much more substantial support and defence, as well as a better covering, than the frail one, which is obtained by the assistance of art. But, when he had recourse to the adhesive plaster, with a view to lessen the probability of those ulcers breaking out again, he little expected, that an application so simple would prove the easiest, most efficacious, and most agreeable means of treating ulcers.

Although the first cases, in which Mr. Baynton tried this practice, were of an unfavourable nature, yet he had soon the satisfaction to perceive, that it occasioned very little pain, and materially accelerated the cure, while the size of the cicatrices was much less than it would have been, had the cures been obtained by any of the common methods.

At first, however, the success was not quite perfect: as, in many instances, he was not able to remove the slips of plaster, without removing some portion of the adjacent skin, which by occasioning a new wound, proved a disagreeable circumstance, in a part so disposed to inflame and ulcerate, as that in the vicinity of an old sore: he therefore endeavoured to obviate that inconvenience by keeping the plasters and bandages well moistened with spring-water, for some time, before they were removed from the limb. He had soon the satisfaction to observe, that the inconvenience was not only prevented, but that every succeeding case justified the confidence he now began to place in the remedy. He also discovered, that moistening the bandages was attended with advantages which he did not expect: for, while the parts were wet and cool, the patients were much more comfortable, and the surrounding inflammation was sooner removed.

By the mode of treatment here recommended, Mr. Baynton found, that the discharge was lessened, the offensive smell removed, and the pain abated in a very short time. But, besides these advantages he also found, that the callous edges were in a few days level with the surface of the sore; that the growth of fungus was prevented, and the necessity of applying painful escharotics much lessened, if not entirely done away. Mr. Baynton gives the following description of his method:—

The parts should be first cleared of the hair,

sometimes found in considerable quantities upon the legs, by means of a razor, that none of the discharges, by being retained, may become acrid, and inflame the skin, and that the dressings may be removed with ease at each time of their renewal; which, in some cases where the discharges are very profuse, and the ulcers very irritable, may, perhaps, be necessary, twice in the twenty-four hours, but which I have in every instance, been only under the necessity of performing once in that space of time.

"The plaster is directed to be cut into slips, about two inches in breadth, and of a length, that will, after being passed round the limb, leave an end of about four or five inches. The middle of the piece so prepared is to be applied to the sound part of the limb, opposite to the inferior part of the ulcer, so that the lower edge of the plaster may be placed about an inch below the lower edge of the sore, and the ends drawn over the ulcer with as much gradual extension as the patient can well bear; other slips are to be secured in the same way, each above and in contact with each other, until the whole surface of the sore and the limb, is completely covered, at least one inch below, and two or three above, the diseased part.

"The whole of the leg should then be equally defended with pieces of soft calico, three or four times doubled, and a bandage of the same, about three inches in breadth, and four or five yards in length, or rather as much as will be sufficient to support the limb from the toes to the knee; should be applied as smoothly as can be possibly performed by the surgeon, and with as much firmness as can be borne by the patient. It is to be first passed round the leg, at the ankle joint, then as many times round the foot as will cover and support every part of it, except the toes, and afterwards up the limb, till it reaches the knee, observing that each turn of the bandage should have its lower edge so placed, as to be about an inch above the lower edge of the fold below it.

"If the parts be much inflamed, or the discharge very profuse, they should be well moistened, and kept cool with cold spring-water, poured upon them as often as the heat may indicate to be necessary, or, perhaps, at least, once every hour. The patient may take what exercise he pleases, and it will be always found, that an alleviation of his pain and the promotion of his cure will follow as its consequence, though, under other modes of treating the disease, it aggravates the pain, and prevents the cure.

"These means, when it can be made convenient, should be applied soon after rising in the morning, as the legs of persons affected with this disease are then found most free from tumefaction, and the advantages will be greater than when they are applied to limbs, in a swollen state. But, at whatever time the applications be made, or in whatever condition the parts be found, I believe it will always happen, that cures may be obtained by these means alone, except in one species of the disease, which seldom occurs. The first application will sometimes occasion pain, which, however, subsides in a short time, and it is felt less sensibly at every succeeding dressing. The force, with which the ends of the plaster are drawn over the limb, must then be gradually increased, and when the parts are restored to their natural state of ease and sensibility, which will soon happen, as

much may be applied as the calico will bear, or the surgeon can exert : especially if the limb be in that enlarged and compressible state, which has been denominated the scorbutic, or if the edges of the wound be widely separated from each other."

Mr. Baynton afterwards takes notice of the breaking of the skin near the ulcers ; a circumstance which sometimes proved troublesome, and arose partly from the mechanical effect of the adhesive plasters, and partly from the irritating quality of the plaster. But he only considers such sores of serious consequence, when they are situated over the tendon of Achilles, in which situation they are sometimes several weeks in getting well ; and with the view of preventing these, he recommends a small shred of soft leather to be put under the adhesive plaster.

Mr. Baynton adds, " that cures will be generally obtained without difficulty, by the mere application of the slips and bandage ; but, when the parts are much inflamed, and the secretions great, or the season hot, the frequent application of cold water will be found a valuable auxiliary, and may be always safely had recourse to, where the heat of the part is greater than is natural, and the body free from perspiration." (See *A Descriptive Account of a new Method of treating old Ulcers of the Legs*, edit. 2. 1799.)

One circumstance, strongly in favour of the advantages of the foregoing mode of treatment, deserves particular notice : when M. Roux visited the London hospitals, a few years ago, he had for the first time an opportunity of seeing this practice, which had never been tried in France. The plan appeared to him so different from every thing which he had been accustomed to see in his own country, where ulcers were almost always treated by rest in a horizontal posture, and emollient applications, that he left London somewhat prejudiced against the new method. Subsequently to his return to Paris, however, he gave it a fair trial, and experience entirely changed his opinion, as he had the candour to acknowledge. (See *Rélation d'un Voyage fait à Londres en 1814, ou Parallèle de la Chirurgie Angloise avec la Chirurgie Française*, par P. J. Roux, p. 150.)

Mr. Scott cuts the plaster into slips, fifteen inches long, and two broad. The foot being placed at a right angle with the leg, one of the slips is to be applied from the first bone of the great toe, along the inner edge of the foot, around the posterior part of the os calcis, to the first bone of the little toe. The middle of another slip should then be placed under the bottom of the os calcis, and its ends extended perpendicularly up on each side of the leg. The third slip is to be applied along the foot, parallel to the first, and overlapping one-half of it. The fourth is to be placed parallel to the second, partially overlapping it, and extending perpendicularly up the sides of the leg. In this manner, the slips of plaster are to be applied alternately along the foot and up each side of the leg, until the limb is covered from the toes to the knee. Then a calico bandage is applied, but not too tightly. In severe cases, Mr. Higginbottom begins with a bread and water poultice for 18 or 24 hours. After this the leg is washed well with soap and water and then wiped dry. The inflamed part of the skin is next moistened with pure water, and the nitrate of silver passed twice over it, and a little beyond it.

A piece of lint is put over the ulcer ; the linen, spread with the ointment above specified ; and lastly, a linen compress and calico roller. The dressings are taken off on the fourth day. The discharge having been removed, the nitrate of silver is now to be applied both to the ulcer and the adjacent skin. After three more days, when the eschar begins to loosen, the nitrate of silver is applied again, &c. With this plan, Mr. Higginbottom sometimes combines Mr. Baynton's method, as modified by Mr. Scott. (See *Higginbottom, On Nitrate of Silver*, p. 129.)

In some cases of old ulcers, with a pale and flabby surface, and without a vestige of granulation, Mr. Skye finds the exhibition of laudanum, or opium, night and morning, improve the health, and promote the healing process. The average dose is half, or two-thirds, of a grain. Mr. Skye recommends the ulcer to be cleaned daily, covered with some unirritating dressing, and a roller lightly applied. (See *F. Skye, On the Cure of various Forms of Ulcer, and Granulating Wounds*, 8vo. Lond. 1837.) I have sometimes tried this plan in University College Hospital, for obstinate chronic ulcers of large size ; but I have not yet been able to ascertain, whether the good which was obtained resulted from the opium, the quietude, the dressings, the diet, or other things which patients in hospitals usually have the benefit of.

OF ULCERS ATTENDED WITH SOME SPECIFIC DISEASED ACTION, EITHER CONSTITUTIONAL OR LOCAL.

1. Ulcers which yield to Mercury.

Here I shall exclude from consideration venereal ulcers, as this subject is treated of in the article VENEREAL DISEASE, and notice only such sores as are produced by other diseases of the general system, or of the parts, and are capable of being cured by mercury.

Perhaps, there is no greater source of error in the whole practice of surgery, than the supposition that a sore, when it yields to mercury, must be of a syphilitic nature. Surgeons, however, who run into this absurdity, can hardly be imagined to be unaware, that so potent a medicine must have effects on numerous diseases of very different descriptions. Sir E. Home accurately remarks, that many ulcers, unconnected with the venereal disease, which receive no benefit from other medicines, heal under a mercurial course, or yield to mercurial applications.

One class of ulcers noticed by Sir E. Home, as deriving benefit from mercury, occur on the instep and foot, have a very thickened edge, and are attended with a diseased state of the surrounding skin, so as to bear some resemblance to elephantiasis. They are frequently observed affecting servants who live in opulent families, in an indolent and luxurious way. Sir E. Home states that fumigations with the red sulphuret of mercury heal these ulcers, and resolve in a great degree the swelling of the surrounding parts. In some instances, an ointment of calomel and hog's lard ; in others, the camphorated weak mercurial ointment, is the best application.

Many diseased ulcers, particularly those of a superficial kind, with a thickened edge, may be healed, when they are dressed with a solution of one grain of bichloride of mercury, in an ounce of water, containing a little spirit.

2. *Ulcers curable by Hemlock.*

Sir E. Home places more reliance on hemlock, as an external, than an internal remedy for ulcers. The ulcers, which usually receive benefit from hemlock applications, look like those of an irritable sort; but the surrounding parts are thickened in consequence of some diseased action. Such sores occur near the ankle, which joint is at the same time enlarged. Sometimes, but not so often, they take place over the ligaments of the knee. On account of their situation, and the swelling of the joint, they may be suspected to be scrofulous, though they are more sensible than strumous ulcers usually are. The sores just described are rendered less painful, their diseased disposition is checked, and the swelling of the joint diminished, by hemlock. Several irritable scrofulous ulcers are also particularly benefited by this medicine. Sir E. Home gives the preference to hemlock poultices, unless their weight should be objectionable, in which case he advises lint to be dipped in a decoction of the herb, and put on the sore.

Sometimes an ointment is made with the inspissated juice, or extract. The internal use of hemlock, for certain obstinate ulcerations of the tongue and lip, I have elsewhere noticed. See *LIPS* and *TONGUE*.

3. *Ulcers curable by Salt Water.*

Sir E. Home takes notice of other specific ulcers, which yield to this application after resisting other remedies. Poultices, made with sea-water, are often employed; but this gentleman seems to prefer keeping the part immersed in the water in a tepid state, about a quarter of an hour, twice a day.

When sea-water poultices bring out pimples, in cases of scrofulous ulcers on the legs and feet, Sir E. Home found, that this disagreeable circumstance might be obviated by diluting such water with an equal quantity of a decoction of poppies. After a time, the salt-water may be tried by itself again. While each fresh poultice is preparing, the part should also be immersed in such water, warmed.

When there is a tendency to anasarca, or when there is an unusual coldness in the limb, unattended with any propensity to mortification, tepid salt-water may be used with infinite advantage.

4. *Ulcers curable by Nitrate of Silver.*

Sir E. Home notices, under this head, an ulcer which does not penetrate more deeply than the cutis; but spreads in all directions, producing ulceration on the surface of the skin, and often extending nearly through its whole thickness. The part first affected heals, while the skin beyond it is in a state of ulceration.

Of this description are, a leprous eruption, mostly seen in men impressed in Ireland; a disease of the skin induced by buboes, which have continued a great while after the venereal virus has been destroyed: and the ring-worm.

All these diseases are most easily cured by applying to them a solution of nitrate of silver.

The leprous eruption is communicated by contact, and makes its appearance in the form of a boil. This is converted into an ulcer, which discharges a fetid fluid, by which the surrounding

skin is excoriated, and the ulceration is extended over a large surface. The pain is most severe, and the discharge greatest in hot weather. The parts first diseased heal, while others are becoming ulcerated, and the disease is always rendered worse by spirituous liquors, salt provisions, and catching cold.

Sir E. Home remarks, that the disease in the skin produced by the effects of very irritable buboes, in constitutions broken down by mercury, is attended with ulceration of a more violent, deep, and painful kind, than the foregoing distemper. The progress of this disorder is, in other respects, very similar to that of the leprous eruption.

Although it is only in warm climates that the ringworm occurs in the form of an ulcer, a mild species of it takes place in summer-time in this country. It seems to be infectious; though it often comes on independently of infection. It commences with an efflorescence, which is attended with very trivial swelling, and spreads from a central point. The circumference of the efflorescence becomes raised into a welt, while the rest assumes a scurfy appearance. The welt becomes covered with a scab, which falls off and leaves an ulcerated ring, in general not more than a quarter of an inch wide. The outer margin of this ring continues to ulcerate, while the inner one heals, so that the circle becomes larger and larger. The discharge consists of a thin, acrid fluid, which seems to have a great share in making the disease spread.

For the three preceding diseases, a solution of nitrate of silver is strongly recommended by Sir E. Home.

5. *Ulcers which yield to Arsenic.*

The sores which come under the definition of *noli me tangere* or *lupus*, derive great benefit from this powerful remedy. Sir E. Home observes that they are nearly allied to cancer, differing from it in not contaminating the neighbouring parts by absorption, and only spreading by immediate contact.

From some cases which fell under Sir E. Home's observation, he discovered that arsenic was not only efficacious as an external, but also as an internal remedy. I shall not unnecessarily enlarge upon this subject in the present place, as the reader may refer to the articles *ARSENIC*, *CANCER*, *LUPUS*, *HOSPITAL GANGRENE*, &c., for additional information relative to the uses of this mineral in the practice of surgery.

Sir E. Home is an advocate for its employment, both internally and externally, for ulcers of untoward appearance on the legs. The *fungated* ulcer is particularly pointed out by him as being benefited by arsenic. This ulcer occurs on the calf of the leg, and on the sole of the foot. From its surface a fungus shoots out, which is entirely different from common granulations. The new formed substance is radiated in its structure, the bottom of the ulcer being the central point, and the external surface, which is continually increasing, the circumference. The substance of this fungus is very tender, and readily bleeds. The first stage of the disease sometimes has the appearance of a scrofulous affection of the metatarsal bones; but the parts seem more enlarged, and when the skin ulcerates, a fungus shoots out, and betrays the nature of the case.

One species of the fungated ulcer is capable of contaminating the lymphatic glands; the other is not so. The first, which is represented by Sir E. Home as being incurable by arsenic, or any other known medicine, I believe to be truly cancerous, from the examples of it, which have fallen under my observation.

The second yields to arsenic; the mode of employing which may be learnt by turning to the articles ARSENIC, CANCER, HOSPITAL GANGRENE, LUPUS, &c.

6. Ulcers attended with Varicose Veins.

A certain kind of ulcer is very apt to occur on the inside of the leg, and is equally difficult to cure, and liable to break out again. It has the look of a mild, indolent sore; but the branches and trunk of the internal vena saphena are enlarged, and this varix of the veins keeps the ulcer from healing. The sore is seldom deep, usually spreads along the surface, and has an oval shape, the ends of which are vertically situated. There is a pain affecting the limb rather deeply, extending up in the course of the veins, and exasperated by keeping the leg a long while in an erect posture.

This is a kind of ulcer, which derives immense benefit from a calico, stocking, or India rubber bandage, applied from the toes to the knee, although the direct operation of the pressure on the sore is itself productive of no particular good.

Sir E. Home found, however, that many patients could not bear laced stockings, nor tight bandages, and that others received no relief from them. He represents that, in consequence of the size of the vena saphena, and its numberless convolutions, the return of blood from the smaller branches is so impeded, as to retard the circulation in the smaller arteries, and to interfere with their action in forming healthy granulations. The coats and valves of the veins also become thickened, so that the latter parts (the valves) do not do their office of supporting the weight of the column of blood.

These reflections induced him to think, that some benefit might be obtained from applying a ligature round the vena saphena, where this vessel passes over the knee-joint, so as to take off a part of the pressure of the column of blood. The following way of performing the operation was recommended: "As the veins are only turgid in the erect posture, the operation should be performed while the patient is standing; and if placed upon a table on which there is a chair, the back of the chair will serve him to rest upon; and he will have the knee-joint at a very convenient height for the surgeon. The leg to be operated upon must stand with the inner ankle facing the light, which will expose very advantageously the enlarged vena saphena passing over the knee-joint. While the patient is in this posture, if a fold of the skin, which is very loose at this part, is pinched up transversely, and kept in that position by the finger and thumb of the surgeon on one side, and of an assistant on the other, this fold may be divided by a pointed scalpel, pushed through with the back of the knife towards the limb, to prevent the vein being wounded; much in the same way as the skin is divided in making an issue. This will expose the vein sufficiently; but there is commonly a thin membranous fascia confining it in its situation; and when that is met with, the vein had better be laterally disengaged by the point of the knife. This is most expeditiously done by laying hold of

the fascia with a pair of dissecting forceps, and dividing it; for it is difficult to cut upon parts which give little resistance, and there is a risk of wounding the vein. After this, a silver crooked needle, with the point rounded off, will readily force its way through the cellular membrane connected with the vein, without any danger of wounding the vessel, and carry a ligature round it. This part, or, indeed, what may be considered as the whole of the operation, being finished, the patient had better be put to bed, so as to allow the vein to be in its easiest state before the ligature is tied, and then a knot is to be made upon the vein; this gives some pain, but it is by no means severe. The edges of the wound in the skin are now to be brought together by sticking-plaster, except where the ligature passes out, and a compress and bandage applied, so as to keep up a moderate degree of pressure on the veins, both above and below the part included in the ligature." (Home, *On Ulcers*, p. 296. ed. 2.)

As a general practice, I never entertained any doubt about the preference which ought to be given to bandages, especially the stocking and India rubber ones. Indeed, the risk attending the plan of tying and dividing large veins, has now been displayed in so many fatal examples, that I begin to think, in a few years more, such operations will only be mentioned as things which ought not to be done. Sir Astley Cooper, indeed, long ago entered his protest against them, and mentions several cases in which the experiment had a fatal result. (*Lectures*, &c. vol. i. p. 205.)

It appears that A. Paré proposed and performed an operation similar to that described by Sir E. Home. (*The Works of A. Paré*, translated by Johnson, folio, p. 319.) An account of Sir Benjamin Brodie's operation for the cure of varicose veins, and some additional remarks on the treatment of ulcers accompanied with varices, will be found in the article VEINS.

7. Ulcers from Irritation of the Nails.

Sometimes portions of the nails grow against, or even into, the flesh of the fingers or toes, a fungus arises there, and notwithstanding the repeated application of caustic, the disease returns, and the patient continues in a state of considerable pain, and seriously disabled. The treatment, recommended by Sir Astley Cooper, consists in paring the nail till it is as thin as it can be made, without the production of bleeding; its edge is then to be raised, and a small bit of lint placed between it and the sore. When, however, the irritation is so great, that even the application of lint cannot be endured, he slits up the nail, and turns it back with forceps, or even removes it. (*Lectures*, &c. p. 200. vol. i.) A common plan is to apply Plunket's caustic, a strong solution of nitrate of silver, the liquor arsenicalis, or a blister, so as to produce a separation of the offending part of the nail; but such treatment is often tedious. According to Mr. Wardrop, the shape of the nail is not really altered, and the chief point in the treatment is not to cut away any of it, but to reduce the swelling of the soft parts which press against the nail, and he has generally found, that the application of lunar caustic destroys the painful and irritable ulcerated surface, whilst it promotes the absorption of the thickened parts. (See *Med. Chir. Trans.* vol. v. p. 131, &c.)

Mr. Stafford's method of treating deep excavated ulcers, consists in pouring into the excavation melted wax of an extremely adhesive quality, and just of that temperature which it has when it is on the point of cooling, and when it will immediately become solid in the ulcer. In this manner the under surface of the wax, when cold, comes into close contact with the general surface of the sore, and the whole excavation is filled by it. The ulcer having been cleaned with dry lint, a brush is then to be dipped in the melted wax, which is to be allowed to drop from it into the sore. After the wax has become solid, it is to be retained in its place with a strip or two of adhesive plaster. This mode of dressing is to be renewed on the third day. The presence of the mass of wax seems to Mr. Stafford to have the effect of exciting the growth of healthy granulations. The wax consists of four parts of white wax, and one of Venice turpentine. The cases to which he conceives this treatment adapted, are "the open and excavated bubo; ulcers of the legs; indolent scrofulous sores; excavations in the flesh in consequence of sloughing phagedæna; ulcers situated over large arteries; sinuses and fistulous passages, that have been laid open; the sores left by extensive burns; broken chilblains; and, in short, those of any depth, from whatever cause they may arise." He also speaks of its utility in cancerous ulcers. (See *Stafford's Essay upon the Treatment of the Deep and Excavated Ulcer*, 8vo. Lond. 1829.) I do not hear of this practice being followed.

A description of what has sometimes been called the *hospital sore*, is given under the head of *HOSPITAL GANGRENE*.

Consult *Michael Underwood*, On Ulcers of the Legs, &c. 8vo. Lond. 1783; and *Surgical Tracts*, 3d ed. 1799. *B. Bell*, On the Theory and Management of Ulcers, &c. ed. 8vo. 1791. *J. Merck*, De Curatationibus Ulerum difficultium præsertim in Cruribus Obolurum, 4to. Goett. 1776. *G. A. Brambilla*, Delle Ulcere delle Estremità Inferiore, 4to. Milano, 1793. *Baynton's* Descriptive Account of a New Method of Treating Old Ulcers of the Legs, 1799. ed. 2. 8vo. Bristol, 1799. *Whately*, On the Cure of Wounds and Ulcers on the Legs, without Rest, 8vo. Lond. 1799. *Sir Frederick Hume's* Practical Observations on Ulcers on the Legs, edit. 2. 1801. *John Bell*, Principles of Surgery, vol. i. 1801. *J. Hunter*, On the Blood, Inflammation, &c. *C. Curtis*, An Account of the Diseases of India, &c. with Obs. on Ulcers and the Hospital Sores of that Country, &c. 8vo. Edin. 1807. *Sir Benjamin Brodie*, On Varicose Veins of the Legs, in *Med. Chir. Trans.* vol. vii. p. 195, &c. *P. J. Roux*, Voyage fait à Londres en 1814, ou Parallèle de la Chirurgie Anglaise avec la Chirurgie Française, p. 142, &c. Paris, 1815. *Dr. John Thomson's* Lectures on Inflammation, p. 423, &c. Edin. 1813. *Dr. Devay*, On the Treatment of Sinuous Ulcers, in *Med. Chir. Trans.* vol. vii. p. 482, &c. *Sir A. Cooper's* Lectures, vol. i. 1824. *C. Rust*, De Ulerum Diagnostis, et Etologia Nonnulla, 4to. Berolii, 1831. *P. Duchatlet*, Sur la Véritable Cause des Ulcères qui affectent fréquemment les Extrémités Inférieures d'un Grand Nombre d'Artisans de la Ville de Paris; in *Annales d'Hygiène Publique*, &c. t. iv. p. 239, 1830. The stages of several cutaneous affections, attended with ulceration, have been excellently described by *William Bateman*, *Alibert*, *Rayer*, and others. *R. A. Stafford*, On the Deep and Excavated Ulcer, 8vo. Lond. 1829. *John Higginbottom*, On the Nitrate of Silver, 8vo. Lond. 1829. *J. C. Spender*, On Ulcerous Diseases of the Leg, 8vo. Lond. 1835. *Fred. Skye*, On the Cure of various Forms of Ulcer and Granulating Wounds, 8vo. Lond. 1837. *Robert Liston*, On Practical Surgery, p. 261. 8vo. Lond. 1837. *P. F. Blandin*, in *Dict. de Méd. et de Chir. Pratiques*, art. *Ulcère*.

UNGUENTUM ACIDI SULPHURICI.—*R* Acidi Sulphurici 3j. Adipis Suillæ præparatæ 3j. These are to be well mixed together in a glass mortar.—This ointment has been used for the cure of the itch; for the reduction of

some chronic swellings of joints; and, with camphor added to it, for promoting the dispersion of bronchocele.

As sulphuric acid is particularly destructive of vegetable substances, the parts, to which this ointment is applied, should always be covered with flannel, instead of linen.

UNGUENTUM ANTIMONII POTASSIO-TARTRATIS, vel **ANTIMONII TARTRATIS**.—*R* Antim. Tart. 3j. Adipis Suillæ 3j. Misce.—Frequently used for exciting irritation, pustules, and even ulceration of the skin, with the view of relieving diseases in the vicinity of the irritated part, as is exemplified in the treatment of some diseases of the eyes and joints, and a variety of indolent swellings.

UNGUENTUM CETACEI.—*R* Cetacei 5vj. Cereæ Albæ 3ij. Olivæ Olei 3iij. These are to be melted upon a slow fire, and then briskly stirred till cold.—This ointment, spread on lint, serves as a simple dressing for wounds, ulcers, &c.

UNGUENTUM CONII.—*R* Foliorum Conii recentium, Adipis Suillæ præparatæ, sing. 3iv. The hemlock is to be bruised in a marble mortar, after which the lard is to be added, and the two ingredients thoroughly incorporated by beating. They are then to be gently melted over the fire, and after being strained through a cloth, and the fibrous part of the hemlock well pressed, the ointment is to be stirred till quite cold.—It is sometimes applied to cancerous or scrofulous sores. (*Pharm. Chirurg.*)

The Pharmacopœia of St. Bartholomew's Hospital directs the unguentum conii, vel cicutæ, to be made as follows:—*R* Foliorum Cicutæ lbj. Adipis Suillæ lbss. Boil the leaves in the melted hog's lard, until they become crisp. Then strain the ointment. The ointment may also be made, by mixing the extractum conii with spermaceti ointment.

UNGUENTUM DIGITALIS.—*R* Foliorum Digitalis Purpureæ recentium, Adipis Suillæ præparatæ, sing. 3iv. This ointment may be made in the same manner as the unguentum conii, and tried in the same cases.

UNGUENTUM ELEMI COMPOSITUM.—*R* Elemi lbj. Terebinthinæ 3x. Sevi Ovis præparati lbij. Olei Olivæ 3ij. Melt the elemi with the suet; remove them from the fire, and mix them immediately with the turpentine and oil. Then strain the mixture.—Sometimes employed as a stimulating dressing.

UNGUENTUM GALLÆ CAMPHORATUM.—*R* Gallarum Pulveris Subtilissimi 3ij. Camphoræ vel Opii ʒiij. 3ss. Adipis Suillæ præparatæ 3ij. Misce.—A common application to piles, after their inflammatory state has been diminished by cold lotions, bleeding, aperient medicines, and leeches.

UNGUENTUM HELLEBORI ALBI.—*R* Hellebori Albi Pulv. 3j. Adipis Suillæ præparatæ 3iv. Olei Limonis ʒss. Misce.—This ointment has been used for the itch, and some other cutaneous diseases.

UNGUENTUM HYDRARGYRI FORTIUS.—See MERCURY.

UNGUENTUM HYDRARGYRI BINIODIDI.—*R* Hydr. Biniodidi 3j. Cereæ Albæ 3ij. Adipis Suillæ 3vj. Melt the wax and lard together, and add the biniodide.

UNGUENTUM HYDRARGYRI IODIDI.

Prepared as the foregoing.—Both are good applications to many obstinate ulcerations about the face, and in other situations, and especially to those which are of the nature of lupus. They are also applied to scrofulous and cancerous ulcers.

UNGUENTUM HYDRARGYRI CAMPHORATUM.—℞ Unguenti Hydrargyri ʒj. Camphoræ 3 ss. Misce.—Often recommended to be rubbed on thickened, indurated parts, with the view of exciting the action of the absorbents. Rubbed along the course of the urethra, it is serviceable in the chronic stage of chordee.

UNGUENTUM HYDRARGYRI MITIUS.—℞ Unguenti Hydrargyri Fort. lbj. Adipis Suillæ præparatæ lbj. Misce.—The weaker mercurial ointment is often rubbed on indurated, thickened parts and tumours, when the object is merely to promote their absorption; and it is not advisable to employ the unguentum hydrargyri fort. lest a salivation should be induced.

UNGUENTUM HYDRARGYRI NITRATIS.—This ointment is a celebrated application to the inside of the eyelids, in chronic ophthalmia, and also to specks on the cornea. When blended with a little olive oil, it also forms an eligible stimulating dressing for numerous kinds of sores. It is efficacious in porrigo, lupus, and other cutaneous diseases.

UNGUENTUM HYDRARGYRI NITRICO-OXYDI.—℞ Hydrargyri Nitrico-oxydi ʒj. Cerae Albæ ʒij. Adipis præpar. ʒvj. Misce.—This is a common stimulating application to indolent ulcers, and sores in general.

UNGUENTUM HYDRARGYRI PRÆCIPITATI ALBI.—℞ Hydrarg. Præcip. Albi ʒj. Adipis præparatæ ʒss. Misce.—Sometimes applied in cases of porrigo. At the Bloomsbury Dispensary, about ten gr. of the bichloride of mercury are added to each ounce of lard, and the proportion of the white precipitate rather lessened.

UNGUENTUM IODINII COMP.—℞ Iodinii ʒss. Potassii Iodidi ʒj. Spir. Rectif. ʒj. Adipis Suillæ ʒj. —Frictions with it over bronchocoele, and glands in the state of chronic enlargement, frequently prove useful.

UNGUENTUM LIQ. PLUMBI ACETATIS.—℞ Liquoris Plumbi Acetatis ʒv. Adipis Suillæ lbj. Cerae Albæ ʒiv. Melt the ingredients together, and continue to stir them till cold. —This ointment is employed with great advantage as a simple dressing. According to Mr. Dunn, of Scarborough, it is much improved by pouring the liquified mixture, before the lead has been added to it, into cold water. It is then to be rubbed in a mortar, or on a slab, with the liq. plumbi acet. The water occasions a fine white cloudy precipitation, which gives to the composition a better appearance.

UNGUENTUM OPHTHALMICUM.—℞ Adipis Suillæ præparatæ ʒss. Tutie præparatæ, Bol. Armen., sing. ʒij. Præcip. Hydrarg. Albi ʒj. Misce.—Janin's celebrated ophthalmic ointment.

UNGUENTUM OXYGENATUM, vel ACIDI NITROSI.—℞ Axungie Suillæ recentis non salsæ uncias sedecim. Leni calore in vase vitreo lente liquifacis aut continua agitatione instillantur Acidi Nitrici uncia duæ. Massa igni exponatur, donec ebullire cœpit; tunc ab igne removeatur, frigefactaque servetur.

In this process, the nitric acid is decomposed, the nitrous gas escaping, and the oxygen combining with the lard. This ointment was particularly recommended by Alyon, as an application to venereal and herpetic ulcerations. Its virtues vary considerably, according to the strength of the acid employed.

UNGUENTUM PICIS.—℞ Picis, Sevi Ovilli præparati, sing. lbss. Melt, and then strain them.

UNGUENTUM PICIS COMPOSITUM.—℞ Unguenti Picis, Unguenti Plumbi Superaetatis, sing. lbss. Misce.

The two preceding ointments are applicable to porrigo, and some other diseases of the skin.

UNGUENTUM PICIS CUM SULPHURE.—℞ Unguenti Picis, Unguenti Sulphuris, sing. ʒiv. Misce.—One of the most common applications to porrigo.

UNGUENTUM RESINÆ.—℞ Resinæ Flavæ, Cerae Flavæ, sing. lbj. Olei Olivæ lbj. Melt the resin and wax with a slow fire; then add the oil, and strain the mixture while hot. —This is a common application to ulcers which stand in need of being gently stimulated.

UNGUENTUM SAMBUCCI.—℞ Florum Sambuci, Adipis Suillæ, singulorum lbj. The hog's lard being melted, boil the elder flowers in it till they become crisp, then strain the mixture.

UNGUENTUM SULPHURIS COMP. P. L. —The common itch ointment.

UNGUENTUM TUTIÆ.—℞ Tutie præparatæ, Unguenti Cetacei, q. s. Misce.

UNGUENTUM TUTIÆ COMPOSITUM.—℞ Tutie præparatæ, Lapidis Calaminaris præparati, sing. ʒvj. Camphoræ ʒij. Unguenti Sambuci lbj. Misce.—Occasionally applied to the inside of the eyelids, piles, ulcerations, excoriations, &c.

UNGUENTUM VERATRIÆ.—℞ Veratriæ, gr. x. —gr. xl. Axung. ʒj. Misce.—The veratria ointment, so much commended by Dr. Turnbull for neuralgia, dropsy, paralysis, rheumatism, &c., is employed with different proportions of the veratria in different cases. In neuralgic affections, sometimes it is applied at once in the strongest form specified above, but, in the generality of cases, ten gr. to each ounce of lard, are sufficient to begin with.

UNGUENTUM ZINCI.—℞ Zinci Oxydi ʒj. Adipis præpar. ʒvj. Misce.—An astringent application, the uses of which are familiarly known.

UNION BY THE FIRST INTENTION.

—When the opposite surfaces of a wound are brought into contact, and grow together at once, without suppurating, union by the first intention is said to take place. When wounds heal by suppurating, granulating, &c. they are sometimes surgically described as getting well by the second intention. (See WOUNDS.)

URETHRA. Before speaking of some diseases of the urethra, I will request the reader's attention to a few points of surgical anatomy, very necessary to be well understood by all who have occasion to pass instruments into this passage. From certain facts, specified by M. Malgaigne, it appears, that when the penis is lifted up, but not extended, a catheter has only to pass at most seven French inches and a half, when it will enter the bladder

and that a catheter, which is allowed to remain, will project at least an inch into the bladder, if it has passed to the extent of seven French inches. (See also *Velpéu, Anat. Chir.* t. xxi. p. 234. 8vo. Paris, 1838.) The length of the prostatic portion of the urethra is variously estimated from six to ten lines (*Malgaigne*); twelve to fifteen (*Ducamp*); eight to eleven (*Lisfranc*); that of the membranous, or muscular portion, from five to eight lines (*Malgaigne*); nine to ten (*Ducamp*); and seven to eleven (*Lisfranc*). "Its extent is not the same superiorly as inferiorly. Here it is very short, limited in front by the posterior extremity of the bulb, and behind by the prostate; so that superiorly its length is about an inch, and inferiorly, four or five lines." (*Benjamin Phillips, On the Urethra, &c.* p. 11.) The spongy portion is subject to the greatest variation, and is the only part of the urethra, in which the different positions and the extension of the penis make a change. In the relaxed stage of the organ, there is an angle in the spongy portion of the canal, corresponding to one of about 45° , which is effaced during an erection. Reasoning from beneath the symphysis of the pubes, the two other portions of the urethra ascend obliquely backwards, so that the vesical orifice of this canal is three or four lines above the level of the arch of the pubes, and one inch behind the symphysis. M. Malgaigne also states, that when a straight catheter had been introduced into the bladder of a dead subject, laid out upon a table, the instrument described, in relation to the ground and the axis of the body, an angle of about 45° . When the penis is raised, as during an erection, the angle in the spongy portion is effaced; but the curve in the membranous and prostatic parts remains unaffected.

The direction of the canal, when the organ is quiescent, has been usually compared to the letter S; and Mr. Benjamin Phillips believes, that this may be nearly correct when the bladder and rectum are distended; "but when the penis is placed against the abdomen, there is found only one curvature, and this almost disappears when the bladder and rectum are undistended. If we place the penis in a direction nearly at right angles with the ideal axis of the body, and look at the urethra in that portion of its course which has not reached the symphysis of the pubes, it will be seen, that it forms a curvature, which presents its convexity inferiorly; and that, after arriving in front of the pubes, the direction of the canal presents a straight line. When the corpora cavernosa are healthy, we may remove all curvatures with the exception of the first. In order to attain this end, M. Amussat has recommended, that the position of the penis should be such as to form with the axis of the thighs (the patient being in the erect position) an angle of 40° to 45° ." (*On the Urethra, its Diseases, &c.* p. 17.)

The urethra then is far from being straight; but it may be rendered so. The parietes of the urethra being soft and yielding, it is capable of being dilated to a certain degree. If its lower side then be depressed, by means of any solid instrument, to the level of the root of the penis, and its upper side be brought by the same instrument below the symphysis of the pubes, the angle in the spongy portion, and the curve in the rest of the canal, must both be at once obliterated. But, in order that the root of the penis may be thus depressed, M. Malgaigne

observes, that its suspensory ligament, which connects it to the symphysis of the pubes and to the linea alba, must be loose; and that, when the penis is attached higher than usual, or the symphysis descends lower, greater difficulty is experienced in rendering the urethra straight. The same thing occurs when the prostate gland is in a state of enlargement, which carries the vesical orifice of the urethra above its natural level. This is well represented in two plates of Stanley's work on Lithotomy. In two subjects, having hypertrophy of the prostate, Mr. B. Phillips ascertained the level of the most depending portion of the prostatic part of the urethra to be from six to seven lines and a half below the level of the vesical orifice of this canal; whereas, in healthy subjects, he found it to be only from three to five. (*Op. cit.* p. 18.) The spongy is the most dilatable portion of the urethra, but as any yielding of it upwards is prevented by the corpora cavernosa, between which it is lodged, the dilatation is almost entirely at the expense of its lower side, and admits of being carried to the greatest degree at the bulb, where the spongy substance is most abundant. At this point, corresponding to one almost directly under the symphysis, the canal suddenly becomes narrower at the commencement of its membranous portion. Afterwards, it enlarges again in its prostatic part, but here its floor has two lateral grooves in it, occasioned by the projection of the verumontanum in the middle. At the entrance of the bladder, there is also on this same lower side of the canal a transverse prominence, formed by the substance of the prostate gland, and a few fibres of the sphincter, which prominence is termed by M. Amussat the *pyloric valve*. The upper side of the urethra, being every where smooth and firm, presents no obstacle of this kind.

Hence it is manifest, that when the beak of a catheter is inclined against the lower side of the urethra, there are two stoppages, as it were mechanical ones, and met with even in the dead subject; but there are two others, which exist only in the living body, and which depend upon the contraction of the sphincter vesicæ. Such, according to M. Malgaigne, is the urethra of the adult male subject. In the child, the difficulties are less; the penis is less raised; the symphysis of the pubes does not descend so far; the prostate is nearly flat; the corpus spongiosum is but little developed; and the lower side of the urethra is so firm, that, until the age of twelve or fifteen, scarcely any obstacle is felt in the whole course of the canal. In an old man, the reverse is the case: the corpus spongiosum, which is looser, admits of being depressed further towards the bulb; the prostate gland is frequently enlarged; and what M. Amussat calls the *pyloric valve* more strongly marked. From all the foregoing circumstances, it follows, that, *ceteris paribus*, it is more easy to sound, or pass an instrument into the bladder of a child, than an adult, and an adult, than an old person. (See *J. F. Malgaigne, Manuel de Méd. Opér.* p. 630. ed. 2. 12mo. Paris, 1837.) In children, however, for reasons stated by all anatomists, and particularly noticed by Mr. B. Phillips, the urethra is more curved. (*On the Urethra, &c.* p. 19.) The male urethra being long, and narrow, having also the angle and curve in it above described, and being surrounded by the prostate gland, and other parts whose diseased states are liable to interrupt the functions of this canal, we cannot be surprised at the

fact, that it is subject to more numerous, as well as far more serious diseases, than the short, capacious, and simple urethra of the female. Thus, as an able surgeon remarks, "a mechanical obstruction to the flow of urine through the male urethra may arise in various ways. There may be an enlargement of the prostate gland, by which one extremity of the urethra is surrounded; an abscess in the perinæum; or one of the mucous follicles may be inflamed, and converted into a solid tumour; and any one of these, as well as some other causes, may operate so as to produce the effect. The most common cause of difficult micturition, however, is a contraction, or stricture of the urethra itself." (*Sir Benj. Brodie, On Dis. of the Urinary Organs, p. 2. ed. 2.*)

Mr. Benjamin Phillips does not concur in the opinion, that the membranous portion of the urethra is the most frequent seat of false passages, and he maintains that it possesses much solidity. "False passages (he observes) are less frequent here than in the bulbous portion of the canal. (See also *Velpeau, Méd. Opér. t. iii. p. 908.*) The reason of this must be immediately evident: false passages are ordinarily made in consequence of the difficulty experienced in the endeavour to pass an instrument through the strictured portion of the tube. Stricture is most frequently seated at the point of junction, between the bulbous and membranous portions of the canal; consequently the false passage will be usually anterior to this latter point." (*On the Urethra, its Diseases, &c. p. 15. See also Velpeau, vol. cit. p. 910.*) "*Aussi est ce bien plutôt à son entrée, à son départ du bulbe, que sur elle-même, qu'on observe les déchirures et les perforations traumatiques.*"

In the articles CATHETER, and URINE, RETENTION OF, I have noticed the advice of Sir Benjamin Brodie and of M. Velpeau to keep the beak of the catheter, staff, or sound against the upper side of the urethra. "This side of the urethra, forming the concave margin of the segment of a circle, is, on this very account, shorter than the other, and less disposed to wrinkle. Having no excavation, and being closely adherent to the lower surface of the penis, it presents in its spongy part great regularity, and is so strong as not to be in danger of injury from the catheter." There is, however, as M. Velpeau explains, a small portion of the upper side of the urethra almost naked, just in front of the symphysis, where the corpora cavernosa diverge from the bulb to be inserted into the ram of the ischium and os pubis; and where the beak of the instrument, if carelessly pushed on, may do mischief. (*See Velpeau, Méd. Opér. t. iii. p. 907.*)

This subject has not been overlooked by Mr. Benjamin Phillips. "In introducing an instrument into the urethra or bladder, (says he) it is necessary to recollect, that the two opposed parietes of the urethra — the superior and inferior — differ singularly as to their configuration, and that we cannot indifferently follow the one or the other with the beak of an instrument. The inferior portion is yielding; for, neither along the penis nor at the height of the scrotum, nor beneath the pubic symphysis, is it supported by any thing solid. In gliding along the canal, the beak of the sound may easily push before it the lining membrane of the urethra; for, along its surface we meet in old men with infections of the mem-

brane, resulting from its flaccidity, which occasionally have a tendency to arrest the progress of the instrument. Some orifices of mucous follicles, and, among others, those of the glands of Cowper, are, according to general opinion, susceptible of receiving and arresting the beak of a sound, especially if it be of a small size. Lastly, at the level of the bulb, and in front of the contour of the neck of the bladder, on the sides of the verumontanum, there exist on the inferior surface marked depressions, the orifices of which are presented towards the external orifice of the urethra; against these the beak of the sound passes, and by them occasionally prevented from making further progress.

"If we examine by means of dissections (attentively made), false passages formed in the urethra during life, or after death, in subjects submitted to catheterism, we find, that they are produced by the rupture of the inferior parietes of this canal, and that the greater number of those passages exist either at the situation of the depression I have pointed out, or at the bulb. The disposition of the superior part of the urethra is infinitely more favourable as a conductor for instruments, than the inferior. Sustained in front by the corpora cavernosa, and behind by the pubic symphysis, it presents great firmness: and we find only longitudinal replications, which are removed by the distention produced by the instrument; and no obstacle is here presented to its progress. No depression exists here under ordinary circumstances. There is no projection of the prostate into this portion of the tube; neither do we find many follicles, either isolated or grouped; nor any considerable orifice." (*On the Urethra, &c. p. 129.*) For additional remarks, see CATHETER, and URINE, RETENTION OF.

URETHRA, DESTRUCTION OF PART OF THE.—The attempts to complete the canal by operations, performed on the Taliacotian principles, will be noticed in the article URINARY FISTULA.

URETHRA, STRICTURES OF.—A stricture of the urethra has been defined by one modern writer "to be a morbid alteration of action, or of structure, by which a part of the canal is rendered narrower than it is by nature." (*Wilson, On the Male Urinary and Genital Organs, p. 361.*) Lisfranc defines stricture to be that morbid condition of the urethra, in which the canal, for a greater or lesser extent, cannot resume its ordinary capacity. Few persons take much notice of the first symptoms of a stricture, till they have either become violent, or other inconveniences have been the consequence. A patient may have a considerable stricture, yet be unconscious that his urine does not come away freely; and, in consequence of a stricture, there may even be a tendency to inflammation and suppuration in the perinæum, while he feels no obstruction to the passage of his urine, and does not suspect that he has any other complaint. Many cases of this kind have come under my observation.

Three kinds of strictures are described; viz. the permanent stricture, which arises from an alteration in the structure of the affected part of the urethra; the mixed, consisting of a permanent stricture and a spasm; and the spasmodic.

Spasmodic stricture is suspected by some writers to arise from the whole or a part of the canal of the urethra being so highly irritable, that the slightest stimulus will cause it to contract, and

occasion the stream of urine to be suddenly obstructed. Thus, spasmodic strictures are considered by Mr. Stafford as being often the result of faulty digestion. He has known a spasmodic stricture follow the eating of high-seasoned and indigestible food, or the drinking of acidulous liquors; and he asserts that the spasmodic state of the urethra will cease, if the irritating substance in the alimentary canal be carried off, or the acid neutralised. When general irritability exists, he believes that spasmodic affection of the urethra may be brought on by urine of an irritating quality, or any other local stimulation of the urethra, as by a bougie, &c. (*On Strictures in the Urethra, &c.* p. 3.)

Whether the urethra be a truly muscular canal, and whether a variety of circumstances, remarked in its healthy and diseased state, can be accounted for by its elasticity, the action of the muscles in the perineum, and other principles, without supposing the canal to be itself muscular, are questions on which different opinions are entertained. Until a very recent date, perhaps, the majority of the schools in this country maintained the doctrine of muscularity, either in the membrane of the urethra itself, or in the substance immediately surrounding it. The latter has been alleged to be the real case. "From Mr. Bauer's examinations (says Sir Everard Home) we find that the human urethra is made up of two parts, an internal membrane, and an external muscular covering. The internal membrane is exceedingly thin, and no fibres are met with that can give it a power of contraction. When it is put on the stretch in a transverse direction, the circumference of the canal is no ways increased; but when stretched longitudinally, a small degree of elongation is produced. When a transverse section of the urethra is made, while in a collapsed state, the internal membrane is found thrown into folds, pressed together by the surrounding parts." It is afterwards explained, that "the muscular covering by which the membrane is surrounded, or enclosed, is made up of fasciculi of very short fibres, which appear to be interwoven together, and to be connected by their origins and insertions with one another. *They all have a longitudinal direction.* There is a greater thickness of this muscular structure upon the upper than the under surface of the urethra, which is still more evident as it approaches nearer to the external orifice. The fasciculi are united together by an elastic substance of the consistence of mucus. Immediately beyond the muscular portion of the urethra, is the cellular structure of the corpus spongiosum."

Formerly "it was believed, that either the lining of the urethra was composed of *circular* fibres, possessed of a power of contraction, or that it was immediately surrounded by such fibres; and, therefore, that the disease, commonly known by the name of a stricture in the urethra, was produced by a contraction of some of these *circular* fibres; and that permanent stricture was a term applied to these parts, when, in consequence of inflammation, they became confined to that particular state. We now find, that the lining of the urethra is never met with in a contracted state, but is thrown into folds* by the action of the elastic ligamentous covering of the corpus spongiosum, and the swell of the longitudinal muscular fibres within it; and when these fibres have, by acting

through their whole length, reduced the urethra to its shortest state, the pressure upon the internal membrane is so great, that there is not room for the urine to pass, till these fibres are relaxed by elongating the whole canal.

"A *spasmodic stricture* is in reality a contraction of a small portion of the longitudinal muscular fibres, while the rest are relaxed; and as this may take place either all round, or upon any one side, it explains what is met with in practice, and could not before be satisfactorily accounted for; the mark or impression of a stricture sometimes forming a circular depression upon the bougie; at other times, only on one side.

"A *permanent stricture* is that contraction of the canal which takes place in consequence of coagulable lymph being exuded between the fasciculi of muscular fibres, and upon the internal membrane, in different quantities, according to circumstances; and in the same proportion, diminishing the passage for the urine at that part, or completely closing it up." (*Sir Everard Home, in Phil. Trans.* 1820; and *Pract. Obs. on Strictures*, vol. iii. p. 26, &c. 8vo. Lond. 1821.) These views do not agree with the investigations of some of the most minute anatomists of the present day.

John Hunter is generally regarded as the head of the party which infer that the urethra is muscular; and his opinions on the subject were strenuously defended by Sir Everard Home. M. Velpeau is also on the same side (*Méd. Opér.* t. iii. p. 909.), as well as Messrs. Howship and B. Phillips. (*On the Urethra, &c.* p. 131.) Sir Charles Bell, on the contrary, denied the muscularity either in structure or function of the urethra; and one critical writer observes, that his arguments (*On Dis. of the Urethra*, Letter iii. p. 94—105.) must be conclusive to every one who knows what are the proofs of muscular structure, and can appreciate the difference between matters of fact and matters of opinion. (*Ed. Med. Journ.* No. 114. p. 220.) On this point, Mr. Clement carefully examined the testimonies of De Graaf, Morgagni, Haller, Laentaui, Portal, Cloquet, and Sir Charles Bell; and the evidence, thus brought together, indisputably proves that the urethra is not a muscular structure. From these facts, and from those contained in the excellent paper of Mr. John Shaw, Mr. Clement is declared by the above critic writer, to have completely refuted the inferences of Sir Everard Home. (See *W. J. Clement's Obs. on Surgery and Pathology*, 8vo. Lond. 1832.) So long, however, as certain phenomena adverted to by M. Velpeau, Sir B. Brodie, and others continue inexplicable, without the existence of a contractile power in the urethra, I should not be disposed to join in the positive conclusion that no such contractility resides in the urethra, though it may not be muscular.

An explanation of certain facts observed in practice, in relation to the foregoing disputed point, may, however, be derived from circumstances quite independent of any muscular structure in the urethra itself. I have adverted to what M. Amussat terms the *pyloric valve*, situated at the vesical orifice of the urethra: this is partly muscular, and may, therefore, sometimes be concerned in producing a spasmodic impediment to the escape of the urine. But, with reference more particularly to strictures, I beg leave to cite the following statements of Sir Benjamin Brodie. "It is

usual (says he) to regard strictures of the male urethra as being spasmodic, or permanent; and I cannot but believe that the distinction is well founded. A man, who is otherwise healthy, voids his urine one day in a full stream. On the following day, perhaps, he is exposed to cold and damp; or he dines out, and forgets, amid the company of his friends, the quantity of champagne, or punch, or other liquor containing a combination of alcohol with a vegetable acid, which he drinks. On the next morning he finds himself unable to void his urine. If you send him to bed, apply warmth, and give him Dover's powder; it is not improbable that, in the course of a few hours, the urine will begin to flow. After the lapse of a few more hours, you give him a draught of infusion of senna and sulphate of magnesia, and when this has acted on the bowels, he makes water in a full stream.

"You are called to another patient under the same circumstances, except that he is suffering more severely. You feel the distended bladder occupying the lower part of the abdomen, and forming a distinct tumour, extending nearly to the navel. The case is urgent, requiring active treatment and immediate relief. On the introduction of a bougie, you discover an obstruction in what is termed the membranous part of the urethra. Having no small bougie at hand, you press one of a middle or full size against the obstruction for a few minutes; and then withdraw it at the moment when there is a sudden and violent impulse to make water. Although the bougie has not penetrated into the contracted part of the urethra, so as to dilate it mechanically, on its being withdrawn it often happens, that the patient begins to make water in a considerable stream. In other instances, the same effect is produced by touching the obstruction with the nitrate of silver. Now, in these cases, the difficulty of micturition comes on suddenly, and subsides suddenly; and we must presume that the cause of it is a temporary, and not a permanent, change in the condition of the urethra.

"Under such circumstances, we find that the obstruction is *always at one part*; that is, at what is called (not very properly) *the membranous portion of the urethra*. And here be it remembered that the canal is surrounded by a muscle of no inconsiderable size, connected by a small double tendon to the arch of the pubes. A particular description of this muscle has been given by the late Mr. Wilson, in the first volume of the *Med. Chir. Trans.*; and it seems to afford a reasonable explanation of the phenomena which I have just described.

† "In another, and much more common series of cases, the patient's history is nearly as follows: he voids his urine in a diminished stream; and you find, on inquiry, that the diminution has been going on for months, or even for years. By degrees the stream becomes still further diminished, so that it is no larger than a thread; and, at last, there is no stream at all, the urine being voided only in drops, and not without much difficulty and straining. Should the patient die, and an opportunity be thus afforded of examining the state of the diseased parts, you find the urethra contracted in one portion of its canal, its membrane thickened at the point of contraction, and converted into a substance of the consistence, though without the

fibrous structure, of ligament. These cases are manifestly essentially different from the last. The contraction, if not relieved by art, goes on uniformly increasing. We say that there is a *permanent stricture*." (Sir B. Brodie, *On Dis. of the Urinary Organs*, p. 3—5.)

When the disease is altogether spasmodic, the first symptom is a difficulty of making water, which condition speedily terminates in complete retention of urine. In permanent strictures, which are the most common, the stream of urine becomes diminished, long before there is any absolute difficulty of micturition. (Sir B. Brodie, *Op. cit.* p. 11.)

According to Sir A. Cooper, the earliest symptom of a permanent stricture is the retention of a few drops of urine in the urethra, after the patient has made water, which drops soon escape, and slightly wet the linen, while another small quantity of urine, collected between the neck of the bladder and the stricture, may be expelled by pressure on the lower side of the urethra. This inability of completely emptying the urethra, however, is observed in the generality of persons after a certain age, and even in youngish individuals, who have led irregular lives: much stress, therefore, cannot be laid upon this circumstance alone. The next thing noticed, he says, is an irritable state of the bladder, evinced by the patient not being able to sleep so long as usual, without discharging his urine. As the disease increases, the stream of urine is forked, spiral, flattened, or scattered; and, in a more advanced stage, the water is often voided only by drops, especially when the urethra is under the influence of cold, irritation, or the effects of intemperance. When the stream of urine is thus altered, or broken, Mr. Hunter recommends the passage to be examined with a bougie; and, if one of a common size can be readily introduced, and the patient is of advanced years, the difficulty of voiding the urine is likely to depend on a diseased enlargement of the prostate gland, which should be examined. (See PROSTATE GLAND.)

As the disease makes progress, the stream of urine becomes more and more diminished, till, at last, some exposure to cold, imprudence in diet, or other causes disturbing the general health, bring on a complete stoppage of urine. (See URINE, RETENTION OF.)

In diseases of the urethra, and also of the prostate gland and bladder, there is commonly an uneasiness about the perinæum, anus, and lower part of the abdomen. (Hunter.)

The first progress of the contraction is generally very slow; but, when once it has so far increased as not to be wholly relaxed by the force of the urine, its subsequent advances are more rapid, and new symptoms are perceived. The urine is voided more frequently, does not pass without a considerable effort, attended with pain; and a straining sensation continues, after the bladder is emptied. If the patient accidentally catch cold, drink a glass of spirituous liquor, acid beverage, or punch, commit an excess in drinking wine, or remove quickly from a warm to a cold temperature, the urine will, perhaps, pass only in drops, or be entirely obstructed. These causes, according to Sir Everard Home's view, induce, in the longitudinal fibres at the contracted part, a spasmodic action, by which it is closed. Cold, externally applied to the body, has so great an effect upon a spasmodic stricture,

that a patient who can make water without the smallest difficulty in a warm room, is often quite unable to void a drop, on making the attempt in the open air. However, on returning to a warm room, and sitting down a little while, he becomes able again to expel his urine. The symptoms of a stricture are more frequent in persons who lead a sedentary life, than in others whose pursuits are active.

In the early stage of stricture, there is frequently a discharge of mucus, or of a muco-purulent fluid from the urethra, attended with a sensation of itching, or even with a slight degree of heat and pain in making water. Whatever may be the seat of stricture, this fluid is found by Sir Benjamin Brodie to be secreted from the first two or three inches of the urethra, nearest the orifice in the glans. (*Op. cit.* p. 11.)

Strictures in the urethra, thus being frequently attended with a discharge, and pain in making water, especially after any excess, are occasionally mistaken, and treated as a gonorrhœa or a gleet. These symptoms often come on a few hours after connexion with women; the degree of inflammation is very slight; the discharge is the first symptom, and is more violent at the commencement than at any other period. The inflammation subsides in a few days, leaving only the discharge, which also frequently disappears in five or six days, whether any means be employed or not for its removal. (*Home.*)

Stricture of the urethra rarely occurs before the age of puberty, or in advanced age. The following observations delivered by Sir Benjamin Brodie, I deem of great value to the practical surgeon. "It you are consulted by two patients, on account of a difficulty in making water; the one a young, the other an old man; the chances are, that the first suffers from stricture. If the old man states, that the difficulty, of which he complains, has existed for a series of years, you may conclude that he also labours under stricture. If, on the other hand, you can trace it back to a few days, or weeks only, or even if he says that it has been coming on for the last year or two, then, it is most probable, that the impediment to the flow of urine arises from an enlargement of the prostate gland." (*On Dis. of the Urinary Organs*, p. 10.)

In consequence of the natural sympathy between the urethra and testicles, the latter organs are apt to swell in cases of stricture; and, as there is also a discharge, the disease may be mistaken for a common hernia humoralis, and a treatment on very wrong principles instituted.

The permanent stricture consists in a thickening of structure, whereby the diameter of the diseased part of the passage is lessened. However, the diameter of the affected portion of the canal even now varies, according as the spasmodic action of the muscles about the perinæum, and the effects of inflammation, contribute more or less to a temporary increase of the obstruction. In the language of Sir Everard Home, the case may be both a permanent stricture, and a spasmodic one; permanent, because the diseased part of the urethra is always narrower than the rest of this passage; and spasmodic, inasmuch as the stricture may be rendered still more contracted by spasm affecting the muscular structure, whatever that may be, adjoining the disease. In the contracted state, the passage is closed up; in the relaxed, the urine can

pass through it in a small stream. Here I think, that the observation made by numerous practical surgeons should be remembered, viz. that such spasm has never been noticed by them as affecting a stricture situated more forward in the passage, than where it may be supposed to be under the influence of the action of the muscles in the perinæum. Indeed, one experienced surgeon declares, that he has never met with a spasmodic stricture, except at the point where the urethra passes through Camper's ligament. (See *Mayo's Outlines of Human Pathology*, p. 549.)

In old cases of stricture, the muscular coat of the bladder becomes thickened and stronger than natural, in consequence of more force being necessary to propel the urine through the obstructed part. The bladder, in this thickened state, does not admit of the usual dilatation, so that the patient is obliged to make water very frequently, and he is unable to pass the whole night without making this evacuation once or twice. (*Home.*)

A nocturnal emission of the semen is another common symptom of a stricture; and some patients, as I have noticed in my practice, seem to have no other complaint attendant on the disease in its less advanced stages.

A periodical discharge is sometimes brought on by cold, or other occasional causes. When the inflammation extends to the bladder, the frequency of making water is considerably increased, and the urine very turbid. It is voided for twelve or twenty-four hours, once or even twice every hour; and, when allowed to stand, it deposits a substance in the form of powder, consisting of coagulable lymph. This is the slightest kind of attack.

Sometimes the bladder is inflamed in a greater degree, and secretes pus, which is discharged with the urine. In a still more violent attack, the discharge is similar to the white of an egg, and particularly adhesive. When the inflammation becomes still worse, the affection sometimes extends to the peritoneum, and the patient dies.

Sir Benjamin Brodie adverts to some of these conditions. "In many cases (says he) where the disease is of long standing, the inner membrane of the bladder becomes affected with chronic inflammation. It then secretes a ropy, adhesive mucus, which is sometimes so abundant as to obstruct the canal of the urethra, close the stricture, and seriously increase the difficulty of making water. Sir Benjamin Brodie has also met with several cases, in which the internal membrane of the bladder was found after death, not only inflamed, but encrusted, over a large part of its surface with coagulated lymph. Specimens of such changes are preserved in University College Museum. This effusion of lymph is the result of acute inflammation, chronic producing a secretion of adhesive mucus. The lymph is chiefly, if not exclusively, observed, where the patient has died after having been harassed by repeated attacks of retention of urine." (*Op. cit.* p. 23.)

As strictures of long standing always impede the passage of the urine, the bladder acts with augmented force to overcome the resistance. In this manner the stricture is kept in a continual state of irritation, and the obstruction becomes more and more considerable.

In a few cases, indeed, the diseased part of the urethra, is rendered quite impervious; and the

patient's life is preserved by the urethra ulcerating, at some point behind the obstruction, and fistulous openings taking place in the perinæum. (See *FISTULÆ IN PERINÆO.*) It does not often happen, that the bladder itself gives way.

As Sir A. Cooper has observed, piles are sometimes a consequence of strictures; and the efforts made by the abdominal muscles to expel the urine, are occasionally a cause of the direct or oblique inguinal hernia. On the other hand, piles are sometimes believed to be the cause of spasmodic stricture. "We may presume (says Sir Benjamin Brodie, in noticing the effect of acid spirituous drinks on strictures) that the absorption from a blister acts in a similar manner; that is, by increasing the stimulating effects of the urine. Gravel or stone in the bladder will produce the same effects. Diseases of the kidney and of the rectum, as hemorrhoids or carcinoma, act sympathetically on the urethra, and not unfrequently give rise to spasmodic stricture." (*Op. cit.* p. 9.)

In some instances, the mucous membrane protrudes through some of the interstices of the muscular fibres, forming small cysts communicating with the cavity of the bladder. They are believed to be produced while the patient is straining to discharge his urine, the pressure of which against the mucous membrane forces portions of it between the muscular fibres. In all probability, the change is a gradual one. In University College Museum are several preparations of the bladder thus altered, and usually termed sacculated. In some of them calculi may be noticed. Sir Benjamin Brodie has a preparation of this last kind, taken from a patient who had disease of the prostate gland (*Op. cit.* p. 24.); a case in which the combination of the sacculated bladder with calculi is certainly more common than in cases of stricture, partly, perhaps, on account of the patient's usual period of life, the generally longer continuance of the obstruction, and the longer habit of straining to make the urine pass.

Strictures are frequently attended with constitutional symptoms, one of which is a complete paroxysm of fever. The cold fit is very severe; this is followed by a hot fit, and then a profuse perspiration. During the rigor, nausea and vomiting generally occur; and, at this period, the patient has occasion to make water frequently, seldom experiencing, at the same time, any strangury. When the fit is tolerably complete, the patient suffers, in general, only one; in the opposite circumstance, two; but Sir E. Home believed that a greater number rarely happens. Such febrile paroxysms are most frequent in warm countries; but do every now and then take place in this climate, particularly in consequence of exposure to cold, excesses, and the introduction both of common and armed bougies. Sir A. Cooper has observed them to be common in that stage of the disease, in which the urine is blended with pus.

The following are the observations of Sir Benjamin Brodie, on this part of the subject. "I have said, that rigors sometimes occur during the formation of abscess. In this there is nothing remarkable, as rigors mark the formation of abscess under a variety of other circumstances. But rigors also occur in many cases of stricture, independent of abscess. We observe them most frequently in patients from hot climates, especially from the East Indies. They usually recur at irregular

periods; being in many instances induced by the introduction of a bougie, or by the application of caustic to the stricture. The paroxysm very nearly resembles that of an intermittent fever; and it is more severe where it follows the use of the bougie, than where it occurs independently of it. In general, the cold fit having been followed by a hot fit, and that by profuse perspiration, the patient is relieved. At other times, however, the constitution is disturbed for a great length of time afterwards; and sometimes the rigor is followed by an attack of fever, which lasts for several days, or even for some weeks. I met with one case in which a rigor followed the application of caustic to a stricture, and this was succeeded by an attack of mania, which did not subside for nearly a month. In another case, a gentleman had laboured under stricture for many years, during which no bougie had ever been made to enter the bladder. I succeeded in the introduction of a small gum catheter; but, in a few hours afterwards, the patient had a rigor. He then remained affected with fever, attended with a rheumatic inflammation of the muscles of the back of the neck. From the effects of the latter he had not recovered a long time afterwards; and I believe that his neck is stiff, and drawn to one side, even to the present day." (*Sir B. Brodie, Op. cit.* p. 25.) I remember one man in St. Bartholomew's Hospital, who was attacked with violent shiverings directly after the application of a caustic bougie; and he died in four or five days, from the constitutional disturbance thus induced.

When a permanent stricture is not considerable, it appears, on examination after death, to be merely a narrowing of the urethra; but, in a more advanced state, it usually consists of a ridge, which forms a projection in the passage. (*Home.*) The latter form of the disease is now generally regarded by pathologists, as the effect of chronic inflammation. (*C. Bell, Bower, Sir A. Cooper, &c.*)

Mr. Hunter observed, that the disease generally occupied no great length of the passage; and, if the disease be recent, such is the fact. In these cases, the contraction is not broader than if it had been produced by surrounding the urethra with a piece of packthread. However, Mr. Hunter had seen the urethra contracted for more than an inch in length, owing to its coat, or internal membrane, being irregularly thickened, and forming a winding canal. I once saw a man in the Queen's Bench, whose urethra was completely obliterated from the glans to the perinæum, where a fistula had formed, out of which he voided his urine. Besides these varieties of stricture, Sir A. Cooper used to demonstrate in his lectures a kind of stricture produced by the extension of a membranous band across the passage.

The contractions, which occupy a considerable extent of the passage, are generally extremely irregular; greater in the middle, and becoming gradually less towards each extremity; and their structure resembles that of cartilage, being indurated and tough. In these cases, which are usually of long standing, the membrane likewise partakes of the change, being firmer and thicker than natural. (*See Stafford, On Strictures, &c.* p. 11.)

A stricture does not always arise from an equal contraction of the urethra all round; for, in some instances, the contraction is only on one side.

The contraction of one side of the canal may throw the passage to the opposite side, which often renders the introduction of a bougie difficult. The contracted part is whiter than the rest of the urethra, and is harder in its consistence. In some cases there are several strictures. Mr. Hunter met with half a dozen in one urethra, and he observes, that a stricture is frequently attended with small tightnesses in other parts of the passage. According to the same authority, every part of the urethra is not equally subject to strictures, the bulbous portion being much the most subject to them. A stricture is sometimes situated on this side of the bulb, *but very seldom beyond it*, that is, *nearer the bladder*. Mr. Hunter never saw a stricture in that part of the urethra which passes through the prostate gland; and the bulb, besides being the most frequent seat of this disease, is also subject to it in its worst forms.

Sir Everard Home measured the length of the urethra in different subjects, and examined the diameters of the several parts of the passage. Strictures, according to this gentleman, *occur most commonly just behind the bulb* of the urethra, the distance from the external orifice being $6\frac{1}{2}$ or 7 inches. The situation, next in the order of frequency, is about $4\frac{1}{2}$ inches from the orifice of the glans. The disease does also occur at $3\frac{1}{2}$ inches, and, sometimes, almost close to the external orifice. The two parts of the urethra most frequently affected with strictures, are naturally the narrowest. Sometimes the very orifice of the urethra is contracted, and the circumstance often leads to an erroneous supposition, that the whole canal is naturally formed of the same size.

In almost all the cases which Sir E. Home met with, there was one stricture, about seven inches from the external orifice, whether there were any others or not.

We have seen that Mr. Hunter and Sir E. Home do not agree respecting the most frequent place of strictures. Sir A. Cooper also partly differs from both these authorities; for, though he coincides with Mr. Hunter in setting down the most common situation to be in front of the bulb, just where this part joins the corpus spongiosum, yet he varies from both in representing strictures in the membranous and prostatic portions of the urethra, as next in order of frequency.

Soemmerring represents the seat of stricture as being especially at the posterior part of the urethra, in the vicinity of the bulb; rarely in front of this, and *never* in the part of the canal surrounded by the prostate gland. In the latter assertion, however, Mr. Benjamin Phillips considers him to be in error, and two cases are quoted from Lallemand in proof of the misstatement. (*Benj. Phillips, on the Urethra, its Diseases, &c.* p. 150.)

Amongst the consequences of the disease which are found on dissection, are, first, in very bad cases, a great dilatation of the urethra behind the stricture: secondly, a considerable thickening of the coats of the bladder, as already mentioned: thirdly, enlargement of the ureters, an effect of their being distended with urine, during the retentions common in the advanced stages of the disease: fourthly, the kidneys are often diseased, their glandular structure being sometimes entirely destroyed, and the rest of them enormously dilated; a mode in which the case may prove fatal. The prostate gland is frequently enlarged; ab-

scesses are occasionally found in it, with fistulæ leading from them to the perinæum, or parts around, and its natural ducts are often considerably dilated. (See *Stafford, On Strictures, &c.* p. 41.; ed. 2.) The kidneys suffer the same kind of change as from disease of the prostate gland. (See *PROSTATE GLAND.*)

I attended, with Mr. Hooper of the London Road, Mr. Y——, a theatrical performer, who was in a dying state from effusion of urine, abscesses, and sloughing, resulting from bad strictures. In attempting to make an outlet for the urine near the prostate, I opened an abscess from which about a quart of fetid pus escaped. In the post mortem examination, nearly all the cellular tissue in the pelvis was the seat of abscess, and about half of the rectum was black and gangrenous. The bladder and kidneys were also much diseased.

The portion of the urethra between the stricture and the bladder is generally more or less inflamed; and ulceration of it much disposed to take place, and to lead to abscesses and fistulæ in the perinæum.

Sir Benjamin Brodie concurs with Sir Everard Home in representing the ordinary situation of a permanent stricture to be at the anterior extremity of the membranous part of the urethra, just behind the bulb. "Sometimes (as he adds) the *original* stricture is anterior to the bulb between it and the external orifice of the urethra. These cases, however, are comparatively rare. It is worthy of remark, that a stricture in the anterior portion of the urethra is seldom complicated with spasm, probably because there are no muscular fibres immediately surrounding the canal at this part. In some very old cases, we find a permanent stricture behind the bulb, and another anterior to it; and, in other cases, where the disenso has been of still longer duration, we find the whole urethra more or less contracted, and the membrane of it thickened; the contraction being greater in some parts, and less in others. In old cases, the urethra becomes diseased behind the stricture in various ways. Small irregular prominences, or tubercles, are sometimes found on its inner surface, which seem to have had their origin in minute depositions of coagulated lymph, which subsequently have become organised. The orifices of the mucous glands, and those of the prostatic ducts, are often preternaturally dilated; and, indeed, the whole canal of the urethra, behind the stricture, is widened in consequence of the bladder forcibly impelling the urine into it, there being, at the same time, an insufficient outlet for its escape. This dilatation is most remarkable, when the stricture, is in the anterior part of the canal. I attended a gentleman, who, for many years, had laboured under a stricture, situated about three inches from the external meatus. The urethra behind the obstruction was so dilated, that whenever he made water, a tumour as large as a small orange, and affording a distinct fluctuation, was to be felt in the perinæum; it might be compared to a second bladder. Once, when he sent for me, on account of a complete retention of urine, I punctured the tumour in the perinæum, and immediately the urine gushed out in a full stream. From that time the urine was passed regularly through the artificial opening; all difficulty in voiding it was at an end, and thus I was enabled to direct my whole attention to the removal of the

stricture." The perineal opening then healed. (Sir B. Brodie, *Op. cit.* p. 7.) In other cases of long standing, this gentleman has occasionally found an oblong, irregular, indurated gristly mass at the lower part of the penis, just where it is covered by the scrotum. In one instance, it remained after the stricture had been relieved, and was ascertained, after the patient's decease, to consist in a deposition of lymph in the corpus spongiosum, with a sinus leading from the urethra into it.

With respect to the causes of strictures, some writers impute the disorder to the effects of gonorrhœa, and often to the method of cure. Mr. Hunter entertained strong doubts, however, whether strictures commonly, or ever, proceeded from these causes; though he acknowledges that, since most men have had gonorrhœa, a refutation of the opinion is difficult. He was led to think, that strictures did not commonly arise from such causes, by reflecting that they are common to most passages in the human body. They often take place in the œsophagus; the intestines, particularly the rectum; the anus; the prepuce, so as to produce phimosis; and in the lachrymal duct, so as to occasion a fistula lachrymalis. Strictures sometimes take place when there have been no previous venereal complaints. Mr. Hunter saw an instance of this kind in a young man, nineteen years of age, who had had the complaint for eight years, and which, therefore, began when he was only eleven years old. He was of a weak scrofulous habit. Mr. Hunter had also seen a stricture in a boy only four years old, and a fistula in perinæo in consequence of it. Strictures, he says, happen as frequently in persons who have had gonorrhœa in a slight degree, as in others who have had it in a severe form.

However, it must not be dissembled, that many judicious and experienced men still regard Mr. Hunter's conclusions on this question as erroneous; and Sir A. Cooper, in particular, differs from him so much, as to say that he considers gonorrhœa, in ninety-nine cases out of a hundred, to be the cause of strictures. At the same time he admits the possibility of their origin from other causes, and mentions a case which he saw himself, and which arose from an injury received by a child, as it was riding on horseback. Delpech also describes strictures as a frequent consequence of gonorrhœa; and he is a zealous advocate for cubebs and copaiva, in this last disorder, because his observations lead him to believe, that, by shortening its duration, they materially lessen the chance of strictures. (*Clinique de Chir.* p. 271.)

It is not an uncommon belief, that strictures arise from the use of astringent injections in the treatment of the gonorrhœa. Sir Everard Home was of this opinion, and so was the late Mr. Wilson. (*On the Male Genital and Urinary Organs*, p. 370.) The latter gentleman, however, mentions some circumstances, calculated to raise doubts on this point, especially the fact that, while injections rarely enter far into the urethra, the most common seat of a stricture is where the membranous part of the canal joins the bulb. Mr. Hunter himself deemed the opinion founded on prejudice, and states, that he had seen as many strictures after gonorrhœa, which had been cured without injections, as after cases which had been treated with these latter applications.

Sir Benjamin Brodie believes, that more blame

has been attached to astringent injections than they really merit. "It is the abuse (says he), and not the use, of injections, which is to be deprecated. I have no hesitation in saying, that there is greater danger as to the production of stricture from a very long-continued gonorrhœa, or gleet, than from the prudent use of a mild astringent injection." (*Op. cit.* p. 10.)

Mr. Hunter rejected the doctrine, that strictures are a consequence of ulcers in the urethra; for ulcers hardly ever occur in this passage, except when there are strictures: and it is now generally admitted, that, in gonorrhœa, there are no sores in the urethra. But though an ulcer, or abscess in the urethra, is not the ordinary cause of stricture, it is occasionally so, as the experience of Sir Benjamin Brodie confirms. Strictures are sometimes produced by external violence, though the passage would appear to be capable of frequently bearing considerable wounds and other injuries, without this consequence. Thus, strictures are not common from lithotomy, and, in a modern work, we read the case of a serious gunshot wound of the urethra, where no stricture ensued. (*See Annuaire Méd. Chir. des Hôpitaux de Paris*, 4to. 1819.)

According to my friend Mr. Macilwain, strictures are mostly preceded by a state of the passage, called an *irritable urethra*, which has great share in bringing them on. The morbid sensibility, by which it is chiefly characterised, may affect the whole passage, or only part of it; in which last case the prostatic portion is almost always that which is affected. In cases of irritable urethra, the size of the stream of urine varies remarkably at different times, the variation being alleged to be much greater than in examples of stricture. (*On Strictures*, p. 9, &c.) There can be no doubt, that what this gentleman has so well described as the *irritable urethra*, is the same case which some other writers denominate *spasmodic stricture*.

Here, it appears to Sir Benjamin Brodie, that "the cause is generally something which acts as a source of local irritation. The urine may be unnaturally stimulating, from its containing an excess of lithic acid. Hence, the spasm comes on often after indulgence in spirituous or fermented liquors, especially those which contain a combination of alcohol with acid, such as champagne or punch, &c." (*Op. cit.* p. 9.)

SPASMODIC STRICTURES, OR IRRITABLE URETHRA.

These cases should be treated by removing the cause, and, if they depend upon disordered digestion, whatever gives rise to this state must be avoided, or removed. If, says Mr. Stafford, the spasmodic stricture depend upon the extreme irritability of the urethra, occasioned by a morbid irritability of the stomach, and produced by some irritating cause in that organ, we should remove the offending matter, or neutralise its effects; we may also exhibit opium, camphor, and other antispasmodics, or employ fomentations. If the urine be of too stimulating a quality, mucilaginous drinks and alkalies may be prescribed. The diet should be plain, and medicines given to promote digestion and the excretions. Whenever the evacuation of urine is attended with much pain, spasm, and a diminution of the stream, leeches should be applied to the perinæum, the patient put into the

warm bath, and aperients given. These remedies are to be repeated at least twice a week, or oftener, according to circumstances. When the pain and irritation in the urethra have subsided, and not sooner, a bougie may be introduced to ascertain the state of the passage. If the instrument give much pain, and be resisted by spasm, it is to be concluded that the inflammation of the urethra is not subdued, and the antiphlogistic soothing means, leeches, low diet, fomentations, opium, hyosciamus, conium, subcarbonate of potash, opiate clysters, and purgative medicines, must be continued. Afterwards, that is to say, when the inflammation has been quite subdued, the morbid irritability of the urethra may be removed by the gentle and occasional employment of bougies, or catheters. (See *Stafford, On Strictures*, p. 42, &c.)

There is only one class of strictures, for which medicine is of essential service. Sir Benjamin Brodie describes them as being cases induced by sand in the urine, by the formation of a number of small calculi, or even by too abundant formation of lithic acid. Here, attention to diet and mode of living, and the exhibition of purgatives, and alkalies, will give success to the bougie which otherwise would not attend it. In all cases, bodily exertion, cold and damp, and excesses in diet, should be avoided; and, if irritation prevails, the bowels kept open, and the compound powder of ipecacuanha prescribed, or some other opiate taken into the stomach, or in the form of a clyster. (See *Brodie, Op. cit.* p. 45.)

EXAMINATION OF THE URETHRA, AND TREATMENT OF STRICTURES ON THE PRINCIPLE OF DILATATION.

Although the symptoms and history of the case may leave little doubt about the existence of a permanent stricture, the surgeon refrains from giving a positive opinion until he has examined the urethra with a bougie, or other instrument. For this purpose, Sir Benjamin Brodie prefers a common bougie of full size, or large enough to fill the urethra, without stretching it. A small bougie may lead to deception by passing through a stricture without being stopped, and occasion the belief that there is no stricture. Its point is also liable to be entangled in the orifice of one of the mucous follicles, or in some accidental irregularity of the canal, thus, inducing the belief, that there is a stricture, when there is none. Sir Benjamin Brodie judiciously recommends a bougie, that is, cylindrical. There is (he observes) no advantage in any bougie being conical, except it be a small one. "A conical bougie, becoming larger towards that part which is held in the hand, is likely to distend forcibly the orifice of the urethra, and to excite inflammation in it. (*On Dis. of the Urinary Organs*, p. 27.)

On the other hand, Mr. Guthrie, instead of examining a stricture with a bougie of full size, prefers one that will pass without inconvenience, and, after that has been allowed to remain a quarter of an hour, a larger one is substituted for it; for he concurs in the fact, now generally known, that a larger bougie can always be introduced, if it immediately follow the removal of a small one, than can be got into the bladder, without being thus preceded by the instrument of less dimensions. This principle is decidedly right to be attended to

in the treatment; but, for the first examination of the urethra, I prefer a bougie of rather a full size, for the reasons assigned by Sir B. Brodie.

It is generally found most convenient to introduce the bougie smeared with sweet oil, while the patient is standing, unless he be very weak and disposed to faint. Sir Benjamin Brodie keeps the extremity of it, which is held in his right hand, close at first to the patient's left groin; and having pushed on the bougie in this position of it, until it will go no further, he then brings it horizontally forwards, and then passes it gently towards the bladder. "If the patient has well marked symptoms of stricture, and the bougie meets with an obstruction in some part of the urethra, you may consider this as sufficient to indicate the existence of the disease. If, however, the patient has no such well-marked symptoms, you should not advance at once to the conclusion, that there is a stricture, because the bougie does not immediately enter the bladder. There may be some accidental irregularity in the urethra, in which the extremity of even a large bougie may be entangled; or, if you are at all rough in the use of the bougie, a spasm may have been induced in the membranous part of the urethra, or in the muscles surrounding it, preventing the bougie from being passed, although no such obstruction exists at other times. Under these circumstances, you should introduce a silver catheter, or a metallic sound, having a moderate curve, and warmed to the temperature of the body; and, probably, if there be no stricture, the metallic instrument will be readily introduced." (*Brodie, Op. cit.* p. 28.)

The cure of strictures may be accomplished either by a dilatation of the contracted part, or a destruction of it by ulceration, or escharotics. To these methods are to be added, first, the plan of forcing a passage through the stricture with a conical sound, as practised by the French surgeons, when they cannot otherwise get through the stricture, and the symptoms are urgent. (See *J. G. Crosse, Sketches of the Medical Schools of Paris*, 8vo. Lond. 1815, p. 111.; and *First Lines of the Practice of Surgery*, ed. 6.) Secondly, The method of cutting down to the obliterated portion of the urethra, and attempting to cure the obstruction by the removal of the diseased parts, tracing the continuation of the passage, and trying to heal the wound over a catheter. Both these two last practices are attended with such difficulties and dangers as should make a prudent surgeon reluctant to adopt them, except under the most urgent circumstances, in which every milder method has failed. Thirdly, The practice of perforating strictures with a sharp instrument, introduced from the orifice of the urethra. Dilatation may be accomplished by means of bougies, sounds, or catheters, both metallic and elastic; and the removal of strictures by ulceration may also be effected with the same instruments: their destruction is accomplished with caustic, or armed bougies.

The cure by dilatation is principally mechanical, when effected by bougies, the powers of which are generally those of a wedge. However, as Mr. Hunter states, their ultimate effect is not always so simple as that of a wedge upon inanimate matter: for pressure makes living parts either adapt themselves to their new position, or else recede by ulceration. Bougies, of course, either dilate strictures, or make them ulcerate.

The disease has generally made considerable progress, before surgical assistance is required, and the stricture may be so advanced, that a small bougie cannot be made to pass without a great deal of trouble. If the end of a small bougie, let it be ever so small, can be introduced through the stricture, *the cure is then in our power.* However, a small bougie frequently cannot pass in the first instance, and even not after repeated trials.

Often, when the stricture is very considerable, a great deal of trouble is given by occasional spasms, which either resist the introduction of a bougie altogether, or only allow a very small one to pass. At other periods, however, a larger one may be introduced. In these circumstances, Mr. Hunter sometimes made the point of the bougie enter, by rubbing the outside of the perineum with the finger of one hand, while he pushed the bougie on with the other. He also frequently succeeded by letting the bougie remain a little while close to the stricture, and then pushing it on. Sometimes the spasm may be taken off by dipping the glans penis in cold water.

Although, in cases of permanent strictures, the bougie may not pass at first, yet, after repeated trials, it will often find its way. In this manner, future attempts become more certain and easy. However, the success of the subsequent trials to introduce a bougie, does not always depend on the instrument having been once or twice passed. Sometimes it can be introduced to-day, but not to-morrow; and, in this state, the case may continue for weeks. But, in general, the introduction of a bougie becomes gradually less difficult.

When the passage is very small, it is not easy to know whether the bougie has entered the stricture or not; for bougies, as slender as those which must be at first employed, bend so readily, that the surgeon is apt to fancy, that they are passing along the urethra, while they are only bending. Thus, Chopart relates a case, in which he believed he had passed a bougie through the stricture, because he had introduced a sufficient length of the instrument into the urethra to reach the bladder; but, a few hours afterwards, he was astonished at seeing both ends of the bougie at the orifice of the urethra, the point, when pressed against the stricture, having turned back, and its retrograde movement carried on to the extent specified by the further pressure employed. Mr. Hunter advises the surgeon first to make himself acquainted with the situation of the stricture, by means of a common-sized bougie; and then to take a smaller one, and when its point arrives at the stricture, the instrument is to be gently pushed forward, but only for a short time. This is a good plan, the value of which is well known to every practical surgeon. If the bougie has passed further into the penis, the surgeon may know how far it has entered the stricture, by taking the pressure off the bougie. For, if it recoil, he may be sure that it has not passed; at least, has not passed far, but only bent. On the contrary, if it remain fixed, and do not recoil, it has certainly entered the stricture.

A bougie may frequently be introduced a little way into the stricture, and then it bends, and cannot be pushed further. To determine whether this is the case, Mr. Hunter says, it is necessary to withdraw the bougie and examine its end. If the end be blunted, we may be sure that the bougie has not entered at all: but if it be flattened for

an eighth, or tenth of an inch, be grooved, or have its outer waxen coat pushed up to that extent; or if there be a circular impression made upon the bougie, or only a dent on one side, made by the stricture; we may be sure the instrument has passed as far as these appearances extend. It then becomes necessary to introduce another of exactly the same size, and in the same manner, and to let it remain so long as the patient can bear it, or convenience will allow. By repetitions of this plan, the stricture will be overcome.

When wax bougies are employed, Sir A. Cooper recommends the surgeon always to give them the natural curvature of the passage, before their introduction. He also approves of the plan of warming the bougie first used, so that it may be soft enough to receive the impression of the stricture, and show its form and situation. After the first bougie is withdrawn, he directs one of rather larger size to be introduced; and as soon as this is taken out, another of still larger size to be introduced. (On repeating the operation, two bougies are again introduced, the first being of the same size as that last used, and the second of an increased diameter. By continuing this method, he assures us, that strictures may be more speedily cured, than in the ordinary mode. He does not consider it necessary to let the bougie remain any length of time in the urethra. This last plan continues to gain ground, the custom of wearing the bougie being less frequently observed than formerly.)

Mr. Hunter remarks, that the time which each bougie ought to remain in the passage must be determined by the feelings of the patient; for, if possible, no pain should ever be given. If the patient should experience very acute pain when the bougie is passing, it ought not to be left in the urethra above five, or, at most, ten minutes; or not so long if the pain be exceedingly severe. Each time of application should afterwards be lengthened so gradually as to be imperceptible to the feelings of the patient, and the irritability of the parts. Mr. Hunter affirms, that he has known many patients who could not bear a bougie to remain in the passage ten, or even five minutes, till after several days, and even weeks, but who, in time, were able to wear the instrument for hours, and this, at last, without any difficulty. The best time for keeping a bougie in the urethra, is when the patient has least to do; or in the morning, while he is in bed, if he can introduce the instrument himself.

Sir Benjamin Brodie recommends the bougie, if small, to be of a conical shape, but, if of a middling, or full size, to be cylindrical. He ascertains the size of the stream of urine, and introduces a bougie of this size, whatever it may be. If the bougie be very small, he uses it straight; but, otherwise, somewhat curved. When it has once entered the stricture and bladder, he allows it to remain for a few minutes; and, in two or three days, introduces either the same bougie, or one of the same size. He then withdraws it, and introduces one of a larger size, allowing this to remain for a few minutes, and, in two or three days more, he repeats the operation. In the following statement and advice, I perfectly concur:—"This method of curing strictures is applicable to a great number of cases, and, whenever it will answer the purpose, I would advise you to resort to it in preference to other methods." (See Brodie, *On Dis.*

of the *Urinary Organs*, p. 46.) The common bougie much more rarely tears the membrane of the urethra, than metallic instruments. The tendency of the disease to return after this method of treatment—the common argument against it—will apply to all the various plans of removing stricture by dilatation.

The bougie should be increased in size according to the facility with which the stricture becomes dilated, and the ease with which the patient bears the dilatation. If the parts are very firm or irritable, the increase of the size of the bougie should be slow, so as to allow them to become gradually adapted to the augmented size of the instrument. But if the sensibility of the parts will allow, the increase of the size of the bougie may be somewhat quicker, but never more sudden, than the patient can easily bear. The surgeon must continue to increase the size of the bougie till one of large size can freely pass; nor should the use of this be discontinued till after three weeks or a month, in order that the dilated part may have time to become habituated to its new position, and lose its disposition to contract again. However, Mr. Hunter believed that the permanency of a cure, effected on the principle of dilatation, could seldom be depended upon. I am decidedly of opinion, with Sir A. Cooper, that no bougies should ever be used, which are larger than those now usually numbered 14.

It was John Hunter's opinion, that no man, who has ever had a stricture, and is cured of it, should rely on the cure as lasting; but should always be prepared for a return, and keep some bougies in his own possession: he should not go a journey, even of a week, without them; and the number should be according to the time, which he is absent, and the place to which he is going, for, in many parts of the world, he cannot be supplied with them.

To prevent the inconvenience of a bougie slipping out, that is left in the urethra, or the mischief of its gliding into the bladder, a soft cotton thread must be tied round that end of it, which is out of the urethra, and the two ends may then be tied loosely round the root of the penis. The redundant part of the bougie remaining out of the urethra, is usually clipped off.

In many examples, in which a stricture is accompanied with excessive irritability in the urethra, much pain, and a tendency to frequent retentions of urine, when a common bougie is employed, it becomes advisable to alter the plan of treatment, and use either metallic sounds, or elastic gum catheters: but, to elastic gum bougies, which always tend to a straight form, and therefore do not adapt themselves to the natural course of the urethra, I have a strong objection, founded on experience. In fact, they tend to keep their point always in contact with the lower side of the curved portion of the urethra; and, consequently, for strictures in that part of the passage, are by no means eligible.

With respect to the invention termed a *dilator*, its use is far from being approved by modern surgeons, and its employment is impossible, except when the stricture will permit the entrance of a bougie, or other instrument of small size, in which event, the dilator is unnecessary, because the other instrument will operate with greater facility and certainty. (See Macilwain, *On the Mucous Canals*, p. 55.)

OF DILATING STRICTURES WITH METALLIC CATHETERS, OR SOUNDS.

Some surgeons prefer sounds composed of metal, flexible enough to allow their curvature to be adapted to the bend of the urethra, yet sufficiently firm to retain the figure given them while they are employed. At present they are less used than formerly. Others use steel or silver sounds, which, in cases where it is necessary to have an instrument possessing more firmness than a wax bougie, and having a point more unchangeably turned upwards than that of the latter instrument are decidedly advantageous. Sir A. Cooper commonly employs what he calls a silver instrument, shaped like a catheter, but conical towards the point, and gradually increasing in breadth for some distance from it. The situation, form, and size of the stricture having been first ascertained with a wax bougie, the silver one is introduced, the point of which is passed into the stricture, and dilated as it more and more the further it enters. When the instrument is not at hand, a silver catheter may be used instead of it.

The metallic sounds preferred by Sir Benjamin Brodie, when of small or middling size, are made of silver; but when longer, of steel or of steel plated, or of a composition similar to, but firmer than, that of the flexible metallic bougie. "These sounds (he remarks) should be very slightly curved, and, for ordinary cases, not more than eight and a half, or nine inches in length, exclusive of the handle. Sometimes you will find it best to introduce them without turning, that is, with the concavity towards the patient's abdomen. At other times, you will pass them more readily by keeping the handle in the first instance, towards the patient's left groin, giving the instrument a half turn afterwards as it approaches the stricture. In either case, if you wish to avoid making a false passage, take care that the point is kept sliding, as it were, against the upper surface of the urethra. Press the instrument steadily and firmly against the stricture, in the expectation that it will gradually become dilated, and allow the point to enter. Then pass the instrument into the bladder, provided that you can do so readily, and without the application of force, but not otherwise. Two or three days after this, introduce the sound which has been pressed before; withdraw it; and introduce another of a size larger; and thus you go on dilating the stricture, in the same way as with a common bougie. Never use one of the very small metallic instruments, if you can avoid it. Always try a small bougie first; and, if possible, begin the dilatation of the stricture with the latter, deferring the use of the metallic instrument until the stricture is so far dilated," that a sound of moderate size may be passed. A very small one, unless employed with great caution, may easily perforate the urethra, and penetrate the cellular tissue of the perinaeum, or even the rectum. (See Brodie, *On Dis. of the Urinary Organs*, p. 48.)

The cases, in which the use of metallic sounds is preferable to that of the common bougie, seem to Sir Benjamin Brodie to be: 1. Those of old glistly, or cartilaginous strictures, which the common bougie is incapable of dilating. 2. Those in which a false passage has been formed, into which a common bougie is likely to penetrate, but which the metallic instrument can be made to avoid. 3. Some recent cases, in which the smooth

polished surface of the metallic instrument occasions less pain and spasm than the softer, but less polished substance of the waxen bougie. (See *Op. cit.* p. 50.) The point of a metallic instrument is evidently always more under the management of the surgeon than that of a bougie, especially a smallish one—an important consideration in favour of the former.

If the contraction is considerable, Mr. Liston prefers a small silver catheter; if not, a plated metal bougie of moderate size, slightly curved throughout, and smeared with some bland liniment. (*On Practical Surgery*, p. 380.)

In cases of small close stricture, I have for many years followed in private practice the method which Mr. John Brodie commends: I begin with a small wax bougie, or sometimes a small gum catheter, and as soon as the stricture has been somewhat dilated, and will admit of an instrument of increased diameter, I have recourse to metallic bougies, or silver sounds, using larger and larger ones, in proportion as the stricture yields.

Delpech adverts to examples in which the stricture is such that no bougie can penetrate it. If the stricture and attendant swelling be then of small extent, he first employs catgut bougies, of greater or lesser fineness, softening their ends by biting them, and letting the saliva penetrate them, so as to give them the form of a small, very supple pencil. When the catgut (as often happens in such a case) passes beyond the obstruction, Delpech fastens it to the penis, keeps the patient perfectly quiet, and changes the dilating substance every two hours, increasing its diameter every time. Immediately there is room enough for the admission of a small bougie (which should be before the end of the day), he employs the latter, and relinquishes the catgut. A catgut bougie, he says, ought to be changed thus frequently, because the moisture of the passage makes it swell, and untwists it in an irregular manner, so that knots are liable to be formed, and render its extraction very difficult and painful, attended sometimes with an actual laceration. The catgut may even break when it has been left in the passage too long, and the surgeon attempts to withdraw it. What remains behind may then glide into the bladder, and become the nucleus of a calculus. (*Delpech, Clinique de Chir.* p. 273.) In this country, catgut bougies are more frequently used for the relief of retention of urine from close old strictures, than for the cure of the latter, though they are sometimes so employed, and generally under the very circumstances specified by Delpech.

Respecting the shape of metallic instruments for the urethra, an observation has been made by Mr. Stanley, which merits attention; viz., that, according to the natural course of the urethra, as indicated by careful dissection, the part of them corresponding to the curve of the urethra under the arch of the pubes, should form a considerable segment of a circle, about one and a half, or two inches in diameter; and the remainder be perfectly straight. They are thus straight, except for about two inches from their points. Mr. Macilwain saw Baron Larrey employ a catheter even less curved, which the latter had been using for many years. Mr. Macilwain states, that he has never found any catheter so easy of introduction as Mr. Stanley's, or any which conveyed to the

operator so clear a conviction of the exact part of the urethra, through which it was passing. (See *Macilwain, On the Mucous Canals, &c.* p. 27.)

CURE OF STRICTURES BY ULCERATION.

This is also accomplished by means of a bougie, or metallic instrument, and the plan has been tried both when the bougie can, or cannot be introduced through the stricture. In the first instance, the method is decidedly improper, because the stricture admits of being dilated.

In order to cure the first case, by making the stricture ulcerate, the bougie was introduced as far through the contracted part as possible and the size of the instrument quickly augmented; in this manner ulceration was produced in the part that was pressed upon; and Mr. Hunter remarks, that the cure will be more lasting, because more of the stricture is destroyed than when the parts are simply dilated. Yet the method is little deserving of praise; and Mr. Hunter himself admits, that few patients will submit to it, and that few, indeed, would be able to bear it, since it is apt to bring on violent spasms in the part, and retention of urine.

If the smallest bougie cannot be made to pass a stricture, by using some degree of force, dilatation becomes impracticable; and, as the stricture must be destroyed, something else must be tried. In many cases, says Mr. Hunter, it may be proper to get rid of the stricture by making it ulcerate. Bougies intended to excite ulceration need not be so small as in the foregoing cases, as they are not designed to be passed through the stricture; and, in consequence of being of middling size, they may be more easily applied to the parts causing the obstruction. The force applied to a bougie, in this case, should not be great; for a stricture is the hardest part of the urethra; and if a bougie is forcibly pushed on, its end may slip off the stricture, before ulceration has commenced, and make a false passage.

In trying to cure strictures by ulceration, the utmost attention must be paid; and if the patient does not make water better, notwithstanding the bougie passes further, the surgeon may be sure that he is making a false passage. When the stricture has so far yielded as to allow a small bougie to be introduced, the treatment is then to be conducted on the principle of dilatation.

The attempt to remove strictures by exciting ulceration of them, is at the present day almost completely abandoned, or only used when the stricture will absolutely not admit of other methods. The perforation of a stricture with Mr. Stafford's instrument, would now generally be preferred to this plan, unless rendered unnecessary by the use of caustic.

TREATMENT OF STRICTURES WITH ELASTIC GUM CATHETERS.

Desault commonly cured all strictures by the skilful employment of flexible gum catheters, which his patients were directed to wear a certain length of time every day. These last instruments produce less pain and irritation than any kind of bougie, more especially when the wires are withdrawn; and were I to be myself afflicted with strictures, I should feel strongly disposed to attempt their removal by the use of elastic gum catheters, which are unquestionably one of the mildest and quickest

means of cure. I have seen cases, however, in which smooth metallic sounds caused much less irritation than any other kind of instrument; but, in general, those made of elastic gum occasion but little pain. Frequently the gum catheter will admit of being kept in the urethra day and night; and it will dilate the stricture much beyond its own diameter. If it can be introduced without the wire or stilet, this will be the mildest and best plan; but when this method is impracticable, Sir Benjamin Brodie recommends the use of a catheter which is mounted on a strong, unyielding iron stilet, with a flat iron handle, like that of a sound or staff. "Being so mounted, it is more readily directed into the bladder than when mounted in the usual way on a piece of thin flexible wire. When the gum catheter has entered the bladder, withdraw the stilet, and leave the catheter with a wooden peg in its orifice, which the patient is to take out whenever he has occasion to void his urine, it being at the same time secured by a suitable bandage. After three or four days, you may withdraw the catheter for twelve hours; or, if much supuration is induced in the urethra, you may withdraw it for a longer period: then introduce a larger catheter than the first; and thus you may, in the course of ten days or a fortnight, dilate a very contracted urethra to its full diameter. (Sir B. Brodie, *Op. cit.* p. 51.)

Sir B. Brodie sets down this method as advantageous: 1.—Where time is of much value, and it is of great consequence to the patient to obtain a prompt cure. 2. Where a stricture is gristly, and not readily dilatable by the ordinary method. 3. Where, from the long continuance of the disease, the urethra has become irregular in shape. 4. Where a false passage has been made. 5. Where a severe rigor follows each introduction of a bougie, not as the immediate effect of the operation, but in consequence of the urine flowing through the part which the bougie has dilated. By employing a gum catheter, and allowing it to remain, the contact of the urine with the urethra may be prevented.

CURE OF STRICTURES WITH NITRATE OF SILVER.

Wiseman mentions the plan of curing strictures, or caruncles, as they were once called, by means of caustic. Fr. Roncalli also described a method of applying the lapis infernalis to strictures, in a work published early in the last century; and this is the more worthy of being mentioned, because the instrument used by him for the purpose, is very much like what was subsequently proposed by Mr. Hunter. (*Exercitatione agens novum Methodum extirpandi Carunculas et curandi Fistulas Urethrae*; Brixæ, 1720.)

Alphonso Ferri sometimes employed bougies impregnated with verdigris, arsenic, and quicklime; and the bougies made use of by Loyseau for Henry IV. king of France, in the very beginning of the 17th century, contained savine.

About the year 1752, Mr. Hunter attended a chimney-sweeper who had a stricture. Not finding that any benefit was derived from the use of common bougies, for the space of six months, he conceived that the stricture might be destroyed with escharotics; and the first attempt which he made was with red precipitate. He

put some salve on the end of a bougie, and then dipped it in the powder. The bougie, in this state, was passed down to the stricture; but it brought on considerable inflammation all along the passage. He then introduced a silver cannula down to the stricture, and again passed the bougie, with precipitate, through the tube. As the patient, however, did not make water any better, and the smallest bougie could not be introduced through the stricture, it was suspected that the precipitate had not sufficient power to destroy the obstruction. Mr. Hunter was induced, therefore, to fasten a small piece of the nitrate of silver on the end of a piece of wire, with sealing-wax, and introduce the caustic through the cannula to the stricture. After having made the application three times, at intervals of two days, he found that the man voided his urine much more freely; and on applying the caustic a fourth time, the cannula went through the stricture. A bougie was afterwards, for a little while, introduced, and the man completely recovered.

Having experienced this success, Mr. Hunter tried to invent an instrument better suited to the purpose than the above contrivance, and consisting of a cannula, with its end closed with a little knob, or button, that could be withdrawn as soon as the instrument reached the stricture, and the period arrived for applying the caustic, which was introduced through the cannula by means of a portercayon.

However, when the stricture was beyond the straight part of the urethra, Mr. Hunter owned that it was difficult to apply the caustic through a cannula.

A better mode of applying nitrate of silver to strictures was afterwards suggested by Mr. Hunter, and introduced into practice by Sir E. Home. This gentleman directs us to take a bougie of the size that can be readily passed down to the stricture, and to insert a small piece of lunar caustic into the end of it, letting the caustic be even with the surface, but surrounded everywhere laterally by the substance of the bougie. This should be done some little time before it is required to be used; for the materials of which the bougie is composed become warm and soft by being handled in inserting the caustic; and, therefore, the hold which the bougie has of the caustic, is rendered more secure after the wax has been allowed to cool and harden. The bougie thus prepared is to be oiled and made ready for use; but, before passing it, a common bougie of the same size is to be introduced down to the stricture, in order to clear the canal, and to measure the exact distance of the stricture from the orifice of the urethra. This distance being marked upon the armed bougie, it is to be passed down to the stricture as soon as the other is withdrawn. The caustic, in its passage, is scarcely allowed to come into contact with any part of the membrane, because the point of the bougie, of which the nitrate of silver forms the central part, always moves in the middle line of the canal; and, indeed, the quickness with which it is conveyed to the stricture prevents any injury of the membrane lining the passage when the caustic accidentally touches it.

In this mode the caustic is passed down, with little or no irritation, to the lining of the urethra; it is applied in the most advantageous manner to

the stricture, and can be retained in that situation sufficiently long to produce the desired effect.

The following reasons are urged in favour of the employment of bougies armed with nitrate of silver: a permanent cure is effected, which common bougies cannot accomplish; the pain arising from the application is inconsiderable; and neither irritation nor inflammation is found to ensue. The meaning of these remarks, however, is to be received as a general one, liable to exceptions. Indeed, Sir E. Home himself acknowledges, that some inconveniences occasionally follow the use of armed bougies. He remarks, however, "that whatever, *à priori*, might be supposed to be the effects of so violent an application to a membrane, so sensible and irritable as the urethra—and I will admit, that it is very natural to conceive they would be very severe—the result of experience (the only thing to be relied on), evinces the contrary. The pain that is brought on is by no means violent; and neither irritation nor inflammation is found to take place.

"That cases do occur in which strictures have produced so much mischief, and rendered so great an extent of the canal diseased that the use of the caustic has proved unsuccessful, is certainly true; and several of these cases have fallen within my own knowledge. But when it is stated that none, even of these, were made worse by its use; that no bad consequences attend it; and that no other mode, at present known, is equally efficacious—any occasional want of success cannot be considered as an objection to this mode of practice.

"But if the apprehension of violent effects from the caustic, however ill-founded, cannot be removed, let the alternative be considered; namely, the only operation previously in use, where a stricture cannot be dilated by the bougie.

"In those cases, we are obliged to have recourse to means certainly more severe and violent, laying open with a knife the diseased urethra, and passing through the divided parts a flexible gum catheter into the bladder. This I have done myself, and have frequently seen performed by Mr. Hunter, and it always succeeded; neither bringing on so much inflammation as was expected, nor being attended with any symptoms of irritation.

"This practice has by other surgeons been carried still further; the portion of diseased urethra has been dissected out, and entirely removed; nor has so severe an operation always brought on untoward symptoms; and patients have recovered.

"If the membrane of the urethra, when diseased, is capable of suffering so much injury, without any consequent symptoms of irritation, it cannot be doubted that it will bear with impunity to be touched, in a very partial manner, several different times with lunar caustic."

Sir Everard afterwards proceeds—"Having met with a number of facts, from which a general principle appears to be established, that the irritable state of a stricture is kept up, and even increased, by the use of the bougie, but lessened and entirely destroyed by the application of lunar caustic, I am desirous to communicate my observations upon these facts, and to recommend the use of the caustic, in many cases of irritable stricture, in preference to the bougie.

"As the use of the caustic upon this principle is, I believe, entirely new, and is contrary to every notion that has been formed upon the subject, it will require something more than general asser-

tion to gain even the attention of many of my readers, still more their belief; I shall therefore detail the circumstances, as they occurred, by which I conceive the propriety of this practice to be established; and afterwards make some observations upon the principle on which it depends.

"My connection in practice with Mr. Hunter afforded me opportunities of attending to cases of stricture, in all their different stages: many of them brought on during a long residence in India, attended with great irritability, and exceedingly difficult of cure.

"One case of this kind admitted the passing of a small bougie; but, in the course of three years, very little was gained by a steady perseverance in the use of that instrument, either in dilating the canal, or palliating the symptoms of stricture: this made me look upon the bougie as less efficacious than I had always been taught to believe it. I was willing, however, to consider this as an uncommon case, depending more on the peculiarities of the patient's constitution than on the nature of the disease; but I found, on a particular inquiry, that several other gentlemen, from India were under circumstances nearly similar; the bougie only preventing the increase of the stricture, but being unable to dilate it beyond a certain size; and when it was left off, the stricture in less than two months returned to its former state of contraction.

"In August, 1794, a gentleman consulted me for some symptoms which had been considered as indicating the presence of gonorrhoea; but as they did not yield to the common treatment in the usual time, he was induced to take my advice respecting the nature of his complaint. In the necessary inquiry to obtain a perfect history of the case, among other things it was stated that, nineteen years before, there was a stricture which became very troublesome; and that Mr. Hunter, by the desire of the patient, had applied the caustic, by which the stricture was removed, and it never afterwards returned. He said that he was one of the first persons on whom the caustic had been used. From this account I was naturally led to believe, that the stricture had gradually returned, and was now increased so much as to produce the present symptoms; a discharge being almost always a symptom of stricture when it is much contracted; but upon examining the canal, a bougie of full size passed into the bladder without the smallest impediment. I therefore took up the case as an inflammation in the urethra; and large doses of the balsam of copaiva, given internally, effected a cure.

"The circumstance of a stricture having been removed nineteen years before, and not returning, made a strong impression on my mind; and made me desirous to ascertain whether this practice could be employed in cases of stricture in general, and the cure produced by it equally permanent. A short time afterwards, I had an opportunity of trying it in the following case:—

"A captain in the East India Company's service, in September, 1794, applied to me for assistance. His complaints were, great irritation in the urethra and bladder, constant desire to make water, and an inability to void it, except in very small quantities. These symptoms had been at first supposed to arise from gonorrhoea, afterwards rendered more severe by catching cold; but,

not yielding to the usual remedies for gonorrhœa, they were investigated more minutely, and a stricture was discovered in the urethra. The mode of treatment was now changed, and the bougie employed; but its use aggravated all the symptoms, and brought on so great a degree of irritability in the bladder and urethra that there was an alarm for the patient's life, which was the reason for applying for my assistance.

"Besides the local symptoms, this patient had those of quick pulse, white tongue, hot and dry skin, loss of appetite, and total want of sleep, with frequent attacks of spasm in the bladder and urethra. A very small flexible gum catheter was passed, and the water drawn off, in quantity about a pint, which gave him great relief: this was repeated morning and evening, to keep the bladder in as easy a state as possible; but, in other respects, he continued much the same.

"As the present symptoms were brought on by the use of the bougie, little good was to be expected from that instrument; and where the urethra had been so easily irritated, and was disposed to continue in that state, there was no prospect of the use of the bougie afterwards effecting a cure. These circumstances I explained to the patient; and mentioned, in proof of my opinion, the case in which so little had been effected in three years.

"I then proposed to him a trial of the caustic, with a view to deaden the edge of the stricture, as the only probable means of effecting a cure. The degree of irritation was already great: I was, however, led to believe that the application of the caustic was not likely to increase it; since, by destroying the irritable part, it might lessen, and even remove, the spasmodic affection; but if, contrary to my expectation, the irritation continued, we still should be able to draw off the water, as the slough formed by the caustic would prevent the edge of the stricture from acting, and obstructing the instrument.

"The application of the caustic was, upon these grounds, determined on; and it was applied in the following manner:—

"I passed a common bougie, nearly the size of the canal, down to the stricture, to ascertain its exact situation, and to make the canal of the urethra as open as possible. The distance was then marked upon a bougie armed with caustic, of the same size, which was conveyed down as quickly as the nature of the operation would admit. It was retained upon the stricture, with a slight degree of pressure; at first there was no pain from the caustic, but a soreness from pressure; in less than a minute a change was felt in the sensation of the part; it was at first a heat, succeeded by the burning pain peculiar to caustic; as soon as this was distinctly felt, the bougie and caustic were withdrawn, having remained in the urethra about a minute altogether. The soreness, he said, was entirely local, by no means severe, was unaccompanied by irritation along the canal, and he thought the uneasiness in the bladder diminished by it. He described the pain as resembling very exactly the first symptoms of gonorrhœa. This sensation lasted half an hour after withdrawing the bougie.

"The caustic was applied about one o'clock in the afternoon, and he passed the day more free from irritation, than he had been since the beginning of the attack, which had lasted six days. In the

evening the water was drawn off with more ease than the night before. He passed a tolerable night, and the next day continued free from irritation. On the third day the caustic was again applied in the forenoon: the painful sensation was less than on the former application, lasted a shorter time; and in an hour after the armed bougie was withdrawn, he made water freely for the first time since the commencement of his indisposition. He said the irritation in the bladder was removed, and he felt very well; his appetite returned, he slept very well, and continued to void his urine with ease.

"In this state, nothing was done till the fifth day, leaving always a day between the applications of the caustic.

"On this day a common-sized bougie went readily into the bladder; it was immediately withdrawn, and the cure was considered as complete; no bougie was afterwards passed, lest it might bring back an irritation upon the passage. I met this gentleman twelve months afterwards, and he assured me he had continued perfectly well; and I have since learned that, in three years, there has been no return."

The foregoing case, together with another which Sir E. Home has related, convinced this gentleman that he had discovered an effectual mode of treating such strictures as do not admit of being relieved by the common bougie. Hence, he adopted the use of armed bougies as a general practice; but he has not concealed the circumstances under which the method does not prove successful. Sir Everard informs us that, "In some constitutions, where the patients have resided long in warm climates, every time the caustic is applied to a stricture, a regular paroxysm of fever, called by the patient an *ague*, takes place; and this has been so violent as to render it impossible to pursue this mode of practice. Of this I have met with two instances. I consider this disposition to fever as the effect of climate, and not of any natural peculiarity of constitution; for the brother of one of these patients laboured under the same disease, but, as he had not been in warm climates, it was removed by the caustic without his experiencing such attacks."

In *gouty* constitutions, attacks of the gout have, in two instances, brought on spasmodic constrictions after the stricture had been removed by caustic. This, however, cannot be called a failure of the caustic: it only shows, that gout can affect strictures, and reproduce them.

"In some patients, the strictures are so obdurate, that the use of the caustic is necessary to be continued for a longer time, than the parts can bear its application, or even that of the bougie passing along the urethra: irritation, therefore, comes on and stops the progress of the cure; and when the same means are resorted to again, the same thing takes place. The cases of failure of this kind that I have met with, some of which may yet ultimately be cured if the patients will take the necessary steps for that purpose, amount in all to six.

"In some patients, the stricture is readily removed by the caustic, but, in a few weeks contracts again. The stricture being wholly spasmodic, the caustic, by taking off the spasm, is allowed to pass through, and cannot completely destroy the stricture. Of this kind, I have met with one instance, which I must consider as a failure, as I

have hitherto been unable to get the better of it.

In those cases where the caustic gradually removes the stricture, and brings the urethra to a size, that allows the patient to make water perfectly well, if there is any return, it is not to be attributed to the failure of the caustic, but to the want of proper management, either from the caustic being too small, or its use left off too soon; but, all such cases are, I believe, within the power of being cured by the caustic, if its use is recurred to when that is found necessary."

The power of caustic, however, to effect a more lasting cure, than other methods, is sometimes doubted, or even disbelieved. I have known several patients, whose disease returned after they had been apparently cured with armed bougies. Indeed, the necessity of occasionally passing a common bougie, is as great after this treatment, as after others; an important fact, which Baron Boyer insists upon, on account of the many relapses with which he is acquainted. (*Mal. Chir.* t. ix. p. 227.) Delpach also assures us, that he has had abundant opportunity of learning the incurable nature of strictures: they only admit (he says) of temporary relief, and have an invincible tendency gradually to return. He declares, that this is constantly the case, whatever treatment may have been adopted. It would be abusing the credulity of patients and medical men, and insulting truth, to pretend the contrary. (*Sec Chirurgie Clinique*, t. i. p. 273.)

For the generality of strictures in the urethra, which do not occupy more extent of the canal, than if caused by a piece of packthread being tied round it, bougies, armed with lunar caustic, answer very well; and so do common bougies, and metallic instruments, to which the preference, as I believe, ought generally to be given. For cases also, in which the urethra is diminished in diameter, for an inch or more, bougies or sounds must be most advantageous; that is to say, when they can be introduced through the stricture, so as to cure it on the principle of dilatation.

Whether, in certain cases, where no progress can be made with common bougies, it is better to try caustic, or attempt to force the obstruction with a sound, is a question, on which there is a great deal of difference of opinion. "The practice of pressing firm bougies, or metallic instruments, so as to force the stricture, or to produce an ulceration of it (says a modern writer), so frequently has been found to form false passages, fistulae, and gangrene, that I need here make no further observation on the practice, or its consequences. All the advantages that can be gained by pressure, tearing through the stricture, or producing ulceration of it, may be obtained by a careful and judicious use of the caustic, which will be found on the whole a safer application, and will be attended with less inflammation and pain." (*Wilson, On the Male Urinary and Genital Organs*, p. 383.) This gentleman is not, however, an advocate for the caustic in every case. "I consider it," says he, "the safest practice in cases, which will not yield to the introduction of bougies, and which require a portion of the stricture to be destroyed; but, the symptoms which sometimes attend its use, and the injury, which may be done by its improper application, should confine it to those cases." (P. 385.)

Sir A. Cooper is of opinion, that caustic bougies ought never to be employed, except when the stricture is accompanied with fistula in perinæo, and the fistula is behind the stricture, in which case there can be no risk of a retention of urine being produced by the caustic. In France, caustic bougies never had many advocates: under particular circumstances, however, their employment was sanctioned by Delpach. He says, that the swelling of the parietes of the urethra, in the situation of the stricture, may bring them into so close contact, that no bougies nor catgut will pass, and the difficulty may be still further increased by some slight deformity of the same point of the passage. Such, he remarks, are the cases, in which he has found bougies, armed with nitrate of silver of great service. His plan, however, is only to remove with caustic the impediment to the passage of a small bougie; and as soon as this can be introduced, he discontinues the caustic, and practises simple dilatation. (*Chir. Clinique*, t. i. p. 275.)

The following are some of the general directions given by Sir E. Home, how to apply lunar caustic to strictures:—

"The distance of the stricture from the external orifice is to be measured, and the canal cleared by passing a common bougie, fully as large as that which is armed. The armed bougie, with the distance marked upon it, is then to be introduced, and applied to the stricture: when it is brought in contact with the obstruction, it is to be steadily retained there, with a moderate degree of pressure at first, and less as it is longer continued, since the bougie becomes soft by remaining in the urethra, and readily bends, if the pressure is too great. The time it is to remain depends a great deal upon the sensations of the patient, and the length of time the parts have been diseased; but, on the first trial, it should be less than a minute, as it then commonly gives greater pain than on any subsequent application. The pain, produced by the caustic, is not felt so immediately as it would be natural to expect; the first sensation arises from the pressure of the bougie on the stricture; a little afterwards, there is the feeling of heat in the parts; and lastly, that of pain.

"As soon as the caustic begins to act, the surgeon, who makes the application, is made sensible of it by the smaller arteries of the parts beating with unusual violence, which is very distinctly felt by the finger and thumb, that grasp the penis.

"The pain, that is brought on by the caustic, lasts for some time after it is withdrawn; but this period differs in almost every patient, being sometimes extended to half an hour, and sometimes only a few minutes.

"The kind of pain is heat and soreness which is not severe, not being accompanied with the peculiar irritation, upon so many occasions experienced by patients who have strictures; an irritation that cannot be described, which is most insupportable, and is too often brought on by dilating strictures with the bougie." In the volume from which the above directions are taken, Sir Everard Home recommends the patient to make water, as soon as the armed bougie is withdrawn; but, in a subsequent volume he explains his change of opinion upon this point:—"I not only have no wish that the patient should make water immediately after the application, but would rather that

it be retained some time." (*On Strictures*, vol. iii. p. 51. 8vo. Lond. 1821.)

"It happens not unfrequently," he says, "that, at the first time of making water, some blood passes along with it. This is rather favourable; as, when the parts bleed, the stricture usually proves to be so far destroyed; that at the next trial the bougie passes through it. Every other day appears, in general, to be as often as it is prudent to apply the caustic. I have, however, done it every day, in very obstinate cases, where the parts are less sensible, without any detriment."

In his third volume, he states, that he now rarely passes the bougie oftener than every third day; and never, when the pain from the last application has not entirely gone off. He also never continues any one application beyond the time, when the pain begins to extend further than the spot to which the armed bougie is applied. (Vol. iii. p. 51.)

The bougie, which is passed down to prepare the way for the caustic and measure the distance for the armed bougie, must be made of soft materials, that it may readily receive an impression from the part against which it is pressed; and its colour should be light, so as to admit of those impressions being more distinctly seen. With the assistance of such bougies, the surgeon can discover the size and shape of the orifice of the stricture; ascertain with accuracy the progress of the caustic upon it; see whether it is on one side of the canal, or equally all round; and apply the caustic accordingly.

"When the soft bougie passes through the stricture, by leaving it in the canal a few minutes, it can be known whether the stricture is completely destroyed or only relaxed: in the last case, there is an impression on the side of the bougie." (*Home On Strictures*, vol. i.)

I think the advice given by Delpéch, not to let the end of the caustic be covered with any greasy substance, is good; for, certainly, its action must thus be lessened, or even defeated. It appears to Sir Benjamin Brodie, that the cases to which this plan is applicable, are:—1. Those of spasmodic stricture, where two or three applications of the caustic may be sufficient to relieve all the urgent symptoms. 2. Some cases of old stricture, in which it still retains considerable disposition to spasm. Here he directs the caustic to be applied only two or three times, just to relieve the spasmodic contraction, after which the bougie or sound may be resorted to. 3. Cases of peculiarly irritable strictures. However, Sir Benjamin rarely uses armed bougies in his own practice, and never in the first instance, because, although the caustic often removes spasm, it also very often induces it. In many instances, it enables a patient to make water with more facility; but, in many others, it brings on a severe retention of urine. He observes also, what I have noticed, that profuse, and even dangerous hemorrhage, is a more frequent consequence of the use of caustic than that of a common bougie; he finds, likewise, that, where there is a disposition to rigors, the application of caustic is almost sure to produce them. He believes, moreover, that, if not used with great caution, it is more likely to cause abscesses, than the employment of common bougies. Sir Benjamin Brodie adverts also to the danger of using it

where there is a false passage, and its utter inefficiency in cases of old stricture, where there is much alteration in the structure of the parts. (*Op. cit.* p. 55.) Nitrate of silver bougies, however, retain some advocates; amongst whom I may mention the late Mr. Guthrie, Mr. B. Phillips, and M. Ducamp, who invented a most ingenious instrument, by means of which the caustic could be applied in a circular and lateral direction, without any possibility of its touching any part of the urethra, except the stricture. This instrument may be seen at the shop of Messrs. Weiss, in the Strand. (*Chir. Clinique*, p. 276.)

OF PERFORATING AND CUTTING THROUGH STRICTURES.

From time to time, proposals have been made to perforate very bad, extensive and unyielding strictures with a pointed or cutting instrument, applied through a tube. In cases of permanent stricture, where the part is irregularly thickened, and so indurated as to resemble cartilage, and the canal so contracted, that it is either quite impermeable, or will only admit a bougie of the smallest size, Mr. Stafford disapproves of attempting the cure either by exciting ulceration, or by forcing a passage through the stricture with a conical sound, or by the use of caustic, or by cutting down, to the obstruction through the perinæum. Of course, when a small bougie can be introduced through the stricture, several of these plans must be quite unnecessary, because the best treatment can be successfully continued on the principle of dilatation, unless it be argued, that the cartilaginous induration of the stricture will defeat the method; a point, on which much doubt may be entertained. Instead of these plans, and especially in preference to the employment of armed bougies, Mr. Stafford recommends the use of what he calls the lancetted stilette, with which he divides the stricture. For this purpose, he has invented two instruments: one, for the division of permanent strictures, which yet admit of a small bougie, or wire, being passed through them; the other, for the division of those strictures which are impervious. The instrument for the latter cases, he calls the double lancetted stilette: it consists of a round silver graduated sheath, open at both ends, of the size of catheter No. 10, but with rather a less curve, and furnished with a stilette, which is also hollow, and open at both ends. At one end of the stilette are two oblong lancets; and at the other a handle, resembling a button. When the instrument is complete, the stilette fits into the sheath, so that by pushing the handle, the lancets will project from the extremity of the tube, and, by drawing it back, they will recede again. The instrument is passed over a wire down to the stricture, and the lancets are thrust forwards on each side of it, by which means the contraction is made as large as the natural size of the urethra. The armed stilette, for the division of impervious strictures, resembles that which has first been described, excepting that the stilette is solid, and furnished with only one lancet. The exact distance of the stricture from the orifice of the urethra having been first ascertained, the smallest catheter, capable of containing a wire, is to be introduced into the bladder. The wire, which is double the length of the catheter, and blunted at one end, so that it may not injure the bladder, is then pushed for-

ward, and the catheter gradually withdrawn. The armed catheter is then passed over the wire, until its point rests against the stricture, when the handle of the stilette is to be gently and gradually pressed. As soon as any impression is made, the lancets should be allowed to retire into their sheaths, and the blunt point of the instrument be urged forward. If it should not pass on, the lancets may be made to project again. After the stricture has been divided, the armed catheter should be withdrawn, and one of elastic gum introduced. Mr. Stafford recommends this to be kept in for a day or two, in order to prevent the union of the divided parts, and the possibility of extravasation of urine. After its removal, a bougie is to be passed twice a week, or oftener, according to circumstances. The other kind of stilette, for impervious strictures is to be used in the same manner, except that it is not passed over a wire. (See *Stafford, On Strictures*, p. 71, &c.) This gentleman adduces many examples of the success of the foregoing treatment; and he states that, with moderate care and skill, there will be no risk of making a false passage. Neither do his accounts mention any troublesome degree of hemorrhage as being the result.

I believe with Sir Benjamin Brodie, that the cases in which this practice is advisable are very few. "If (says this gentleman) it be required at all, it can only be in cases of very old stricture. But an old stricture occupies a considerable portion of the urethra; and in the division of it, there must always be danger of the cutting instrument penetrating into the surrounding cellular membrane; an accident which may be followed in some instances by extravasation of the urine and the death of the patient; in others, by the formation of a new passage, with all its attendant inconveniences, instead of the restoration of the old one. (*Op. cit.* p. 58.) I have never had occasion in the hospital to practise this operation; but I lately had a patient on whom it had been performed; but the stricture had returned, and was cured by metallic bougies. Mr. Mayo states, that he has adopted the practice successfully, and recommends it in impervious stricture, situated in the first four inches of the urethra, where the canal admits of being drawn into a straight line. "At the common situation of stricture (he adds) this method is dangerous and uncertain, if the contraction is otherwise impervious to instruments; it is less dangerous, but unnecessary, when a small bougie can be passed through the stricture." (*Outlines of Human Pathology*, p. 552.)

In cases of old inveterate stricture, it has been proposed to cut into the urethra in the anterior part of the perinæum, to divide the stricture with a knife, then to introduce a gum catheter through the whole of the urethra into the bladder, and heal the wound while the patient wears the catheter, and makes water through it. I have already mentioned this proceeding as having been frequently performed in Sir Everard Home's time. When all the cellular tissue in the perinæum is swollen and thickened, this operation is by no means so easy as is sometimes represented. I once saw Mr. Abernethy attempt it, and he was obliged to give it up. "I suppose (observes Sir Benjamin Brodie) that no surgeon would think it right to recommend such an operation, if he were able to introduce any kind of instrument through the

stricture into the bladder; and it is evident that if it be performed where no instrument can be passed, the operation must be at once severe and difficult." (*On Dis. of the Urinary Organs*, p. 58.) In Sir Charles Bell's reports may be found some good observations on this subject, to which I must be content with referring.

In the United States of America the practice has been adopted, to some extent, by Professor Jameson of Baltimore, who follows nearly the same method as has been occasionally resorted to for many years past in England. The following account of it is from Dr. Reese's American ed. of this work:—

"So numerous have been the failures of surgical treatment in strictures of the urethra, that many surgeons have considered a severe stricture, and especially a series of strictures in this canal, the most incurable and unmanageable of surgical diseases. The great number of strictures found in the incurable wards of our hospitals, almshouses, and infirmaries, have long rendered this affection an opprobrium chirurgiæ. The most skilful will often do mischief with the armed bougie; and if they by caution avoid this, still their failure will often be a painful source of mortification.

"Professor Jameson, of Baltimore, has introduced an operation by which he has succeeded in curing a large number of obstinate cases; and although he only advises and performs this operation in the worst instances of severe, long-continued, and complicated stricture, the proportion of cures has been greater than is ordinarily found in the practice of any surgeon who treats all kinds of cases indiscriminately by any of the former methods.

"In the *Amer. Med. Recorder* for 1824, Dr. Jameson has published an Essay on Stricture of the Urethra, in which he reports a number of cases, with their treatment and results. Several of these cases came under my own notice; and, during my former residence in Baltimore, I witnessed his operation several times, and had an opportunity of seeing his success, and the entire removal of the disease.

"This operation consists in opening the urethra through the perinæum, and introducing a flexible catheter through the penis into the bladder, which is suffered to remain until the wound in the urethra is united.

"The patient is tied as for lithotomy, and a sound introduced as far as it can be passed, which serves as a guide, if it can be introduced, as far as the bulb. An incision is now made through the perinæum, and the urethra laid open. In bad cases he advises to divide the triangular ligament both above and below the urethra. The forefinger is then to be introduced through the remainder of the stricture. When it is necessary to divide the muscles surrounding the membranous part of the urethra, a director is first introduced, and the incision made with a scalpel or bistoury, when the finger may be passed into the bladder. A flexible catheter is now passed through the penis into the bladder, and the wound is placed in the most favourable circumstances to unite.

"Though this operation is as severe, and even sometimes more difficult than lithotomy, Dr. J.'s experience has shown that it is seldom attended with danger. The only cases in which this opera-

tion would be advisable, are those in which no sound or staff can be passed into the bladder; and herein consists the difficulty of the operation. It is a means, however, which has afforded relief in cases which had otherwise been abandoned as hopeless."

Mr. Mayo is of opinion, that division of a stricture from the perinæum should be practised only in cases of rupture of the urethra behind a stricture, and of urinary fistula, with extensive sinuses, and general thickening of the perinæum, the strength threatening to fail from urinary irritation. The following is his description of the operation, which I believe corresponds to the usual mode of proceeding:—"A free incision is to be made in the perinæum towards the urethra, a full-sized staff, is to be passed down to the stricture, the urethra is to be opened upon the groove of the staff, immediately anterior to the stricture; the staff being then drawn back, the scalpel is to be carried in the direction of the urethra, *through the stricture*. A catheter is finally passed into the bladder, and retained there." He adds: "In complicated urinary fistula, with stricture impervious to instruments, the best practice is, to perform the same operation, *having previously dilated the urethra to behind the scrotum*." The general induration disappears in forty-eight hours. The catheter is to be changed every day. Mr. Mayo has performed this operation several times; but he states, that he would never resort to it again, merely for a stricture with retention, but unattended with rupture of the urethra or an exhausting urinary fistula. (*On Human Pathology*, p. 552.) I presume that Mr. Mayo, however, would prefer opening the dilated part of the urethra behind a stricture, to the operation of puncturing the bladder where the duration of a retention of urine from this cause had placed the patient in imminent danger of extravasation of urine.

CURE OF STRICTURES WITH POTASSA FUSA.

Mr. Whately argues, that strictures are not merely contracted fibres of the urethra, but really diseased portions of the membrane lining that canal, with a continued disposition to increased contraction. Hence he conceives that a remedy, calculated both to remove the diseased affection, and to dilate the contracted part, might perfectly cure the complaint, without putting the patient to the inconvenience of wearing a bougie. Such a remedy, he says, is caustic, when judiciously used; but, instead of nitrate of silver, he recommends the potassa fusa; which, he says, when used in the manner, and with the precautions about to be described, will be found to possess singular efficacy. Of its safety, he is also as well convinced as of its efficacy.

However, if the potassa fusa be applied while the parts are in a highly inflamed, or irritable state, it will tend to

tending to gangrene; if the habit be bad, and the patient very far advanced in years, the most mischievous effects may be expected from the application; and the use of any kind of caustic, under such circumstances, for strictures in the urethra, is censured as dangerous in the extreme.

Mr. Whately represents, that if the patient be affected with fever, or any other acute disease, if he be much indisposed from any cause; if, in particular, he have a gonorrhœa, attended with

much inflammation and irritation in the urethra; if the prepuce, glans, or any other part of the penis, or the parts adjoining to it, be swelled and inflamed; if the urethra, and especially the strictured part of it, be so irritable as not to bear the touch of a bougie—the use of the caustic is for the present forbidden. Mr. Whately also enjoins great caution in applying this remedy to persons advanced in years. Even when no objections of the above kind exist, the caustic should not be resorted to in the first instance. In every case of stricture, before venturing to employ the caustic, we ought to be able to pass into the bladder a bougie of at least a size larger than one of the finest sort. This is necessary, both to let the caustic be applied to the whole surface of the stricture, and to relieve a retention of urine, should it occur during the use of the caustic.

When the urethra is very irritable, Mr. Whately recommends a common bougie to be introduced every day, and kept in the urethra; at first, for a few minutes only; but, by degrees, for a longer time; till the irritability of the parts has been sufficiently lessened.

When the urethra is rendered so impervious by a stricture, that a small bougie cannot be passed into the bladder, which viscous is also in a painful inflamed state, Mr. Whately asserts that caustic, in any form or quantity, must not be immediately employed; but that the stricture should be first rendered capable of allowing a bougie, a little larger than one of the finest size, to be introduced into the bladder. When this is done, the urine is more freely evacuated, and the consequent irritation and inflammation of the bladder lessened, if not removed, together with the danger of a retention of urine. Caustic may then be advantageously conveyed into the centre of the stricture.

When the surgeon, by a steady perseverance and dexterity, has succeeded in getting a fine bougie through the worst stricture into the bladder, the instrument should be worn, for a few hours, every day, till the passage is sufficiently dilated to admit a larger one.

For the purpose of arming a bougie, Mr. Whately advises us to put a small quantity of caustic potassa upon a piece of strong paper, and to break the bit of caustic with a hammer into small pieces of about the size of large and small pins' heads. In doing this, care should be taken not to reduce it to powder. Thus broken, it should be kept for use in a phial, closed with a ground stopper. The bougie should have a proper degree of curvature given to it, by drawing it several times between the finger and thumb of the left hand.

Before the caustic is inserted into the bougie, it is necessary to ascertain the exact distance of the stricture from the extremity of the penis. For this purpose, the bougie, which should be just large enough to enter the stricture with some degree of tightness, ought to be gently introduced into the urethra; and when its point stops at the stricture, which it almost always does before it will enter it, a notch is to be made with the finger-nail on the upper or curved portion of the bougie, on the outside of the urethra, exactly half an inch from the extremity of the penis. When the bougie is withdrawn, a small hole, about the sixteenth part of an inch deep, should be made at the extremity of its rounded end. A large blanket-

pin, two inches and a half in length, with the head struck off, will answer the purpose; the hole being made with the point of the pin. The extremity of the bougie should then be made perfectly smooth with the finger and thumb, taking care that, in doing this, the hole in its centre be not closed. Some of the broken caustic should then be put on a piece of writing-paper, and a piece, less in size than the smallest pin's head, should be selected; the particle, indeed, says Mr. Whately, cannot be too small for the first application. Let this be inserted into the hole of the bougie with a pocket-knife, spatula, or some such instrument, and pushed into it with the blunt end of the pin, so as to make the caustic sink a very little below the margin of the hole. To prevent the potassa fusa from coming out, the hole should then be contracted a little with the finger; and the remaining vacancy in it is to be filled with hog's lard. This last substance (continues Mr. Whately) will prevent the caustic from acting on the sound part of the urethra as the bougie passes to the stricture. When the bougie is quite prepared, let it be first oiled, and immediately afterwards introduced, by a very gentle motion, with the curvature upwards, as far as the anterior part of the stricture, upon which the caustic is to be applied. In doing this, the end of the bougie, held by the finger and thumb, should be a good deal inclined towards the abdomen, on the first introduction of the instrument, in order to preserve its curvature. After it has passed about five inches, this end should be gradually brought downwards, as the bougie passes on, till it forms a right angle with the body. The bougie is known to have arrived at the stricture by the resistance made to its progress.

As soon as the bougie has reached the anterior part of the stricture, it should rest there for a few seconds, that the caustic may begin to dissolve. It should then be pushed very gently forward, about one-eighth of an inch; after which there should be another pause, for a second or two. The bougie should then be carried forward, in the same gentle manner, till it has got through the stricture. The sense of feeling will generally inform the operator when the point of the bougie has proceeded so far; but the notch in the bougie is to be an additional guide, by becoming very near the orifice of the urethra when the end of the instrument has just got through the stricture.

The bougie should now be immediately withdrawn, by a very gentle motion, to the part at which it was first made to rest awhile: then it should be very slowly passed through the stricture a second time; but without letting the bougie stop in its passage. If the patient complain of pain, or be faint, the bougie should be immediately withdrawn; but if these effects are not produced, we may repeat the operation of passing and withdrawing the bougie through the stricture once or twice more, before we finish the operation, which will take up, in the whole, about two minutes.

The first application of the potassa fusa in this manner gives, according to Mr. Whately's account, very little pain. A slight scalding in making water, and a trifling discharge during the first day or two, however, are commonly produced.

At the end of seven days the application of the caustic is to be repeated in the same manner. When the first application has enlarged the aperture of the stricture, which may be known by

passing a bougie through it, of the same size as that by which the caustic was conveyed, the bougie, used in the second operation, should be a size larger than the one used in the first; but it must not be too large to pass through the stricture. If the patient had no pain on the first application, the bit of potassa fusa may also be trivially larger. At the end of seven days more, the armed bougie should be introduced a third time. At this and all future applications, the bougie should be increased in size in proportion as the aperture in the stricture becomes dilated. The quantity of caustic, however, is never to be increased in a ratio to the size of the bougie. In no cases whatever does Mr. Whately apply more of the potassa fusa at a time, than a piece about the size of a common pin's head. Twelve bits of the largest size which this gentleman ever uses, weigh one grain.

When there are several strictures, the potassa fusa should be generally applied to only one at a time.

An interval of seven days is what Mr. Whately generally allows to elapse between the applications of the caustic. The rule, however, may now and then be deviated from; but the potassa fusa ought never to be reapplied, till the action of the last application has completely ceased. In a few instances, the interval may only be five days; in some others, it may be eight, nine, or even a longer space.

In the above method of using the potassa fusa, Mr. Whately represents that this substance is equally diffused over every part of the strictured surface, and only *abrades* the membrane of the stricture, without producing a slough. The degree of this abrasion, he says, may be increased or lessened as circumstances dictate, by paying attention to the quantity of the caustic.

The foregoing account will convey an adequate idea of the late Mr. Whately's method, in which I never saw any recommendation but that of novelty. To *abrade* without destroying is rather too nice a distinction for a practical man, doing business, as it were, in the dark. Nor can I conceive that a liquid caustic (for so it is represented as becoming) can be applied with the accuracy to strictures which Mr. Whately seems to suppose happens. This, however, is merely my own sentiment; and I do not wish to conceal that there have been a few surgeons who believed Mr. Whately's plan to be the most obliging for all cases in which the stricture was irritable, or far advanced. (See *Hewship's Pract. Obs. on the Urinary Organs*, p. 207.) On the other hand, I know some eminent surgeons, who formerly took up this practice with great zeal, and now have entirely abandoned it. I consider it the worst and most random mode of applying caustic to strictures, and more likely to act on the sound than the diseased portion of the urethra. Sir A. Cooper is decidedly averse to this use of the potassa fusa, which, he says, is much too soluble, and calculated to produce a great deal of inflammation by running over an extensive surface. In this objection I fully concur.

Upon the whole, I may safely declare that caustic bougies of every kind are now much less frequently used in London than they were in the time of Hume and Whately. Several distinguished practitioners who, to my knowledge, were then ac-

customed to recommend and employ them, have returned either to the use of common bougies, sounds, or catheters. We learn from M. Roux that caustic bougies never had many advocates in France; and the inquiries which he made when he was in London authorised him to announce to his countrymen, after his return, that such instruments were not more in general favour here than they were at Paris. (*See Voyage fait à Londres en 1814, ou Parallèle de la Chirurgie Anglaise, &c.*, p. 315.)

Cases of stricture, where the disease is far advanced, of long standing, and attended with such obstruction that no kind of common bougie can be introduced, appear to me to be examples in which either perforation on Mr. Stafford's plan, or cutting down to, and dividing the stricture, may be justifiable. Instead of this, however, some surgeons have preferred the employment of a conical sound, made of iron, silver, or platinum, with sufficient force to make its way through the stricture by laceration. An interesting case of cartilaginous stricture and fistula in perinaeo is recorded by Melppech, where a false passage was made with a caustic bougie, which actually pierced the rectum: two days after this accident, the stricture was forced with a conical sound, which fortunately eluded the false passage, and entered the bladder; an abscess in the perinaeum followed, but the case ended well under the use of gum catheters. (*Chir. Clin.* p. 280.) When the treatment of strictures brings on severe shiverings, followed by febrile symptoms, opium is the best medicine to be given, and the introduction of instruments into the passage should be suspended. When hemorrhage from the urethra is occasioned by the use of bougies, or other instruments, cold evaporating lotions to the perinaeum, or the cold bath itself, is the most effectual way of suppressing it. In one case mentioned by Sir A. Cooper, he was under the necessity of dividing the artery of the bulb; a measure which completely succeeded.

John Hunter, On the Venereal Disease, 2d ed. *Sir Everard Home*, Practical Obs. on the Treatment of Strictures in the Urethra and Oesophagus, 3 vols. 8vo. Lond. *Thomas Whately*, An improved Method of treating Strictures in the Urethra, ed. 2. 1806. *M. W. Andrews*, Obs. on the Application of Lunar Caustic to Strictures in the Urethra and Oesophagus, 8vo. Lond. 1807. *T. Luzmore's* Practical Obs. on Strictures, &c. 8vo. Lond. 1809. *Sommerring*, Abhandlung über die schnell und langsam tödtlichen Krankheiten der Harnblase und Harnroöhre bey Männern im hohen Alter, 4to. Frankf. 1809. *Sir Charles Bell*, Letters concerning the Diseases of the Urethra, 1810; subsequently republished with additions by Mr. Shaw: also Surgical Reports, 8vo. Lond. 1816-18. *James Wilson*, On the Structure and Physiology of the Male Urinary and Genital Organs, and their Diseases, 8vo. Lond. 1821. *James Arnott*, On Stricture of the Urethra, 8vo. Lond. 1819. *J. Cross*, Sketches of the Medical Schools of Paris, p. 111, &c. 8vo. Lond. 1815. *Theod. Ducamp*, Traité des Rétentions d'Urine, &c. 8vo. Paris, 1822. *Alf. Felsen*, Nouv. Blém. de Méd. Opér. t. iii. 8vo. Paris, 1832. *Boyer*, Traité des Mal. Chir. t. ix. Paris, 1824. *J. Howship*, On the Urinary Organs, 8vo. Lond. 1823. *W. J. Clement*, On Surgery and Pathology, 8vo. Lond. 1832. *G. Macdowall*, On Diseases of the Mucous Canals, 8vo. Lond. 1830. *Melppech*, Chirurgie Clinique de Montpellier, t. 1. 4to. Paris, 1833. *R. A. Stafford*, On Strictures of the Urethra, ed. 2. 8vo. Lond. 1825. *Benjamin Phillips*, On the Urethra, its Diseases, &c. 8vo. Lond. 1832. *G. J. Guthrie*, On the Anatomy and Diseases of the Neck of the Bladder, and Urethra, 8vo. Lond. 1834. *Sir Benjamin Brodie*, On Dis. of the Urinary Organs, 8vo. Lond. 1836, ed. 2. *Herbert Mayo*, Outlines of Human Pathology, 8vo. Lond. 1835. *Robert Liston's* Practical Surgery, 8vo. Lond. 1837.

URETHRA, FALSE PASSAGE IN.—One

of the worst consequences of using catheters and bougies in an improper manner, is the rupture of the urethra, or the formation of a false passage by ulceration. When once the new passage has been formed, whenever the bougie is introduced, it cannot be hindered from going into the false track, and its action on the stricture is altogether frustrated.

If the formation of a false passage is known, or even strongly suspected in the first instance, the patient should be desired to keep himself as quiet as possible in the recumbent position, and no attempt made to pass any instrument for a week, or even a longer period. The part lacerated may then possibly heal; whereas, if the bougie or sound is used, the false passage will be rendered permanent by the instrument repeatedly entering it. (*See Brodie, On Dis. of the Urinary Organs*, p. 49. ed. 2.)

In this kind of case Mr. Hunter advised the following operation:—Pass a staff, or any such instrument, into the urethra, as far as it will go, which will probably be to the bottom of the new passage, and beyond the stricture. Feel for the end of the instrument externally, and cut upon it, making the wound about an inch long, if the disease be before the scrotum; and an inch and a half, or more, if in the perinaeum. If the new passage be between the urethra and body of the penis, you will most probably get into the sound urethra before you come to the instrument, or new passage. If so, introduce a probe into the urethra through the wound, and pass it towards the glans penis, or, in other words, towards the stricture. When it meets with an obstruction, this must be the stricture, which is now to be got through, and afterwards dilated. To complete the operation, withdraw the probe, and, instead of it, introduce a hollow cannula forwards to the stricture in the urethra. Then introduce another cannula from the glans downward, till the two tubes are opposite each other, having the stricture between them. An assistant is now to take hold of the urethra on the outside, with his finger and thumb, just where the two cannulae meet, in order to keep them in their places. Through the upper cannula next introduce a piercing instrument, which is to perforate the stricture, and enter the lower cannula. The piercing instrument is now to be withdrawn, and a bougie introduced through the first cannula and stricture, into the second cannula. The tubes are to be withdrawn, and the end of the bougie in the wound, directed into the bladder, through the further portion of the urethra. Instead of a bougie, surgeons of the present time would, of course, employ a gum-catheter, which, by hindering the urine from passing through the wound, and, at the same time, by acting on the remains of the stricture-wound, fulfil the two great indications.

If a false passage be made, leading from one part of the urethra to another, and the urine pass through the new channel, it becomes lined by a kind of membrane, resembling that of the natural canal. (*Stafford, On Strictures*, p. 39. ed. 2.) Indeed, all fistulous passages communicating with the urethra, become, after time, lined by such a texture.

URINARY ABSCESES. Extravasations of urine may be in three different states. This fluid may be collected in a single pouch, or cavity, bounded by the adhesive inflammation; it may be

widely diffused in the cellular tissue ; or, lastly, it may present itself mixed with pus, after having excited inflammation and suppuration in the parts amongst which it is situated. This case is termed an *urinary abscess*.

Extravasations of urine always imply a perforation, or breach, either in the kidneys, ureters, bladder, or urethra. The solution of continuity may be produced by a variety of causes. It is most frequently the effect of a forcible distention of the bladder, and portion of the urethra next it, in consequence of a retention of urine. The bursting of phlegmonous abscesses, into the urethra, sometimes occasion it. It may also be produced by the penetration of the urinary organs with a sword, spicula of bone, or other foreign body ; there are likewise examples of effusion of urine from the displacement of the cannula of the trocar, after the operation of puncturing the bladder. Other cases may be caused by false passages in the urethra ; or by violent contusions of the perinæum, attended with laceration of the urethra.

The mischief which extravasated urine produces is greater and more extensive when this fluid spreads in the cellular tissue, than when confined in a kind of cyst. The mischief is also generally less when the urethra is free, than when it is closed, as in cases of retention. The more or less loose texture of the parts in which such effusions happen, likewise makes a considerable difference in their progress and extent. When the pelvis or infundibulum of the kidney, or the upper part of the ureter, gives way, the urine is commonly effused in the loins and iliac fossæ, between the peritonæum and the adjacent parts. When the lower part of the ureter, or the bladder, near its lower portion, gives way, the extravasation is generally included within the pelvis.

But, when the rupture occurs in the anterior parietes of the bladder, near its upper part, and, especially, when it takes place at a time when this organ is extremely distended and dilated, the urine becomes effused behind and above the pubes, sometimes ascends to the epigastric region, between the peritonæum and the abdominal muscles, and, after having followed the course of the spermatic vessels, it may make its exit at the ring, and be extravasated in the groins and scrotum. If the rupture has happened in the urethra, the common situation of the effusion is in the perinæum and scrotum and penis ; but, in this case, the urine is prevented from descending down the thighs, or towards the nates, by the connections of the superficial and deep perinæal fasciæ. It may pass, however, towards the groins, and even, sometimes, as I have now and then witnessed, under the skin of the abdomen, up to the hypochondria and sides of the chest. With the exception of bile, there is no fluid, the extravasation of which leads to more dangerous consequences, than that of the urine. If it is not promptly discharged, it soon excites suppuration and sloughing of the cellular tissue, and indeed, mortification of all textures amongst which it flows.

While extravasation of urine is confined to the interior of the pelvis, and lumbar and iliac regions, without manifesting itself externally, there is no certain sign of its existence. The history of the case, however, joined with the present symptoms, may lead to a suspicion of such extravasation. Thus, when, in consequence of retention of urine, the patient has suddenly experienced great relief, with-

out any of the urine having been discharged the natural way ; when he has at the same instant felt a kind of pricking in the loins, or pelvis ; when to the ease, which lasted only a few hours, symptoms more severe than the former ones having succeeded (such as violent fever, hiccup, vomiting, &c.), an internal extravasation is to be suspected.

In the article *BLADDER*, I have described the symptoms and effects which result from a rupture of the fundus of that organ, by a blow on the hypogastric region, at a period when it happens to be distended.

As soon as the extravasation is apparent externally, the case is announced by symptoms, which hardly ever deceive. The preceding retention of urine ; the sudden appearance of the swelling caused by this fluid ; the rapid progress of the tumour ; the kind of crepitation perceptible in it, like that which occurs in emphysema ; the shining tension and œdema of the skin ; the diminution of such symptoms as depended entirely upon the retention ; are the first changes which are observable, when the extravasation is somewhat considerable.

If the patient is not speedily assisted, and the urine continues to be extravasated, the tumour spreads more and more ; the skin assumes a red violet colour ; gangrenous eschars are formed, the separation of which gives issue to a very fetid sanies, in which the smell of urine is readily distinguishable. Portions of dead cellular tissue are presently discharged together with a brown fetid sanies ; the sloughing extends ; and the dressings are continually wetted with the urine.

When one of the ureters is wounded, or opened by ulceration, and an urinary abscess is formed in the loins, the aid to be derived from surgery is limited to making an opening in the extravasation as soon as it can be felt externally. Here, the surgeon seldom has it in his power to re-establish the natural course of the urine, or to hinder this fluid at once from passing through the wound. However, if the abscess were produced by a calculus lodged in the infundibulum or ureter, and it could be felt and taken hold of with a pair of forceps, introduced into the opening, its extraction would promote the healing of the ulcer by rendering the natural channel for the urine free.

When the opening by which the urine has become extravasated, is in the bladder, or urethra, one indication, that does not present itself in the foregoing case, may be fulfilled, viz. the urine may be drawn off by means of a catheter which is to be kept introduced. By this measure, we not only immediately stop the progress of the extravasation, but attack the very cause of it, by removing the obstacles to the natural course of the urine. The introduction of the catheter then becomes a matter of the most urgent necessity ; but is often attended with great difficulty. Besides the ordinary obstruction of the canal, the surgeon may have to surmount obstacles which the urinary swellings, situated in the course of the urethra, create to the passage of the instrument. When these tumours are considerable, Desault recommends them to be opened before the catheter is employed. In cases of extravasation from stricture, a catheter may almost always be introduced, because, after the escape of the urine, the stricture either becomes relaxed, or is partly destroyed by the ulceration, which lets the urine become effused

from the membranous portion of the urethra. If, however, the catheter could not be passed, ought we to puncture the bladder, or have recourse to the operation of cutting into the dilated portion of the urethra between the stricture and the bladder?

Desault very properly condemned both these proceedings; for he found it a more simple and beneficial practice merely to make a free external opening in the collection of effused urine. This measure at once affords an outlet for the urine, and arrests the extension of the extravasation. It is indispensably requisite for the purpose of putting a stop to the symptoms depending upon the effusion and stagnation of the urine. But if the catheter can be introduced, an opening is still deemed proper, and even some exceptions stated by Desault are not recognised by modern surgeons. (*Œuvres Chir.* t. iii. p. 277—287.)

The manner of opening such collections varies according as the urine may be in one cavity, or widely effused in the cellular tissue. In the first case, a simple incision, the whole length of the cavity, will suffice for emptying and healing it. In the second, if the extravasation is extensive, the incisions must be multiplied. It would be absurd to spare the parts; for all those, with which the urine has come into contact, seldom escape mortification. The incisions, which are made, hardly ever have the effect of saving them; but, by accelerating the discharge of putrid sanies and stagnant urine, they prevent mischief, which would originate from a further lodgment. At all events, when the operation is at all delayed, the destruction of all the parts in contact with this irritating fluid, is inevitable. The approach of mortification is indicated by the crepitation under the bistoury, resembling the kind of noise produced by tearing parchment. The extent and depth of the incisions must be proportioned to those of the abscess. When the extravasation occupies the scrotum, long deep incisions should be made in that part, as well as in the skin of the penis, and in every place where the urine is effused.

Practitioners, unaccustomed to see such diseases, would be alarmed at the extent of the sore produced by the separation of the sloughs. Sometimes the whole scrotum, skin of the penis, and that of the groins, perinæum, and upper part of the thigh, mortify, and the naked testicles hang by the spermatic cords, in the midst of this enormous ulcer. It is hardly conceivable how cicatrization could take place over the exposed testicles; but the resources of nature are unlimited. She unites the testicles and the cords to the subjacent parts, and, drawing the skin from the circumference to the centre of the ulcer, she covers these organs again, and furnishes them with a sort of new scrotum. This statement is founded upon numerous cases, in which nature always followed this course. The cicatrization of the ulcer is even more expeditious than might be expected. In all this business, what does the surgeon do? If the introduction of the catheter is excepted, which, indeed, is absolutely necessary for the radical cure, his assistance is very limited; for, when patients are not exhausted by the tediousness of the disorder, when they are of a good constitution, and in the prime of life, they get well as quickly and certainly, with the aid of a good diet and simple dressings, as when they take internal

medicines, and use a multiplicity of compound topical applications. Emollient poultices and fomentations are proper until the sloughs are detached. The ulcer may afterwards be dressed. When prostration of strength, and tendency to sloughing continue, bark, wine, and antiseptics may be ordered. But, in every case, the catheter is the essential means of cure; for without it, the effusion of urine will be but incompletely checked by incisions, and the cuts themselves will be converted into urinary fistulæ. (See *BLADDER, RUPTURE OF; FISTULÆ IN PERINÆO; FRACTURES OF THE OSSA INNOMINATA; GUN-SHOT WOUNDS OF THE ABDOMEN; URINE, RETENTION OF; AND URINARY FISTULÆ.*)

URINARY CALCULI. A true explanation of the nature of urinary calculi must have been quite impossible, until chemistry had made considerable progress, and the methods of analysis advanced far towards perfection; and, as will appear in the course of this article, all the valuable knowledge which now exists upon this interesting subject, is in reality the fruit of modern investigations. It is to be regretted, however, that our information on many points is far from being settled or complete, as any impartial and judicious reader may soon convince himself by a reference to the able and scientific views, entertained by Dr. Prout, of various questions, relative to the formation of gravel and calculi, and the treatment of such cases in all their varieties. (See *An Inquiry into the Nature and Treatment of Gravel and Calculus, and other Diseases connected with a deranged Operation of the Urinary Organs*, 8vo. Lond. 1821.)

Mechanical deposits from the urine are divided by Dr. Prout into three classes:—1. Pulverulent, or amorphous sediments. 2. Crystallized sediments, usually denominated gravel. 3. Solid concretions, or calculi, formed by the aggregation of these sediments.

Pulverulent, or Amorphous Sediments, are described by Dr. Prout as almost always existing in a state of solution in the urine before it is discharged, and even afterwards until it begins to cool, when they are deposited in the state of a fine powder, the particles of which do not appear to be crystallized. Their colour is, for the most part brown, or yellow; and, generally speaking, they consist of two species of neutral saline compounds; viz. the lithates of ammonia, soda, and lime, tinged more or less with the colouring principle of the urine, and with the purpurates of the same bases, and constituting what are usually denominated *pink* and *liveritious* sediments; and, secondly, the earthy phosphates, namely, the phosphate of lime, and the triple phosphate of magnesia and ammonia, constituting for the most part, sediments nearly white. The two species of sediments are frequently mixed together; though the lithates generally prevail.

Crystallized Sediments, or Gravel, are commonly voided in the form of minute angular grains, or crystals, composed, 1. Of lithic acid, nearly pure; 2. Of triple phosphate of magnesia and ammonia; and, 3. Of oxalate of lime. The crystals of lithic acid, which are by far the most frequent, are always more or less of a red colour. Those composed of the triple phosphate of magnesia and ammonia are nearly white; while others, composed of the oxalate of lime, which

are extremely rare, are of a dark, blackish green colour. It is further remarked, that these different varieties of crystallized deposits are never voided together, though they not unfrequently occur with amorphous sediments. (*Prout, Op. cit. p. 79, &c.*)

Soliti Concretions, or Urinary Calculi, arising from the precipitation and consolidation of the urinary sediments, may be formed in any of the cavities, to which the urine has access; and hence, they are met with in the kidneys, ureters, bladder, and urethra. Most of them are believed to be originally produced in the kidneys, from which they afterwards descend with the urine. To this statement, however, the cases in which calculi are formed upon foreign bodies introduced into the bladder through the urethra, an accidental wound, or some ulcerated communication between the intestines and the bladder, are manifest exceptions. In the centre of urinary calculi, bullets, splinters of bone, pieces of bougies, and wool, pins, needles, nuts, &c. are frequently observed; and it would appear that a very minute substance is capable of becoming a nucleus; a mere clot of blood, or a little bit of chaff, if not soon voided, being sufficient to lead to the formation of a stone in the bladder. A needle, that had been swallowed, insinuated itself into the bladder, and became the nucleus of a calculus. (See *Dublin Journ. of Med. Science*, No. 1.) Many instances are recorded of calculi containing hairs, which doubtless were the original nuclei of them. Such concretions are termed by French pathologists *calculs piliifères*, a subject adverted to by M. Jules Cloquet. (*Pathol. Chir. p. 101.*) Lithic acid is itself very commonly the nucleus, even where the whole calculus is not of the same material.

That many urinary calculi are originally produced in the kidney, is certain; first, from the severe pain which the passage of such foreign bodies down the ureter always excites; and, secondly, from their being often discovered in the infundibula and pelvis of that viscus after death. This last fact is well illustrated in the first plate of Dr. Marcelet's interesting *Essai on the Chemical History and Medical Treatment of Calculous Disorders*, 8vo. 1817." The engraving is taken from a preparation in the Museum of Guy's Hospital. In this instance, there were several calculi closely pressed against each other; but, in another example, drawn from a specimen in Mr. Abernethy's museum, the renal concretion was composed of a single mass, which represented a complete cast of the pelvis, and part of the infundibula of the kidney. In this form of the disease, the kidney loses at last all vestiges of its natural structure, and is converted into a kind of cyst, filled with the extraneous substance. When so complete an alteration of the structure takes place, the secretion of urine must of course be entirely carried on by the other kidney. However, in some instances, the inconvenience thus produced is so slight, that it almost escapes notice; and sometimes even both kidneys are diseased in a very great degree, and yet life is preserved for a considerable time. (*Op. cit. p. 3, 4.*)

Calculi are sometimes found in the ureters, especially at the upper part; but it is not supposed that they are originally formed there; an event, not likely to happen, unless there were

some cause retarding the descent of the urine through those tubes. The common belief is, that all calculi found in the ureter are first produced in the infundibula and pelvis of the kidney, from which they afterwards descend with the urine.

The generality of calculi, however, which leave the kidney, are of small size, and, consequently, after a time, and exciting some pain and inconvenience, they usually pass into the cavity of the bladder. Indeed, as Dr. Marcelet remarks, the bladder is the most frequent seat of calculi: not only because all urinary concretions, or their nuclei, formed in the kidneys, tend to fall into that organ; but, also, because a stone may be, and probably often is, originally formed in the bladder itself.

Renal concretions vary considerably in their number, size, and shape. In some cases, a single small calculus has been found occupying one of the foregoing situations; while, in other instances, an innumerable collection of calculous substances are observed filling the whole of the cavity of the pelvis and infundibula of the kidney, distending its parietes, and even obstructing the passage of the urine out of this viscus, which is converted into a sort of membranous cyst. Lastly, a single stone in the kidney may acquire a very large size there; or a great number of small calculi, in the same situation, may become cemented together, so as to form one mass of enormous dimensions, and the shape of which invariably corresponds to the space in which it is, as it were, moulded. Hence, renal calculi often present a variety of odd, irregular figures, resembling those commonly observed in specimens of coral.

Great disorder of the stomach, frequent vomiting, and great irritability of the bladder, are common effects of a calculus in the kidney. Sir A. Cooper met with a case, in which the chief pain was at the anterior superior spinous process of the ilium.

It has been already remarked, that urinary concretions of large size very often exist in the kidney, without their presence being indicated by any external circumstances, or attended with any symptoms, sufficiently unequivocal to constitute a ground for suspecting the importance of their cause. On the other hand, it is very usual for renal calculi, of middling dimensions, to excite serious and alarming complaints. The reason of this difference becomes obvious, when it is recollected that smallish concretions are readily carried with the urine into the ureter, and become fixed in the narrow portion of the tube. But very large calculi can be contained only in the upper part of this canal, where its parietes are more yielding, and the space in them more capacious.

Calculi of middling size, in their passage through the ureter, cause, at first, a feeling of heaviness, or an indeterminate sense of uneasiness, and an obtuse pain in the region of the corresponding kidney. These complaints occur at intervals of greater or less duration. At length, the pain grows more urgent and annoying, attended with flatulence, heart-burn, frequent vomiting, painful retraction of the testicle, and sometimes acute fever. As Sir A. Cooper has remarked, it is at the period when the calculus is passing over the lumbar plexus, that a great deal of pain is felt in the groin and in the course of the anterior crural nerve, just

as the spasmodic contraction of the cremaster arises at the time when the calculus is descending over the spermatic plexus. The patient makes water frequently, and in small quantities at a time; and the urine is high-coloured and bloody. The patient cannot sit upright, his body being bent forwards towards the affected side. These symptoms may have more or less duration, and then suddenly cease. They may also subside, and recur several times, at intervals of some days. In the latter case, the pain is felt at each attack to be situated lower in the track of the ureter. Lastly, when the symptoms have entirely disappeared, the urine is more abundant, not so high-coloured, and easily discharged, the stream sometimes bringing out with it the urinary concretion, after its entrance into the bladder.

Suppuration of the kidney, and an abscess in the lumbar region, in consequence of renal calculi, are not very common events. However, these are the only cases of the kind, in which the interposition of surgery can be useful. By adverting to previous circumstances, and the irregularity of the pain about the kidney, the practitioner may suspect the nature of a phlegmonous tumour in the situation of this viscus. Whatever may be his conjectures, however, he must carefully abstain from the use of his lancet, until purulent matter is plainly under the integuments. He may then safely make an opening, from which urine and pus will be discharged, and through which the calculi themselves may sometimes be felt and extracted. If they cannot be readily touched with a probe, let not the surgeon rashly conceive, that he is justified in endeavouring to discover them with his knife. Their situation may be such as to baffle all his endeavours, and the operation itself might cause a most dangerous hemorrhage, and other fatal mischief. The opening of an abscess of the kidney may remain a long while fistulous, and, indeed warrant the conclusion that the healing is prevented by the presence of some extraneous substances; but a prudent practitioner will never think of performing any operation for their extraction, unless they can be distinctly felt, and nature has brought them tolerably near to the surface. (See NEPHROTOMY.) Sir A. Cooper, in his lectures, mentions a singular case, in which Mr. Cline was able plainly to feel, in a very thin patient, a calculus situated in the kidney. He adverts also to another example, in which a great deal of purulent matter had been voided from the bowels before death, and, on opening the body, a calculus was found lodged in the ureter, between which tube and the colon an open communication existed, through which the abscess of the kidney had discharged itself into the intestines. In one particular case, related by the same experienced surgeon, a calculus, fixed in the ureter, gave rise to a renal abscess, which burst into the cavity of the abdomen, and the patient's death quickly followed.

Urinary calculi, which form upon foreign bodies accidentally introduced into the bladder, and acting as nuclei, are always single, unless the number of foreign bodies themselves happen to be greater. It is curious also to find, from the observations of Mr. Murray Forbes (*On Gravel and Gout*, p. 74. 8vo. Lond. 1793) and Dr. Marcet, that, in such instances, the deposition most frequently, if not always, consists of the earthy phosphate, and especially of the fusible calculus.

Thus, in the collection of Mr. R. Smith, of Bristol, there is a pin, a piece of bougie, and four pieces of stick, coated with fusible matter. (See *Med. Chir. Trans.* vol. xi. p. 11.) But when calculi originate from a particular diathesis, there may be many of them lodged in the bladder at the same time. Several distinct nuclei may descend successively from the kidneys, and each may increase in a separate manner. Sometimes, however, calculi in the bladder, which are at first distinct and unconnected, become afterwards cemented together, so as to make only one mass.

The magnitude of calculi in the bladder is generally in an inverse ratio to their number. Some hundreds have been found in one bladder; but they were not larger than a pea. One very remarkable instance has lately been recorded, in which 398 calculi, from the size of a pea to that of an olive, were found in the bladder after death. By analysis, they were found to consist of phosphate of lime, phosphate of magnesia, and uric acid. (*Mag. der Ausländischen Literatur, Hamb. Jan. Feb. 1822*; and *Journ. of Foreign Med.* No. 15.) It is observed by Sir Astley Cooper, that when a great number of calculi are found in the bladder, the circumstance is generally attended with an enlargement of the prostate gland, directly behind which a sacculus is formed. In cases of diseased prostate gland, the bladder can seldom be completely emptied; and this partial stagnation of the urine in the sac, here alluded to, is supposed to facilitate the production of calculi. From their number and collision against each other, their surfaces are generally smooth, and their shape is commonly roundish. (See *Med. Chir. Trans.* vol. xi. p. 359; and *art. PROSTATE GLAND.*) Other calculi have been met with of so large a size, that they were more than six inches in diameter. In Fourcroy's museum, and in that of the *École de Médecine*, at Paris, may be seen some calculi, which filled the whole cavity of the bladder; and, in the *Phil. Trans.* for 1809, the late Sir James Earle described an enormous stone which he extracted, after death, from the bladder of the late Sir David Ogilvie, who had been unsuccessfully cut for it. This calculus, which was of the fusible kind, weighed forty-four ounces, and was of an oval shape, its long axis measuring sixteen inches, and the shorter fourteen. The average size of vesical calculi may be compared with that of a chestnut, walnut, or a small hen's egg. Their size depends very much upon their composition, the largest being of the fusible kind. Their weight differs from a few grains to upwards of fifty ounces; but, on an average, it is from two to six ounces. Their weight is not always proportioned to their size; for substances of different qualities enter into their composition, and diversify their heaviness.

The urinary salts, in calculous patients, are not continually precipitated in the same quantities: in some cases, indeed, the process appears to be even suspended for a considerable time. Hence, a stone of middling size, already formed, may increase but very slowly; and it has actually happened that a calculus, which could be plainly felt with a sound, has remained more than ten years in the bladder, and, yet, after all this time, been only of a moderate size.

According to Dr. Marcet, the form of urinary calculi is mostly spheroidal, sometimes egg-

shaped, but often flattened on two sides like an almond. (P. 50.) Sometimes, the calculous matter, which descends from the kidneys, is in the form of minute spherical grains, which have a singular tendency to unite either to each other, or to calculi already lodged in the bladder.

When there are several loose calculi in the bladder together, they seldom lie long in contact with each other while their size is diminutive, but are incessantly changing their situation as the patient moves about, or alters the position of his body. Hence, their increase is at first regular and uniform; but when they have attained a more considerable size, or by their numbers compose a large mass, their relative situation is more permanent, and many of their surfaces being in this manner usually covered, no longer receive any additional depositions. Every other part of these calculi, however, goes on increasing. It is thus that stones, with surfaces corresponding to those of other stones, are produced, and which are aptly denominated by the French writers "*pierres à facettes*."

Dr. Marcet has likewise taken notice of the angular shape of certain calculi, and remarked the rare occurrence of their being sometimes almost cubic. His work contains the engraving of a species of calculus, which somewhat resembles a pear, with a circular protuberance at its broader end, apparently moulded in the neck of the bladder.

The same intelligent writer has also particularly considered the variety in the colours and surfaces of calculi, which often afford indications of their chemical nature. "When they have a brownish, or fawn-colour, somewhat like mahogany wood, with a smooth, though sometimes finely tuberculated surface, they almost always consist of lithic acid. When cut open, they appear to be formed of concentric layers, sometimes homogeneous, sometimes alternating with other substances. The colour, however, cannot be considered as a certain criterion, since other kinds of calculi may often be coloured in the bladder in a similar manner, by bloody mucus, or other vitiated secretions.

"When calculi are white, or greyish-white, they always consist of earthy phosphates: this is particularly the case with the species called fusible. And when they are dark brown, or almost black, hard in their texture, and covered with tubercles or protuberances, they are generally of the species which has been distinguished by the name of *mulberry*, and consist of oxalate of lime.

"Calculi have sometimes an uneven, crystalline surface, studded with shining transparent particles. Their appearance always denotes the presence of the ammoniaco-magnesian phosphate." (Marcet, p. 52.)

A large calculus, especially when it has a rough irregular surface, produces a great deal of irritation of the bladder, which contracts more closely round it. The contact, however, is remarked to be particularly exact at the transverse line which extends between the terminations of the two ureters in the bladder; a part of this organ which generally becomes more thickened than the rest. Sometimes, indeed, the cavity of the bladder is nearly effaced, and the urine can be retained only a very short time; or, if it be not evacuated, it spreads uniformly round the calculus, especially above and below the above-described

transverse projection, which is less yielding than other parts of this organ. Hence, the surface of the stone, towards the orifices of the ureters, does not enlarge so fast as the other sides of it; and a circular groove is produced, giving the foreign body the shape of a calabash. Such calculi are generally very large, and sometimes even of enormous size. In the latter circumstance, the foreign body fills the cavity of the bladder so completely, that there is no space left for the lodgment of the urine there, which fluid then generally passes along a sort of groove, situated in a line reaching from the lower termination of the ureter to the neck of the bladder. This state is, of course, accompanied with a complete incontinence.

Urinary calculi are not always loose and moveable in the cavity of the bladder, being sometimes fixed in various ways to certain points of the circumference of this organ; a subject which has been noticed in the article LITHOTOMY.

When the bladder protrudes from the abdomen, so as to form a hernia, a stone is occasionally situated in the displaced portion of it. This circumstance has the same effect as a sacculated bladder; for the foreign body is thereby fixed, and it cannot be propelled towards the neck of the bladder at the period when the urine is discharged. Also, in cases of prolapsus uteri, when the bladder is drawn downwards, a stone has sometimes been found lodged at the lowest part of it. The possibility of the complication of a calculus, with such displacements of the bladder, ought to be well remembered, since, if the nature of the case be detected, its treatment becomes materially simplified.

Various local causes, as blows on the loins, which injure the structure, or derange the function of the kidney, are enumerated by Mr. Crosse as often giving rise to calculous deposits; and so may inflammation of the pelvis of the kidney, or increased mucous secretion from the urinary passages. Strictures of the urethra, and enlargements of the prostate gland, by detaining the urine in the bladder (see PROSTATE GLAND, and URETHRA, STRICTURES OF), have a powerful tendency to produce disease in that organ, and thus promote the formation of calculi. (See J. G. Crosse, *On the formation, &c. of Urinary Calculi*, &c. 4to. Lond. 1832.)

The symptoms of a stone in the bladder having been detailed in the article LITHOTOMY, the enumeration of them need not here be repeated. They are all so equivocal, and bear so great a resemblance to the effects of several other disorders, that they cannot be depended upon, and consequently no well-informed surgeon will venture to pronounce positively, that there is a calculus in the bladder, unless he can distinctly feel it with a sound. (See LITHOTOMY and SOUNDING.) As for the operation, if the surgeon cannot plainly feel the calculus immediately before he commences the incisions, it ought to be postponed.

If a foreign body be introduced into a cavity to which the urine has access, whatever may be the nature of the immersed substance, it always becomes after a time incrustated with calculous matter, though it undergoes no chemical change in its composition. In such cases, it is found (see Forbes, *On Gravel and Gout*, 8vo. Lond. 1793; and Marcet, *On the Chemical Hist. &c. of Calculous Disorders*, 8vo. Lond. 1817.) that the concretion mostly, if not always, consists of the earthy phosphates. Here, the operation of any particular

diathesis is beyond all suspicion, because the foreign body, which forms the nucleus would lead to the production of a calculus in all descriptions of patients.

There are some countries where patients with calculi are tolerably numerous; and other parts of the world, where the disease is rare, or never met with; and yet the difference cannot always be accounted for by any geographical circumstance which is constant, or any definable peculiarity of constitution, climate, diet, or mode of life. One fact, however, I believe is certain, viz. the uniform rarity of the disease in *very hot* countries. In tropical climates, urinary calculi are almost unknown; and, as Dr. Marcet observes, the testimony of Dr. Scott on this point, who long resided in India, must be considered valuable. Dr. Scott affirms that, between the tropics, he never met with a single instance of the formation of a stone in the urinary bladder, although he knew of some cases which had been imported, and were not cured by climate. (See Marcet, *On the Chemical History and Med. Treatment of Calculous Disorders*, chap. ii. 8vo. Lond. 1817.) Yet, as calculi frequently form on various nuclei, bullets, pieces of bougies, &c. of course, even in India, calculi of the triple phosphate kind will originate from this cause, though very rarely, perhaps, from the lithic acid diathesis. It seems as if, during the free perspiration kept up by a warm temperature, something were carried off from the blood by the skin, which would otherwise cause the urine to be loaded with lithic acid. (See Dr. Phillip in *Med. Trans. of the College of Physicians*, vol. vi.)

Urinary calculi are said also to be very uncommon in Spain and Africa, though patients with gravel are numerous in Majorca, which lies between them. (Magendie, *Récherches sur les Causes, &c. de la Gravelle*, p. 31. 8vo. Paris, 1818.) The usual belief is, that calculi are most frequent in damp, cold countries, like England and Holland, but that in such other parts of the world as are either very hot, or cold, the disease is rare. However, in every estimate of this kind, the number of the inhabitants of the countries, or districts in question, is always an essential thing for consideration, because the proportion of stone-patients, in a given number of individuals, is invariably rather small; and, therefore, in referring to the rarity of such patients in very cold countries, it is to be considered whether the fact may not be, in some measure, ascribable to the fewness of the inhabitants. The state of medicine and surgery, in the countries from which the information is transmitted, is likewise another thing for contemplation, inasmuch as patients are not likely to be reported as suffering from, or dying of stone, where the nature of diseases is not scientifically observed, morbid anatomy is uncultivated, and the operation of sounding never attempted. However, as our East India native regiments are furnished with excellent surgeons, I consider it well proved that, in those regiments, the disease is uncommon; for otherwise, the statement would no doubt have been contradicted by them. Some papers, however, lately published in the *Transactions of the Medical Society of Calcutta*, are stated to throw a degree of doubt on the supposed rarity of calculous complaints in India; but, as I have not yet read those papers, I must now be content with merely referring to them. At the same time, the ages of the indi-

viduals, to whom any calculation applies, is always to be taken into consideration, before any inference be drawn respecting the cause of the rarity of calculi: because, if the disease be rare amongst soldiers in India, it is also rare amongst soldiers in Europe; and, therefore, climate would not explain the fact in both parts of the world. But, probably, the recollection that common soldiers are neither children, nor men above the middle period of life, and that the first formation of stone in youths, adults, and middle-aged persons, is uncommon, unless some extraneous substance happen to enter the bladder and form the nucleus, may furnish a reason for the infrequency of the disease amongst soldiers, applicable, perhaps, to such individuals in every country. And that the children of soldiers, like those of other persons, are not exempt from the disease, I know very well, having had occasion myself to operate upon a patient of this kind during my service with the army.

The preceding consideration, also, of the general age of sailors in the royal navy, and of the little chance there must be of a boy with stone being sent to sea, or of any sailor being admitted on board of a King's ship with that disorder, unless it be wilfully concealed by the man himself, furnish to my mind a better explanation of the cause of so few cases of stone having been met with amongst seafaring persons, than any of the references to the habits or mode of life of a sailor, made by Mr. C. Hutchison in his ingenious paper. (See *Med. Chir. Trans.* vol. ix. p. 443, &c.) From this gentleman's account it seems that out of 86,000 patients admitted into the naval hospitals at Haslar, Plymouth, and Deal, in the space of sixteen years, there have only been eight calculous cases, or one in 10,750 patients. Two of these cases were boys, about fourteen years of age, "who had laboured under symptoms of stone for some years previously to the admission into the service, and into which they had recently entered, expressly for the purpose of deriving benefit from our magnificent institutions; one was a marine who had been at sea a few months only; three were adult seamen, and the seventh a marine; but their length of service afloat could not be at all ascertained: the eighth and last case was a warrant-officer, advanced in years, who had been serving in ordinary, that is, in a ship in harbour, for a considerable time previously to the operation." Subsequently to the period embraced by the returns collected by Mr. C. Hutchison, a boy has also been operated upon in Haslar Hospital. (Vol. cit. p. 449.) Mr. R. Smith, of Bristol, has published an interesting statistical inquiry into the frequency of stone in the bladder in Great Britain and Ireland, though, strictly, it is a comparative estimate of the number of operations for stone in different parts of the kingdom in given spaces of time, and not of the number of calculous patients. (See *Med. Chir. Trans.* vol. xi.) So far as I can judge from the facts stated in Mr. Smith's paper, and from what I know about the average number of operations for stone in London, not more than 180 can be fairly reckoned as the annual total in Great Britain and Ireland, which is about 1 for each 100,000 of the population, taken at 18 millions. Now, if this fact be recollected, in computing the rarity of stone operations in the navy, and the other circumstances of there being

few children and old men in that service, and of every man being examined by a surgeon, as to the state of his health, before he is entered, I think the reason of the infrequency of stone in the navy will be tolerably clear. However, as sailors live partly in very hot and partly in very cold climates, even if they were of the ages most subject to calculi, they may perhaps be rather less disposed to the complaint than individuals of the same periods of life constantly resident in England. In the cold country of Sweden, urinary calculi are said to be infrequent (*Richerand Nosogr. Chir.* t. iii. p. 528. ed. 4.); and, as surgery is there highly cultivated, the uncontradicted statement weighs considerably in favour of the truth of the general belief in the rarity of this disorder in very cold countries. But, as I have already said, the number of inhabitants, to which any particular evidence on this point relates, is an essential inquiry before a safe inference can be drawn.

It is perfectly well ascertained, that the greater number of urinary calculi are composed chiefly of lithic, or uric acid, which is naturally contained either in a free or combined state in the urine of man, and all other animals which consume a great deal of food abounding in azote, as flesh of every kind, fish, shell-fish, eggs, &c. Whenever the urine will redden the tincture of turnsol, Magendie infers, with the generality of chemists, that it contains lithic acid, the proportion of which, he says, varies, according to the quantity of substances abounding in azote, taken as food. And Magendie further observes, that when animals live altogether on flesh, their urine is full of uric acid, and even may be entirely composed of it, as is proved, with respect to birds, by the experiments both of Dr. Wollaston and Vauquelin. Here Magendie cannot mean free uric acid, but this acid in a state of combination; for, as Dr. Prout has observed, there is no instance known, in which lithic, or uric acid is secreted in a pure state: birds, serpents, &c. always secrete it in combination with ammonia; in the gouty chalk-stone it is secreted in combination with soda. (*On the Nature, &c. of Gravel and Calculus*, p. 13.) On the contrary, if animals live on vegetables, as is the case with the herbivorous class, Magendie states, that there is no appearance of lithic acid in their urine. In a series of experiments, communicated by Magendie to the Academy of Sciences in 1816, this distinguished physiologist exemplified that, if a carnivorous animal be deprived of all nutriment containing azote, and be fed with sugar, gum, oil, and other substances considered to be nutritious, and having no azote, in their composition, the urine, in three or four weeks, will contain no lithic acid. (See *Mém. sur les Propriétés nutritives des Substances qui ne contiennent pas d'Azote*. Paris, 1817.) A dog, allowed only sugar and distilled water, soon began to grow lean, and died apparently starved on the 32d day from the commencement of his diet. The inference, which Magendie draws from his experiments, and from some cases which he has detailed, is, that the quantity of uric acid in the urine, and, of course, the tendency to gravel and calculous disorders, depend very much upon the kind of food. However, he takes into consideration the relative proportion of the uric acid to the urine itself, because, if this be also abundant, the liability to calculi is counteracted. It would appear, also, from his observations, that

the urine not only becomes impregnated with a great proportion of uric acid in animals, which eat a large quantity of flesh, but is also scanty; and that, on the other hand, a vegetable diet always promotes the secretion of a large quantity of fluid from the kidneys, as well as checks the formation of the acid in question. Magendie is also disposed to believe, that the rarity of calculi in hot climates may be partly traced to the kind of food employed. In fact, it is well known, that in a considerable part of Asia, many millions of the inhabitants never eat flesh. But, though this circumstance must be allowed to have full weight, with respect to the sects which religiously decline animal food, the influence of climate cannot be rejected, because calculi are rare in all hot countries, whether meat be freely eaten or not. At the same time, the tenor of this gentleman's reasoning may be true, that, setting out of the question the influence of climate, a vegetable diet tends to prevent the formation of lithic acid calculi, while eating large quantities of such food, as contains a great deal of azote, has the opposite effect.

However, Magendie himself is not so partial to his theory as not to confess, that it is liable to objections; for, says he, individuals are met with every day, who, from their age, manner of living, and habits appear to be subjected to every condition, calculated to produce the gravel, and yet they remain free from it. Hence, he infers, that there must be some unknown causes, which sometimes keep the uric acid dissolved, even where its quantity in the urine is copious. On the other hand, he admits, that certain persons are met with, whose regimen and mode of life ought to exempt them from gravel, and still they are afflicted. In proof of this fact, he adverts to the poor inhabitants of a district in Sussex, mentioned by Dr. Scudamore (*On the Nature and Cure of Gout*, &c. 8vo. Lond. 1817), who live almost entirely on vegetable matter and hard beer, and many of whom are much troubled with gravel. Magendie might also have recollected, that some birds which live entirely on vegetable matter, as several singing-birds kept in cages, void a good deal of the lithate of ammonia. Magendie refers to examples of gravel being always produced in certain individuals after any unusual exertion, and in other apparently healthy subjects, after any difficulty of digestion, flatulence, the eating of salad, raw fruit, &c. With regard to the dyspepsia, frequently attendant on calculous disorders, and other chronic diseases, Magendie sets down the complaints of the stomach and of the urinary organs, as probably only two effects of the same cause, and not mutually productive of each other. (See *Recherches, &c. sur les Causes, &c. de la Gravelle*, 8vo. Paris, 1818.)

On this last point, M. Magendie is probably incorrect. It was formerly supposed, that pure lithic acid was dissolved in the urine; but Dr. Prout proved, that such acid is nearly insoluble, and "that under ordinary circumstances, it exists only in the form of lithate of ammonia, which is a very soluble salt. It is this, and not the uncombined acid, which causes healthy urine to redden litmus paper. In very cold weather, the urine, as it cools, deposits the lithate of ammonia, blended with some other animal matter. It is the lithate of ammonia also, which forms the principal part of the soft, or uncrystallised sediment deposited in

the vessel by the urine of persons who labour under dyspepsia, and some other bodily ailments, &c. The presence of another acid in the urine causes the lithic acid, even in the bladder, to be precipitated in the form of a red sand. Whatever the kind of acid may be that produces this effect, whether them uratic, or phosphoric, or another, we find that those who are liable to the formation of acid in the stomach, are especially liable to the deposition of red sand. If the digestion be weak, and the food in consequence remains in the stomach long enough to become acedent, the red sand is generated. If the food be indigestible, or, if it be taken in too large a quantity, the same effect may be produced in the most healthy person. The free use of fermented liquors, and especially of those which contain acid already, such as punch and champagne, or sugar, which may become acid in the stomach, leads to the same result. Persons who lead a sedentary life, and who never take exercise, so as to produce perspiration, are also especially liable to the formation of red sand. (*Sir Benjamin Brodie on Dis. of the Urinary Organs*, ed. 2. p. 167.)

It is a common belief, that there is a close connexion between gout and the formation of stone in the bladder. Thus, Sir Benjamin Brodie observes, that, when the urine contains a superabundant acid, which precipitates the red sand, or lithic acid, it is usually bright and transparent, and of a copper colour, resembling in appearance Madeira wine. In general, the patient is troubled with dyspeptic symptoms, and frequently he is liable to gout. The same peculiar constitution, the same luxurious diet, the same inactive life, which makes him subject to the one, makes him also subject to the other. The red sand is composed of crystals of lithic acid in its pure state; while chalk-stones, which are formed in the bursæ and cellular tissue of gouty patients, are composed of the same acid in combination with soda. In the better classes of society, the deposit of red sand takes place chiefly in adults; but, in the lower classes, principally in children. These facts are accounted for by Sir Benjamin Brodie, by the following considerations:—Adult persons in affluent circumstances, for the most part, lead a more luxurious and indolent life than their children; while, among those of lower condition, the diet of the children is frequently unwholesome, and little attention paid to disorder of the digestive organs. (*Op. cit.* p. 169.)

It should be observed, that Magendie's observations are meant to apply only to cases of gravel, and where the substance voided is lithic acid. And, as for other instances in which the calculous matter is formed of phosphate of lime, oxalate of lime, cystic oxide, &c. he deems the causes entirely unknown. According to one modern writer, when the production of acidulous fluid in the stomach coincides with a poor diet, oxalate of lime is frequently formed in the kidney. (See *T. King, On Lithotripsy and Lithotomy compared*, p. 302. 8vo. Lond: 1832.) One thing is certain, that Magendie's theory will not account for the origin of calculi, unless a predisposition to the disease, from other unknown or conjectured causes, be taken as a matter of fact. Indeed, this admission he makes himself; and he enumerates various circumstances conducive to gravel, besides a diet of food abounding in azote, as advanced age—a

sedentary life, and hard study; long retention of urine in the bladder; strong wines and liquors. In fact, without the predisposition, arising from unknown causes, and particular periods of life, a meat diet will not render the occurrence of calculi frequent, as is exemplified in sailors, who eat a great deal of salt beef and pork. And, on the contrary, that the eating of little, or no animal food, will not always prevent the formation of calculi, when there is a tendency to it from time of life, diathesis, or other causes, is sufficiently proved by the frequency of the disease in infants, in whose food there is a much smaller proportion of meat and azotic substances, than in the usual diet of an adult.

Mr. Crosse, of Norwich, joins many writers, in considering the prevailing source of urinary calculi to be dyspepsia, leading to the generation of acid in the stomach, and to the superabundance of lithic acid in the urine. That disease, however, so often exists without the production of urinary concretions, that he deems it necessary for the origin of the latter, that it should be united with other exciting causes, as want of sufficient exertion, variable climate, peculiar diathesis, or local disease in some part of the urinary organs. (*On Formation, &c. of the Urinary Calculus*, 4to. Lond. 1835.)

With respect to *amorphous sediments*, the circumstances which Dr. Prout has observed to produce a lithic acid diathesis in persons, subject to slight dyspepsia, but in other respects healthy, are: 1. Simple errors in diet. 2. Unusual, or unnatural exercise, either bodily or mental, particularly after eating, and the want of proper exercise at all other times. 3. Debilitating circumstances. (*On Gravel, Calculus, &c.* p. 113.) An unusually heavy meal, especially of animal food, or bread, he says, is invariably followed by a deposition of the lithate of ammonia from the urine. Heavy, unfermented bread, and compact, hard-boiled, fat dumplings, or puddings, he finds particularly apt to produce such an effect.

Crystallised sediments, or gravel, consisting of nearly pure lithic acid, Dr. Prout ascribes to a free acid being sometimes generated in the kidneys, and, combining with the ammonia, with which the lithic acid is previously united, so as to precipitate the latter in a pure crystallised state. According to the investigations of Dr. Prout, the precipitating acid is not constantly the same, though generally the phosphoric, and sometimes the sulphuric. (P. 127, 128.)

The same intelligent writer represents the circumstances, which promote the formation of urinary sediments in general, as being either *natural*, or *acquired*. "With respect to those of the first description (says he), it cannot, I think, be doubted, that certain individuals are much more liable to these sediments, than others. This tendency is not infrequently inherited: thus, I know a family, where the grandfather and father have actually lithic calculi in the bladder; and where the grandson, a youth of twelve or thirteen years of age, has a very strong tendency to the same disease; his urine depositing frequently very large quantities of lithic acid, both in the form of amorphous and crystallised sediments. On the other hand, the disposition to generate these sediments in excess, is, like gout, or rather simultaneously with gout, but too frequently acquired by indolent habits,

and excess in eating and drinking. Most frequently, however, the tendency to these diseases is connected with some unknown causes, peculiar to certain districts, or countries, as, for example, the district, of which Norwich may be considered the centre, in which more calculous cases occur than in the whole of Ireland or Scotland. In such instances, the water, diet, temperature, &c. of the district, has been each accused, in its turn, of being the exciting cause; but (says Dr. Prout), the circumstance, I believe, still remains unexplained. I have, in one or two instances, seen a fit of lithic gravel induced in the predisposed by sitting on a damp, cold seat for some hours. Sometimes also a tendency to lithic calculus is evidently connected with local injury, or disease of the kidney. (P. 133.)

The difficulty of tracing the causes of the formation of calculi, is rather increased than lessened, by the fact that, except when the urinary organs are much diseased, the patient may appear to be in perfect health. Indeed, persons of the strongest constitutions are often troubled with the stone, quite independently of the entrance of any foreign body, as a nucleus, into the bladder; and it is now universally admitted, that lithic acid itself constitutes by far the most common nucleus, even when other calculous matter is deposited round it. (See *Prout on Gravel*, p. 95.) It is sometimes conjectured, that the female is less liable, than the male sex, to calculi; but, whether this is the fact, or whether the circumstance can be satisfactorily explained on another principle, viz. the facility with which lithic acid sand, and any calculi of moderate size are generally discharged through the short and capacious meatus urinarius, are questions, perhaps, not yet completely settled.

Infants, and children to the age of twelve, or fourteen, are very liable to stone. However, it is asserted by Delpach that, at this period of life, relapses are unfrequent; that is to say, an entirely fresh stone is hardly ever formed again; and, if a return of the complaint happens, the quickness of its recurrence, and an attentive examination of the calculus, will mostly prove, either that the second stone has formed round a fragment of the first, left behind, or that it existed when the former one was taken out, but was not discovered. I am not inclined to put much faith in this statement, because it is hardly credible, that the calculous diathesis of childhood can be at all diminished by the circumstance of there having already been one calculus, and of the patient having had the bladder opened for its removal.

Dr. Marcet thinks, that the disorder is frequent only among the children of the poor classes; and that, in those of the higher ranks, or even of the lowest classes, *provided they are well fed*, the same frequency is not observed. "In the Foundling Hospital, for instance, within the last 27 years, during which 1151 children have been admitted, only three cases of stone have occurred, all of which were among children while at nurse in the country. And, in the Military Asylum at Chelsea, which contains about 1250 children, and into which upwards of 6000 of them have been already admitted, no more than one single case of stone has occurred." (See *Marcet's Essay on Calculous Disorders*, p. 36.) However, supposing that the

foregoing statement refers to operations for stone, and that the average number of operations for the population of Great Britain and Ireland, is annually about one for each 100,000 inhabitants, the inference, drawn by Dr. Marcet, which moreover does not agree with later statistical reports, cannot be received, because, in the total number of children specified as having been admitted into the above, charities, even when every allowance is made for the time comprised in the calculation, the proportion of operations is far beyond the average, with reference to the population in general. And, that stone cases are more numerous in the children of the poor, than in those of the higher classes, is a fact, which perhaps may be explained by the recollection, that the mass of the population consists of the poor and laborious classes.

In the period of life, between the age of twelve or fourteen, and that of forty, the liability to stone in the bladder is much less than in infancy, childhood, or old age. And, no doubt, many of the cases, which do present themselves in adults, or middle-aged individuals, either began at an earlier period of life, or are owing to some extraneous nucleus.

According to Delpach, in old men, who are particularly subject to calculi, the disposition to the return of the disease always continues during life; and, hence, in them, relapses are frequent. (*Précis des Mal. Chir.* t. ii. p. 193, &c.)

The following table, collected by Dr. Prout, exhibits the proportion of stone cases before and after puberty, and of their occurrence in the different sexes:

	Bristol.	Leeds.	Norwich.	Total.	Consisting of	
					Males.	Females.
14 yrs. & under	178	96	235	509		
Above 14 years	177	101	271	549		
	355	197	506		1014	44

Thus, nearly one half of the whole number of stone cases occur before the completion of the 14th year; and it appears also from Mr. Smith's valuable reports, that there is an evident increase in the number of cases, about the age of 40 years. (See *Prout on Gravel*, &c. p. 210.; and *R. Smith, in Med. Chir. Trans.* vol. x.)

Dr. Marcet has estimated the comparative frequency of the disease in various countries, and in the different stations of life, and tried to ascertain whether its frequency be influenced by varieties of climate, or situation, or by peculiarities in our habits and occupations. He instituted inquiries at all the great hospitals of the metropolis, in the hope of getting at some useful records concerning the vast number of patients, on whom lithotomy had been performed in those establishments. In London he found it impossible to obtain all the particulars of such cases, as no entry of them had been preserved. The Norwich Hospital, however, afforded him some details which are interesting. All the calculi which have been extracted in that hospital for 44 years, viz. from 1772 to 1816, and which amount to 506, have been carefully preserved, with the circumstances annexed to each stone, and the event of the operation distinctly recorded: Dr. Marcet has given the results of these records in the following table:

	Number of Operations.			Deaths.		
	Children under 14.	Adults.	Total.	Children.	Adults.	Total.
Females	227	251	478	12	56	68
Males	8	20	28	1	1	2
	235	271	506	13	57	70

It appears, says Dr. Marcet, from the above table, that the mean annual number of cases of lithotomy in the Norwich Hospital, during 44 years, has been $1\frac{1}{2}$, or 23 in every two years; and that the total number of fatal cases in the 506 operations is 70, or 1 in $7\frac{1}{4}$, or 4 in 29. The proportion of females who have undergone the operation, is to that of males, as 58 to 1000, or about 1 to 17; that the mortality from the operation in children was only about 1 in 18; while in adults it was 4 in 19, or nearly quadruple.

According to Mr. Smith, the mortality from lithotomy at the Bristol Infirmary has been in the following proportions:

Age.	Rate of Mortality.
10 years of age and under,	1 in $4\frac{1}{2}$
Between 10 and 20 -	1 5
20 30 -	1 7
30 40 -	1 5
40 50 -	1 $3\frac{1}{2}$
50 60 -	1 $4\frac{1}{2}$
60 70 -	1 2 $\frac{1}{2}$
70 80 -	1 2 $\frac{1}{2}$
Mean at all ages,	1 in $4\frac{1}{2}$

The following table is also from Mr. Smith's paper, and refers to the Leeds Hospital. (See *Med. Chir. Trans.* vol. x.)

	Cases of Lithotomy.	died	
From 1767 to 1777	24 of which	2	or 1 in 12
1777 1787	62 —	8	1 7 $\frac{1}{2}$
1787 1797	23 —	3	1 7 $\frac{1}{2}$
1797 1807	42 —	7	1 6
1807 1817	46 —	8	1 5 $\frac{1}{2}$
Mean at all ages,		1	in $7\frac{1}{2}$

In the Norfolk Infirmary, the mortality has been much less in children than adults. But, at St. Bartholomew's, the proportion of deaths in children, during the 20 years that I frequently attended operations for stone there, was very great. In the Bristol Infirmary, the risk in children seems to have been about equal to what it has been in adults. In all calculations of this kind, however, it is to be recollected, that as operations for the stone are done, not only by surgeons of various degrees of skill, but in different ways, and even with instruments of great diversity, such computations do not give the fair average of any one method of operating.

Now, where the patients are equally favourable, but the results of any given number of operations on them are considerably different, the skill of the surgeons, the particular methods of operating pur-

sued, the kinds of instruments used, the general healthiness of the hospital itself, and the treatment after the patients are put to bed, are considerations by which questions, apparently inexplicable, might sometimes be solved.

From the year 1772 to 1816, the Norwich Hospital received 18,859 patients of all kinds, making an average of 428 annual admissions; and Dr. Marcet observes, that the proportion of 506 operations of lithotomy, out of 18,859 patients, which corresponds to about 1 in 38, exceeds, in an astonishing degree, that obtained from any of the other public institutions, whose records he examined.

Next to the records of the Norwich Hospital, Dr. Marcet derived the most distinct information of this kind from Cheselden, who mentions in his work on anatomy that, during the course of his public practice in St. Thomas's Hospital, a period of about 20 years, he had performed the operation of the stone 213 times, and lost only 20 patients. This was about 2 cases in 21, which is much less than the common average.

In St. Thomas's Hospital, during ten years, the operation of lithotomy had been done on an average 11 times in each two years; and one case of stone had occurred in each 528 patients admitted.

In St. Bartholomew's, lithotomy was performed 56 times in the years 1812, 1813, 1814, 1815, and 1816. The annual average about 11, or 1 in each 340 patients of all descriptions.

In Guy's Hospital, lithotomy had been performed on an average about 9 or 10 times annually, during the space of 20 or 30 years. The proportion of calculous patients there was also estimated by Dr. Marcet as 1 in about 300 cases of all kinds.

Dr. Marcet's inquiries inclined him to think, that lithotomy, in the London hospitals, has been of late gradually becoming less frequent; and this he conceives may be owing partly to a real reduction in the frequency of the stone, from some alteration in the diet, or habits of the people; partly to the use of appropriate medicines; and partly to the circumstance of calculous patients not resorting so exclusively, as was formerly the case, to the great London hospitals for the operation. Subsequently to the period when Dr. Marcet wrote, the frequency of lithotomy has been still more remarkably lessened by the introduction of lithotripsy.

In the Royal Infirmary at Edinburgh, the average number of stone cases annually, during the six years preceding the period of Dr. Marcet's publication, is said not to have exceeded 2, although about 2000 patients had been admitted there every year.

Dr. Marcet was informed by M. Roux, that in La Charité at Paris, ten or twelve cases of stone occur every year, out of about 2600 patients, and that the proportion of deaths from the operation there, is 1 in 5 or 6.

With respect to the Hôpital des Enfants Malades, in the same city, Dr. Marcet states, on the authority of Dr. Biett, that about 6 cases of stone are received every year into that establishment, where about 3000 children of both sexes are annually admitted. There had been only 3 cases in females, and what is remarkable, only 2 deaths from the operation in the course of seven years.

At Geneva, in a population of 30,000, lithotomy had been performed only thirteen times in the space

of twenty years, though good surgeons were never wanting in that town to perform the operation whenever an opportunity presented itself. Out of these thirteen patients, seven were not strictly Genevese, though belonging to the neighbouring districts, and one was an Englishman; so that the disease would at first sight appear to be a rare occurrence at Geneva. But, continues Dr. Marcet, *if the smallness of the Genevese population be taken into account*, this proportion of calculous cases may not fall very short of that observed in other places. At Lyons, a populous town, not more than eighty miles distant from Geneva, the disease is stated to be rather frequent.

With regard to the chemical nature of urinary calculi, there was nothing known until 1776, when Scheele published, on the subject, in the Stockholm Transactions. He there stated, that all the urinary calculi, which he had examined, consisted of a peculiar concrete substance, now well known by the name of *lithic*, or *uric acid*, which he also showed was soluble in alkaline lixivium. Scheele further discovered, that the lithic matter was, in some degree, capable of being dissolved in cold water; that this solution possessed acid properties, and in particular, that of reddening litmus; that it was acted upon in a peculiar manner when boiled in nitric acid; and lastly, that human urine always contained this substance in greater or less quantity, and often let it separate in the form of a brick-coloured sediment, by the mere effect of cooling.

The discovery made by Scheele was confirmed by Bergmann and Morveau, and the investigation of the subject was afterwards prosecuted by others with redoubled ardour. As Professor Murray observes, experiments continued to be repeated and diversified on these concretions, and on their solvents. At length it was fully ascertained, that there existed others besides those composed of uric acid; and, latterly, our knowledge of them has been much extended by the researches of Pearson, Wollaston, Fourcroy, and Vauquelin. Several important facts have also been established by the talents and industry of some other distinguished men; viz. Dr. Henry, of Manchester; Professor Brande, of the Royal Institution of London; Dr. Marcet, late of Guy's Hospital; and Dr. Prout, of London. The facts and considerations of the latter writer render it probable, however, that the common opinion of pure lithic acid being contained in the urine is not exactly correct; but that this acid "in healthy urine exists in a state of combination with ammonia, and that, in reality, this fluid contains no uncombined acid at all." (*On the Nature, &c. of Gravel and Calculus*, c. 13.)

The credit which is due to Dr. Wollaston for his valuable and original discoveries respecting urinary calculi, is very considerable; a truth, which I have particular pleasure in recording here, since his merits have not been fairly appreciated by the French chemists. Indeed, as Dr. Marcet observes, it is the more desirable that his claims should be placed in the clearest point of view, as the late celebrated M. Fourcroy, both in his "*Système des Connoissances Chimiques*," and in his various papers on this particular subject, has in a most unaccountable manner overlooked Dr. Wollaston's labours, and in describing results, exactly similar to those previously obtained and published by the English chemist, has claimed them as his own discoveries. Yet Dr. Wollaston's paper was printed

in our Philosophical Transactions, two years before Fourcroy published his Memoir in the "*Annales de Chimie*," and three years before he gave to the world his "*Système des Connoissances Chimiques*;" and he discussed in these works a paper of Dr. Pearson on the lithic acid, published in a volume of the Philosophical Transactions (for 1798) subsequent to that which contained the account of Dr. Wollaston's discoveries! (See *Marcet's Essay on Calculous Disorders*, p. 60.; also *Murray's Syst. of Chem.* vol. iv. p. 636. ed. of 1809.)

It would appear then, that Scheele first discovered the nature of those urinary calculi which consist of lithic acid; but that Dr. Wollaston first ascertained the nature of several other kinds, some of which have also been described at a later period by Fourcroy and Vauquelin. On the whole there are five species of concretions, whose chemical properties were first pointed out by Dr. Wollaston, and no less than four belong to the urinary organs. These are, 1st. Gouty concretions. 2dly. The fusible calculus. 3dly. The mulberry calculus. 4thly. The calculus of the prostate gland. 5thly. The cystic oxide, discovered in 1810.

1. *Lithic Acid Calculus*. Dr. Prout believes, that at least two-thirds of the whole number of calculi originate from lithic acid; for, as it forms by far the most common nucleus, round which other calculous matter is subsequently deposited, if such nuclei had not been formed and detained, two persons at least out of three who suffer from stone, would never have been troubled with the disorder. (*On Gravel, Calculus, &c.* p. 95.)

Lithic acid forms a hard, inodorous concretion, of a yellowish, or brown colour, similar to that of wood, of various shades. According to Professor Murray, calculi of this kind are in fine, close layers, fibrous, or radiated, and generally smooth on their surface, though sometimes a little rough. They are rather brittle, and have a specific gravity, varying from 1,276, to 1,786, but usually above 1,500. One part of lithic acid is said to dissolve in 1720 parts of cold water, and 1150 parts of boiling water (*Marcet*, p. 65.); and this solution turns vegetable blues to a red colour. When it has been dissolved in boiling water, small yellowish crystals are deposited as the fluid becomes cold. Lithic acid calculi blacken, but are not melted by the blow-pipe, emitting a peculiar animal smell, and gradually evaporating, until a small quantity of white ash remains, which is alkaline. By distillation, they yield ammonia and prussic acid. They are soluble in the cold, in a solution of pure potassa, or soda, and from the solution a precipitate of a fine white powder is thrown down by the acid. Lime water likewise dissolves them, but more sparingly. According to Scheele, they remain unchanged in solutions of the alkaline carbonates; a statement, which agrees with that of Dr. Prout, who accounts for the effect said to be produced by the alkaline carbonates upon calculi in the bladder, by their property of dissolving the lithate of ammonia. (*Egan*, in *Trans. of Irish Acad.* 1805; *Prout on Gravel, &c.* p. 84.) They are not much acted upon by ammonia. They are not soluble either in the muriatic or sulphuric acid; though they are so in the nitric, when assisted by heat; and the residue of this solution, when evaporated to dryness, assumes a remarkably bright pink co-

lour, which disappears on adding either an acid, or an alkali. In many of these calculi, the lithic acid is nearly pure; in others, there is an intermixture of other ingredients, particularly of phosphate of lime, and phosphate of ammonia and magnesia; and, in almost all of them, there is a portion of animal matter, which occasions the smell, when they are burnt, and the loss in their analysis. (See *Murray's Chemistry*, vol. iv. p. 640.; and *Marcet's Essay on the Chem. and Med. Hist. of Calculous Disorders*, 8vo, Lond. 1817.)

A great quantity of uric acid is formed in gouty constitutions, and deposited in the joints, or soft parts, in the state of lithate of ammonia. Sir Everard Home removed a tumour weighing four ounces, from the heel of a gentleman, a martyr to the gout; and when analysed by Professor Brande, it was found to be principally composed of uric acid. (*On Strictures*, vol. iii. p. 313.)

2. *Lithate of Ammonia Calculus*, according to Dr. Prout, is generally of the colour of clay. Its surface is sometimes smooth; sometimes tuberculated. It is composed of concentric layers, and its fracture resembles that of compact limestone. It is generally of small size, and rather uncommon; but the lithate of ammonia very frequently occurs, mixed with lithic acid, forming a mixed variety of calculus. Under the flame of the blow-pipe, it usually decrepitates strongly. It is much more soluble in water than the lithic acid calculus; and always gives off a strong smell of ammonia on being heated with caustic potash. *The lithate of ammonia is also readily soluble in the alkaline subcarbonates, which pure lithic acid is not.* (Prout on *Gravel*, &c. p. 83.)

3. *Bone Earth, Phosphate of Lime Calculus*. The presence of phosphate of lime in urinary calculi had been mentioned by Bergmann and others, when Dr. Wollaston first ascertained, that some calculi are entirely composed of it. From the investigations of Dr. Wollaston, it appears, that this substance sometimes, though rarely, composes the entire calculus, but that, in general, it is mixed with other ingredients, particularly with uric acid and phosphate of magnesia and ammonia. In the first case, the calculus is described as being of a pale brown colour, and so smooth as to appear polished. When sawn through, it is found very regularly laminated, and the laminæ, in general, adhere so slightly to each other, as to separate with ease into concentric crusts. It dissolves entirely, though slowly, in muriatic, or nitric acid. Exposed to the flame of the blow-pipe, it is at first slightly charred, but soon becomes perfectly white, retaining its form, until urged with the utmost heat from a common blow-pipe, when it may be completely fused. It appears to be more fusible than the phosphate of lime, which forms the basis of bone; a circumstance which Dr. Wollaston ascribes to the latter containing a larger quantity of lime. (*Phil. Trans.* 1797.) It appears from the investigations of Dr. Prout, that the inner membrane of the bladder, when affected with chronic inflammation, may secrete a quantity of adhesive mucus, containing phosphate of lime. A portion of the phosphate of lime, thus produced, mixed probably with some of the triple phosphate from the urine, is deposited on the lymph, and thus the incrustation takes place. (See *Brodie on the Urinary Organs*, p. 224.)

4. *Triple Phosphate of Magnesia and Ammonia Calculus*. The existence of this calculus in the intestines of animals was first pointed out by Fourcroy; but, its being a constituent part of some urinary calculi of the human subject was originally discovered by Dr. Wollaston. (*Phil. Trans.* 1797.) According to Dr. Prout, this species of calculus is always nearly white; its surface is commonly uneven, and covered with minute shining crystals. Its texture is not laminated, and it is easily broken and reduced to powder. In some rare instances, however, it is hard and compact, and when broken, exhibits a crystalline texture, and is more or less transparent. Calculi, composed entirely of the phosphate of magnesia and ammonia, are rare, but specimens, in which they constitute the predominant ingredient, are by no means uncommon. (Prout, p. 86.) When the blow-pipe is applied, an ammoniacal smell is perceived, the fragment diminishes in size, and if the heat be strongly urged, it ultimately undergoes an imperfect fusion, being reduced to the state of phosphate of magnesia. (P. 69.) Dr. Wollaston describes the form of the crystals of this salt, as being a short triliteral prism, having one angle a right angle, and the other two equal, terminated by a pyramid of three or six sides. These crystals, as Dr. Marcet has explained, are but very sparingly soluble in water, but very readily in most, if not all, the acids; and, on precipitation, they re-assume the crystallised form. From the solutions of these crystals in muriatic acid, sal ammoniac may be obtained by sublimation. Solutions of caustic alkalis disengage ammonia from the triple salt, the alkali combining with a portion of the phosphoric acid. One fact, of great importance, respecting this species of calculus, is mentioned by Sir A. Cooper in his lectures; viz., that it is particularly liable to be reproduced after lithotomy, and therefore, until the patient's diathesis has been corrected by medical treatment, he cautions surgeons not to perform the operation. In cases of this description, he says, a substance like mortar is discharged from the bladder, and the urine is very fetid.

5. *Fusible Calculus*. Mr. Tennant first discovered that this substance was different from the lithic acid, and that, when urged by the blow-pipe, instead of being nearly consumed, a large part of it melted into a white vitreous globule. The nature of the fusible calculus was afterwards more fully investigated and explained by Dr. Wollaston. (*Phil. Trans.* 1797.) According to the excellent description lately given of this calculus by Dr. Marcet, it is commonly whiter and more friable than any other species. It sometimes resembles a mass of chalk, leaving a white dust on the fingers, and separates easily into layers, or laminæ, the interstices of which are often studded with sparkling crystals of the triple phosphate. At other times, it appears in the form of a spongy and very friable whitish mass, in which the laminated structure is not obvious. Calculi of this kind often acquire a very large size, and they are apt to mould themselves in the contracted cavity of the bladder, assuming a peculiarity of form, which Dr. Marcet has never observed in any of the other species of calculi, and which consists in the stone terminating, at its broader end, in a kind of pe-

duncle, corresponding to the neck of the bladder. The chemical composition of the fusible calculus is a mixture of the triple phosphate of magnesia and ammonia, and of the phosphate of lime. These two salts, which, when separate, are infusible, or nearly so, when mixed together and urged by the blow-pipe, easily run into a vitreous globule. The composition of this substance, says Dr. Marcet, may be shown in various ways. Thus, if it be pulverised, and acetic acid poured upon it, the triple crystals will be readily dissolved, while the phosphate of lime will scarcely be acted upon; after which the muriatic acid will readily dissolve the latter phosphate, leaving a small residue, consisting of lithic acid, a portion of which is always found mixed with the fusible calculus.

It is also remarked by Dr. Marcet, that many of the calculi, which form round extraneous bodies in the bladder, are of the fusible kind. And the calculous matter sometimes deposited between the prepuce and glands is found to be of the same nature.

6. *Mulberry Calculus*, or *Oxalate of Lime*, is mostly of a dark-brown colour, its interior being often grey. Its surface is usually uneven, presenting tubercles more or less prominent, frequently rounded, sometimes pointed, and either rough or polished. It is very hard, difficult to saw, and appears to consist of successive unequal layers: excepting the few stones, which contain a proportion of silica, it is the heaviest of the urinary concretions. Though this calculus has been named *mulberry*, from its resemblance to that fruit, yet, as Dr. Marcet has observed, there are many concretions of this class, which, far from having the mulberry appearance, are remarkably smooth and pale-coloured, as may be seen in plate 8, fig. 6. of that gentleman's essay. According to Mr. Brande, persons, who have voided this species of calculus, are much less liable to a return of the complaint, than other patients who discharge lithic calculi. (*Phil. Trans.* 1808.)

With regard to chemical characters (says Professor Murray), it is less affected by the application of the usual re-agents than any other calculus. The pure alkaline solutions have no effect upon it, and the acids dissolve it with great difficulty. When it is reduced, however, to fine powder, both muriatic and nitric acid dissolve it slowly. The solutions of the alkaline carbonates decompose it, as Fourcroy and Vauquelin have observed; and this affords us the easiest method of analysing it. The calculus in powder being digested in the solution, carbonate of lime is soon formed, which remains insoluble, and is easily distinguished by the effervescence produced by the addition of weak acetic acid, while there is obtained in solution the compound of oxalic acid with the alkali of the alkaline carbonate. From this the oxalic acid may be precipitated by the acetate of lead, or of barytes; and this oxalate, thus formed, may be afterwards decomposed by sulphuric acid. Another method of analysing this calculus is by exposure to heat: its acid is decomposed, and by raising the heat sufficiently, pure lime is obtained, amounting to about a third of the weight of the calculus. According to Fourcroy and Vauquelin, the oxalate of lime calculus contains more animal matter than any other. This animal matter appeared to them to be a mixture of albumen and urée. The composition

of a calculus of this species, analysed by Mr. Brande, was oxalate of lime, 65 grains; uric acid, 16 grains; phosphate of lime, 15 grains; animal matter, 4 grains.

7. *The Cystic Oxide Calculus* is small, and very rare. It was first described by Dr. Wollaston. (*Phil. Trans.* for 1810.) In external appearance, it bears a greater resemblance to the triple phosphate of magnesia, than any other sort of calculus. However, it is more compact, and does not consist of distinct laminæ, but appears as one mass confusedly crystallised throughout its substance. It has a yellowish semi-transparency, and a peculiar glistening lustre. Under the blow-pipe, it gives a singularly fetid smell, quite different from that of lithic acid, or the smell of prussic acid. In consequence of the readiness, with which this species of calculus unites both with acids and alkalies, in common with other oxides, and the fact of its also containing oxygen (as is proved by the formation of carbonic acid by distillation), Dr. Wollaston named it an oxide, and the term *cystic* was added from its having been originally found only in the bladder in two examples. Dr. Marcet, however, has subsequently met with no less than three instances of calculi formed of cystic oxide, all of which were unquestionably of renal origin.

8. *Alternating Calculus*. Lithic strata frequently alternate with layers of oxalate of lime, or with the phosphates. Sometimes also the mulberry alternates with the phosphates, and, in a few instances, three, or even four, species of calculi occur in the same stone, disposed in distinct concentric laminæ. On the comparative frequency of these and other varieties of calculi, Dr. Prout's work contains valuable information.

9. *Compound Calculi, with their Ingredients intimately mixed*. Under this title, Dr. Marcet comprehends certain calculi, which have no characteristic feature, by which they can be considered as distinctly belonging to any of the other classes. He observes, that they may sometimes be recognised by their more or less irregular figure, and their less determinate colour; by their being less distinctly, if at all, divisible into strata; and by their often possessing a considerable hardness. By chemical analysis confused results are obtained. (*See Essay on the Chem. and Med. Hist. of Calculous Disorders*, p. 90.)

10. *Calculi of the Prostate Gland*. The composition of these calculi is said to have been first explained by Dr. Wollaston. (*See Phil. Trans.* for 1797.) They all consist of phosphate of lime, the earth not being redundant, as in bones. Their size varies from that of a pin's head to that of a hazel-nut. Their form is more or less spheroidal, and they are of a yellowish brown colour.

Fourcroy described a species of urinary calculus, composed of the urate or lithate of ammonia. Dr. Wollaston, Mr. Brande, and Dr. Marcet, did not, however, satisfactorily ascertain the presence of this substance in any of the concretions which they examined. As also urea and the triple phosphate, both of which afford ammonia, are frequently present in lithic calculi, it was conjectured that these circumstances might have given rise to the analytical results, from which the existence of urate of ammonia had been inferred. (*Brande, in Phil. Trans.* 1808; *Marcet's Essay*, p. 93.) The investigations of Dr. Proft, however, es-

ish the reality of the lithate of ammonia

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Dr. Marcet met with two specimens of urinary calculi, entirely different from any which have hitherto been noticed. One of these he named *xanthic oxide*, from ξανθός, *yellow*, because one of its most characteristic properties is that of forming a lemon-coloured compound when acted upon by nitric acid. The chemical properties of the other new calculus, mentioned by Dr. Marcet, correspond to those of fibrine, and he therefore suggests the propriety of distinguishing it by the term *fibrinous*. For a particular description of these new substances, I must refer to this gentleman's essay.

11. *Carbonate of Lime Calculus*. This substance is not enumerated by Dr. Marcet, as entering in the composition of urinary calculi. But according to Mr. R. Smith, there can be no doubt of the fact. Dr. W. H. Gilby, of Clifton, he says, detected it decidedly in four instances. "A notice of it will be found in Mr. Tilloch's Journ. for 1817, vol. xlix. p. 188., in the account of a curious calculus, given to me by Mr. G. M. Burroughs, of Clifton; the nucleus of which is a common cinder, an inch and a half long and one broad. Since the publication of that paper (continues Mr. Smith) Mr. H. Sully, of Wiveliscombe, sent me three oddly shaped calculi, which he removed from a lad, together with fifteen pea-sized ones previously voided by the urethra, which are entirely carbonate of lime, held together by animal mucus." (See *Med. Chir. Trans.* vol. xi. p. 14.) Dr. Prout has also seen small calculi composed almost entirely of carbonate of lime. (*On Gravel*, &c. p. 89.)

Dr. Prout has investigated, with considerable talent, the comparative prevalence of the different forms of urinary deposits, and the order of their succession. His data are taken from the examinations, made by Professor Brande, of the calculi in the Hunterian Collection; by Dr. Marcet, of those at Norwich and Guy's Hospital; by Dr. Henry, of those at Manchester; and by Mr. Smith, of others preserved at the Bristol Infirmary. The whole number of calculi examined was 823; of these, 294 were classed under the name of lithic acid, 98 of which were nearly pure; 151 were mixed with a little of the oxalate of lime, and 45 with a little of the phosphates; 113 consisted of oxalate of lime. Three were of cystic oxide; 202 were phosphates, of which sixteen were nearly pure; 84 mixed with a small proportion of lithic acid; 8 consisted of phosphate of lime nearly pure; 3 of triple phosphate nearly pure, and 91 were fusible or mixed calculi; 186 were alternating calculi, or those whose laminæ varied, but consisted of lithic acid, oxalate of lime, and phosphates; of these, 15 consisted of lithic acid and oxalate of lime, the first being in the greatest proportion; 40 of the oxalate of lime, in the greatest proportion, and lithic acid in the least; 51 of the lithic acid and the phosphates; 49 of the oxalate of lime and the phosphates; 12 of the oxalate of lime, lithic acid, and the phosphates; 1 of fusible and lithic; 2 of fusible, and oxalate of lime; and 16, the composition of which was not mentioned.

Of compound calculi, whose composition was not specified, there were 25. (See *W. Prout's Inquiry into the Nature, &c. of Gravel and Calculus*, p. 94.)

The proportion of lithic acid calculi is some-

what more than one-third of the whole number. But, as this acid is the common nucleus, round which other calculeous matter is deposited, Dr. Prout computes the proportion of calculi, originating from it, to be at least two-thirds of the whole number. According to the experiments of the same physician, the red crystalline calculus is composed of nearly pure lithic acid; and the earthy, amorphous one, consists of lithic acid, more or less ammonia, generally a little of the phosphates, and sometimes a small portion of the oxalate of lime. The lighter the colour, the greater in general the proportion of lithate of ammonia and the phosphates. (P. 97.)

Oxalate of lime calculi form one-seventh of the whole number, without any regularity, however, in different museums.

Cystic oxide calculi are so rare, that the proportion found was only 1 in 274.

Calculi, composed of the phosphates, made about one-fourth of the whole number.

Alternating calculi amounted to between one-fourth and one-fifth; but Dr. Prout offers good reasons for believing, that the data, from which the estimate is drawn, cannot be depended upon. For additional information on this branch of the subject, I must refer to Dr. Prout's valuable work.

In the article LITHOTOMY I have noticed the symptoms, and partly also the pathological effects of calculi. According to the researches of Mr. Crosse, the irritation produced by the existence of calculi in the bladder gives rise to chronic inflammation of its internal membrane and to vitiated secretions, but very seldom to ulceration. Sometimes abscesses are formed in the thickened coats, from which matter may either find an outlet into the bladder or into the peritoneal cavity, so as to prove destructive. Small sacculi of the bladder are met with in a great proportion of those who have long laboured under stone; but large ones are very rare. They may likewise be produced by the effects of strictures, which form a very serious complication with calculus, and sometimes give rise to the disease. When a calculus has existed long, and the symptoms are severe, and particularly when it is attended with stricture or enlarged prostate, the kidney often becomes involved, the ureters becoming enlarged, and the inflammation extending to the kidney itself. "The pelvic cavities (says Mr. Crosse) become altered in shape and enlarged; the infundibula extended or unfolded, and the lining membrane of all the cavities, thus acted upon from repeated attacks of inflammation, is thickened, and furnishes a catarrhal secretion. The parenchymatous substance of the kidney is more or less absorbed; the mammary projections are obliterated; spurious hydatids occupy the cortical part, and all the serious evils, ulceration, contiguous abscess, or gangrene, described in speaking of calculi in this organ, are met with as sequelæ of the vesical calculus." (J. G. Crosse.)

The stone being a severe affliction, and the operation hazardous and painful, a variety of experiments have been instituted for the purpose of discovering a solvent for urinary calculi. Hitherto, however, all the remedies and plans, which have been tried, have been attended with very limited, and by no means unequivocal success, notwithstanding many persons may have been deceived into a contrary opinion.

The dissolution of stones in the bladder has been attempted by *lithontriptic medicines*, as they are termed, and by fluids injected into this viscus. At the present day, practitioners direct their endeavours very much to the correction of those particular diatheses, or states of the constitution, on which the formation of various calculi depend; and more confidence seems to be placed in this aim, than in any schemes for the dissolution of urinary concretions. It is certain that, in the latter project, many difficulties present themselves, and amongst these some of the most serious are the great variety in the composition of calculi; the impossibility of knowing the exact ingredients of a stone while it is concealed in the bladder, though many useful suggestions for assisting the judgment on this point have been offered by Dr. Prout: and, lastly, if the right solvent were ascertained, as calculated upon chemical principles applied to urinary concretions out of the body, it is obvious, that any medicines, taken by the mouth, are liable to so many changes in the alimentary canal, and in the lymphatic and vascular system, that it must be exceedingly difficult to get them in an unaltered state and effective quantity into the bladder; while, if this were possible (as it is in the way of injection through a catheter), the bladder itself might be incapable of bearing the application, and the patient lose his life in the experiment.

As Dr. Prout well observes, a calculus in the bladder may be considered a substance placed in a solution of various principles in a certain quantity of water. If any of the more insoluble of these principles exist in this solution in a state of supersaturation, the calculus will afford a nucleus, round which the excess will be deposited. But if none exist in a state of excess, of course none can be deposited, and the calculus will not increase in bulk.

Whoever studies the chemical properties of the urine, says Dr. Marcet, will learn, that "if any alkali (a few drops of ammonia, for instance) be added to recent urine, a white cloud appears, and a sediment, consisting of phosphate of lime, with some ammoniaco-magnesian phosphate, subsides, in the proportion of about two grains of the precipitate from four ounces of urine. Lime-water produces a precipitate of a similar kind, which is still more copious; for the lime in combining with the excess of phosphoric, and perhaps also of lactic acid, not only precipitates the phosphate of lime, which these acids held in solution, but it decomposes the other phosphates, thus generating an additional quantity of the phosphate of lime, which is also deposited.

"If, on the contrary (observes the same author), a small quantity of any acid, either the phosphoric, the muriatic, or, indeed, even common vinegar, be added to recent healthy urine, and the mixture be allowed to stand for one or two days, small reddish crystalline particles of lithic acid will be gradually deposited on the inner surface of the vessel.

"It is on these two general facts, that our principles of chemical treatment ultimately rest. Whenever the lithic secretion predominates, the alkalies are the appropriate remedies; and the acids, particularly the muriatic, are the agents to be resorted to, when the calcareous or magnesian salts prevail in the deposit." (P. 147—148.)

Alkalies taken into the stomach reach the uri-

nary passages through the medium of the circulation; and it is also suspected, that the acids likewise do so, though this circumstance is still a question. Unfortunately the quantity of either alkalies or acids, which thus mixes with the urine, is so small that no impression is made upon calculi of magnitude. The researches of Dr. Marcet, Dr. Prout, and others, have clearly proved, however, that such medicines are often capable of checking a tendency to the formation of stone, and sometimes of bringing on a calculous deposit depending upon the altered state of the system. Indeed, Dr. Marcet expresses his decided opinion that, even supposing not an atom of alkali or acid ever reached the bladder, still it would not be unreasonable to expect, that these remedies may respectively produce the desired changes during the first stages of assimilation; in one case, by neutralising any morbid excess of acid in the primæ viæ; and, in the other, by checking a tendency to alkaliescence, or otherwise disturbing those affinities which, in the subsequent processes of assimilation and secretion, give rise to calculous affections. (P. 153.)

The best way of taking alkalies is by drinking soda-water as a common beverage. It was asserted, however, by the late Sir G. Blane, that when the alkalies were combined with citric acid, as in the ordinary saline draught, they also had the effect of depriving the urine of its acid properties.

Dr. Marcet refers to carbonic acid itself no solvent power, and does not even adopt Mr. Brande's opinion, that this acid passes into the urine when patients drink fluids impregnated with it.

But it may be inquired, if no known internal medicine will dissolve a stone already formed, what is the good of merely altering the diathesis, and checking the increase of the calculus, as lithotomy must still be necessary? The reasons for persevering in the aim of correcting any particular state of the system, and the urinary secretion on which state the increase of calculus depends, are very important; for it is found, that though medicines may be quite incapable of dissolving a calculus, they relieve a great deal of the distress and suffering, apparently the effect of the diathesis itself, as will be presently noticed; and sometimes afford such ease, that the operation may be postponed until the health is improved, or in a very old subject even be dispensed with altogether. The aim is also of high importance, with the view of preventing relapses.

As the lithic acid diathesis seems to be concerned in the production of about two-thirds of the whole number of the urinary calculi, the correction of it has been a chief aim amongst modern practitioners. For this purpose M. Magendie, whose experiments tend to prove, that this diathesis may be lessened and removed by abstinence from animal food, and other nutriment abounding in azote, founds his practice very much upon this alleged fact. His indications, however, are four in number; viz., 1. To lessen the quantity of uric acid produced by the kidneys; 2. To augment the secretion of urine; a maxim, which leads him to consider cutaneous perspiration injurious; a statement, which I think must be rejected, considering the rarity of calculi in hot climates, independently of the sentiments of Dr. Wilson Philip, that the precipitating acid (if such be the cause) is thrown off by the skin, and consequently that ensuring a due performance of the cutaneous functions

must in these cases be beneficial. (See *Medical Trans. of the College of Physicians*, vol. vi.) 3. To prevent the lithic acid from assuming a solid form, by saturating it. 4. When gravel and calculi are formed, to promote their discharge and attempt their dissolution. (*Récherches, &c. sur la Gravelle*, p. 42.)

For correcting the lithic acid diathesis, Dr. Prout particularly enjoins the avoidance of errors in diet, exercise, &c. The error of quantity of food he deems worse, than the error of quality. Patients, he says, should abstain altogether from things which manifestly disagree with them, and which must be unwholesome to all, such as heavy unfermented bread, hard-boiled and fat puddings, salted and dried meats, accescent fruits, and (if the digestive organs be debilitated) soups of every kind. In general also wines, and particularly those of an accescent quality, should be avoided. The wearing of flannel, the preserving a regular state of the bowels, and the occasional use of alterative medicines, are likewise commended. (*Prout, on Gravel, &c.* p. 135.)

According to the same author, the treatment of calculous affections is either of a local, or general description. The local treatment is nearly the same in all the species; the general treatment will depend upon the nature of the calculous diathesis.

What Dr. Prout calls the local treatment consists chiefly in prescribing hyoscinum and opium, either alone, or combined with uva ursi. The hyoscinum, he says, is generally preferable in the lithic acid diathesis and opium in the phosphatic. He also recommends the use of opium in the form of injection and embrocation, and especially in that of a suppository. The warm bath, fomentations, and sitting over hot water, are spoken of as other means of relief.

According to the observations of the same well-informed writer, the distressing symptoms, produced by lithic acid calculi, have a very constant relation to the severity of the diathesis present; a circumstance, which, he says, is also more or less true with respect to all the other kinds of calculi: that is to say, in proportion as the urine is unnatural, and loaded with gravel and amorphous sediments, in the same proportion are the patient's sufferings. Hence, our first object should be to restore the urine to its natural state. The first means to be recommended, in ordinary cases, is usually a dose of calomel and antimonial powder, the Plummer's pill, or some other alterative purgative, taken at night, to be followed up the next morning by an alkaline diuretic purgative, composed, for example, of Rochelle salts and magnesia, or subcarbonate of soda: during the day, a strong infusion of uva ursi, combined with hyoscinum and the liquor potassæ, may be taken. These means are to be persisted in for a greater or less time, according to the circumstances, and till the urine begins to be natural; they may then be gradually left off, or varied, as occasion may require; and, under this plan, it will be found, that in the majority of cases, not only the urine will assume its natural state, but most, or all the distressing symptoms of calculus in the bladder, will be very much diminished, and, in many instances, disappear. It is obvious also, that, while the urine is in its natural state, the calculus cannot increase in size.

"After the diathesis is once fairly broken by these means, it may in general be easily prevented from recurring, by attention to the diet and other circumstances, formerly mentioned as inducing this diathesis, and by the occasional use of medicines; and the patient will scarcely know that he has a calculus in the bladder; at least, from the pain that it gives him. I state this with confidence; but at the same time, I wish to be understood to mean, that the freedom from pain, &c. depend, in no inconsiderable degree, upon the size of the calculus, its smoothness, upon the exercise a patient is obliged to take, &c., all of which are presumed to be favourable; for it must be sufficiently obvious, that a foreign substance in the bladder cannot be prevented from acting mechanically, and from occasionally producing bloody urine, or a temporary stoppage of the discharge of that secretion from the bladder, and similar symptoms, if the patient is obliged to take severe exercise." (*Prout, on Gravel, &c.* p. 202—204.)

At the beginning of the eighteenth century, lime and the alkalis were known to be frequently productive of relief in cases of stone; and in particular, the nostrum of a Mrs. Steevens, the active ingredients of which were calcined egg-shells and soap, acquired such celebrity for the cures which it effected, that much anxiety was expressed, that her formula should be made public. The consequence was, that in the year 1739 parliament appointed a committee of 22 respectable men to investigate the merits of the remedy in question; and, on their very favourable report, the secret was purchased for the sum of 5000*l*. These proceedings naturally interested our neighbours, and in the years 1740 and 1741 Morand communicated to the Academy of Sciences two memoirs, in which are reported numerous cases, where the new remedy was tried, and mostly with success; the greater number of the patients being described as either benefited, or actually cured.

In many instances, stones, which had been unquestionably felt, were no longer to be discovered; and, as the same persons were examined by surgeons of eminence, both before, and after, the exhibition of the medicines, it is no wonder that the conclusion was drawn, that the stones had been really dissolved. From the cessation of this success, however, and from its now being known, that stones occasionally become lodged in a kind of cyst, on the outside of the general cavity of the bladder, so as to cause no longer any material suffering, surgeons of the present day are inclined to suspect, that this must have happened in some of Mrs. Steevens's cases. This was certainly what happened to one of the patients, as Dr. W. Hunter informs us. It is evident, that a stone so situated would not in general produce a great deal of irritation, nor admit of being felt with a sound. (See *LITHOTOMY*.)

That, in the lithic acid diathesis, the carbonates of soda and potassa, taken in large doses, have the effect of passing into the urine, and saturating the redundant lithic acid, in the unhealthy state of that fluid, is a fact decidedly proved. If there were any doubt yet remaining upon this point, it would be immediately removed by the perusal of the case of the celebrated Mascagni, as detailed by himself. (See *Mém. della Soc. Ital.* 1804.) This eminent anatomist being much afflicted with gravel, derived benefit from drinking the *aqua alca-*

lina nephritica, or Seltzer water; but, conceiving that more good might result from a trial of carbonate of potash, he took at first half a drachm of this substance in the morning, and as much in the evening, dissolved in ten ounces of water. The second day, the dose was augmented to two drachms, and on the third to three, which quantity, dissolved in 20 ounces of water, was continued for ten days. "Before taking the carbonate of potash (says Mascagni), my urine was very acid, and immediately reddened litmus paper: as soon as the medicine was begun, I made the same experiment with the urine then voided, and found the intensity of the colour of the paper less. *The second day, the paper was very little altered; and, on the third, the urine did not redden it all.* The acid in my urine, therefore, was saturated, and, at the same time, the pain in my loins diminished, and no more gravel was voided with my urine. Afterwards, the pain ceased entirely, the urine became clearer, and I perceived that it contained an excess of potash." Being attacked again at a subsequent period with the gravel, Mascagni adopted the same treatment, and experienced equal benefit from it.

In the lithic acid diathesis, the liquor potassæ has sometimes been thought to have more efficacy than the carbonate; but it does not generally agree so well with the stomach.

Sir E. Home and Mr. Hatchett first suggested the utility of giving magnesia in cases of stone; and the proposal was communicated to the public by Professor Brande (*Phil. Trans.* 1810). As Dr. Marcet observes, magnesia is often found advantageous in long-protracted cases, in which the constant use of the subcarbonated, or caustic alkalis, would injure the stomach. But, he properly remarks, that if magnesia is sometimes beneficial, it has of late years often done harm. For, as this earth is the base of one of the most common species of calculi, viz. that containing the phosphate of ammonia and magnesia, there is nearly an even chance, when magnesia is prescribed, without any previous knowledge of the nature of the calculus, that it will prove injurious. Magnesia, also, when long and profusely administered, sometimes forms large masses in the intestinal canal, causing serious distress, and even fatal consequences.

Sir Benjamin Brodie has known several instances in which a great deal of distress was experienced from the lodgment of such a concretion in the rectum; and he refers to a case, in which Mr. Wilson examined the body of a patient, in whom many pounds of magnesia were found collected in the colon, above a contracted part of the rectum. (*On the Urinary Organs*, p. 173, ed. 2.) The same distinguished surgeon likewise enjoins great care in adjusting the doses of alkaline remedies to the peculiar circumstances of each case. "If you give too little of the alkali, the result is not obtained, and the lithic acid is still deposited, although in smaller quantity: if you give too much, you not only prevent the formation of the red sand, but you render the urine alkaline, and a white sand (the triple phosphate of ammonia and magnesia) is deposited in its place." (P. 172.) Hence, in the exhibition of alkaline remedies, he recommends each case to be made the subject of a distinct experiment, and the patient to be made to enter into the surgeon's views,

and assist him with observations. "You should be provided with paper, coloured blue by an infusion of litmus; and also with the same paper, slightly reddened by immersion in a very weak acid. Healthy urine ought to turn the blue litmus paper a little red; and you ought not to give alkaline remedies in such a dose as to destroy this property altogether; still less ought you to render the urine alkaline. If the urine turns the red paper blue, the patient is in danger of suffering from a deposition of the phosphates; and the alkalis must be given in smaller quantity." After all, however, Sir Benjamin Brodie remarks in the general observation, that more is to be effected by diet and mode of living, than by medicine.

I have already noticed the effect of a free secretion from the skin in preventing calculous disorders, or, at all events, in rendering them less frequent. A copious perspiration, if it cannot be produced by exercise, may be so by the sulphur fuming, or hot air bath. "The hot air bath (Sir Benjamin Brodie remarks) is certainly of great advantage to those persons who, having led an inactive life, are subject to dyspepsia, and those twinges in the limbs, especially in the feet, which, sooner or later, are followed by a regular attack of gout; and I believe that it may also be employed beneficially in cases, in which the patient suffers from a too large proportion of lithic acid in the urine. It is worthy of observation, that the perspiration, produced by the hot air bath, is highly acid, reddening the blue litmus paper nearly as much as it is reddened by acid urine." (*Op. cit.* 176.)

According to Dr. Prout, purgatives will sometimes stop certain calculous depositions, especially in children; and Dr. Henry, of Manchester, observed, that a quack medicine, composed of turpentine and opium, would occasionally produce a plentiful discharge of lithic acid from the bladder.

The state of the system, which leads to the production of alkaline urine, and of white sand, is very different from that which is attended with a too acid condition of the urine, and the formation of red sand. The latter occurs in individuals, who are over-fed, or over-stimulated, and take little exercise; but the alkaline urine indicates debility of the system. In a person who is exhausted by too severe mental or bodily exertions, or has long been worn by mental anxiety, the urine becomes alkaline. In many instances, a course of mercury renders the urine alkaline: in some individuals, even a single dose of calomel will produce the same effect. In a person who is already weak, the further degree of exhaustion, resulting from the operation of an active purgative, will render the urine alkaline. Injuries of the spine will have the same effect. This fact Sir Benjamin Brodie observed as long ago as 1807; and always mentioned it in his Lectures ever since 1808. (*Op. cit.* p. 180.) It follows, from the foregoing facts, that when there is a deposit of the triple phosphate, purgatives, and especially mercurial ones, should be employed with great caution. Alkaline remedies are to be avoided, and acids exhibited, as first suggested by Dr. Wollaston. The patient may drink lemonade, or eat oranges, or lemons; but if the vegetable acids disagree, the mineral acids may be tried. The dose of the acid must depend on circumstances, and be regulated ac-

cording to the results of frequent examinations of the urine with the reddened litmus and yellow turmeric paper. "From five to ten minims of muriatic acid, given three times daily, will generally be sufficient; but, in extreme cases, you may give as much as thirty or forty minims, or even more, of the strong nitric acid, in the course of the day, sufficiently diluted with syrup and water." (*Sir B. Brodie, Op. cit. p. 187.*) Tonics are also serviceable, as bark, sulphate of quinine, and preparations of iron. The diet should be rather a generous one, but easy of digestion. Fermented liquors and acidulous wines may be taken in moderation; and opium and henbane, if they do not interfere with digestion, are very useful. When the phosphate of lime is deposited, together with a ropy mucous secretion from the lining of the bladder, the indication is to remove the cause, namely, the chronic inflammation of that membrane. As Sir Benjamin Brodie has explained, however, bleeding is injurious. The cause "may depend on stricture of the urethra; and may be relieved immediately on the stricture being dilated with a bougie. It may depend on a partial retention of urine in the bladder, in consequence of an enlargement of the prostate gland. The bladder must then be emptied by the introduction of a gum catheter, once or twice, or three times, daily. It is seldom advisable in these cases to keep the catheter constantly retained in the bladder; for then the catheter becomes itself a source of irritation, keeping up the inflammation of the bladder, and adding to the cause, on which the deposition of the phosphate of lime depends. Perfect rest, in the horizontal posture, opiate clysters, or suppositories, opium, extract of henbane, or lettuce, given by the mouth, will also be useful. The exhibition of the decoction of the root of the *pareira brava* is in many instances productive of excellent effects. It has a remarkable influence over the secretion of the ropy alkaline mucus. Injections into the bladder of warm water, and even of a weak solution of nitric acid, are sometimes useful." (*Sir B. Brodie, Op. cit. p. 189.*) When the secretion of the triple phosphate by the kidneys, and that of phosphate of lime by the bladder, are coexistent, this gentleman unites the two modes of treatment called for by this combination, and which seem to him quite compatible.

As medicines taken into the stomach will not dissolve urinary calculi, though they may correct the particular diathesis on which their formation depends, and by altering the quality of the urine, even bring the bladder into a less irritable state, solvent injections have been introduced through a catheter directly into the bladder. Fourcroy and Vauquelin ascertained, that a solution of potassa, or soda, not too strong to be swallowed, softens and dissolves small calculi, composed of uric acid and urate of ammonia, when these are left in the liquid a few days. They proved that a beverage, merely acidulated with nitric or muriatic acid, dissolves, with still greater quickness, calculi formed of the phosphate of lime, and of the triple phosphate of ammonia and magnesia. They also ascertained that calculi, composed of the oxalate of lime, which are the most difficult of solution, may be softened, and almost quite dissolved, in nitric acid greatly diluted, provided they are kept in the mixture a sufficient time.

Liquids are then known, which will dissolve

calculi of various compositions; but, as I have already hinted, much difficulty occurs in employing them effectually in practice. For, although they can be easily injected into the bladder, this organ is so extremely tender and irritable, that the action of such liquids upon it as would be requisite for dissolving a stone, would produce sufferings which no man could endure, and the most dangerous and fatal effects on the bladder itself. Another objection to this practice also arises from the surgeon never knowing what the exact composition of a calculus is, before this body is extracted, and his consequent inability to determine what solvent ought to be tried.

Until the complete success of lithontriptics is established, therefore, the operation of lithotomy must continue an indispensable practice, wherever the patient's sufferings are great, and the calculus too large to be voided, or extracted through the urethra, or the circumstances such as to prevent the successful application of the lithotritic instruments devised by M. Le Roy D'Etiolles, Dr. Civiale, and Baron Heurteloup, and which are calculated to reduce the calculus to powder, or small particles, so that it may be discharged with the urine. (See LITHOTRITY.) In the early stage, before calculi have exceeded a certain size, if they cannot be expelled with the urine, they may sometimes be taken out by means of the urethral forceps invented by Weiss, of the Strand: this instrument is shaped like a sound, but its end, after introduction into the bladder, admits of being opened, and made to grasp the calculus, which is then to be drawn through the urethra. The urine is first to be discharged through a catheter. (See *an Account of a Case, in which numerous Calculi were extracted without cutting Instruments* by Sir A. Cooper, in *Med. Chir. Trans.* vol. xi. p. 349.; also, LITHOTOMY.)

With the view of ascertaining whether the case is adapted, or not, to this operation, Mr. Crosse adverts to various circumstances which he conceives assist in forming a correct judgment of the size of the calculus. The existence of calculous symptoms only for a short period, and particularly the tracing of the calculus a little time previously through the urethra into the bladder, seem to Mr. Crosse to afford a presumption that such calculus is a small one. An audible click on examination; the sudden occurrence of retention of urine; and pain, after complete freedom from inconvenience for a day or two, appear to the same gentleman to indicate the same circumstance. But, if pressure above the os pubis, when the bladder is empty, produces a shooting pain in the glans penis; or, if the patient feels something moving in its cavity on turning in bed, when urine occupies the bladder; or, if change of posture from the horizontal to the erect produce a smart pain in the glans penis and neck of the bladder; or, if the concussion of walking or riding occasion pain in the glans, or render the urine bloody; and particularly, if on sounding, there is produced the sensation of a dull noise, firm resistance, and considerable extent of surface touched, it may be concluded that the calculus is too large to be extracted through the urethra. Even when a calculus is not small enough to admit of being drawn completely through the urethra, if it can be drawn into this passage out of the bladder, an immense advantage is gained for the patient; because its

excision from the urethra may then be performed without any danger to the patient's life—which is not the case with regard to an operation requiring a wound of the bladder itself. Under urgent retention, and impossibility of extracting the calculus by forceps, Mr. Mayo believes, that it would be better to push it back towards the membranous part, and cut upon it from the perinæum, than open the urethra anterior to the scrotum, where fistulæ, difficult of cure, might be produced. (See *Outlines of Human Pathology*, p. 554.) I have seen a very clever urethral forceps combined with a small lithotrite (the invention of Messrs. Weiss), which, if the calculus were drawn into the urethra, but could not be brought through the whole of the passage, would at once hold and pulverise it. This would be infinitely more advantageous than either cutting into any part of the urethra, or pushing the calculus back into the bladder to be acted upon by the ordinary lithotrite.

Consult *T. Lobb*, *A Treatise on Dissolvents of the Stone*, 8vo. Lond. 1739. *Stephen Hales*, *Experiments and Observations on Mrs. Stevens's Medicines*, 8vo. Lond. 1741. *Morand*, in *Mém. de l'Acad. des Sciences*, 1740 and 1741. *J. Ruitz*, *New Experiments on Joanna Stevens's Medicines*, 8vo. Lond. 1742. *D. Hyatt*, *An Essay on the Virtues of Lime Water and Soap, in the Cure of Stone*, 8vo. Edinb. 1761. *D. Hartley*, *A View of the present Evidence for and against Mrs. Stevens's Medicine*, 8vo. Lond. 1739; and Supplement, 1740. *N. Hulnc*, *A safe and easy Remedy for the Stone*, &c. 4to. Lond. 1778. *Wm. Butler*, *Method of Cure for the Stone, chiefly by injections*, 12mo. Edinb. 1754. *B. Langrish*, *Physical Experiments upon Brutes, in order to discover a safe Method of dissolving Stones in the Bladder by Injections*, 8vo. Lond. 1745. *J. Jurin*, *Effects of Soap-ley, taken internally for the Stone*, 2d edit. with an Appendix, 12mo. Lond. 1745. *J. F. Schreiber*, *De Medicamento à J. Stevens, contra Calculum, divulgato inefficac et noxio*, Göt. 1744. *Murray Forbes*, *A Treatise upon Gravel and Gout, with an Examination of Dr. Austin's Theory of Stone, an Inquiry into the Operation of Solvents*, &c. 8vo. Lond. 1793. *W. Austin*, *A Treatise on the Origin and component Parts of the Stone*, &c. 8vo. Lond. 1791. *T. Beddoes*, *On the Nature and Cure of Calculus*, &c. 8vo. Lond. 1793. *J. S. Dorsey*, *An Essay on the Lithontriptic Virtues of the Gastric Liquor*, 8vo. Philadelphia, 1802. *M. Gravid*, *De Uva Ursina, ejus que et Aquæ Calcis Vi lithontriptica*, &c. Patav. 1764. *Scheele*, in *Stockholm Trans. Fourcroy*, in *Système des Connoissances Chimiques*, 1801. *Wollaston*, *Praison*, and *Brande*, in *Phil. Trans. and Journal of Science and Arts*, vols. vi. and viii. &c. *A. Marcet*, *On the Chemical History and Medical Treatment of Calculous Disorders*, 8vo. Lond. 1817: a work full of valuable information. *Wilson Philip*, in *Medical Trans.* vol. vi. *Dr. Hecury*, in *Med. Chir. Trans.* vol. x. *C. Scudamore*, *On Gout*, &c. edit. 3. *F. Magendie*, *Récherches Physiologiques et Médicales sur les Causes*, &c. de la Gravelle, 8vo. Paris, 1818. *Ph. v. Wallher*, *Ueber die Harnsteine*, in *Journ. für Chir.* b. i. Berlin, 1820. *A. Copland Hutchison*, *On the Comparative Infrequency of Urinary Calculi among Seafaring People*, vid. *Med. Chir. Trans.* vol. ix. *R. Smith*, *A Statistical Enquiry into the Frequency of Stone in the Bladder, in Great Britain and Ireland*, vid. *Med. Chir. Trans.* vol. xi. *W. Probst*, *An Enquiry into the Nature and Treatment of Gravel, Calculus*, &c. 8vo. Lond. 1821: a work abounding in original valuable observations. *J. Wilson*, *On the Structure and Physiology of the Male Urinary and Genital Organs, and the Nature and Treatment of their Diseases*, 8vo. Lond. 1821. *J. P. Frank*, *On Urinary Calculi*, see *Journ. of Foreign Med.* No. xix. *Sir Benjamin Brodie*, *On Dis. of the Urinary Organs*, p. 166, &c. ed. 2. 8vo. Lond. 1835. *John Green Crosse*, *On the Formation, Constituents, and Extraction of Urinary Calculus*, 4to. Lond. 1835. *Thomas King*, *Lithotripsy and Lithotomy compared*, &c. 8vo. Lond. 1832. *Dr. Yelloly's Analysis*, in *Phil. Trans. And Remarks on the Tendency to Calculous Diseases*, &c. 8vo. Lond. 1829.

URINARY FISTULÆ. By an urinary fistula is implied a deep, narrow ulcer, which leads into some of the urinary passages. However, as a fistula after a time becomes lined by a kind of

membrane resembling a mucous one, it is not strictly correct to describe the whole fistula as an ulcer, though its orifice may really have this character. John Hunter, in his *Treatise on the Blood*, &c.; and Baron Dupuytren, in his *Leçons sur l'Anat. Pathologique*, both recognised the analogy between the texture lining old fistulæ and mucous membranes. Laennec adopted the same view, and still more recently M. Villermé published a description of the membrane investing fistulæ, in which he also notices the great resemblance between such a membrane and a mucous one. Some examples of the same kind were likewise described by Cruveilhier (*Essai sur l'Anat. Pathol.* t. ii.). M. Chaussier long ago adverted to the fact, that membranes full of numerous villi, like those of mucous surfaces, often surround abscesses of long standing, which have no external opening. Lastly, M. Cruveilhier, and other pathologists, admit the possibility of the reproduction of mucous membranes, after they have suffered a loss of substance. In all these cases, according to M. Andral, the new mucous membrane is the result of the gradual transformation of the cellular tissue. (See *Andral, Anat. Pathol.* t. i. p. 252.) Whether it is so, or the result of the organisation of the coagulating lymph around the abscess, is a question which need not now detain us. It is not, however, every sinus, met with near the urethra, that is truly an urinary fistula. One of the chief circumstances, tending to evince that a sinus has no communication with the urethra, is, that no urine has ever escaped through the opening; for, with respect to the judgment formed from the impossibility of making a probe touch a catheter in the passage, it must be exceedingly fallacious, because the winding course of the sinus, or the small size of its communication with the urethra, may prevent the instruments from touching one another.

The indications in the treatment of such a case, depend upon the nature of its complications. When sinuses are kept up by a separation of the scrotum from the parietes of the urethra, Desault recommends exact compression to be made over the part; which method, he says, is sometimes sufficient to accomplish a cure. When this plan fails, the healing of the sinus may be promoted by practising an incision on one side of the scrotum, and carrying it as far as the denuded portion of the urethra. When sinuses exist, and they depend upon the smallness of the opening, or its unfavourable situation for the discharge of the matter, the aperture should be enlarged, by making an incision into the main collection of pus. When bones are diseased, exfoliation must be awaited; and, in every instance, the treatment should vary according to the cause upon which the fistula depends.

Fistulæ communicating with the urethra, but having no external opening, are sometimes produced in consequence of the bursting of an abscess into this canal; the ulceration, from a retention of urine; a false passage; and the healing of the external part of the wound made in lithotomy, while the internal part is not united.

In these cases, there is a discharge of pus from the urethra, before, and sometimes after, the issue of the urine; and one may feel, in the course of the urethra, a tumour, which increases while the patient is making water, and afterwards disappears on pressure, attended with a fresh discharge from the penis of a mixture of pus and urine.

These internal urinary fistulæ may be cured by preventing the urine from passing into them, and lodging there. The catheters employed should be neither too large nor too small. If too large, they would exactly fill the canal, and the pus and urine contained in the fistulæ could not be discharged. If too small, the urine would insinuate itself between them and the sides of the urethra, and enter the fistulæ. Their use must be continued till the ulcer is entirely healed. But, modern surgeons are not content, like Huguault, with merely using a catheter but make an early puncture, or incision, into every abscess formed near, or communicating with, any portion of the urinary passages.

The most frequent urinary fistulæ are those which are termed *complete*. Their origin may be in the ureters, bladder, or urethra. Those which arise in the ureters sometimes terminate in the colon, and the urine is discharged *per anum*, mixed with the feces. But, most commonly, they make their appearance externally, either in the lumbar, or inguinal regions. Those which communicate with the bladder have also different terminations. When they proceed from the upper and interior part of this organ, they ordinarily pierce the parietes of the abdomen above the pubes, and towards the navel. They also sometimes terminate in the groins. When they originate in the posterior parietes of the bladder, they sometimes tend into the cavity of the abdomen, where they almost always prove mortal; and sometimes into the intestines, if there should be adhesions between these and the bladder, so as to favour this communication. When the opening in the bladder is near its lower part, the fistula sometimes terminates in the rectum of the male and the vagina of the female subject; but, most frequently, it ends in the perinæum, in both sexes. With regard to the fistulæ, which originate in the urethra, they usually open externally in the perinæum, the scrotum, or the penis, and sometimes also in the rectum. It is not uncommon to see the external opening of these fistulæ at a great distance from the internal one, and to find it in the middle and even the lower part of the thighs, the groins, parietes of the abdomen, and as high as the sides of the chest. Often there is only one opening in the urethra, while there are several situated externally, more or less distant from one another.

Most of these fistulæ are the consequences of retention of urine, and owing to the same causes. Those, which communicate with the rectum in the male subject, sometimes depend upon this intestine having been wounded in the operation of lithotomy; and those which open into the vagina are often the effect of a violent contusion, caused by the head of the child in difficult labour, or of ulceration produced by pessaries which are too large, and the margins of which are too sharp and irregular. Carcinoma of the rectum and vagina may also give rise to fistulæ, by extending into the bladder.

The discharge of urine from the external orifice of the fistula is an unequivocal proof of its communication with the urinary passages; when the fistula is narrow, and there is no obstruction in the urethra, the urine sometimes escapes more readily the latter way, than through the fistula. It may also be difficult, or even impossible to find out the internal orifice of the fistula with a probe. When the fistula communicates with the rectum or vagina,

a staff introduced through the urethra may, sometimes be felt within those parts.

When fistulæ of the bladder or urethra are the consequences of retention of urine produced by strictures, which still exist, or have even increased since the formation of the fistulæ, the circumstance may render the introduction of the catheter difficult. In this case, if the catheter cannot be passed, the surgeon must endeavour to remove the stricture with bougies or other instruments, on the principles explained in the article URETHRA, STRICTURES OF. "In general (as Sir Everard Home observes), where fistulæ take place in perinæo, in consequence of a stricture, the removal of the stricture is sufficient to give the fistula a disposition to heal. There are, however, cases which require more being done for that purpose; and simply laying them open is not sufficient." (See FISTULÆ IN PERINÆO.) Under such circumstances, he finds the actual cautery the surest means of making the part heal. In one case he passed a bougie into the urethra, and scorched the edge of the fistula with a hot wire, introduced so far as to touch the bougie. In another instance, a full-sized silver sound was passed into the bladder, and the direction of the fistula having been ascertained with a probe, a female steel sound was heated to redness, and "at the moment at which it passed from a red to a black heat, it was hurried down through the fistula (about two inches and a half) to the sound in the urethra." In both these cases, a cure was effected. (Home, *On Strictures*, vol. iii. p. 262, &c.)

In the article FISTULÆ IN PERINÆO, I have noticed a case of numerous and most inveterate urinary fistulæ, which Mr. A. C. Hutchinson cured with the actual cautery. Mr. Liston, like Sir E. Home, sometimes employs a heated wire. "Fistulous openings, communicating with the urinary passage, (he says) almost uniformly close after the removal of their cause, upon the restoration of the canal throughout to its natural calibre. The frequent introduction of instruments, or the long retention of them, will rather tend to aggravate the disease than otherwise. The retention of a catheter for many days, or weeks, is scarcely advisable under any circumstances: abscess is apt to form in the course of the canal, portions of it are destroyed by ulceration; and some of the most untractable openings, those anterior to the scrotum, I have known to be thus occasioned. The occasional use of a bougie, and the gradual expansion of the urethra to its proper size, is the first step to be adopted, with the view of ridding the patient of the inconvenience attendant upon the discharge of the urine through the scrotum, perinæum, or rectum. Should the track still remain pervious, the use of bougies being for a considerable time discontinued, the urethra being clear, and the patient's health being besides perfectly good, some means must be adopted to cause contraction. If there has been little, or no loss of substance, the application of a heated wire will be found the most simple and manageable plan. A speculum of course should be used, in order to bring the aperture of the fistula into view when it is situated within the sphincter of the anus. The application is made, if possible, through the whole track, and effectually, so as to cause a thin slough; great destruction of tissue is not desirable. The good effects

will not be felt, probably, for a great many weeks ; in the first instance, in fact, after the separation of the slough, the passage is widened, and the flow of urine is even more profuse than before. The amendment is gradual, as the contraction and cicatrization proceed. A second application, but of a smaller wire may be required, if, after a certain period the dribbling has not ceased entirely." (*Liston's Practical Surgery*, p. 392.) The circumstances which should regulate the employment of catheters in these cases, are more particularly considered in the article FISTULÆ IN PERINÆO.

As Sir Astley Cooper has observed, apertures in the urethra, attended with loss of substance, are extremely difficult to heal. The difficulty of curing fistulous openings in the portion of the urethra between the glans and the scrotum, is particularly insisted upon by Dieffenbach :—" In the remaining part of the urethra, between the anterior boundary of the scrotum and the bladder, the cure of small, and of even large openings, notwithstanding the numerous difficulties connected with them (he says) is comparatively easy. Fistulæ, and even larger openings, in the posterior part of the urethra — whether the result of operations, or produced by strictures, infiltration of urine, lodgment of calculi, or unskilful catheterism — are, generally speaking, capable of being cured by merely keeping a catheter in the bladder. The circumstance, which seems to Dieffenbach to operate most favourably in the cure of deficiencies in this portion of the urethra, is the thickness of the soft parts investing it ; parts also reproduced with great facility. How differently circumstanced, says he, is the urethra in the free portion of the penis ! Here it lies below the corpora cavernosa, covered by exceedingly thin skin, quite inferior to the cutaneous texture of the scrotum in reproductive power, or in that of forming granulations for the repair of even moderate urethral deficiencies. Joined with this disadvantage is that of the continual flow of urine. Professor Dieffenbach adverts to the facility with which the wound made by the lithotomist, in the posterior portion of the urethra, generally heals ; the thick mass of soft parts throwing out an abundance of granulations, on which the urine, as it trickles away, scarcely produces sufficient influence to interrupt perceptibly the healing process ; and he contrasts with this case the difficulty of healing even a small fistulous opening in the anterior portion of the urethra, occasioned by the escape of the urine. Sir Astley Cooper relates a case, where the urethra had sloughed at the junction of the scrotum with the penis : the opening healed at its margin, but a large fistulous orifice still remained. Bougies, the plans of excoriating the edges of the opening with blistering plaster, and even paring them off, and bringing the fresh-cut surfaces together with the twisted suture, had all been tried in vain. In this example, a cure was effected by applying the nitrous acid to the edge of the fistulous orifice, and to the skin, three quarters of an inch around it ; the principle, on which Sir A. Cooper rested his hopes of success, being the contraction of the skin in cicatrization. The first application having produced considerable amendment, the plan was repeated several times in the course of about nine months ; at the end of which time, the fis-

tula was closed. He is of opinion, that such practice will only succeed in cases where the skin is very loose, and the scrotum forms a part of the fistulous orifice. If the skin be much confined, he suggests raising a piece of skin from the scrotum, paring off the edges of the fistulous orifice, and removing the skin to a small extent around it. The skin, thus raised, is to be turned half round, so that its raw surface may be applied to the opening, and unite. An elastic catheter is first to be introduced. In one successful operation of this kind, the flap was held by four sutures ; and small slips of adhesive plaster, and a bandage employed to support the scrotum. In the course of the treatment, pressure was found necessary to prevent the occasional passage of urine through the wound. (*Sir A. Cooper, Surgical Essays*, part ii. p. 221. &c.)

Mr. Earle met with a case, in which the integuments in the perinæum, and above an inch of the canal of the urethra, had sloughed away, in consequence of external violence. At the man's entrance into St. Bartholomew's Hospital, a large smooth cicatrix occupied the place of the urethra, no vestige of which remained in that part. The integuments on the right side had suffered less extensively than those on the left ; so that when the catheter was introduced, that portion of the instrument, which passed over the cicatrix, could be about half covered, by drawing the skin and healed part from the right, towards the opposite side. The treatment was therefore begun by confining the knees together over a pillow, and applying a kind of truss, which kept the skin constantly pressed towards the left side. While these measures were going on, the opportunity was taken of dilating the anterior portion of the urethra with bougies. Afterwards the following operation, which I had the pleasure of seeing, was performed : a portion of the integuments was removed, about an inch and a half long, and one-third of an inch in width, on the left side of the cicatrix. The groove, thus formed, was intended for the reception of the edge of the skin to be detached from the opposite side. An incision was then made across the perinæum, above and below, so as to pare away the callous edges of the urethra. The skin was next dissected off from a portion of integument on the right side of the perinæum, about an inch and a half in length, and half an inch broad, leaving a smooth space, of rather more than an inch, between the cut surfaces. The integuments, on the right side, were now dissected up, turned over a catheter, and brought in contact with the opposite groove. The detached portion of cicatrix bled little during the operation ; and before it could be applied to the groove, its edge had so livid an appearance as to create an apprehension that it must perish. Two sutures were employed, to assist in retaining it in the desired position ; and some straps of adhesive plaster and a bandage, completed the dressings. The day after the operation, it was evident that some urine had escaped by the side of the catheter ; and, on the third day, when the dressings were removed, it was found, that the portion of flesh, which had been deprived of skin, had sloughed, but that a sufficient quantity had united, above and below, to form a canal, open at one side, and large enough to include the whole catheter. After the parts had healed, some urine

could be made to pass through the urethra, when pressure was applied to the left side of the remaining fistula. Various attempts were afterwards made to excoriate its edges, and unite them; but without success.

A second operation was therefore done in the summer of 1820, and integuments were now borrowed from the opposite side to that from which they had been taken in the first operation. "A deep groove was made on the right side, the surface was denuded of its cutis to some extent, a considerable portion of integument was then detached from the left sides, and in order to obtain healthy skin (says Mr. Earle), I encroached a little on the thigh, and laid bare the edge of the fascia lata. Instead of passing any ligature through the detached portion, the old quill-suture was employed, which was passed from the two outer cut surfaces. A pud of adhesive plaster was interposed between the ligatures and the flap of skin." The catheter was not left in the urethra, but introduced about three times in 24 hours. By this operation, much more was gained, and about two thirds of the deficient part of the canal were restored; but, still a small aperture remained at the upper part. This opening could not be closed by touching it with escharotics; and, consequently, a third operation on a smaller scale was done, which so nearly completed the cure, as to leave only an orifice, large enough to admit a bristle, and this opening subsequently closed, and the patient remained quite well in March, 1821. (See *Phil. Trans.* for 1821.)

Whoever wishes to obtain a full acquaintance with this subject, should not omit to consult the writings of Dieffenbach. I have already noticed his remarks on the great difficulty of curing fistulous openings and deficiencies in the anterior portion of the urethra; and especially the increase of difficulty from the effect of the escape of the urine on the healing process in this situation. This fact suggested to him the idea, that operations for the cure of such fistulous openings and deficiencies would answer better, if an opening were made nearer the bladder, at some distance from the fistula, and a catheter introduced into it before the operations were undertaken. The apprehension of making another fistulous opening, however, deterred him from putting the suggestion into practice: but the same idea he realised in a less hazardous way; namely, by detaching the semicircles, or bridges, formed by the lateral incisions:—1. An elastic gum catheter having been introduced into the bladder, the edges of the opening are seized with the hook forceps, and removed with the scalpel, so as to form a wound, terminating anteriorly and posteriorly in a sharp point. The surgeon then lays hold of the edges again, and detaches the skin from the subjacent parts, to the extent of three or four lines around. 2. As many twisted sutures are then applied as are necessary to close the fissure. 3. The lateral incisions on both sides of the penis are parallel to, and double the length, of the fissure to which the sutures are applied. This plan he found successful. The thin cutaneous edges of every urethral opening, he observes, afford insignificant points of union, whereas the tendency of these parts to adhere by their under surface to another surface is uncommonly strong: in other

words, the tendency of an union of edges is slight; but to an adhesion of surface very powerful. The plan, therefore, which Professor Dieffenbach laid down for himself in all difficult cases, for the future, (holding in view the difference of circumstances) was this, to form a large raw surface, and to cover this with the detached skin, and then to unite the edges with sutures; attaching, however, less importance to the latter proceeding. In cases of larger deficiencies, particularly, where there is a smaller edge of skin on each side, he employs the continued suture, and after the lateral incisions have been made, what he terms a *splint suture*, for rendering the closure of the opening more complete. This consists of two little splints, of moderately stiff leather, having each three eyelet-holes. They are applied so as to press the margins of the opening together, along with the skin; and the needles are passed through the holes and also through both edges of the wound,—and finally threads are twisted round the ends of the needles. The principle of this suture is manifestly similar to that of the quilled one.

In some other operations, Professor Dieffenbach was not content with drawing away the skin in a straight direction, from one place to another in its immediate vicinity, but he drew it from a greater distance, or turned it laterally, or twisted it round as a flap with a pedicle; and thus, as it were transplanted it. In cases of considerable loss of substance in the posterior portion of the penis, he finds the employment of the skin of the scrotum, most convenient; in cases of extensive destruction of the urethra about the middle of the penis, he employs the skin of the dorsum of this organ; for openings close behind the fold of the prepuce, he takes the skin covering the central part of the penis; and for apertures close behind the glans, under the foreskin, the prepuce itself. Sometimes he makes the whole skin of the penis revolve on its axis for the purpose of covering large deficiencies in the middle of the urethra. But one of Dieffenbach's latest improvements for small urinary fistulæ, consists in exciting inflammation in the edges of some urinary fistulæ by pencilling them several times in the day with tincture of cantharides, introducing a gum catheter into the urethra, and then passing a strong double-waxed silk thread round the opening, at the distance of one fourth of an inch from its edge. As it is not easy to make the needle describe an entire circle at once, it will be necessary to bring it out at least three times, and then introduce it again through the same puncture. Lastly, it is brought out, with the ends of the ligature through the first puncture. Great care must be taken not to puncture the urethra, as this might cause effusion of urine. After the ligature has been gradually tightened, the bougie or catheter is removed, and the patient allowed to pass his urine in the natural way. (See *Dieffenbach's New Method of Cure in Cases of Unnatural Openings in the Urethra*, transl. by John Swift. *Dubl. Journ. of Med. Science*, vol. x. p. 279. &c.)

Here we see the same art by which new noses and under lips are formed, extending itself to cases, where it may be the means of extricating some individuals from a state, in which life is hardly desirable. The surgeon of judgment, however, will never forget, that such an operation is only indicated, where the fistula is large,

the urethra free from obstruction, and bougies and the catheter insufficient.

When fistulæ terminate in the lower part of the bladder, Desault advised the utmost care to be taken to prevent the catheter from being stopped up, and the instrument from being displaced, or slipping out of the bladder; for which last purpose, the catheter bracelet described by Sir E. Hume seems well calculated. However, when the fistula communicates with the urethra, Desault believed that no advantage was derived from keeping the catheter open. In both cases, he recommended the continuance of the catheter, not only until the fistula was cured, but also until the obstacles which hinder the urine from passing the natural way were removed. This is a point on which I need not here enlarge, as it is particularly considered in the article FISTULÆ IN PERINÆO.

I have been lately gratified with the perusal of a very interesting case, published by Dr. Houston, of fracture of the pelvis, complicated with injury and sloughing of the urethra, and remarkably extensive urinary fistulæ, which were cured by operation after the lapse of one year and a half. Want of space compels me to omit the history of all the patient's sufferings; and to notice chiefly the circumstances relating to the operation alluded to. After a time, all the symptoms attendant on fractures of the bones became less urgent, whilst those consequent on injury of the urinary passages assumed a more dangerous character. The fistula in the perinæum became nearly closed, notwithstanding every effort to keep it open; the urethra could not transmit the urine, which was consequently forced to make its way out of the back and thigh; and even these channels were only kept free by repeated burstings. The patient became emaciated and hectic; all his secretions emitted an urinary odour; and he had night-sweats, shiverings, and all the distressing symptoms usually attendant on extensive disease of the urinary organs. On account of the projection of the callus from the united fracture of the rami of the ischium and os pubis, no instrument could be got along the urethra further than the arch of the pubes; and the perinæum was so narrowed, distorted, and shrivelled up, and so hidden by the anehylosed thigh, as to preclude any chance of reaching the urethra by an incision in that region. Tapping above the pubes, or from the rectum, seemed to Dr. Houston liable to great objections. During this embarrassment, as he was one day exploring the cavity of the rectum with his finger, he happened to detect, through the coats of the gut, in the situation of the membranous part of the urethra, a soft pit, or sac, of the form and size of the mouth of a thimble, soft in the centre, and surrounded by a hardened ring: it was also the seat of pain, when pressed with the point of the finger. It occurred to Dr. Houston that this cavity might perhaps be a sort of reservoir, into which the urine flowed directly from the neck of the bladder, and from which it subsequently passed off through the several tortuous fistulæ opened for its evacuation. It also appeared to him probable that an incision from the perinæum into this space might be followed by some good result. An incision was accordingly made, as in lithotomy, in the left side of the perinæum, regardless of the original fistulous orifice, which lay to the right. The skin and cellular membrane

were divided; and then with the finger of the left hand in the rectum, to guard that intestine from being wounded, the knife was pushed straight inwards in the direction of the sac. A hard, cartilaginous structure, which lay in front of the cavity aimed at, and which had been only partially divided by the knife in its entrance, was then cut across with a probe-pointed bistoury, in the direction of the tuberosity of the ischium. The opening, thus made, of the structure immediately bounding the sac, was sufficiently wide to admit the end of the finger, to which it felt as a tight ring. This aperture was the full depth of a finger from the surface, and as wide as the diminished space between the rami of the opposite ossa pubis and ischii would safely allow. A probe, passed along the original fistulous track, was felt by the finger in the sac, thus affording a direct proof of a connection between that cavity and the urinary passage. No instrument, however, could be passed through the wound into the bladder. A large bougie open at the extremity, (a gum catheter?) and wrapped round with lint, was introduced to the bottom of the wound, and fastened to the inside of the thigh.

At first, all went on well: the greater part of the urine was discharged through the bougie, and the remainder passed along the side of that instrument; but, on the fourth day, an unexpected and profuse bleeding came on, which, however, ceased on the following day. Two days after this all the urine flowed by the wound, and none issued from any other passage. In a few more days a little urine began to flow from the urethra; the swelling and hardness about the fistulæ in the back and thigh had greatly subsided; and the discharge of purulent matter from these apertures had nearly ceased. The largest bougie was now introduced daily to keep the wound open; and the resistance, which it had hitherto met with on reaching a certain point, was no longer experienced, so that the instrument passed into the wound for more than half its length, without any additional pain. As a new experiment, the bougie was withdrawn, and a gum elastic catheter introduced in its stead, when unexpectedly a large quantity of clear urine flowed through its canal: the instrument had gone into the bladder. With the view of connecting the original urethra with this new passage, Dr. Houston began to dilate with a small silver catheter that part of the tube in front of the perinæum, which had become narrowed by inflammation and disuse, and, after several days' trial, found the point of the instrument come in contact under the pubes with the bougie, which had previously passed through the perineal wound into the bladder. "Having succeeded thus far (says Dr. Houston) and practised the operation for a few days, gradually enlarging the catheter, I substituted a long, widely-grooved, silver director for the perineal bougie, and, on the groove of this instrument, succeeded in conducting the silver catheter the entire way along the urethra into the bladder. This step being gained, my next object was to introduce in the same way a gum elastic catheter, which, by admitting of being left for a longer time in the passage, possessed an advantage over the silver one." In this object, Dr. Houston also succeeded, and the instrument was in this way introduced, every morning, and left in the bladder an hour or two. Five

URINARY FISTULÆ.

weeks after the operation, the patient made water nearly at natural intervals, and most of the fluid came in a full stream by the urethra; and the fistulæ in the back and thigh had entirely healed. The last step towards the restoration of the urethral canal consisted in passing a middle-sized gum elastic catheter into the bladder, without the assistance of the director. "The main cause of the difficulty to the introduction of the instrument lay in the crookedness of the urethra, in its passage through the perinæum, arising from the projection of the rami of the pubes and ischium towards the left side, which pushed the canal obliquely in that direction." The case terminated in a perfect cure, with the exception of the lameness arising from the ankylosis of the hip, and shortened state of the limb. (See *Houston's Report*, in *Dublin Journ. of Med. Science*, vol. viii. p. 11, &c.) The particulars of this case seem to me to be amongst the most interesting ever published in relation to urinary fistulæ, and such as every practical surgeon should be acquainted with.

Fistulæ of the bladder, *vesico-vaginal fistulæ*, as they are termed, communicating with the vagina, and produced by difficult labours, are almost constantly attended with loss of substance. The forcible contusion, occasioned by the child's head on the anterior parietes of the vagina and bottom of the bladder, gives rise to the formation of sloughs, the separation of which sometimes leaves apertures large enough to admit the finger, and hence the difficulty of the cure. However, vesico-vaginal fistulæ may arise from various causes: in a few instances, they are congenital, and depend upon imperfect development of the parts. Accidental cases, which are those usually met with, may proceed from causes which act either from within the bladder upon the vagina, or inversely, or from within the uterus; and sometimes from the improper use of obstetric and other instruments. In the first class of causes may be specified pins, which penetrate from the bladder into the vagina, and calculi, which destroy the partition between them; to the second belong pessaries, cancer, syphilitic and phagedenic ulceration; to the third, which is infinitely more common than all the rest, the pressure of the head of the child in a protracted labour upon the recto-vaginal partition. Among the causes of the fourth class, may be mentioned the employment of dilators, the perforator, and of instruments for the removal of calculi. The only cases which I have seen arose from sloughing, occasioned by the pressure of the head of the child; or from the effects of cancerous, syphilitic, or phagedenic ulceration.

The diagnosis of vesico-vaginal fistulæ has been well treated of by M. Jobert. If ischuria should follow a difficult labour, its dependence on the formation of a fistula of this kind cannot be ascertained until after the separation of the slough, which happens at various periods, sometimes not till the tenth or twelfth day after delivery; and one case is recorded, in which a month elapsed before the urine began to dribble away by the fistulous opening. Sometimes, after parturition, the neck of the bladder does not quickly recover its contractile power. Indeed, some women, throughout life, have difficulty in retaining their urine, which comes away by drops whenever they lie down. As the urine passes first into the vagina,

and then escapes from it, the suspicion of a urinary fistula may be excited. The introduction of a catheter will immediately decide the point, if it be not settled by the return of the parts to their normal functions. In order to distinguish a fistulous communication between the vagina and bladder, M. Jobert recommends the finger to be passed along the anterior paries of the former, so as to detect any loss of substance. A coloured lotion may then be injected through a catheter into the bladder, and the finger, being within the vagina, will perceive the escape of the fluid by the fistulous aperture. A sound, introduced into the bladder, may also be felt through the fistulous opening, by passing the finger into the vagina. For the examination of vesico-vaginal fistulæ, the speculum is of great service, and some cases may thereby be detected, not discoverable by any other means.

In treating such fistulæ, Desault deemed the two chief indications to be—1st, to hinder the urine from passing into the vagina; 2dly, to keep the edges of the division as closely as possible together, so as to give them an opportunity of uniting. In women, the introduction of the catheter is easy; but the instrument is more difficult to be fixed, than in men. Desault contends, however, that it is very essential to have it so fixed in the bladder, that the urine may escape. He found, that the only effectual plan was to fasten the catheter to a point that always retained the same position with respect to the meatus urinarius. He used a kind of machine, made after the manner of a truss, the circle of which was long enough to embrace the upper part of the pelvis, and had in its middle an oval plate, intended to be placed upon the pubes. In the centre of this plate was a groove, to which a piece of silver was fitted, curved so that one of its ends, with an aperture in it, came over the vulva, on a level with the meatus urinarius. This piece of silver admitted of being fastened to the plate with a screw. After the catheter had been introduced and arranged in the bladder, so that its beak and eyes were situated at the lowest part of this viscus, the end of the instrument was put through the aperture of the piece of silver, which slid into the groove of the plate, and it was afterwards fixed in the way already explained. By means of this machine, the catheter was securely fixed, without incommoding the patient even when she was walking.

In these last cases, large catheters, with full-sized apertures, should be employed, so that the urine may more readily escape through the instrument, than fall into the vagina. In the early part of the treatment, the catheters should also be left constantly open.

In order to keep the edges of the division as near together as possible, Desault introduced into the vagina a soft kind of pessary, large enough to fill the vagina without distending it. By this means, the form of the fistula was changed from round to oval, which is the most favourable to its re-union; and the advantage was gained of closing the fistula, and hindering the urine from falling into the vagina. The efficacy of the catheter, when properly fixed, has been illustrated in an interesting case, published by Dr. Cumin, of Glasgow, who, however, considers the introduction of the pessary into the vagina useless and objectionable. (See *Edin. Med. Journ.* No. lxxviii. p. 62—64.)

The cure of vesico-vaginal fistula has likewise been attempted with the cautery or caustics. The nitrate of silver has frequently been preferred, the vagina being dilated for the purpose with a speculum having two branches. This method can only answer when the fistula is small and unattended with much loss of substance. Under these circumstances, perhaps, as M. Velpeau observes, the nitrate of silver may really be the best means of cure; for though the actual cautery acts more rapidly, it destroys the parts, when it may only be desirable to kindle inflammation in them. (*Med. Op.* t. iii. p. 658.) I believe with Delpech, who had great success with the cautery, that if it be preferred, its action should be limited to the vaginal orifice of the fistula.

Suture is another plan which has been adopted: the edges of the fistula are to be pared off, and the sides of the wound then brought and kept together with a common, or the twisted suture. M. Malagodi of Bologna, had under his care a woman with a longitudinal fistula sufficiently capacious to allow his finger, covered with a glove, to be passed through it into the bladder; by which means he was enabled to hook down, as it were, gradually the two sides of the fistulous opening, and pare off the callous parts of them with a bistoury. In a similar case, M. Roux employed two pair of forceps; one for the right side of the fistula, the other for the left. The blade of each pair of forceps which became inferior when applied, was wider than the upper, and afforded a kind of steady surface on which the requisite incision could be conveniently executed. These were also in part completed with scissors, and the callous edges converted into fresh cut surfaces. A suture was then passed from the vagina into the bladder, at first through the left edge, by means of a curved needle and a common porte-aiguille. This needle was then passed from the bladder into the vagina through the other side of the opening, drawing after it a kind of pin, or a piece of wire, that was attached to the end of the thread. Three pieces of wire, or pins, were thus introduced, and the twisted suture adopted. This operation was followed by peritonitis, and the patient died about twelve days after its performance. M. Schreger partially succeeded by this plan, though, according to M. Velpeau, his means were not so well combined as those adopted by M. Roux. It is remarked by M. Velpeau that, unless the fistula were very large, its edges would not admit of being hooked down with the finger, as done by M. Malagodi, nor of being seized with forceps, as done by M. Roux. The plan is only applicable to longitudinal apertures, while experience proves that vesico-vaginal fistulæ are mostly transverse, or even semilunar, with the concavity situated forwards, between the urethra and the terminations of the ureters in the bladder. Nægel's instrument (a kind of bistoury caché) M. Velpeau conceives would be preferable, if it were less complicated; though M. Malgaigne observes, that it is very defective, inasmuch as it has no fixed point for the action of the blade. The latter surgeon is of opinion, that a pair of blunt-pointed short-bladed scissors, bent twice at right angles, would sometimes prove advantageous where the fistulous opening was longitudinal.

In cases of transverse fistulæ, M. Lewzinski proposed passing the needle from within the bladder, with the aid of a cannula expressly con-

structed for the purpose, and introduced through the urethra. This apparatus has been improved by M. Doyber.

In 1826, M. Lallemand published a case of vesico-vaginal fistula cured by means of an instrument, termed *la sonde érigne*, which consists of a large cannula, about four inches in length; a double hook capable of being made to project from, or return into the cannula, at the option of the surgeon; a circular rim at the outer end of the cannula, to prevent this from slipping into the bladder; and of a spring, by means of which the hooks, introduced into the posterior lip of the fistula, are drawn forwards with a force that can be nicely regulated. In the case alluded to, benefit was derived from this contrivance; but the cure, if completed at all, which M. Velpeau states is doubtful, was not so without the aid of the nitrate of silver. For the details, I must refer to M. Lallemand's own account, or to that given by M. Velpeau. (*Secé Nouv. Elem. de Méd. Opér.* t. iii. p. 653.)

Baron Dupuytren in one instance used with success a large female catheter, furnished at its sides with two flaps or wings, capable of being closed or shut by means of a spring stilet. When the instrument had been introduced, and the wings at its extremity opened, it was drawn outwards, and together with it the posterior lip of the fistula; and some charpie being then placed between the meatus urinarius and the rim of the outer end of the tube, the urethra and the anterior edge of the fistula were pushed back with it.

M. Jobert, in cases of loss of substance, and where the fistula is large, has recourse to a Talia-cotian operation. He pares off the borders of the fistula; forms a flap to supply the place of the lost substance; unites the flap to the fresh cut surface with a suture; and re-establishes the course of the urine. The vesico-vaginal septum is to be carefully drawn out, and the borders of the fistula pared off. This is sometimes accomplished by a finger introduced into the fistula; but M. Jobert commonly employs the vulsellum or forceps invented by Mæxux. With this he takes hold of the edges of the fistula, and pares them off, beginning with the posterior, and finishing with that which is nearer the urethra; for this last purpose he employs either a probe-pointed bistoury, or the scissors used by M. Roux, for the palate suture. The flap is taken from the external labia, or adjacent parts, or both. Its size is to be proportioned to that of the fistula, but somewhat larger, as being then less likely to mortify. The hairs must be first shaved off, and the flap, when cut, so twisted on itself, that the bleeding surfaces may be brought in contact. The pedicle should be of considerable size, and attached to the point nearest the vagina. The flap being doubled and traversed by a waxed thread, M. Jobert passes a catheter into the bladder, and directs the point into the vagina, through the fistula. He next passes the two ends of the thread through the eyes of the catheter. Withdrawing this, he next disengages the thread from the instrument; and then, by pressing with one hand upon the flap, and by drawing the thread with the other, he brings it to the fistula.

The next thing is the suture. The finger being introduced along the flap, a curved needle mounted on the needle-conductor, employed in the palate suture, is then passed above the flap, or the needle may be conveyed by the hand alone. The needle

is passed at once through the flap and margins of the fistula, and withdrawn by means of a pair of dressing forceps. A similar suture is made on the other angle of the fistula. The threads are then tied. The urethral thread is fixed to one of the thighs with diachylon plaster. A catheter is now introduced into the bladder, and it is to be joined to another, so that the urine may be conveyed far away from the parts. The catheter is to be left continually pervious, and fixed by means of cotton threads, fastened to a band which is placed round the body. Quietude in the recumbent posture is to be observed. M. Jobert does not cut through the pedicle of the flap till between the 30th and 40th days. (See *Gazette Méd.* 1836; also *Malgaigne, Man. de Méd. Opér.* p. 725. ed. 2.) The following estimate is made by the latter surgeon of comparative advantages of the various plans:—Cauterization (including the use of the cautery and caustic) is very useful for small fistulae, but not eligible for extensive ones. M. Jobert's method has been attended with the most numerous and durable successes; and M. Manec witnessed two instances himself under M. Jobert, in the Hôpital St. Louis, where it completely answered.

When the rectum is wounded in lithotomy, Desault advised dividing the parts comprehended between the wound of the operation, the opening in the rectum, and the margin of the anus. That such an operation may become necessary in some instances, I will not say; but it can never be proper, until it is seen whether the wound of the rectum will not heal up favourably without such treatment. I have seen two cases, in which the rectum was cut in lithotomy, yet no fistula ensued; and other similar facts have been mentioned to me by professional friends. The success, also, with which the wound has generally been healed after lithotomy, done through the rectum, is another fact tending to prove that the inconveniences of a wound of the latter bowel in the operation have been rather exaggerated.

In a case of urinary fistula, communicating with the rectum, and which could not be healed with the catheter, Sir A. Cooper introduced a catheter into the bladder, and his finger into the rectum, and then made an incision, as in the operation for the stone, in the left side of the raphe, until he felt the staff through the bulb. He then directed a double-edged knife across the perinaeum, between the prostate gland and the rectum, with the intention of dividing the fistulous communication between the urethra and the bowel. A piece of lint was introduced into the wound, and a poultice applied. When the lint was removed, the urine was found to take its course through the opening in perinaeum; the aperture in the rectum gradually healed; and that in the perinaeum quickly closed; the urine being all now discharged in the natural way. (*A. Cooper, Surgical Essays*, part i. p. 215.)

URINE, INCONTINENCE OF.—This complaint is quite the reverse of retention of urine; for as in the latter affection the urine is continually flowing into the bladder without the patient having the power to expel it; so, in the former, it flows out without the patient being able to retain it.

According to Desault, children are particularly liable to the disorder; adults are less frequently afflicted with it; and persons of advanced years appear to be still less liable to it. The last observation may seem to be at variance with the very

numerous examples of patients advanced in years who are incapable of retaining their urine. The fact is, that the overflow of this fluid, or in other words, its dribbling away through the urethra, in some cases of retention, of which it is only a symptom, has been too commonly confounded with an incontinence of urine, though the cases are as different in their nature as possible, and require opposite modes of treatment. In *retentions, depending upon weakness and paralysis of the bladder, the involuntary dribbling of the urine* is generally only an effect of the other disease; and they prevail together. The distended bladder reacts upon the urine, and forces some of it out of the urethra, until the resistance of the sphincter and of the urethra are precisely equal to the expelling power. Sometimes the urine even dribbles away incessantly, as may happen when the action of the bladder is entirely destroyed; for, being then constantly full, it cannot hold any more of the urine that descends to it through the ureters, unless as much be voided through the urethra as is received from the kidneys.

The causes of an incontinence of urine, strictly so called, are the very reverse of those of a retention. The latter case happens whenever the action of the bladder is weakened, and the resistance in the urethra and neck of the bladder increased. On the contrary, an incontinence originates either from the expelling power of the bladder being augmented, while the resistance in the urethra is not proportionately increased; or from the resistance being lessened while the expelling force continues the same. On these principles, Desault thought it easy to explain why the disorder should be most common in children; and one reason which he gives for the circumstance is, that in childhood there is more irritability than at any other period of life. The expulsion of the urine, he observes, is entirely effected by muscular action, while the resistance is merely owing to the sphincter vesicae, the levatores ani, and perhaps to a few other inconsiderable fasciculi of muscular fibres; for the different curvatures of the urethra, and the contractile power of this tube itself, he thought could make only a feeble resistance to the discharge of the urine. An incontinence happens in children because the bladder contracts so suddenly and forcibly that its contents are voided almost before these young subjects are aware of the occasion to make water, and without their being able to restrain the evacuation. There are also many children who, from indolence or carelessness, do not make water immediately the first calls of nature invite them, and who afterwards, on being urgently pressed, wet their clothes. In other young subjects, the sensation which makes the bladder contract, and accompanies the expulsion of the urine, is so slight that the function is performed without any formal act of the will, — without even exciting an impression sufficiently strong to disturb sleep. This is the case with such children as are troubled with an incontinence of urine only in the night-time. Increasing years, by diminishing the irritability of the bladder and making the individual more attentive to his necessities, usually bring about a cure of the infirmity before he has attained the adult age.

It was not, however, the doctrine of Desault, that no period of life, excepting childhood, is subject to incontinence of urine. On the contrary, he

admits that other ages are subject to it; but then it commonly depends upon a want of resistance to the escape of the urine. Thus it may be occasioned by weakness or paralysis of the sphincter vesicæ, and some fibres of the levatores ani.

A calculus, a fungus, or any other extraneous body of irregular shape, may lodge in the neck of the bladder, but not accurately filling it, may allow the urine to escape at the sides; or there may even be in the calculus a groove through which the urine passes into the urethra.

A violent contusion or forcible distention of the sphincter is often followed by an incontinence of urine. Formerly, the complaint used to be common after the mode of lithotomy called the apparatus major, and it is even at present not an unusual consequence of the extraction of calculi from females, either by dilatation or division of the meatus urinarius and neck of the bladder.

Women, after difficult labours, and in whom the child's head has forcibly compressed and weakened the neck of the bladder, are also subject to a species of incontinence of urine; which, however, is sometimes experienced only when they laugh or make exertions.

Incontinence of urine is stated by many writers to be an attendant on palsy and apoplexy. Here they mistake what the French surgeons aptly call the "*retention d'urine avec regorgement*," for an incontinence. In such cases the involuntary discharge of urine has been referred to paralysis of the sphincter of the bladder; but it is forgot that the bladder itself also participates in the paralytic affection; for the sphincter not being a particular muscle, but only a fasciculus of fleshy fibres, formed, as Desault observes, by the junction of those which compose the inner layer of the muscular coat of the bladder, it can only be weakened by the causes here specified, in the same degree, and at the same time as the rest of this organ. Besides, it is proved that the action of the bladder is absolutely necessary for the expulsion of the urine, and that when this organ cannot act, a retention always ensues. Although much less danger attends an incontinence than a retention of urine, the infirmity is a serious affliction; for as the patient's clothes are continually wetted with a fluid, that readily putrifies, the stench which he carries about with him is offensive to himself and every body who approaches him.

In children the disorder usually gets well of itself as they grow up, and acquire strength. When they wet their beds really from idleness and carelessness (which I believe is rarely the case), moderate chastisement may be proper, inasmuch as the fear of correction will make them pay more attention to the earliest call of nature. It has always been my own conviction, that this doctrine is carried to an unjustifiable extent, particularly in schools, and been a pretext for the most absurd kind of severity. Nor is it doubted by any man who understands the subject, that, in almost all cases, the disorder is a true infirmity, arising from the causes already indicated, and not from indolence; the supposed crime taking place, in fact, when the child is asleep and unconscious of what is happening.

If excessive irritability and constitutional weakness be the cause of incontinence of urine, and a very small quantity of urine forces the bladder to contract, the resistance of the urethra being involun-

tarily overcome, an endeavour should be made to lessen such irritability by the use of the warm or the cold bath, sea-bathing, tonics, chalybeates, good air, &c. And, in order to prevent the accident from taking place in the night-time, the child should not take any drink for some time before being put to bed; the bladder should be always emptied before sleep, and if necessary, the child ought to be taken up in the night for the same purpose.

If the infirmity arises from a want of action in the parts, causing the resistance in the urethra, tonics may be tried, especially bark, sulphate of quinine, preparations of iron, and a blister on the sacrum. When the case is incurable, palliative means are the only resource; viz. instruments calculated either to compress the urethra, and intercept the passage of the urine, or to receive the fluid immediately it is voided. The first of these plans is more difficult to accomplish in women than men; but it may be executed by means of an elastic hoop, which goes round the pelvis, and from the middle of which in front, a curved elastic piece of steel descends, and terminates in a small compress, which is contrived to cover accurately the meatus urinarius. (See *Œuvres Chir. de Desault*, par Richat, t. iii. p. 95, &c.) Any contrivance of this kind, however, must create excessive annoyance, so that few women would endure it. I was lately consulted by a gentleman who showed me an admirable invention for the reception of his urine, which had been passing from him involuntarily for some years: it consisted of a water-proof oil-silk tube, about two inches and a half in diameter, extending from the penis down the thigh and leg, under his trowsers, without causing any visible bulging or disfigurement. It would serve for four or five hours at a time, and enabled this individual to mix with society. The machine was made by a German residing in Princes Street, Drury Lane. I have since recommended it for another gentleman similarly afflicted.

Large blisters applied over the os sacrum have often cured an incontinence of urine, both when the complaint seemingly arose from excessive irritability of the bladder, and from paralysis and loss of tone in this organ and the parts, which naturally resist the expulsion of the urine from it, the case being in fact a retention "*par regorgement*," or as one might call it in plain English, a retention combined with incontinence of urine. (See *Med. Obs. and Inq.*) As in some of these cases, the blisters removed also a paralysis of the lower extremities, they might have furnished a hint to the practice of making issues for the relief of palsy of the legs connected with diseased vertebræ. Cantharides have also been given inwardly with success.

URINE, RETENTION OF. — It is observed by the experienced Mr. Hey, that a retention of urine in the bladder, when the natural efforts are incapable of affording relief, is in male subjects a disease of great urgency and danger. Persons advanced in years are more subject to this complaint than the young or middle-aged. It is often brought on by an incautious resistance to the calls of nature; and if not speedily relieved, generally excites some degree of fever.

The distinction, says Mr. Hey, which has sometimes been made between a *suppression* and *retention* of urine, is practical and judicious. The former most properly points out a defect in the se-

erection of the kidneys; the latter, an inability of expelling the urine after it has been secreted.

Retention of urine is an inability, whether total or partial, of expelling by the natural efforts the urine contained in the bladder. The characteristic symptom of this disease, previous to the introduction of the catheter, is a distention of the bladder (to be perceived by an examination of the hypogastrium), after the patient has discharged all the urine which he is capable of expelling. As this complaint may exist when the flow of urine from the bladder is by no means totally stopped, great caution is required to avoid mistakes. Violent efforts to make water are often excited at intervals, and during these strainings small quantities of urine may be expelled. Such a case may be mistaken for stranguery.

At other times a retention of urine may really exist, though the patient can make water in a stream, and discharge in the course of the 24 hours a quantity equal to that which is commonly discharged by a person in health. Under this circumstance, the pain in the hypogastrium and the distention of the bladder will continue till the patient is relieved by the catheter.

And lastly, it sometimes happens, when the bladder has suffered its utmost distention, that the urine runs off by the urethra as fast as it is brought into the bladder by the ureters. Mr. Hey repeatedly knew this circumstance cause a serious misapprehension of the true nature of the disease.

In forming a correct judgment of all these cases it is very necessary to recollect the important division of retentions of urine into the *complete* and *incomplete* forms; a distinction which will at once put the surgeon on his guard against a variety of errors. He should also recollect the practical division of all retentions of urine into two classes; one depending upon an impediment or obstruction at the neck of the bladder, or in the course of the urethra; the other upon causes which operate by weakening and paralyzing the bladder itself, and lessening the force of the detrusor urinæ, and other muscles concerned in expelling the urine. Thus the vesical orifice of the urethra may be blocked up with clotted blood, or be obstructed by a calculus; or by the pressure of a neighbouring abscess; or by a projection of a portion of enlarged prostate. The membranous or spongy parts of the canal may be the seat of strictures, or serve as a lodgment for a small calculus; and the bladder may be weakened and paralysed by over-distention, or from the effects of certain injuries and diseases of the brain, spinal cord, pelvis, sacrum, &c. There is only one particular case which cannot enter into this classification; it is the *incomplete retention of urine*, arising from a wound or rupture of the fundus of the bladder. (See *BLADDER*.) Here, however, we might, perhaps, without much incorrectness, refer the case to the second class, the bladder being incapable of expelling the urine through the urethra efficiently, owing to the rent or aperture in its parietes allowing some of the fluid to escape in another direction.

In every case of retention of urine which the late Mr. Hey had attended, the disease could be ascertained by an examination of the hypogastrium, taken in connection with the other symptoms. The distended bladder forms there a hard and circumscribed tumour, giving pain to the patient

when pressed with the hand. Some obscurity may arise upon the examination of a very corpulent person; but, in all doubtful cases, the catheter should of course be introduced.

Mr. Hey has not adverted to the swelling in the rectum or vagina; nor to cases of contracted bladder, where of course the information derived in ordinary instances from the tumour above the pubes cannot be had; but, in other respects, his observations on the diagnosis are practical and correct. He had seen only a few cases of *ischuria renalis*, or complete suppression of the secretion of urine. The disease proved fatal in all his patients except one, in whom it was brought on by the effect of lead taken into the body by working in a pottery. It subsisted three days during a violent attack of colica pictorum, and was then removed, together with the original disease. Mr. Hey found no difficulty in distinguishing this disorder in any of the cases from *ischuria vesicalis*, though for the satisfaction of some of his patients he introduced the catheter. (*Practical Obs. in Surgery*, p. 374, &c.) Suppression of urine is well known to be one of the common effects of Asiatic, or spasmodic cholera.

Retention of urine may be the effect of a great many different causes; as paralysis of the bladder; inflammation about its neck, or the prostate gland; the presence of foreign bodies in it, or in the urethra; abscess in the course of the urethra, or near the prostate; pressure made on the neck of the bladder by the gravid uterus; chronic enlargement of the prostate gland; strictures in the urethra, &c.

Every case of retention of urine demands prompt assistance; but when the disorder presents itself in its complete form, the mischief of delay is of the most serious nature; for, if the bladder remain preternaturally distended, it not only loses its contractile power, but is soon followed by the bursting either of this viscus itself, or (what is far more usual) of the membranous portion of the urethra. "Conceive a distended bladder, and the spasmodic action of the abdominal muscles and diaphragm of a powerful man squeezing it, and you will readily understand (observes Sir Benjamin Brodie) with what impetus the urine must be forced through the lacerated urethra into the surrounding cellular membrane. In fact, the scrotum, the penis, the perinæum, and sometimes even the groins, and the lower part of the belly, are enormously swollen with the acrid urine. The first effects of this injury are to put an end to the patient's sufferings. There is no more straining, nor spasm, and the stricture itself becomes relaxed, so as to allow the urine to flow through the natural passage. With this interval of relief from misery, a new and generally fatal train of symptoms begin. The urine, under any circumstances, would irritate parts unaccustomed to its contact; but the urine, in case of retention, has been long in the bladder, much of its watery part has become absorbed, and it is in consequence impregnated with saline matter, so that its stimulating properties are much increased. Wherever this acrid fluid penetrates, it first excites inflammation, and then kills the part. The patient is seized with a fit of severe shivering; and the skin of the scrotum and penis, and other parts, then becomes red and inflamed. If you make incisions into it, you find black offensive sloughs underneath,

URINE, RETENTION OF.

If incisions be not made at all, or be not sufficiently extensive, the skin becomes speckled with dark spots; these increase in size, and large patches of it are converted into sloughs. Sometimes a black spot may be seen on the glans penis, which is a most fatal sign; for I never knew one to recover in whom it appeared. It indicates that the urine has been effused into the cells of the *corpus spongiosum*. As this process of sloughing goes on, the constitution becomes affected, as it would have been if the mortification had been induced by any other cause. At first, the pulse is full, and the skin hot; but the depressing effects of the sloughing are soon manifest; the heart beats feebly, and then frequently the pulse becomes irregular, and afterwards intermitting; the skin turns cold and clammy; the patient is troubled with an incessant hiccough, which nothing relieves for more than a few minutes; he mutters in low delirium, and then dies." (*Sir B. Brodie on Dis. of the Urinary Organs*, p. 13.) It appears also from the observations of Desault and Sir Everard Home, that a complete retention of urine, after a time, has the effect of putting a mechanical stoppage to the further secretion of this fluid in the kidneys; a circumstance which sometimes has a principal share in producing death, particularly when this event happens, though the urine is not extravasated.

In some cases, the bladder gives way at its fundus, and the urine escapes into cellular tissue of the pelvis, or occasionally into the cavity of the peritoneum itself, where it is sure to bring on a rapid and fatal attack of peritonitis. Two cases, in which the distended bladder suddenly burst at its fundus, followed by the consequences I have mentioned, are recorded by Sir Everard Home. In some other instances of retention of urine, especially from hypertrophy of the prostate gland, and from paralysis, the bladder does not give way, neither does the urethra; but, after the patient's death, the bladder is found in the state of chronic inflammation, with the mucous lining softened, and even ulcerated, or the membrane may be of a pale colour, the bladder much dilated, and its muscular fibres in the condition of atrophy. (See *Sir B. Brodie, Op. cit.* p. 77.)

In all cases of retention of urine, the indications are manifest: viz. 1st, to adopt such treatment as seems best calculated to procure a discharge of the urine through the natural passage; which object is performed, sometimes by means of fomentations, the warm bath, bleeding, opium, and other medicines; sometimes by the removal of mechanical obstacles to the flow of the urine; but more frequently by the use of the catheter, than any other means. When all these plans fail, it then becomes necessary to make, at all events, an outlet for the urine by a surgical operation. 2dly, The second indication, or that which presents itself after the immediate dangers of the distention of the bladder are thus guarded against, is to remove whatever disease, or other circumstance, constitutes the still existing impediment to the natural expulsion of the urine.

With respect to the fit manner and time of employing the several means for fulfilling the above indications, and the selection which should be made of them, these are important considerations, which vary in different cases, and actually cannot be understood, without due reference to the causes

and circumstances of each individual case. Some of this subject belongs, however, to other parts of this work, to which, in order to avoid the necessity of repetition, I here refer. (See *CATHETER; BLADDER, PUNCTURE OF; PROSTATE GLAND, DISEASES OF; URETHRA, STRICTURES OF, &c.*)

With respect to catheters, we shall find, that some cases require the urine to be drawn off two or three times a day, and the instrument to be taken out after each evacuation; while, in other instances, it is prudent to keep the tube continually introduced. If much difficulty is experienced in passing it, generally speaking, it should not be immediately withdrawn. Here one general caution may be conveniently offered, which is, never to let a silver catheter remain in the passage more than a week, or ten days, without taking it out, and cleaning it; for, if this be not done, the instrument becomes coated with deposits from the urine, so as afterwards not to admit of being withdrawn through the urethra, without great suffering and irritation. The eye in the beak is also apt to become completely blocked up; and sometimes the pressure, which the catheter makes on the part of the urethra, corresponding to the root of the penis, causes in this situation inflammation, followed by a slough as large as a crown piece, and an opening, formed by the loss of substance is left, which may even continue fistulous during the patient's life. These remarks particularly apply to metallic catheters; but, those of elastic gum, especially such as are ordinarily met with in the shops, are apt to spoil and become blocked up with mucus, if not taken out and cleaned or changed, every five or six days. In University College Museum is one of these, on which the deposits from the urine have produced a considerable incrustation. I mentioned, in the article *PROSTATE GLAND, DISEASES OF*, that Messrs. Weiss have succeeded in constructing elastic catheters which may be retained for more than a fortnight in the urethra, without becoming obstructed, besides having the advantage of always retaining a due curve.

1. *Retention of Urine from Stricture.*—Some patients, who have strictures, are much more liable to retention of urine than others. No doubt, as Sir Benjamin Brodie has explained, much depends on the patient's constitution, but much also on his mode of life; and those who are exposed to vicissitudes of temperature, or who indulge in the use of spirituous, or fermented liquors, are troubled with retention of urine more frequently than others, whose mode of life is different. (*Op. cit.* p. 15.) The more or less advanced state of the stricture, and its situation within the influence of the spasmodic action of the muscles about the perineum, and, perhaps, of the muscular fibres of the membranous portion of the urethra itself (*Velpaau, Phillips, &c.*), must also influence the tendency to retention of urine. In some cases, the retention is complete; in others, it is incomplete; the urine dribbling away from time to time, when the bladder becomes distended to a certain point, and yet, that receptacle still remaining full.

Great difference prevails in the treatment of retention of urine from stricture; some practitioners always giving a trial in the first instance to opium, purgatives, the warm bath, and, in young strong persons, to bleeding; while others have recourse at once to the introduction of instruments. If the retention were from a spasmodic affection of the

stricture itself, or of the neck of the bladder, and the retention in a very recent stage, perhaps also incomplete, the first mentioned means are those to which I have usually resorted. The following observations prove that Sir Benjamin Brodie lets his practice be regulated by nearly similar considerations:—"Purgatives," says he, "require some time to produce their effect, and, in most cases at the period of your being called in, the symptoms are too urgent to admit of this delay. Where, however, a stricture is chiefly spasmodic, and the retention follows the too great use of fermented liquor, or spirits, I would advise you, if you were sent for on the commencement of the attack, to prescribe a draught of infusion of senna, with the tartarate of potass and the tincture of jalap. As soon as this has fully operated, and the bowels are emptied, give thirty or forty drops of tincture of opium by the mouth, or order an opiate clyster to be administered, and, in all probability, the attack will subside." (*Op. cit.* p. 37.) The preceding remarks seem to me of great value, as establishing the principles, on which the effects of purgatives, opium, &c. may be tried previously to instruments. The late Mr. Earle wrote in favour of the efficacy of a tobacco enema for the relief of spasmodic retention of urine. (See *Med. Chir. Trans.* vol. vi. p. 32.) But though its power cannot be doubted, its occasionally violent operation, and the generally good effects of opium, especially when prescribed according to the directions given in this article, would incline me to prefer the latter medicine; but if the retention has been of longer continuance, the bladder fully distended, and the patient in much pain, the best practice is that of attempting to give immediate relief by the use of instruments. Sir Benjamin Brodie, who is an advocate for the latter plan, begins with taking one of the smallest gum catheters, which has been kept for a considerable time on a curved wire, and which retains the curved form after the wire is withdrawn. He introduces it without the wire, and, as it approaches the stricture, he turns the concavity of the catheter towards the pubes, elongating the penis at the same time, by drawing it out as much as possible. If the catheter enter the bladder, the patient will obtain immediate relief.

When the gum catheter fails, Sir Benjamin Brodie tries to pass a small catgut bougie; an instrument which Delpach had a high opinion of, and the end of which, just before he used it, he used to render pointed by biting it into that form between his teeth. It is well known that a catgut bougie will frequently procure a discharge of urine, though it may not pass into the bladder. If the stricture grasps it, this is sufficient. "Let it remain in the stricture until there is a violent impulse to make water; then withdraw the bougie, and the urine will follow it in a small stream. If the patient empties the bladder, the object is attained; but otherwise, re-introduce the catgut bougie, or rather introduce another of the same size." If the straight catgut bougie cannot be passed, Sir B. Brodie bends the end of it, so that it may be in rather a higher line, or direction, than the rest of it, and thus keep against the upper surface of the urethra, and avoid the lower, where it would be more likely to be stopped.

If the foregoing instruments prove ineffectual, a silver, or an elastic gum catheter, with a stilet, may

be tried. If the stricture be of recent formation, Sir Benjamin Brodie very properly recommends the catheter to be nearly of the full size; but, in older cases, it is to be considerably smaller. The silver catheter, which he prefers for examples of retention of urine from stricture, are shorter and less curved than ordinary ones, and fixed in a wooden handle, which he finds renders it more manageable. If a gum catheter is employed, he recommends the stilet to be made of iron, and provided with a handle, like that of a sound. "You should (he observes) pass it as far as the obstruction, and having ascertained where it is situated, withdraw the catheter a little—a quarter of an inch, for example—and then, as you pass it on again, towards the bladder, keep the point sliding against the upper part of the urethra, which is towards the pubes, avoiding the lower part, which is of course towards the perinæum. Be careful to employ no violence; if you lacerate the urethra, so as to cause hemorrhage, you will be defeated in your object. Press the catheter firmly, but gently and steadily, against the stricture, keeping in your mind the anatomical position of the parts, and being careful to give the point of the instrument the right direction. When the pressure has been thus carefully continued for some time, the stricture will begin to relax. It will allow the point to enter, and, at last, to pass completely through it into the bladder." (*Op. cit.* p. 34.) If a gum catheter has been used, "it may be prudent to allow it to remain in the urethra and bladder for one or two days, or even for a longer period; and this will go far towards accomplishing the cure of the stricture." The testimony of this judicious surgeon confirms the fact observed by every man of experience, that, even when a catheter or bougie will not enter the bladder, the pressure of it against the stricture for a little while brings on an irresistible desire to make water; and, on withdrawing the instrument at this moment, a stream of urine follows its removal.

When instruments fail, Sir Benjamin Brodie relies chiefly on opium. "From half a drachm to a drachm of laudanum may be given as a clyster, in two or three ounces of thin starch. If this should not succeed (he says), give opium by the mouth, and repeat the dose if necessary, every hour, until the patient can make water. According to my experience, the cases in which the stricture does not become relaxed under the use of opium, if administered freely, are very rare." (*Op. cit.* p. 36.)

In the event of the failure of all the foregoing means, what is to be done? If an outlet is not made for the urine in some manner or another, the urethra will give way behind the stricture, and either an urinary abscess will form, followed by a fistula in perinæo, or the urine, not being kept within any limits by the adhesive inflammation, will diffuse itself widely in the cellular tissue of the perinæum, scrotum, and even the groins, and occasion extensive sloughing of that texture, and, indeed, of the skin, fascia, and every other part with which it comes in contact, attended with so much febrile disturbance as frequently to cause the patient's death. The circumstances under which merely an urinary abscess forms, and not this dangerous degree of sloughing is occasioned, I have noticed in another article. (See *FISTULA IN PERINÆO.*) For the prevention,

however, of this mischief, in either form, the surgeon must prevent the retention from continuing unrelieved beyond a certain period, and, at all events, adopt some measure whereby the distention of the bladder may be effectually removed. The time during which a retention of urine from stricture may continue, before the urethra gives way, is generally much longer than might be expected *à priori*. Extravasation of urine seldom takes place before the third or fourth day. "It may occur (as Sir Benjamin Brodie observes) sooner, but often the period is even later than this." The retention may continue for a week, with occasional short intermissions, during which the urine comes away in small quantities; and then the urethra gives way, and the urine is extravasated. Each case will be variously modified: in one, the secretion of urine may be rapid and abundant, or the bladder may not be so dilatable as in other cases. It is evident, *ceteris paribus*, that the laceration will in these instances happen sooner, than in others, where the secretion of urine is slow and scanty, or where the bladder admits of great distention." (Op. cit. p. 15.) The complete or incomplete form of the retention will, above all things, make an important difference; for, where the distention is hindered from exceeding a certain degree by the occasional flow of urine, many days may elapse before the urethra is ruptured.

The local and general symptoms of an extravasation of urine, I have already described. The direction which the effused urine takes from the ruptured part of the urethra is into the cellular tissue of the perinæum, scrotum, and penis; and if it pass further, it ascends towards the groins, and over the parietes of the abdomen, even up to the outside of the ribs, as I have seen in several instances. The connexions of the superficial and deep perineal fasciæ prevent its extension backwards to the nates and anus, or downwards into the thighs. The surgeon is also to remember the important pathological fact, that when a patient has been repeatedly troubled with retention of urine from stricture, the membranous portion of the urethra behind the stricture becomes considerably dilated. This fact has an important bearing on the question, what operation should generally be preferred in these cases for the formation of an outlet for the urine, when other means have failed, and no more time can be devoted to them, without exposing the patient to all the risks of rupture of the urethra, and an extravasation of urine? Certainly it dictates that the preference should be given to the practice in which Sir Astley Cooper first led the way; but which is mentioned in the writings of Desault, though not with any commendation, and has a powerful advocate in Sir Charles Bell. It may be accomplished either by cutting in the line of the raphe, as I think is preferred by Mr. Guthrie, or else by making the incision as performed for opening the membranous part of the urethra in the lateral operation. If the first plan is followed, a staff should be introduced, if practicable, down to the stricture, just behind the bulb, and thus some guidance will be obtained respecting the place which should form the anterior boundary of the incision. As for its extension backwards, this must be such as will not injure either the rectum or the prostate gland. The staff, if it can be introduced, may also be

used in the other mode of making the incision, which is the plan that I have usually preferred, and in executing which I have always succeeded; and this, sometimes, without the staff. In the latter case, however, as Sir Benjamin Brodie has explained, and especially in a fat person, with a deep perinæum, great difficulty may be experienced. (Op. cit. p. 40.) However, so much more dangerous is a wound of the bladder than a wound of the urethra, and of the skin, fat, and muscles of the perinæum, that, I think, it must be a very particular case indeed which would justify the preference of puncturing the bladder. (See PARACENTESIS.)

Having made an outlet for the urine, and put an end to the immediate urgency of the case, what further is to be done? Ought a gum catheter to be passed from the wound into the bladder? No, it is not advisable, because the urine will escape without it, and it will only cause irritation. Would it be right to pass a catheter immediately into the bladder, through the urethra and the stricture, which will often admit a catheter, as soon as the urine has been voided, though it would not do so previously? I have sometimes adopted this method, in order to make progress in the removal of the stricture, and also with the view of healing up the incision, which the successful introduction of the gum catheter renders no longer absolutely necessary. In other cases, I have not done this, and allowed the urine to escape by the perineal incision, while the treatment of the stricture was continued with sounds, or bougies; then the wound usually heals, without difficulty, in proportion as the obstruction in the urethra yields. The latter plan is, on the whole, perhaps, the best, and always practicable, which the other sometimes is not.

When an urinary abscess has already formed, it is to be opened without the least delay, and the treatment of the stricture continued; and if the case be the more formidable one of extravasation of urine, the principal means of affording the patient the chance of preservation is that of making, without any loss of time, one or more free and deep incisions into the parts loaded with urine, care being taken to let the knife penetrate through the fascia of the perinæum. This will procure an outlet for much of the urine already effused, and, perhaps, save some of the textures from gangrene. Another indication is to get a catheter into the bladder, if practicable, whereby the further escape of urine through the ruptured part of the urethra will be in a great measure prevented: sometimes this can be accomplished; and sometimes not. In the latter case, particular care must be taken to let the incisions be very free; for on them the patient's life principally depends. In all these severe cases of effusion of urine, opium, wine, tonics, and the constitutional remedies, generally resorted to with advantage in other cases of gangrene, are here essentially required.

2. *Of the Retention of Urine to which Persons of advanced Age are liable.*—This disorder is so common in elderly persons, that it is generally allowed to be one of the grievances to which their period of life is particularly exposed. In them, the bladder is less irritable than in younger subjects, and hence it is not so soon stimulated by the presence of the urine. It fact, it is not until a painful sensation arises from the distention of the

coats of the bladder; that the patient is aware of the occasion to discharge the urine. The bladder then contracts; but still would not be able to expel its contents, were it not for the powerful action of the abdominal muscles; nor is the expulsion of the urine even now complete; since the bladder no longer retains the power of effacing the whole of its cavity; on the contrary, after each evacuation, some urine is still left undischarged, and already constitutes an incipient retention. The quantity daily augments, and, at length, not more than half the fluid contained in the bladder is voided at each evacuation.

The complaint particularly attacks old subjects of a plethoric state of body, and of sedentary and studious habits. It also especially afflicts those who, from carelessness, or indolence, do not take time enough to expel the last drops of urine; and others, who are accustomed to discharge their urine into a pot, as they lie in bed, instead of rising for the purpose.

In these cases, the urethra and neighbouring parts seem to be free from every disease capable of preventing the issue of the urine; which has always come away freely, and in a full stream, although it could not be discharged with the same force, nor to the same distance, as formerly. At length, instead of describing an arch as it flows out, it falls down perpendicularly between the legs. Towards the close of the evacuation, the patient is also not sensible of the final contractile effort of the bladder, of which he used to be conscious in his younger days. When he is about to make water, he is obliged to wait some time, before the evacuation commences; and, as the disorder increases, he cannot make water without considerable efforts; the quantity of urine, voided each time, manifestly decreases; the desire to empty the bladder becomes more and more frequent; and lastly, the urine only comes away by drops, and an incontinence succeeds a retention.

In this state, the patient's sufferings are not very great. The tumour, formed by the bladder above the pubes, is indolent; and, if it be pressed upon with some force, a certain quantity of urine is discharged from the urethra.

The retention of urine, arising from old age, is seldom complete: the urine, after having filled and distended the bladder, dribbles out of the urethra, so that the patient voids as much of this fluid in a given time, as he does in a state of health. Nor is this species of retention of urine commonly attended with very urgent symptoms. It does not occasion, like complete retention, a suppression of the urinary secretion in the kidneys; and as the urine escapes through the urethra, after the bladder is distended to a certain degree, the disorder does not produce a rupture, either of this organ or the urethra, and dangerous extravasations of the urine. The swelling of the bladder then continues, without any particular suffering, except a sense of weight about the pubes and perinæum. These circumstances have often led to serious mistakes, and to the disease being regarded as an abscess, or a dropsy.

The indications are to draw off the urine, and restore, if possible, the tone of the bladder. When the retention is incipient, the proper action of the bladder will sometimes return after cold applications are made to the hypogastric region, or thighs,

and the patient goes from a warm into a cool place, in order to make water.

The patient must also be strictly careful to empty the bladder immediately the least inclination to do so is felt; for if this precaution be neglected, the bladder grows more and more inert; the desire to make water subsides; and the retention, which at first consisted of only a few drops, soon becomes complete. It would then be in vain, as Desault observes, to try the expedients above recommended. No stimulus will now make the bladder contract sufficiently to expel the whole of the urine, and the catheter is the only thing by which this fluid can be discharged. This artificial mode of evacuation, however, affords but temporary relief: for, as the bladder is slow in recovering its tone, a relapse would be inevitable if the employment of the catheter were not continued. Hence, this instrument must either be left in the bladder, or introduced as often as the patient has occasion to make water. When a skilful surgeon is constantly at hand, or when the patient knows how to pass the catheter himself, Desault thinks it better to introduce the instrument only when the bladder is to be emptied, by which means the inconvenience, arising from the continual presence of a foreign body will be avoided. In this case, either a silver catheter, or an elastic gum one, may be used with equal advantage; but, if the instrument is to be kept in the bladder, one made of elastic gum, and provided with a curved stilet, is to be preferred. As, in old subjects, the urethra is flaccid, a large catheter is generally found to enter more easily than one of smaller diameter.

As the treatment must be continued for a long while, and the bladder seldom perfectly regains its tone in old age, the patient should be instructed how to introduce the catheter himself, and he is to pass it whenever he wants to make water. After a certain time, however, he may try if he can empty the bladder without this instrument. When he finds that he can expel the urine, he should assure himself, by means of the catheter, that the last drops of this fluid are duly voided. Should they not be so, he must persevere in the use of the instrument.

In this sort of retention, it has been proposed to throw into the bladder astringent injections: Desault tried them; but he does not give a favourable report of the practice.

Warm, balsamic diuretic medicines; as turpentine; balsam of copaiva; cold bathing; the tincture of cantharides; and liniments containing the same; have likewise been praised: but, according to Desault, these means are frequently hurtful to persons of advanced years, and seldom useful. He restricted his own practice to the use of the catheter, which, when skilfully employed, sometimes restored the tone of the bladder, and, when it failed, other means also were ineffectual. A blister over the sacrum has sometimes proved useful.

3. *Retention of Urine from an Affection of the Nerves of the Bladder.*—These nerves may be affected either at their origin, or in the course of their distribution. Injuries of the brain are sometimes followed by retention of urine; but the complaint still more frequently results from those of the spinal marrow, and injuries of the pelvis. A concussion of the spinal cord, from blows, or falls,

upon the vertebral column; the injury which it suffers in fractures and dislocations of the vertebrae; its compression by blood, purulent matter, or other fluid effused in the vertebral canal, and the effects which a caries of the spine has upon it; may all operate as so many causes of retention of urine. This form of the complaint may also be the consequence of tumours situated in the track of the nerves, distributed to the bladder. A retention of urine is not unfrequently noticed in persons who have met with a compound fracture, or other severe injuries of the lower extremities. I have seen many examples of this kind of case, which, I observe, is ascribed by Sir Benjamin Brodie to a paralytic affection of the bladder. (*On Dis. of the Urinary Organs*, p. 76. ed. 2.)

The retention of urine, common in typhus fever, arises from an affection of the nerves of the bladder, and may be analogous to the weakened state of the optic and auditory nerves, so frequent in the same kind of fever. Whatever the cause may be, however, the liability of patients in fevers to retention of urine should never be out of the practitioner's recollection. I was called lately to a lad about seventeen years of age, who had not been able to make water for many hours. He had had no complaint about the urethra; nor could he assign any cause for the retention. I observed, however, that he had typhoid symptoms; and, in fact, he was so weak, that he fainted while the urine was flowing out of the catheter. I directed him to be taken to University College Hospital, where, notwithstanding the use of the catheter and the best medical treatment, he died of typhus in less than a week. I mention this, as one of numerous cases of the same kind which I have seen.

When a retention of urine arises from injury or disease of the spinal marrow, an insensibility and weakness of the lower extremities are almost always concomitant symptoms. The patients suffer very little; most of them are ignorant of their condition, and do not complain of any thing being wrong in the functions of the urinary organs. The surgeon, aware that a retention of urine is common in these cases, should ascertain whether the bladder is distended or not, by manual examination of the hypogastric region, and, in the event of any doubt, by the introduction of a catheter.

As this species of retention of urine is only symptomatic, and not dependent upon any previous defect in the bladder, it is not in itself alarming; but with reference to its cause, it is exceedingly dangerous. Affections of the spine, complicated with injury of the spinal marrow, are often fatal. By means of a catheter, it is always easy to relieve the inconveniences arising from the bladder not contracting, and thus fulfil the only indication which this sort of retention of urine presents, viz. the evacuation of the urine. But this proceeding is merely palliative; and the bladder will not recover its contractile power until the causes of its weakness are removed. The last then is the main object in the treatment, which must vary according to the nature and extent of the disorder.

The consideration in detail of all the means which may be requisite for the relief of the different accidents and diseases of the spine, belongs to other parts of this work. (See DISLOCATIONS AND

FRACTURES OF THE VERTEBRÆ; VERTEBRÆ, DISEASES OF.) In shocks and concussions of the spinal marrow, Desault had a high opinion of the benefit resulting from cupping. This was done on or near the part of the back which had been struck, and the number of scarifications was proportioned to the strength of the patient. The plan was sometimes repeated the same day, and for several days in succession; and when the patient could not bear the loss of more blood, dry cupping was employed, which in this country would be deemed less efficacious than stimulating liniments or blisters. In diseases of the spine, Desault also preferred the moxa to caustic issues.

4. *Retention of Urine from over Distention of the Bladder.*—Desault thought that this form of the disorder might very properly be called *secondary*, because it is invariably preceded and produced by a *primary* retention. Of course, its remote causes are all those circumstances which may bring on the other forms of the complaint; but its immediate cause depends altogether upon the weakness and loss of irritability in the bladder, occasioned by the immoderate distention of its coats. The disorder frequently occurs in persons who, from bashfulness, indolence, or intense occupation, neglect to make water when they first have a desire, or who cannot for a time empty the bladder in consequence of some temporary obstruction in the urethra. Although the impediment to the escape of the urine no longer exists, and the bladder is in other respects sound, yet, as this organ has been weakened by the excessive distention of its coats, it cannot now contract sufficiently to obliterate the whole of its cavity, and expel the last portion of urine.

The indication is simple; for there is not here, as in other retentions of urine, another disease to be remedied. The catheter, when left in the bladder, generally proves adequate to the restoration of the tone of this viscus; I do not conceive, however, that English surgeons will place any confidence in warm diuretics, which were recommended by Desault, though they may join him in the approval of a tonic plan of treatment in general. When the urine flows from the catheter in a rapid stream, and is projected to some distance, and when it also passes out between the catheter and the urethra, it is a sign that the bladder has regained its power of contraction, and that it can empty itself without the aid of the instrument. In this circumstance the catheter is to be discontinued, and the patient may gradually resume his usual mode of life. But when the urine is discharged only in a slow stream, the catheter cannot be laid aside without the bladder becoming distended again, and losing whatever degree of tone it may have recovered.

The time, which the bladder takes to regain its power of contracting, varies considerably in different cases. When the disease is accidental and sudden, it frequently goes off in a few days. When it has come on in a slow manner, it usually lasts about six weeks. However, the cure is not to be despaired of if the paralytic affection of the bladder should continue much longer. Sabatier had seen patients wear a catheter upwards of ninety days, and yet ultimately get completely well. When there is reason for believing that the urine will come away of itself, the use of the catheter may be discontinued. When the patient makes

water very slowly; when he is obliged to make frequent attempts; and when he feels a sense of weight about the neck of the bladder, this organ has not completely recovered its tone, and the employment of the catheter is still necessary. When the patient could make water tolerably well in the day, but not during the rest of the twenty-four hours, Sabatier often saw benefit arise from the catheter being worn only in the night-time.

When three or four months elapse without amendment, Sabatier states his conviction that the tone of the bladder is lost for ever. In this unfortunate case, the patient may continue the gum catheter, which he should be taught to introduce himself as often as necessary. (*Sec Méd. Opératoire*, t. ii.)

Among the means deserving of trial when the contractile power of the bladder does not return with the use of the catheter, I may mention the tincture of cantharides, bark, the sulphate of quinine, steel medicines, blisters applied to the sacrum and kept open with the savine ointment, and sea-bathing, or cold washes to the hypogastric region.

In all cases where the incapacity of the bladder to contract, whether from weakness or paralysis, is the cause of retention, and where, though the bladder continues distended, a certain quantity of urine is voided daily, mistakes are particularly liable to be made. Thus, besides the chance of the disease being mistaken for an abscess, which, as Colot states, was not uncommon in his time, other errors may take place. Sabatier was consulted about a lady who had been advised to repair to some distant mineral waters, with the view of dispersing a tumour which remained after a difficult labour, and was supposed to be in the uterus itself. However, the swelling turned out to be only a retention of urine, as it disappeared as soon as the catheter was introduced. Here no suspicion had been entertained of the real nature of the case, because the patient had voided her urine without any apparent difficulty, and in reasonable quantity, for the five or six weeks during which the swelling existed.

In a thesis by Murray, a case is recorded, in which the swelling of the bladder was so considerable that it was mistaken for dropsy. The abdomen of a delicate woman began to enlarge, without any particular pain, and the cause was at first supposed to be pregnancy; this idea, however, was removed by the enlargement increasing too rapidly, attended with a great deal of anasarca of the lower extremities, arms, and face. The patient was now considered to be dropsical; and a surgeon was sent for to tap the abdomen. The fluctuation in the belly was quite evident. Fortunately, before the operation was performed, a trial of diuretic medicines was determined upon: and while this plan was going on, the patient was attacked with a total retention of urine for three days; a symptom which she had not previously suffered. It was now judged prudent to pass a catheter before the trocar was employed. Eighteen pints of urine were drawn off, and the swelling of the abdomen subsided. The next day twelve more pints of urine were drawn off. The anasarca, which was entirely symptomatic, disappeared. The application of cold water re-established the tone of the bladder, so that when three pints of urine had been drawn off by means of the catheter, the pa-

tient herself could spontaneously expel three or four others with the aid of pressure on the hypogastric region.

The retention of urine caused by weakness or paralysis of the bladder, and the swelling above the pubes, may continue a long while without any inconvenience excepting a sense of weight about the hypogastric region, and frequent inclination to make water. Sabatier has known patients labour under the complaint more than six months.

I remember visiting, with Mr. Miller, of Keppell Street, an old man whose bladder had lost its contractile power, and was so enormously distended that it caused a swelling, which rose very high up towards the ensiform cartilage; and, what is remarkable, there was a pulsation in it, resulting from its lying closely against the large arteries of the pelvis, and, perhaps, the bifurcation of the aorta.

5. *Retention of Urine from Inflammation of the Bladder.*—Desault was perhaps not correct in referring one species of retention to an inflammation of the textures of the bladder generally, and including its muscular fibres, which, he argues, are weakened by the inflammation, and indisposed to act. There is a kind of painful ischuria, not a retention of urine, resulting from an occasional inflammation of the mucous lining of the bladder: as for the effects of an inflammation of the detrusor urinae, I know nothing of them from experience.

Acute inflammation of the testicle or prostate gland may follow the sudden stoppage of gonorrhoea, but in less frequent instances it attacks the mucous membrane of the bladder itself. The latter texture is also sometimes inflamed from the internal or external employment of cantharides. "The patient has a frequent desire to void his urine, with a sensation as if there were urine in the bladder, when there is really no urine in it; and he strains to make water when the bladder is empty." (*Sir B. Brodie, Op. cit.* p. 82.) Desault's account of the symptoms is accurate. He says:—"This form of the complaint makes its attack suddenly, and may be known by the frequent desire to make water; the acute pain in the region of the bladder; pain, which is increased by the efforts to make water, and which shoots up to the loins and along the urethra to the end of the glans; by the frequency and hardness of the pulse, and other symptoms of fever; by the aggravation of the pain, when the hypogastric region is pressed; by the easy passage of a catheter into the bladder; by the acute pain which is excited by the instrument touching the inside of this organ; and by the red inflammatory colour of the urine."

This is not properly a case of retention of urine, but rather of painful and frequent micturition; the bladder being so irritable as to be incapable of bearing even the smallest quantity of urine within it. Hence Desault's theory, which led him to enjoin the use of the catheter, was practically wrong and hurtful, as the bladder is always emptying itself, and the instrument would only increase the inflammation.

The inflammation is to be counteracted by the most powerful antiphlogistic remedies; large and repeated venesections; cupping on the loins; the application of leeches to the perineum and hypogastric regions; the warm bath; occasional doses

of castor oil; opiate clysters; fomentations on the abdomen; and cold mucilaginous beverages.

"Sometimes (as Sir Benjamin Brodie remarks) the urine retains its acid quality, turning the blue litmus paper red; and the sediment which it deposits is of a yellowish colour, having no adhesive quality, and bearing some degree of resemblance to pus; and in these cases, if I am not much mistaken, the patient will derive benefit from the use of mercury, two grains of calomel, and half a grain of opium, being administered twice or three times a day. In other cases the urine is alkaline, turning the reddened litmus paper blue, and depositing a small quantity of tenacious adhesive mucus of a brown colour; and, under these circumstances, I have known much good to arise from the use of the vium colchici, thirty drops being given three times daily for three or four successive days." (Sir B. Brodie, *Op. cit.* p. 83.)

6. *Retention of Urine from Hernia of the Bladder.*—An inability to discharge the urine is a symptom generally attending hernia of the bladder. But the weakness of this organ is not always the sole cause of the infirmity; for the urethra itself makes greater resistance than natural to the issue of the urine. As the neck of the bladder is drawn out of its right position by the portion of this organ which actually protrudes, the beginning of the urethra also undergoes an elongation and a change of its curvature by being pressed towards the symphysis of the pubes, and its diameter is likewise diminished. The urine may also be detained in the pouch composing the hernia, in consequence of the communication between this and the rest of the bladder being too small or indirect, or perhaps from the hernial portion not being compressed by the action of the abdominal muscles, or capable of any contraction itself. However, the rest of this organ within the pelvis can itself rarely expel the last drops of the urine. Its complete contraction cannot be accomplished without great difficulty; and, in the end, it almost invariably follows that the urine is retained both in the protruded and unprotruded portions.

When a retention arising from a hernia of the bladder is complete, and occurs in both parts of this organ, there is, in addition to the symptoms common to other retentions produced by weakness of the bladder, a more or less considerable swelling in the situation of the hernia. The tumour is unattended with any change of the colour of the skin; is not very tender; and it presents a feeling of fluctuation sometimes obscure, sometimes very distinct. When the swelling is pressed upon, the desire to make water is excited or increased, and occasionally a few drops escape from the urethra. As soon as the urine has been drawn off with a catheter, and the patient is put in a posture in which the protruded portion of the bladder is higher than the rest of this organ within the pelvis, the tumour subsides, and it is some time before it becomes large again.

When the hernia is recent, and the protruded portion of the bladder small and reducible, the part ought to be returned and kept up with a truss. When the part is adherent and irreducible, the swelling ought to be emptied by pressure, and supported with a suspensory bandage. If the hernia could in this manner be made to return gradually into the abdominal ring, a truss would afterwards be requisite. Proposals have been

made to endeavour to excite adhesive inflammation in the cavity of the protruded part of the bladder by compression, gradually increased, and thus obliterate the pouch in which the urine lodges. Although Desault thought the attempt cautiously made justifiable, he deemed the result very uncertain.

Were the retention of urine accompanied with a strangulated state of the protruded bladder, and if the contents could not be pressed into the other part of this organ, a puncture of the swelling with a trocar has been advised; but if there were an enterocele also present, as often happens, this operation would be attended intestine. Hence, Desault preferred opening the tumour by a careful incision, and he even approved of cutting away the protruded cyst, if the communication betwixt it and the rest of the bladder were obliterated.

7. *Retention of Urine caused by displacements of the Viscera of the Pelvis.*—The displacements here signified are a retroversion, prolapsus, and inversion of the uterus, and a prolapsus of the vagina or rectum. When the intimate connexions of the bladder with the uterus, and vagina in the female, and with the rectum in the male subject, are considered, it is obvious that the latter parts cannot be displaced without drawing along with them the bladder; and that in this state, whatever may be its contractile power, it cannot contract so perfectly as to expel the whole of the urine. To this deficient action of the bladder is necessarily joined an increase of resistance on the part of the urethra; for the beginning of this canal being drawn by the bladder, changes its accustomed direction, and such alteration cannot be made without the sides of the tube being pressed together. Thus the retroverted uterus draws the os linæ above the pubes, and the posterior part of the bladder is displaced, which, in its turn, draws along with it the commencement of the urethra, pulls it upwards, and increases the curvature, which this canal describes under the symphysis of the pubes, against which it is forcibly applied.

In a prolapsus, or inversion of the womb, vagina, and rectum, the back part of the bladder, instead of being drawn upward and forward, is pulled downward and backward, and the curvature of the urethra is totally altered. Below the pubes, the bladder forms a convexity, and not a large concavity, as in the instance of a retroversion of the womb. This position of the parts should always be recollected in passing the catheter, as it shows what curvature and direction should be given to the instrument, in order to facilitate its introduction.

These retentions of urine are not often followed by any very bad consequences. It is generally sufficient to rectify the wrong position of the bladder, and the commencement of the urethra, by the reduction of the displaced viscera; and a cure is then a matter of course, unless the excessive distention should have induced considerable weakness of the bladder, in which event recourse must be had to the means previously recommended for this state of the organ. The reduction of the viscera generally forms the first indication, and the manner of accomplishing it is described under the head of UTERUS. When the reduction is not immediately practicable, or when it fails to remove at once the retention of urine, the catheter

is to be used. Frequently, when the urine has been drawn off, the reduction becomes more easy; but, sometimes, the altered direction of the urethra renders the introduction of the catheter difficult; nor will the instrument pass, unless it be accommodated to the preternatural state of that canal. Thus, in the retroversion of the uterus, a catheter very much curved answers better than one nearly straight, like that commonly used for females.

A curved catheter, says Desault, also answers in cases of prolapsus uteri, &c.; but with this difference, that in a retroversion, the concavity of the instrument must be turned towards the pubes, but in the prolapsus, towards the anus. Sometimes the catheter will not pass unless it be rotated, as it were; and sometimes, when a silver catheter cannot in any manner be introduced, an elastic one will readily enter.

Were every effort to reduce the viscera and pass a catheter unavailing, and the hazard of the bladder giving way urgent, the surgeon would be called upon to let out the urine with a trochar. (See BLADDER, PUNCTURE OF.)

8. *Retention of Urine from the pressure of the Uterus, or Vagina, on the Neck of the Bladder.*—Besides the distention of the uterus and vagina in pregnancy and parturition (which cases I mean to pass over as belonging more properly to midwifery), there are other conditions of these organs which may give rise to a retention of urine. Thus, it sometimes arises from the presence of various kinds of tumours, or collections of blood or other fluid in the uterus or ovary; or the distention of the vagina with the menses, pessaries, &c. Mr. Colly, of Bridgenorth, has very lately recorded an instance of retention of urine in a young lady, 16 years of age, from imperforate hymen, which, by totally preventing the discharge of the menses, had produced a mechanical obstruction of the meatus urinarius. (See *Trans. of Prov. Med. Association*, vol. i. p. 68. ed. 2.) I have in several instances been called upon to divide a part of the hymen in children, on account of a portion of it extending over the meatus urinarius, and creating an impediment in the easy discharge of the urine.

In such cases, the retention of urine being only symptomatic, the prognosis must depend upon the nature of the cause, of which the interruption of the urinary evacuation is only an effect. The latter complaint is here not very dangerous, because its inconvenience may be obviated by means of the catheter. But when the cause of the retention of urine is easily removed, and the tone of the bladder is not impaired, even the catheter is not always necessary, as when the complaint is induced by a pessary; or collection of blood or of the menses, in the vagina. In other examples, in which the cause of the difficulty of making water cannot be immediately obviated, as in cases of tumours, the catheter must be employed. In scirrhus and cancerous diseases of the uterus, also, this instrument is the only means of relieving the retention of urine, as nature and art can do little for the removal of the cause. It ought to be known, however, that as these last diseases increase, an incontinence often succeeds to a retention of urine, in consequence of ulceration taking place between the upper surface of the vagina and the lower part of the bladder.

9. *Retention of Urine from pressure of the*

Rectum upon the Neck of the Bladder.—Abscesses in the vicinity of this intestine, hemorrhoidal tumours; alvine concretions; and the scirrhus contracted state of the gut, &c., may bring on a retention of urine by pressure on the neck of the bladder. The irritation, also, existing in these cases, may tend to produce the complaint by exciting a spasmodic contraction of the neck of the bladder, and of all the muscular fibres capable of affecting the membranous portion of the urethra. Here the relief of the retention of urine is to be effected by removing or curing the other disorder which operates as its cause. If this cannot be immediately accomplished, the catheter must be used, though, in several instances, it will be better to avoid the irritation of the catheter, and try the effects of bleeding, the warm bath, and opium, which will frequently enable the patient to make water. The last means, however, will not suffice when the cause of the retention is likely to continue a long time.

10. *Retention of Urine from Foreign Bodies in the Bladder.*—Without stopping to consider the uncommon kinds of retention produced by carcinoma, fungous diseases, and hydatids in the bladder, I will pass on to the case in which the urine is obstructed by a calculus at the neck of the bladder. Here the patient, by altering his position, frequently changes the situation of the stone, and is immediately able to make water again. However, this expedient will only procure relief while the calculus is loose in the cavity of the bladder; for after it has become fixed in the commencement of the urethra, it must either be pushed back with a catheter, taken hold of and brought out with the urethral forceps used by Sir A. Cooper, broken or pulverised by lithotritic instruments, or extracted by a kind of operation resembling the apparatus minor. (See LITHOTOMY, and URINARY CALCULI.)

Many instances of various kinds of worms in the bladder are upon record. On this subject, an interesting paper was published by my friend Mr. Lawrence, who met with an example in which an undescribed species of worms was abundantly voided from the bladder. "The origin of those animals (says Mr. Lawrence) which inhabit the internal parts of living bodies, is involved in much obscurity. Although the intestinal worms appear manifestly, from their peculiar form, consistence, and organs, to be particularly designed for those situations in which they are found; although they have generative organs, and no similar animals are known to exist out of living bodies, yet it has been generally conceived that the germs from which they spring enter from the mouth. The production of hydatids in various parts of the body cannot, however, be accounted for on such a supposition; neither can we very easily conceive that ova should enter from without into the urinary organs." The following facts, also stated by Goetze (as Mr. Lawrence observes), entirely overturn this opinion. Professor Brendel, of Göttingen, found ascarides in the rectum of an immature embryo. Blumenbach discovered tæniæ in the intestinal canal of young dogs a few hours after birth, &c. (*Versuch einer Naturgeschichte der Eingeweidewürmer*, p. 55.) The case which Mr. Lawrence has recorded exhibits an unquestionable instance of peculiar and undescribed worms voided from the urinary passages. This gentleman says

that he knows of, no other case in which a distinct species of worm has been clearly proved to come from the bladder. Most of the cases published were instances of common intestinal round worms, which sometimes perforate the intestines, and are discharged by abscesses, or get into the bladder after the formation of adhesions betwixt this organ and the bowels. In other instances, coagula of blood, mucus, or portions of the mucous coat of the bladder, have been mistaken for worms; and, as Mr. Lawrence further observes, some of the descriptions can apply only to larvæ of insects. Two specimens of this last sort he has seen himself, which were sent from the country as worms voided from the bladder. (See *Medico-Chir. Trans.*, vol. ii. p. 382, &c.)

In whatever way these animals get into the bladder, a retention of urine may be produced; either when they are numerous, or when there is only one present, but large enough to obstruct the vesical orifice of the urethra. In the very curious example related by Mr. Lawrence, the passage of the urine was obstructed, and the use of the catheter continually necessary. The oil of turpentine was given internally, with some appearance of benefit at first; but it afterwards brought on febrile symptoms and erysipelas, and its exhibition could not be kept up. It was then injected into the bladder, with an equal part of water. This rather accelerated the discharge of the worms; but they came away at times, whether the injection was used or not; and as this means produced the erysipelatous indispotion again, it was left off. Olive oil was afterwards injected; the irritation after it was less, and the fits of pain about the bladder less violent. It was calculated, at the time when Mr. Lawrence was writing the particulars of the case, that from 800 to 1000 worms had been discharged. For a detail of the symptoms, and a particular description of the worms themselves, I must refer to the above-mentioned publication.

Retention of urine is frequently occasioned by coagula of blood in the bladder. The blood sometimes comes from the kidneys, sometimes from the bladder, and sometimes it regurgitates from the urethra. While fluid, it may be expelled with the urine; but when coagulated, it is no longer capable of being discharged. It is the blood which passes into the bladder after wounds, or the operation of lithotomy, that is most disposed to coagulate. If the clots were too large to pass through a catheter, the best plan would be to inject into the bladder lukewarm water, for the purpose of loosening and dissolving them. An instance of retention of urine from a large quantity of coagulated blood in the bladder, is related in the 2d vol. of the *Medical Gazette*, p. 255. The injection of warm water, and the use of a very long catheter, succeeded in procuring the discharge of the urine.

I have frequently been called to retentions of urine, both in males and females, caused by lodgment of blood in the bladder. In women this sometimes happens where cancerous disease has extended into the bladder from the uterus, or the rectum, though more commonly, under these circumstances, the urine dribbles away involuntarily through the ulcerated opening. But I once attended a female in Southampton-Row, with cancer of the womb, whose bladder was full of blood,

and who required the catheter and injections of tepid water to enable her to void her urine. In the *Med. Chir. Trans.* I have given an account of a gentleman's coachman, who had a fungated scirrhus within the bladder. After passing some bloody urine, he found that he could not make water at all. I introduced a large catheter, and relieved him for about ten days. As he was turning himself in bed, about this period, the upper part of the thigh bone broke; and on examining the broken part, I perceived around it a large indurated mass. In another week he died. On opening his body, a considerable fungus, the source of the hemorrhage in the bladder, and the cause of the retention of urine, was discovered. The preparation of the bladder, and also sections of the fractured thigh bone, with the scirrhous mass around it, I placed in University College Museum. Two examples of fungous growths in the bladder, causing hemorrhage and retention of urine, and death, have been lately recorded, by Mr. Bransby Cooper. (See *Guy's Hospital Reports*, vol. i. p. 202—205.)

In the course of the present summer (1838), I was desired to visit a gentleman at Kingsland, with Mr. Jones of that place. The patient, a few days previously, had been attacked by retention of urine, attended with great pain in the left lumbar region and hip. What urine came away was blended with blood; and sometimes a copious quantity of a viscid clear fluid, like white of egg, was voided. I introduced a catheter, and sounded the patient; but, as I expected, there was no calculus. The age of the patient, and the ease with which a catheter of ordinary size reached the bladder, assured me that there was no disease of the prostate gland. The pain in the loins, and the patient's impaired health and sallow countenance, therefore, led me to say at once that the left kidney was the seat of disease, and that the blood which had caused the retention had descended into the bladder from the kidney. The urine soon became clear again, and was discharged without any difficulty: but the health continued to decline; the left lower extremity became very painful and cedematous; and in less than three months the case had a fatal termination. This gentleman was seen once by Sir B. Brodie with me and Mr. Jones, and he took the same view of it. The *post mortem* examination detected a medullary enlargement of the left kidney; and some degree of the same disease in the right. The urine at the time of Sir B. Brodie's visit was remarkably albuminous.

A retention of urine has sometimes arisen from the entrance of a piece of bougie into the bladder; even whole bougies, which had not been properly secured, have been known to glide into the cavity of that organ. As Desault observes, the urethra appears to possess a kind of antiperistaltic action, by which it tends to draw into the bladder whatever substances it includes; for, says he, it is constantly noticed, that when these substances are once within the urethra, if they be not expelled by the urine, they always advance towards the bladder; a circumstance which cannot be accounted for by their weight.

The insinuation of foreign bodies into the bladder is a serious occurrence both for the patient and surgeon. The former cannot avoid the consequence which will sooner or later originate from the extraneous substance, except by submitting to

a dangerous and painful operation; the latter will be accused of being the author of all the evil, and will find it difficult to exculpate himself. In order to obviate the necessity of cutting into the bladder, in such cases, Dessault proposed the use of small spring forceps, passed into the bladder through a cannula. I think that the surgeon should try what can be done with the urethra-forceps, shaped like a sound, and employed by Sir A. Cooper for the extraction of small calculi from the bladder, by the forceps used in lithotomy. (See LITHOTRITY, LITHOTOMY, and URINARY CALCULI.)

The following is an example of a piece of catheter, three inches long, being extracted from the bladder by means of Weiss's instrument. "On passing a sound (says Mr. Tyrrell) I discovered the piece of catheter, lodged at the fundus of the bladder transversely; its extremities being embraced by that viscus, so as to be held with some firmness. I dislodged it by passing the end of the sound beyond it, and drawing it forwards, moved it to the lower part of the bladder behind the prostate gland; where by sounding, I ascertained that its position was still transverse. From the freedom and extent to which I could move the sound, I concluded that the bladder contained several ounces of urine, and that it was sufficiently distended to afford good opportunity for conducting the plan I had decided to adopt for extracting the piece of catheter. The patient was placed on a bed in a half sitting posture, with his thighs semiflexed. The sound was withdrawn, and I then introduced one of Weiss's instruments for extracting small calculi, which was nearly straight, and had a strong spring. By careful examination with it, I discovered that the extremity of the foreign body, towards the patient's right side, was free, and that the other was covered with a fold of the bladder. After several unsuccessful attempts, I succeeded in seizing the free extremity with the instrument, and, by withdrawing it very cautiously, I brought the piece of catheter into the urethra; when the forceps slipped from it. I immediately introduced my finger into the rectum, for the purpose of compressing the urethra between the foreign body and the bladder, so as to prevent any retrograde movement of the former. This being secured, I again introduced the forceps into the urethra, and, in the first attempt, caught the piece of catheter and drew it out." (*St. Thomas's Hospital Reports*, vol. i. p. 26.)

11. *Retention of Urine from Inflammation of the Urethra.*—In order to comprehend the mechanism of this case, it is necessary to remember that inflammation never exists without swelling, and that every tumefaction of the lining of the urethra must necessarily lessen its diameter. Inflammation of the urethra is most commonly produced by the external application, or internal exhibition, of cantharides; by gonorrhœa; the unskilful use of the catheter; the employment of stimulating injections; bougies, &c. Together with the lessening of the canal by the effect of swelling, there can also be no doubt, that, in many of these instances, a spasmodic contraction of the muscles near the urethra and neck of the bladder also contributes to the retention of urine. Although I have observed that inflamed parts, endued with a contractile power, were not disposed to contract in that state, yet, it should be recollected that, even admitting this to be true, the urethra may be inflamed; and without supposing any

muscular action of its own, there may be a spasmodic action of the muscles here referred to, without supposing them to be themselves involved in the inflammation. Besides, it is to be considered that inflammation is attended with a swelling of the textures affected by it, and thus a diminution of the free state of the urethra may be conceived. The effects of opium, tobacco, and other antispasmodics, often evinced in immediately relieving these kinds of retention of urine, seem indeed to leave no doubt respecting the existence of more or less spasm. Whatever may be the cause of inflammation of the urethra, the diagnosis is free from all obscurity. Besides the general symptoms of inflammation, the patient complains of a scalding sensation in the passage; he experiences a great deal of smarting, which is sometimes insupportable, when he makes water; the penis becomes in some degree swollen, and more tender; and a very little pressure on the urethra gives acute pain. In the mean time, the stream of urine becomes lessened; and, at length, this fluid can only be voided in a very narrow current or only by drops, and often not at all.

The disorder is to be treated on antiphlogistic principles. Diluting; cooling, mucilaginous beverages; venesection; leeches to the perinæum; the warm bath; opium, particularly in the form of clysters; 40 or 50 drops of tincture of hyosciamus with liquor potassæ, every four or six hours; and fomentations; are the means which usually give relief. When inflammation exists in the urethra, it is always desirable to avoid, if possible, the employment of catheters, which create irritation, and of course increase the cause of the retention. It is particularly in cases of this description, and in the retentions of urine arising from strictures, that Mr. Earle suggested the use of tobacco in the form of clysters. (*See Med. Chir. Trans.* vol. vi. p. 82, &c.) But, notwithstanding what I have now stated, if the retention is not relieved, the catheter should not be deferred too long.

12. *Retention of Urine from Laceration of the Urethra.*—The urethra is sometimes ruptured by violent contusions on the perinæum; by fracture of the ramus of the ischium, or os pubis, and displacement of a sharp fragment of the bone; and by the rough and unskilful use of bougies, sounds, and catheters. The consequences usually are an extravasation of urine in the cellular membrane of the scrotum and penis; a considerable dark-coloured swelling of these parts, often followed by sloughing, and inability of properly voiding urine. The treatment consists in introducing a gum catheter into the bladder, with as little delay as possible, and keeping it there until the breach in the canal is repaired. At the same time, the evils threatened by the effusion of the urine are to be averted as much as possible, by making one or more free and deep incisions in a depending part of the swelling, caused by any effusion of urine, and by the employment of fomentation, and antiphlogistic remedies.

13. *Retention of Urine from Tumours situated in the Perinæum, Scrotum, or Penis.*—A retention of urine sometimes arises from abscesses; extravasation of blood; calculi formed in the perinæum and scrotum, within a urinary fistula; the pressure of a sarcocele; hydrocele; a large scrotal hernia; aneurism of the corpus cavernosum; a ligature or tight ring on the penis, &c.

The radical cure of all such retentions of urine, can only be accomplished by curing the disease, on which they are dependent. However, until the cause can be obviated, the urine must if possible, be drawn off with a catheter. Elastic gum catheters usually enter more easily, than those made of silver, as by their flexibility they accommodate themselves better to any deviation of the urethra from its ordinary direction. Desault particularly recommended a catheter of middling size to be selected, and introduced armed with its stilet, until it stops in the canal; when he advised the stilet to be withdrawn for about an inch, in order to leave the beak of the instrument quite free, so that it might follow the curve of the urethra. Then the tube and the stilet were pushed further into the canal, care being taken, however, to keep the stilet drawn back some distance from the extremity of the instrument. With these precautions, Desault generally succeeded in passing the catheter into the bladder. Should the introduction prove neither painful, nor difficult, he thought it better not to annoy the patient by making him continually wear the instrument.

14. *Retention of Urine from Disease of the Prostate Gland.*—When the swelling of the prostate gland is of an inflammatory kind, the retention of urine makes its appearance with the same kind of symptoms, as attend inflammation about the neck of the bladder. Here, similar treatment to that commonly adopted for the retention of urine, produced in the latter case, is indicated; particularly bleeding, leeches to the perineum, fomentations, the warm bath, opening medicines, anodyne clysters, the tinctura ferri muriatis, and, in obstinate urgent cases, an opiate enema. If these means fail, the surgeon may gently endeavour to introduce a catheter.

The symptoms of the retention of urine, caused by chronic enlargement of the prostate gland, and the nature of the impediment to the discharge of that fluid, in such a case, are explained in another part of this work. (See PROSTATE GLAND.) From the remarks there introduced, it appears, that, when the evacuation of the urine begins to be impeded, the catheter should be employed without delay, since the warm bath, opium, hyosciamus, and other narcotics, are here of little service, the impediment to the flow of urine not being spasmodic, but dependent upon changes in the prostate gland, and prostatic portion of the urethra, which operate mechanically in preventing the egress of the urine. And, as Sabatier long ago observed, the urine may not be discharged, though the instrument enter a considerable way, either because its beak becomes entangled in the prostate gland, or between a swollen portion of this gland and the neck of the bladder, and does not reach the urine. Hence, he recommended the employment of a catheter with a very long beak, bent considerably upwards. When, however, all efforts to pass a catheter fail, the only resources are to force a passage with a conical catheter, or to puncture the bladder above the pubes. The latter proceeding is rarely necessary in this particular form of retention of urine, as, with moderate skill, an instrument may almost always be passed by the urethra. Such is also the opinion of Sir Astley Cooper. (See CATHETER, BLADDER, PUNCTURE OF, and PROSTATE GLAND, DISEASE OF.)

15. *Retention of Urine from the Lodgment of Foreign Bodies in the Urethra.*—That such acci-

dent must obstruct the discharge of urine, is too plain to need any particular explanation. Calculi are the most common substances, which bring on this kind of case, but articles introduced into the urethra from without, such as bougies, large pins, &c., are occasionally lodged in the passage; and I once extracted from a man's urethra a long, black pin, with which he had been examining the passage. The head of it was towards the perineum, and the point about two inches from the orifice of the glans. I passed the point through the lower surface of the urethra, and then taking hold of it, drew it further out, turned the head towards the glans, from the orifice of which it was then easily removed. Laennec saw a calculus, as large as a hen's egg, lodged in a child's urethra, the mucous membrane of the part presenting in some points a semi-cartilaginous texture. Indeed, M. Andral mentions this case to corroborate his suspicion, that a mucous membrane may admit of the cartilaginous transformation. (*Andral, Anat. Pathol. t. i. p. 282.*) This child, doubtless, lost its life from the stoppage of urine thus produced, and not duly relieved by the extraction of the foreign body. When calculi lodge, oily injections have been tried, with the view of rendering the passage more slippery, but I believe they have never been of any use. The dilatation of the canal with bougies and catheters, followed by a very forcible expulsion of the urine, has occasionally answered. The ancients sometimes tried the effect of suction. When the foreign body is closely embraced by the urethra, and it cannot be pushed forward by the fingers, Desault recommends endeavouring to extract it with the forceps, invented for the purpose by Mr. Hunter, and which are contained in a cannula; and the urethral forceps, spoken of in the articles *Lithotomy* and *Urinary Calculi*, are better. When, however, the foreign body is too large to be taken out in this manner, it must either be seized and broken with Weiss's small urethral lithotrite, or be extracted by an incision. If an elastic catheter be now kept in the urethra, so as to prevent the urine from coming into contact with the cut part, the wound will mostly heal without difficulty, unless it happens to be, as Dieffenbach explains, in the anterior portion of the urethra. A case is recorded of calculus in the urethra, attended with dysury, where almost instantaneous relief was obtained from the exhibition of a tobacco clyster. The patient soon felt a strong desire to void his urine, and "upon making the attempt, a large calculus came rolling along the urethra, with complete relief of all his complaints." (*See Edinb. Med. and Surgical Journal*, vol. xii. p. 373.)

From what has been stated in the foregoing pages, it appears that the causes of retention of urine are numerous and diversified, each case demanding also, on this account, some peculiarity in the treatment. The following extract from a lecture by Mr. Travers, is replete with instruction, and will make a very appropriate termination of the present article. "It might happen to you (says Mr. Travers) as it has to me, to be called to a patient whose belly is much distended, who is suffering great pain, and into whose bladder you pass a full-sized catheter without any difficulty, and not a drop of urine escapes. However, you feel assured that you have made no mistake, because that peculiar sensation of free motion of the extremity of the catheter with which every man is

familiar, who is accustomed to use it, satisfies you that the instrument is in the bladder. But no relief follows; and in the course of a few hours, or at all events in a very few days, the patient dies. I was called to such a case a few miles out of town. It occurred in a corpulent gentleman, in whom, after death, I found that both ureters were filled with calculi, one at the renal and the other at the vesical extremity, so that not a drop of water found its way from the kidneys to the bladder. The effect of this was to produce an absorption of urine, and arrest the secretion of the gland. In another case, which was under my care many years ago, the same thing happened, only it was more gradual and complicated. First of all there was great dysuria, and then what appeared to be suppression of the secretion, ischuria renalis. We found on one side a very diseased kidney, and a rosebud carcinomatous fungus, shutting up the corresponding ureter at its termination in the bladder; and the other, by which the urine was chiefly secreted, had a calculus impacted in its duct; so that here again it was the ureter and not the urethra that was in fault, though the case was strictly one of retention of urine. I need not say, that in such a case one can do no good. Some time ago a body was opened in St. Thomas's Hospital, in which there was an enormous sac, like a secondary bladder, formed out of the canal of the ureter, which had become obstructed and actually doubled upon itself. My son conducted the examination: it occurred in a patient under the care of Dr. Williams." (See *Lond. Med. Gaz.* vol. xvii. p. 827.)

Fr. M. Colot, Traité de l'Opération de la Taille, avec des Obs. sur la Formation de la Pierre, et les Suppressions de l'Urine, &c. 12mo. Paris, 1727. *Sabatier, De la Médecine Opératoire, t. ii. C. B. Trep, Remarks on Morbid Retentions of Urine, 2d ed.* 8vo. Gloucester, 1784. *Hey's Practical Obs. in Surgery, ed. 3. Schreger, Chirurgische Verläufe, p. 187, &c. of Ischuria Calculosa, 8vo. Nürnberg, 1811. Desault's Parisian Chirurgial Journal, S. T. Soemmering, Abhandlung über die schnell und langsam tödtlichen Krankheiten der Harnblase und Harnröhre bey Männern in hohen Alter.* 4to. Frank. 1809. *Richter, Anfangsgründe der Wunddarneykunst, b. vi. p. 210, &c. Œuvres Chir. de Desault par Bichat, t. iii. Desault et Chopart, Traité des Maladies des Voies Urinaires, 8vo. 1796. Nuche, Nouvelles Recherches sur les Retentions d'Urine par Rétrécissement de l'Utrère, et par Paralysie de la Vessie, &c.* 8vo. Paris, 1806. *Hunter's Practical Obs. on the Treatment of Strictures, p. 3 vols., and on Diseases of the Prostate Gland, 2 vols.* 8vo. Lond. 1811-1818. *H. Earle, in Medico-Chir. Trans. vol. vi. p. 82, &c. J. Hoveship, on Diseases of the Urinary Organs, 8vo. Lond. 1823. B. Phillips, On the Urethra, its Disposes, &c.* 8vo. Lond. 1832. *G. Macbain, On Dis. of the Mucous Canals, &c.* 8vo. Lond. 1830. *Str. Benj. Brodie, On Dis. of the Urinary Organs, ed. 2.* 8vo. Lond. 1835. *Robert Liston, On Practical Surgery, p. 369, &c.* 8vo. Lond. 1837. *Alf. Félpeau, Nouv. Élém. de Méd. Opér. t. iii.* 8vo. Paris, 1832.

UTERUS, INVERSION OF. This case may either be complete or incomplete. When it is incomplete, only the fundus of the uterus passes through the os tincæ. When the inversion is complete, the uterus becomes entirely turned inside out, passing through the opening in its cervix, dragging along with it a part of the vagina, and descending more or less far down, sometimes even between the patient's thighs.

The inversion of the uterus mostly arises from the manner in which the placenta is extracted after delivery. Immediately after parturition, the uterus is not yet contracted, and its cervix is in a widened state. When things are thus disposed, the uterus may easily follow the after-birth, which

is attached to it, and thus become inverted. The event is particularly liable to happen; 1st. When a premature attempt is made to extract the placenta. 2dly. When the funis is pulled outward without due care being taken to support the uterus with the fingers of the left hand. 3dly. When the operator draws out the after-birth too roughly and violently. Though the placenta is sometimes so adherent that its extraction is difficult, and a risk must be encountered of dragging down the uterus with it, this disagreeable accident may generally be avoided by performing the necessary separation of the parts with the fingers, introduced into the cavity of the uterus.

The inversion following delivery, does not always proceed from unskilfulness; but sometimes happens, notwithstanding every precaution, either because the patients themselves make too violent efforts, or because the uterus is enlarged and heavy; or else in consequence of some predisposition, some unusual laxity of the organ, which can neither be foreseen nor prevented. Ruysch saw an inversion of the uterus take place after the expulsion of the placenta, although delivery had occurred in the most favourable way.

Mr. Windsor believes that, when the uterus and vagina are in a relaxed state, and the female has been subject to prolapsus uteri, there is a greater disposition to the occurrence of inversion at the time of labour, than when such condition of the parts does not exist. (*Med. Chir. Trans.* vol. x. p. 360.)

A tendency to the accident is very common in women who have once been afflicted with it. Amand mentions a woman who had an inversion of the uterus after her first delivery, but the part was reduced. She was attended by Amand again in her next confinement, and another inversion of the uterus quite as bad as the first, would have happened, had he not, on perceiving the disposition to the accident, introduced his finger into the cavity of the uterus, and separated the placenta from its attachments, before making any attempt to extract it.

Besides causes connected with parturition, there are others of a different nature. Ruysch, Mauriceau, and Lamotte, supposed an inversion of the uterus could only happen at the time when the placenta was extracted, or a little while afterwards. The accident seemed to them impossible at any other period, both on account of the thickness of the uterus, and the smallness of the os tincæ. However, many facts prove, that the case may also depend on internal causes, and affect women who have never had children, as well as others who have had them. Thus polypi of the uterus may bring on inversion of the part. As their pedicle is attached to the fundus of the uterus, they may easily drag it downward when its texture is lax and soft, particularly as the operation of their weight is continual. (See *Denman's Plates of a Polypus with an Inversion of the Uterus*. Fol. 1801.) Uterine hemorrhages may also be conducive to the accident, both because they relax the texture of the uterus, and because they are usually attended with acute pain, which makes the diaphragm and abdominal muscles act upon the uterus with all their power.

Levret speaks of a case of inversion of the uterus, where the displacement was not noticed until five years after delivery. In this example, it

is conjectured that the very gradual and slow formation of the disease must have been the reason of its not having attracted earlier attention. (*Dict. des Sciences Méd.* t. xxiii. p. 288. Also *Baude-locque*, in *Brogniard, Bulletin des Sciences*, 2. n. 1.)

When an inversion of the uterus takes place after delivery, there are certain symptoms, by which it may easily be known. The uterus in its natural situation, thickened and swelled as it is at this period, presents itself in the hypogastric region in the form of a round circumscribed tumour; but when it has fallen downward and become inverted, a vacancy is felt in the situation which it ought to occupy. When the inversion is incomplete, an examination with the fingers detects in the vagina a tumour shaped like the segment of a sphere, having a smooth surface and surrounded by the cervix uteri, as by a kind of collar, round which the finger may easily be passed, either between it and the uterus, or between it and the vagina. When the inversion is complete, which case is more rare than the preceding, a tumour may be felt in the vagina, from which it sometimes even protrudes, apt to bleed, of an irregular round shape, hanging by a neck, the lower part of which is surrounded by the above circular, thick, fleshy substance, consisting of the os uteri itself. The slightest touch makes the swelling bleed. The part has a red colour, which, however, generally diminishes in proportion to the duration of the displacement. In time, indeed, its surface becomes less sensible to external impressions, and only bleeds at the menstrual periods, the blood oozing from every point of the swelling, and not issuing from a single aperture at the lower part of the tumour, as in cases of prolapsus uteri.

In the incomplete inversion, patients feel acute pain in the groins and kidneys, an oppressive sense of heaviness in the hypogastric region, and a tenesmus, which, compelling them to make violent efforts, forces the uterus further down, and sometimes produces a total inversion of it. Besides these symptoms, more or less copious hemorrhages also occur. When the inversion is complete, the pain is more acute, the loss of blood more considerable, and the patient often affected with peculiar weakness, followed by cold sweats, convulsions and delirium.

In both forms of the disease, if the reduction be not almost immediately effected, fatal consequences frequently ensue, either very soon after the accident, from the violence of the hemorrhage, or at a more or less remote period, partly from repeated losses of blood, and partly from the constitutional irritation and disturbance incessantly kept up.

Happily, as Mr. Windsor observes, the accident admits of remedy, if an intelligent person be present to replace the uterus; for if this be done immediately, and the hand of the accoucheur be retained in the cavity of this organ, until it has contracted, and the patient be afterwards confined to the recumbent posture, she will generally do well. An unsettled point appears to be whether the placenta, if still remaining, should be extracted before or after the reduction. Mr. Windsor, who appears inclined to prefer the latter method, refers to two examples, in which each plan was followed by a recovery. (*See Méd. Chir. Trans.* vol. x. p. 360.)

And in all cases, as the same author remarks, the accoucheur, after the expulsion of the placenta,

should assure himself by manual examination, that the os internum is free, while an endeavour is made to feel the uterus with the hand placed upon the abdomen. "In consequence of the neglect of this practice (says Mr. Windsor), it is to be feared that many lives have been lost; the true cause of the succeeding hemorrhage not being ascertained till too late, as happened in the fatal case that occurred to a midwife here (Manchester) last winter." Some women perish at once, or within a few hours, and when they live longer, the reduction is exceedingly difficult, because the uterus and its cervix are becoming more and more contracted.

In the reduction Sabatier regards the interposition of linen, between the hands and the uterus, as unnecessary, and even disadvantageous, because it prevents the practitioner from having the assistance of a correct feel of the part. The trial should be continued as long as the patient's strength will allow. However, if the tumour were in an inflamed state, it would be prudent to put the patient in the warm bath, use emollient applications, and exhibit anodyne and laxative medicines, &c.

When the reduction cannot be accomplished, many patients die; while others survive, subject to an oppressive sense of weight and frequent hemorrhages, which bring on great emaciation. Sabatier attended two patients, who had had an inversion of the uterus, six months, and yet they were able to go about their family affairs. The same author had heard of other women, who had been afflicted with an inversion of the uterus several years.

If the reduction cannot be performed, and the patient survive the immediate effects of the injury, "some degree of inflammatory symptoms, accompanied with fever, ensues. The abdomen becomes full, tender to the touch, and, at its lower part, sometimes rather hard. There is costiveness of the bowels, and sometimes retention of urine requiring for a time the use of the catheter. By the use of fomentations, enemata, laxatives, and an antiphlogistic regimen, the symptoms abate the power of expelling the urine, especially if the uterus is first raised a little in the vagina, is regained, and the patient gradually recovers the full power of this function. Afterwards she becomes able to walk about, suckles her infant, and perhaps enjoys apparently even a tolerable state of health; yet, the sanguineous discharges generally, after a time, return profusely, and her pale countenance and emaciated appearance indicate the greatest debility.

"About the time when she relinquishes the office of suckling, the menses return more regularly, the discharges of blood are very considerable in quantity, or of long duration; the mucous discharges are generally copious at other times; and the constitution begins to sink under the reiterated losses it sustains. The pulse becomes frequent, the appetite is impaired, a cough, with hectic symptoms, sometimes occurs, and the patient is quite unable to pursue her usual domestic duties. In this state, palliative means, as the use of astringent and other remedies, become inadequate to check the exhausted progress of the complaint, and the unfortunate sufferer must soon perish, unless some decisive means be devised for her relief. In this painful extremity, the extirpation of the uterus itself has been proposed as the most efficient means of relief; and formidable as the operation at first

view seems, it is known to have been already performed with success." (*Windsor, in Med. Chir. Trans.* vol. x. p. 361—363.)

"Where the completely inverted uterus became prolapsed post partum (says Mr. Crosse in his late Retrospective View of Improvements in Medicine, Surgery, and Midwifery) I find it to have been effectually returned after having remained for one month so displaced. In several other instances, the inverted organ being irreducible, was removed by ligature. A case of the uterus inverted and prolapsed, which, with one ovary, came away several hours after delivery, has been contributed by Dr. J. C. Cooke. The patient recovered, and her subsequent history supplied the materials for some physiological remarks. There was sudden and immediate suppression of the lacteal secretion, showing the intimate consent between the uterus and the mammary glands, and proving that neither the presence of the child (a stimulus of necessity), nor maternal affection, was sufficient for the purpose." (See *Trans. of Prov. Med. Association.* vol. v.)

One of the most afflicting consequences of an inversion of the uterus, is so considerable an inflammation of the part, as to induce the danger of its mortifying. In this circumstance the extirpation of the uterus has been also suggested, and even practised: an operation that has had but little success, the majority of patients on whom it has been practised under such circumstances, having died.

The practice of extirpating the inverted uterus, through apprehension of the part mortifying, cannot be too strongly reprobated; for unless mortification has really happened, the uterus may possibly be brought into a state again, in which the inconveniences, arising from its inversion, would be very supportable, and the operation altogether avoided. Even supposing mortification were to take place, the indication would be to appease the bad symptoms, and promote the separation of the sloughs by suitable application, without doing any injury to the living parts. One example, in which the latter practice was successfully adopted, is recorded by Roussel. That the extirpation of the uterus, when this organ is completely or incompletely inverted, totally irreducible, and attended with the sufferings and reduced health, so well described by Mr. Windsor, may sometimes be advisable, cannot now be doubted. The unequivocal examples on record of the removal of the cancerous uterus by Oslander, Dupuytren, Langenbeck, and others, and the cases published by Mr. Newnham, Mr. Windsor, and Dr. C. Johnson (*Dublin Hospital Reports*, vol. iii.), where the inverted and irreducible uterus was successfully extirpated, furnish sufficient evidence in favour of the practice, without referring to numerous other cases reported on older authorities, the correctness of some of which may be questionable.

In fact, polypi, growing from the uterus, frequently attain so considerable a size, that they protrude out of the vagina, and are occasionally mistaken for the uterus itself. The surgeon extirpates the tumour with a ligature; the operation does not deceive him about the nature of the part; his patient has a favourable recovery, and the case is published as an instance of the successful extirpation of the uterus itself.

Although it is easy to distinguish the inversion of the uterus, which happens soon after delivery, it is not so to make out the nature of such cases as happen in other circumstances, notwithstanding the presence of the same kind of symptoms. As cases of the latter kind are uncommon, and consequently not expected, mistakes are the more liable to be made. A polypus has often been mistaken for an inversion of the uterus; but it should be recollected that the upper part of a polypus is always narrow, and the tumour, which is not very sensible, is irreducible; whereas the uterus, in a state of incomplete inversion, forms a semi-spherical swelling, sometimes a little oblong, but always broader above than below. It is very sensible, and may generally be reduced. And when the inversion is complete, the tumour has a greater resemblance to a polypus, inasmuch as it seems to have a pedicle, but the impossibility of introducing a probe far at the circumference of such pedicle, as can be done in cases of polypi, will generally serve at once as a criterion of the nature of the disease.

The greatest obscurity in the diagnosis is said to prevail when the inversion is partial and chronic, because the os uteri then encircles the summit of the tumour just as it does a polypus, and in both cases the finger will pass all round between the parts. (See *Newnham's Essay on Inversio Uteri, with a History of the successful Extirpation of that Organ*, p. 82. 8vo. Lond. 1818.) However, as I do not believe with this gentleman that the neck of a polypus is frequently as large, and sometimes larger than its inferior portion, I should yet expect that the difference in the form of the two swellings perceptible on manual examination, would here be an important criterion. In general, also, the fact that inversion of the uterus first happens at or soon after delivery, is a consideration that would tend to a right discrimination of the cases, inasmuch as the first protrusion of a polypus directly after delivery is rare, and, when it does happen, under these circumstances, is probably always complete and not partial.

Reduction is the only plan, whether the case has arisen from the weight of a polypus or from uterine hemorrhage. However, this proceeding is generally useless, when the disease originates from obesity. In the latter case, as the cause still continues in full force, the uterus is soon displaced again, and a pessary, or an operation for the reduction of the diameter of part of the vagina, is the only means to which the patient can resort.

F. B. Wachter, *De Prolapsu et Inversione Uteri*, Halle, 1745. *Act. Naturæ Cur.*, vol. vi. obs. 107. uterus feliciter extirpatus. *Nauche, Des Maladies de l'Uterus*, 8vo. Paris, 1816. *Oslander, Neue Denkwürdigkeiten*, 1 b. p. 367. C. F. Frick, *Von der Umkehrung, oder eigentlichen Inversione der Gebärmutter*, Münster, 1804. *Sabatier, Méd. Opér.* t. ii. *W. Newnham, On the Symptoms, Causes, and Treatment of Inversio Uteri*, with a History of the successful Extirpation of that Organ, during the Chronic Stage of the Disease, 8vo. Lond. 1818. *J. Windsor, Obs. on Inversion of the Uterus, with a Case of successful Extirpation of that Organ*, *Med. Chir. Trans.* vol. x. p. 358, &c. *Denman's Plates of a Polypus, with an Inversion of the Uterus*, 1801. *Dr. Baillie's Series of Engravings*, &c., fasc. 9. tab. 5. *Siebold's Journ.* b. v. p. 2. s. 406. *Cleghorn, in Med. Communications*, vol. ii. s. a chronic case. *E. B. Herzog, De Inversione Uteri*, 4to. Wirceb. 1817. *Clark C. Manifold Stirr*, *Obs. on the Diseases of Females, attended with Discharges*, 1814-21. *Dewees's Midwifery*, Philadelphia. *Denman's Midwifery*, with Notes by Professor Francis, of New York, 3d ed. 1823. *Ramsbotham's Midwifery*, 1821.

UTERUS, POLYPI OF. (See *POLYPUS*.)
UTERUS, PROLAPSUS OF. The womb, situated in the upper and middle part of the pelvis, is but imperfectly secured in its natural place by means of its broad and round ligaments; hence it sometimes descends into the lesser cavity of the pelvis, so as to pass more or less down the vagina, or even protrude beyond the labia. The first case is the *incomplete*; the second, the *complete*, *prolapsus uteri*.

In the first form of the disease, where the uterus has not passed down so low as to protrude externally, some of the complaints, which the patient experiences, depend upon pressure of the displaced viscus upon parts unaccustomed to it, particularly the bladder and rectum; while other inconveniences arise from the tension of the ligaments destined to retain the organ in its natural position. These last grievances are chiefly a sense of heaviness in the pelvis, and a dragging pain in the loins; symptoms which are aggravated when the patient sits up or walks about, but diminish when she remains in bed, though, as the disease, when neglected, scarcely ever fails to grow worse, they rarely subside altogether. However, such amendment actually sometimes happens, in consequence of the parts becoming gradually habituated to their change of situation. When the disease comes on with great suddenness, the symptoms are remarked to be much more severe than when it takes place slowly; in the first case, long-continued syncope, pain over the whole abdomen, tenesmus, uterine hemorrhage, inflammation of the peritoneum, and severe febrile symptoms, may be excited.

With regard to the effects caused by the pressure of the tumour on the bladder and rectum, they consist of more or less difficulty in voiding the urine and feces. The dysury and constipation increase in proportion as the patient continues in an upright posture, and the uterus descends nearer to the inferior orifice of the vagina. The irritation brings on a considerable mucous discharge, which, when the patient suffers little other inconvenience from the prolapsus, is apt to be mistaken for fluor albus or gonorrhœa.

A woman may become pregnant, notwithstanding an incomplete prolapsus of the womb. The displacement may even take place at a more or less advanced period of gestation (*Portai des Accouchemens*), while, in other still more uncommon instances, the prolapsus has been remarked to disappear, when the period of labour drew near. Cases exemplifying both these facts are related by Loder (*Journ. für die Chir. b. ii. p. 13.*), by Saviard, Portai (*Mém. de l'Acad. de Chir. t. iii.*), in the *Journ. de Médecine*, t. xlv., and by Chopart (*Traité des Maladies des Voies Urinaires*.) A prolapsus uteri may also happen during parturition. (*Garin, Journ. de Méd. continué, t. iv. p. 265.*; *Ducreux, Mém. de l'Acad. de Chir. t. viii. p. 393.*)

When in the course of time the prolapsus uteri changes from the incomplete to the complete state, all the inconveniences depending upon the pressure of the part upon the rectum and bladder subside; that is to say, the feces and urine are now freely voided. But, on the other hand, the symptoms, arising from the stretching of the peritoneum, become considerably worse. The uterus drags down with it the vagina, which becomes doubled on it-

self; and a part of the bladder, connected with the upper part of the latter tube, is also drawn down. Some of the abdominal viscera may even fall into the cul-de-sac, formed by the vagina, and considerably increase the size of the tumour. The swelling, protruding between the thighs, is of an oblong, nearly cylindrical form, and terminates below in a narrow extremity, in which a transverse opening, the os tincæ, may be discerned, from which the menses are discharged at the periods prescribed by nature. However, the cylindrical shape of the tumour may lead to mistakes; for the vagina, being doubled on itself, and exposed to the effects of the air, sometimes looks like skin. Hence women thus afflicted have occasionally been supposed to be hermaphrodites, the tumour being mistaken for a penis. Such a case is recorded by Saviard.

The patient is generally troubled with tenesmus, and sometimes feels acute pain in the tumour itself, which is subject to inflame and ulcerate in consequence of its depending posture, the friction to which it is exposed, and the irritation of the urine.

The direction both of the bladder and urethra becomes horizontal, so that the urine is thrown forwards, or even upwards; in which latter case it wets the abdomen. Frequently the bladder cannot be emptied without the assistance of the catheter; and sometimes the displaced uterus becomes affected with inflammation and swelling. In many cases there are profuse hemorrhages. However, some women become so habituated to the disease, that they hardly seem to experience any annoyance from it; whenever they are in an erect posture, and walk about, the womb falls down, bringing with it the vagina; and as soon as they lie down on their backs, the parts as readily return into their natural position again.

One of the most remarkable circumstances attending a prolapsus uteri, is the elongation which this organ undergoes. Cruveilhier has invariably observed it, and it is correctly represented in a plate published by M. J. Cloquet. (See *Cruveilhier, Anat. Pathol. t. i. livr. 16. p. 1—5.* and *J. Cloquet, Pathol. Chir. pl. 8. fig. 3.*, 4to Paris, 1831.) This elongation chiefly occurs in the point of junction between the body and the neck of the womb, and is accompanied by a striking contraction or increased narrowness of the part.

The displacement of the fundus of the bladder is the inevitable consequence of the connection of the bladder to the vagina. The quick or gradual way, however, in which the prolapsus has occurred, will make great difference in the degree of such displacement. A slowly formed prolapsus allows the cellular tissue, connecting the vagina and bladder, to yield; while a sudden prolapsus leaves no time for it. In one case, where the whole of the fundus of the bladder had been dragged down, M. Cruveilhier found in the displaced portion a large calculus; and in another instance, recorded by M. J. Cloquet, there were two calculi. Calculi, when met with, are usually in the displaced portion of the bladder; but M. Cruveilhier lately met with a case, in which the whole cavity of the undisplaced part of it was filled by a calculus, and the other part of it was free from them.

According to the researches of Cruveilhier, the deviation of the meatus urinarius from its proper course, in cases of prolapsus uteri, is less the effect of the displacement of the bladder than of the

anterior paries of the vagina. This change may occasion retention of urine; and the very considerable size of the bladder, which Cruveilhier has constantly noticed in these cases, he regards as a proof of the difficulty experienced in passing the urine. The alteration in the course of the urethra sometimes makes the introduction of a catheter very difficult; and when this instrument or a probe is introduced into that canal, it is found to pass downwards into the substance of the tumour to a greater or less extent, according to the degree of prolapsus. This is accurately represented in the 10th plate of the work of Madame Boivin and Professor Dugès.

The rectum, which is less adherent to the vagina, and more fixed in its natural situation than the lower part of the bladder, is seldom displaced; and, when it is so, it is only for a small extent; in fact, it could not be displaced in the same degree as the bladder, unless the inversion of the posterior paries of the vagina were as considerable as that of the anterior. In one case referred to by M. Cruveilhier, where there was an incontinence of feces, the rectum, which was dilated and full of fecal matter, had been drawn forwards rather above its lower termination, and it formed a kind of funnel-shaped prolongation. In the example, of which M. Cloquet has given a representation, the rectum was much dilated, and sent forwards a considerable digital prolongation, which extended into the posterior and inferior portion of the sac, formed by the inverted vagina. Here, then, as Cruveilhier observes, we see that there are incontinences of feces *par regorgement*, as well as of urine. The sphincter being kept for a long while distended, at length ceases to resist the discharge of portions of excrement separated from the mass of it.

M. Cruveilhier, in noticing the frequent entrance of the bowels into the pouch formed by the inverted vagina, informs us, that he has not had an opportunity of seeing this in the dead subject, but he met with an instance of it in the living body.

The continual irritation of the inverted vagina occasions, 1. A transformation (incomplete) of the mucous into a cutaneous texture; 2. Sloughs more or less deep in the lowest portion of the tumour, consisting of the neck of the uterus. If such sloughing were to implicate all the thickness of the parietes of the vagina and the peritoneal covering of them, air might insinuate itself into the cavity of the peritoneum and the uterus, and even the bowels protrude, if the latter were contained in the tumour; peritonitis might also ensue. Sometimes the os tincae is obliterated from the effects of the irritation. Cruveilhier expresses his surprise that cancer of the cervix is not more frequent than it is, as a consequence of prolapsus; he has seen but one instance of it from this cause. (See *Cruveilhier Anat. Pathol.* livr. xvi. t. i. pl. 5.)

Cruveilhier, in the second volume of his great work on pathological anatomy, livr. xxvi., gives another plate, and additional observations, explanatory of the changes in the relation of parts, occasioned by the inversion of the vagina or prolapsus of the uterus. It appears from his researches that sometimes the elongation, and sometimes the depression of the uterus, exists in the greater degree. He has met with cases in which the lengthening of the uterus was so considerable, that when the part was viewed within the pelvis, it seemed as if it occupied its right situation. The co-existence of an

inversion or doubling of the vagina, without any displacement of the womb, which has only undergone an elongation, seems to him to prove that, in certain cases at least, the displacement of the uterus has its beginning in the foregoing change of the vagina. This latter becomes inverted on itself, just like the finger of a glove, by a mechanism precisely like that which takes place in intestinal invaginations. "If (observes Professor Cruveilhier) we look upon the cavity of the uterus as a continuation of the parietes of the vagina, there will be, in the commencement of the prolapsus uteri, three duplicatures: 1. A central portion invaginated, which is the uterus; 2. Two folds, or reflections of the vagina. In a later stage, when the invagination is complete, there are only two duplicatures, as in a prolapsus of the rectum; viz. the central part of which is the uterus that has passed into the inverted vagina. However, in most complete prolapsus, some vestige of the second duplicature, formed by the vagina, is constantly met with in the furrow of greater or lesser depth, situated behind the swelling; for though the inversion of the anterior paries of the vagina may be complete, that of the posterior paries is scarcely ever so. Hence, the tumour, caused by prolapsus uteri, is always longer in the vertical direction in front than it is behind.

Another point explained by Cruveilhier is, that in consequence of the relations of the peritoneum with the posterior surface of the uterus and the back part of the vagina, the peritoneum descends much lower in this situation than between the uterus and vagina in front. Hence, the anterior *cul-de-sac* of the peritoneum is generally too inconsiderable to admit the small intestines into it, while the posterior one may receive an enormous mass of them. It is under such circumstances, that the prolapsus may form a swelling as large as a man's head.

One thing well deserving of attention is the greater or less deformity of the os tincae; one of its lips, usually the posterior one, according to Cruveilhier, being very prominent, while the anterior one is effaced. In one case observed by this distinguished pathologist, the orifice, instead of the greater diameter of it, being transverse, extended from before backwards. In some instances, the os tincae was reduced to a very diminutive aperture, scarcely large enough for the discharge of the menstrual fluid. (See *Cruveilhier, Anat. Pathol.* t. ii. livr. 26.)

The incomplete prolapsus alone is subject to obscurity, which however, may be dispelled by manual examination. In this case, however, some precautions are necessary. For instance, as the womb generally returns into its natural situation when the patient lies down, the examination should always be made as she is standing up. For the same reason, if she is in the habit of lying long in bed, the morning is not the best period of the day for the examination. The practitioner may also be deceived if he examine the parts when the rectum and bladder are distended with their contents, in which state the uterus may be hindered from descending so far as at other periods.

If attention be paid to these circumstances, an incomplete prolapsus may always be distinguished without risk of error. However, the records of surgery prove, that the case has sometimes been mistaken by the inexperienced or ignorant for a

polypus, and the part extirpated under this supposition. So serious a blunder will be avoided, if care be taken to remember, that polypi are generally softer and less sensible than the uterus; that in a case of prolapsus the os tincæ is situated at the lower part of the swelling; and that if by chance any resembling aperture should be met with upon the corresponding portion of a polypus, the prolapsus may still be known by the greater depth to which a probe will enter such opening. The partial obliteration or deformed appearance of the os tincæ, in some cases, as explained by Cruveilhier, must be remembered. A polypus of the uterus is generally broadest at that extremity which is nearest the vulva; but the womb, in a state of incomplete prolapsus, forms a tumour, which is narrower below than above. With very few exceptions, the womb is likewise reducible, and the patient directly afterwards feels great relief; whereas a polypus cannot be pushed back, and the attempt, instead of giving relief, only increases the patient's sufferings.

In a complete prolapsus no doubt can ever prevail about the real nature of the case; for whatever uncertainty the feel of the parts may create, none can ever remain when the swelling is distinctly visible.

Although Mauriceau, Saviard, Monro, and Cruveilhier record instances of prolapsus uteri in maidens, such cases are not common. At the Bloomsbury Dispensary, I have seen two examples in the course of seven or eight years. The disease is seldom met with except in women who have had children, and generally in those who have borne a great many. This particularity is ascribed by some writers to the elongation of the ligaments of the uterus in women, in whom this organ has been repeatedly gravid. The same consideration may also account for the frequency of prolapsus uteri during the first months subsequent to parturition, especially as the womb remains for some time after labour more enlarged and heavy than natural. The disease is more common in thin than fat women, and often takes place in females when they suddenly change from a fat to a very emaciated state. The displacement is facilitated by a capacious vagina, by a great width of the lesser cavity of the pelvis, and the effects of tedious and profuse attacks of fluor albus. Prolapsus uteri has also been brought on by violent concussions of the body; the protracted efforts of vomiting, coughing, or crying, hard labour, and lifting, or carrying heavy burdens. In what has been stated, one may discern the reason why the affliction is so frequent amongst the lower classes of society, and why women, for a certain time after parturition, should avoid an erect posture and every kind of exertion.

In the treatment of prolapsus uteri, there are two indications: the first is to reduce the part; and the second is to keep it from falling down again.

In the incomplete prolapsus, the first indication is very easy of accomplishment; and, indeed, when the patient is placed on her back, with her pelvis raised somewhat higher than her chest, the uterus often returns of itself into its natural situation again. At all events, the reduction may be immediately effected by pushing the uterus up into the pelvis with the fingers.

More difficulty generally attends the reduction

of a complete prolapsus. Here the same posture is to be chosen, as in the former case; but the legs and thighs should be bent. The rectum should also be first emptied with clysters. Sometimes, indeed, every attempt at reduction fails, notwithstanding the adoption of the most vigorous measures, the use of the warm bath, purgatives, venesection, low diet, fomentations, &c. Occasionally, the part is returned after a great deal of trouble; but, owing to the long altered state of parts, the reduction brings on worse symptoms, than resulted from the continuance of the prolapsus. Such a case is recorded by Richter. (*Bibl. der Chir.* b. iii. p. 141.) The patient's sufferings were so much increased by the reduction, and so obstinate a constipation came on, that it became absolutely necessary to let the uterus descend again. In any irreducible case, all that can be done, is to support the swelling, and prevent its increase with a suspensory bandage, and draw off the urine with a catheter whenever requisite. In these cases, the altered course of the meatus urinarius is to be remembered, and the catheter directed horizontally towards the rectum; or, rather as Ingleby and Cruveilhier state, the catheter should be directed downwards and backwards, with its concavity turned downwards. "It follows also from the kind of displacement which the bladder undergoes, that the catheter first enters the displaced portion of that organ, and is then conveyed by a lever-like movement into the portion of it that continues in its right place." (*Cruveilhier, Anat. Pathol. Ingleby, Edinb. Surg. Journ.* No. 122.) Sometimes the displacement of the bladder, resulting from prolapsus uteri, causes an incontinence of urine, as exemplified in several instances in the Salpêtrière alluded to by M. Cruveilhier. (*Livr.* 26.)

When the displaced uterus is inflamed and considerably swelled, the attempt at reduction should be preceded by antiphlogistic remedies; the patient should be kept in bed, be put on a low regimen, be bled, take purgative medicines, use the warm bath, and drink diluent beverages, while emollient applications are made to the part itself. This plan of treatment has often been attended with complete success, in cases of prolapsus uteri, of long standing and considerable size. Ruysch disapproved of making any attempt to reduce the uterus, while it was inflamed and swelled. He also thought, that the operation should be postponed when the uterus was in an ulcerated state. However, Sabatier rightly observes, that, as this complication is only accidental and merely arises from the friction, to which the tumour is exposed, and the irritation of the urine, the plan of immediately replacing the part cannot be attended with any danger. On the contrary, since the cause, which produces and keeps up the ulceration, will cease, as soon as the reduction is accomplished, the sores will heal after the uterus is put into its natural situation again.

When a prolapsus uteri occurs in the early stage of pregnancy, this state should not let the practitioner neglect to reduce the part. Several instances are recorded, in which the reduction was successfully accomplished in pregnant women; and one case of this kind is reported by Giraud. (*Journ. de Médecine*, t. xlv.) When pregnancy is far advanced, or the disease is of long standing, the reduction is difficult. Perhaps, says Sabatier,

it may be more prudent, in these circumstances, to let the uterus continue protruded, than to disturb the mother and foetus with reiterated attempts to reduce the part. The uterus, however, should not be left to itself; but be well supported with a suitable bandage, and the patient kept in bed. When the prolapsus uteri occurs at the period of delivery, every attempt at reduction is both useless and dangerous. In this case, the delivery of the foetus should be expedited, by gradually dilating the os tinæ, which, at the same time, should be carefully supported. The extraction of the placenta also requires a great deal of caution, and it should be accomplished by introducing one hand into the uterus, with the palm turned away from the cavity of this viscus, towards the outside of the placenta, which is to be gradually separated from its edges towards its centre.

In cases of complete prolapsus uteri, Ruysch was an advocate for leaving the expulsion of the foetus, if alive, to be effected by nature: and the same writer advises us to be content with supporting the os tinæ. But, when the child is dead, he recommends extracting it with one hand, while the uterus is supported with the other. Sabatier, however, entertains different sentiments. The expulsion of the child, he says, is not less the effect of the contraction of the diaphragm and abdominal muscles, than of the womb itself. Hence, when either of these agents fails to co-operate, the delivery becomes either very difficult or impossible. This is exactly what happens in the present case; for the uterus having fallen down, cannot be compressed by the diaphragm and abdominal muscles. Nor can Sabatier discern the reason why Ruysch should recommend the line of conduct to differ, according to the different state of the child. This is quite passive in parturition, and contributes not in the least to its own expulsion.

The second indication, or that of keeping the uterus reduced, demands the employment of astringent injections and pessaries.

The uterus, in a state of prolapsus, is sometimes affected with scirrhus and cancer. A case of this description was met with by Ruysch; such a complication was seen in one instance by Cruveilhier. (*Anat. Pathol.* livr. xvi.) Its extirpation was completed by MM. Recamier and Marjolin, by means of a ligature, though the patient is stated to have died afterwards from some cause, which, had nothing to do with the operation. Instead of this method, which must inevitably be attended with great risk of tying a portion of the bladder, M. Cruveilhier recommends making an incision into the posterior paries of the vagina, and thus getting into the great peritoneal *cul-de-sac* between the bladder and rectum, drawing the uterus outward, and separating its cellular connexions to the bladder. A woman, whose uterus was cancerous, and in a state of complete prolapsus, without any inversion, was attended by Langenbeck, who succeeded in removing the diseased organ with a knife, and the patient recovered. According to this author's description, after the vagina had been separated from the uterus, the latter organ was detached from the peritoneum, without the latter membrane being opened, a small portion of the fundus uteri being left, however, apparently quite sound. The bleeding was very profuse, and required the use of the needle and ligatures.

The ovaries, and divided ligamenta rotunda, were found connected with the removed portion of the uterus. (*Bibl. für. die Chir.* b.i. p. 551. 12mo, Hanover, 1818.)

Prolapsus uteri is so great an affliction, when it does not admit of relief by ordinary means, that any new suggestion, calculated to render the treatment effectual under such circumstances, ought to be rendered as public as possible. The horizontal position, astringent injections, and pessaries have long been in use, and as every practitioner must have had opportunities of witnessing, they are frequently inefficient, or cannot be persevered in. Dr. Hamilton, of Edinburgh, advised another mechanical contrivance for preventing the prolapsus: it consists of either a strong T bandage, or, in more serious degrees of the disease, of a circular metallic belt, like that of a common truss, provided with a cross, or perpendicular strap, to which is attached a cushion stuffed with horse-hair, about six inches in length, by three in breadth; and of a thickness proportionate to the degree of relaxation, and, consequently, the degree of support required. By this simple means, in conjunction with cold bathing, and suitable constitutional treatment, Dr. Hamilton has found no occasion for pessaries. The cushion, I think, should be covered with oil silk, for the sake of cleanliness. Dr. Hamilton formerly suggested the propriety of endeavouring to relieve very bad and confirmed cases of prolapsus uteri, by exciting adhesive inflammation in the vagina, so as to bring about an agglutination of its surfaces. However, notwithstanding the more or less partial closure of the vagina, occasionally met with in the practice of surgery and midwifery, every pathologist is aware of the difficulty of making a mucous tissue undergo the adhesive inflammation; and this consideration led Dr. Hamilton not to attempt it. A more valuable and practicable operation is that of treating such cases by approximating the pared surfaces of the labia, and uniting them by suture. Dr. Ireland tried this method in Dublin, and has published an account of the success which attended it. (*See Duhl. Journ. of Med. Science*, vol. vi. p. 484.) Cruveilhier prefers to this proposal the plan of bringing about a contraction of the upper part of the vagina, by touching it with the nitrate of silver, or an acid. An anonymous writer remarks, that a similar operation has been several times since performed by Velpeau, Boivin, Langier, and others. Some produce adhesions between the opposite surfaces, by means of wounds, made with the knife; others by means of sloughs and granulating surfaces, resulting from the application of escharotics. "Dr. Ireland seems to attribute the merit of devising this operation to Dr. Marshall Hall; but it is probable that Girardin, who proposed it in the year 1823, has the claim of priority. For an historical account of this operation, I must refer to the *Annali Universali di Medicina*, edited at Milan by Omodei, for December, 1835." (*See Duhl. Journ. of Med. Science*, vol. x. p. 126.) In 1831, the operation was performed by Dr. Fricke, of Hamburgh, with a completely successful result; and he is a strong advocate for it.

The following quotation from Dr. Henning's translation of Madame Boivin's work, p. 53., affords some particulars of Dr. Marshall Hall's operation, which appears to have consisted in the excision of a strip of the mucous membrane of the

vagina. "Dr. Marshall Hall has lately cured a case of complete prolapsus uteri by artificial contraction of the vagina: a strip of the mucous membrane, an inch and a half wide, was removed along the whole of the canal, and the wound was sewed up. We hear nothing of hemorrhage, and are assured that the patient suffered neither pain nor fever after the operation." In a note, the translator mentions, that there was scarcely any hemorrhage; and that in November, 1833, two years after the operation, the uterus and bladder were found by Mr. Vincent to be perfectly supported in their situation.

Professor Dieffenbach has long abandoned the employment of pessaries, (see *Cruveilhier, Anat. Pathol.* t. i. liv. 16.), and adopted the plan of curing bad cases of prolapsus uteri, by removing an oval piece of the membrane of the vagina; a plan, suggested to him by the observation of a case, in which some parts of the vagina sloughed away, while the uterus was in the state of prolapsus. The uterus and the remains of the vagina were reduced during the granulating process, and the result was a complete cure of the disease. As this operation seems to me less safe and eligible than the foregoing one, I omit the details of it, which may be read in the 12th volume of the *Dubl. Journ. of Med. Science*, p. 488, or in *Medizinische Zeitung*, No. 3., 1836. Cruveilhier would prefer the excision of a few pieces of the mucous membrane, near the cervix uteri, to the method adopted by Dr. M. Hall, or Dieffenbach. Both these operations are analogous to Dupuytren's operation for the cure of inveterate cases of prolapsus ani, being founded on the benefit derivable from the contraction of the cicatrix. About two months ago, I practised Dupuytren's operation in University College Hospital, whereby a prolapsus of the rectum, of more than four years' standing, and which had resisted all the ordinary means, was entirely cured.

Mr. Crosse refers to a case (*Révue Méd.* Decembre, 1835), where the uterus, shortly after impregnation, descended as low as the knees, and remained so until the full term of utero-gestation, when delivery was completed by embryo-ulcio with safety to the mother. "Might not the life of the child (he asks) also have been spared by free incision of the os uteri to effect delivery?" (See *Prov. Med. Surg. Trans.* vol. v. p. 92.)

Amongst the various practical deductions from the new relations of the parts in cases of prolapsus uteri, is the possibility of extracting calculi from the bladder, through an incision made in the anterior side of the tumour, with the aid of a director passed into the meatus urinarius, in the manner executed by Ruysch.

Saviard, Obs. Chir. 12mo. Paris, 1702. *J. G. Preund, De novo Artificio curandi Procidendum Uteri*, Francof. ad Viadr. 1710. *Leuret*, in *Journ. de Méd.* t. xi. et *Obs. sur la Cure radicale des plusieurs Polypes*, &c. *Morgagni, De Sedibus et Causis Morborum*, epist. xlv. *Kalmus, De Uteri Delapsu, Suppressionis Urinæ, et subsequentis Mortis Causa*, Gedani, 1732. *White*, in *Med. Obs. and Inq.* vol. ii. *Shaw*, in *Mem. of the Medical Society of London*, vol. i. *Portal, Cours d'Anatomie Méd.* t. v. p. 538. et *Mém. de l'Acad. de Chir.* t. iii. *Sabatier*, in *Mém. de l'Acad. de Chir.* t. iii. p. 361., and *Médecine Opératoire*, t. ii. *Ducroix*, in *Mém. de l'Acad. de Chir.* t. viii. p. 498. *Ostlander*, *Annalen.* b. i. p. 175. *Dict. des Sciences Méd.* t. xxiii. art. *Hysteropexie*. *Dublin Journ. of Med. Science*, vols. vi. x. and xii. *Omodei*, *Annali Univ. di Medicina*, Dec. 1836. *Dieffenbach*, in *Med. Zeitung*, No. 31, 1836. *Cruveilhier, Anat. Pathol.* livr. xvi. and xxvi. Paris,

fol. 1829-36. *Madame Boivin et M. Dugès, Mal. de l'Uterus, et de ses Annexes*, &c. 2 vols. 8vo. Paris, 1833; and transl. by Dr. Hemming. *J. F. Angely*, in *Edinb. Med. and Surgical Jour.* No. 122. p. 157.

UTERUS, RETROVERSION OF, is said to happen, when its fundus falls downwards and backwards, between the rectum and the posterior part of the vagina, while its cervix inclines upwards towards the symphysis pubis. The ancients are suspected to have had some imperfect notions of this case, and, in proof of this opinion, certain passages are referred to in *Ætius*, (*Tetrab.* iv. Serm. 4. C. 77.) *Mercurialis*, *Mercurius*, and others. (See *Dict. des Sciences Méd.* t. xxiii. p. 273.) Be this as it may, it is generally confessed, that the subject had fallen into oblivion, when Dr. William Hunter called the attention of his pupils to the subject, in 1754, and afterwards drew up an interesting paper concerning it. (*Med. Obs. and Inquiries*, vol. iv. 8vo. Lond. 1771.) Subsequently, the knowledge of the subject was extended by the observations of *Wlazeck*, (*De Utero Retroflexo*, Prag. 1777.) the remarks of *Richter*, (*Chir. Bibl.* b. v. p. 521. and b. ix. p. 182.) those of *Wall*, (*Diss. de Uteri Retroversione*, Hal. 1782.) and by the memoir of *Dugrèges*, to which the prize of the Royal Academy of Surgery at Paris was adjudged in the year 1785. According to *Sabatier*, retroversion of the womb was a case, mentioned by *Gregoire* in his private lectures on midwifery, at Paris.

Walter Wall, an English surgeon, who had attended *Gregoire*, suspected that he had met with a retroversio uteri in a woman some months advanced in pregnancy, and he called in Dr. Hunter, in order that he might have the benefit of his advice. However, she was attacked with an obstinate constipation, and retention of urine, and died in about a week. A large tumour was found occupying the whole of the pelvis, and pushing the vagina against the os pubis. It had been found impracticable to push the swelling back into the abdomen, although the patient had been put on her knees and elbows, while one hand had been introduced into the vagina, and two fingers of the other hand into the rectum. Great curiosity existed about what information would be afforded by dissection. On opening the body, the bladder, which was exceedingly full of urine, filled almost the whole anterior part of the abdomen, in the same manner as the uterus does in the last month of pregnancy. When it had been emptied, that part of it, in which the ureters terminate, and which is connected with the vagina and cervix uteri, was found raised up, as high as the upper aperture of the pelvis, by a large tumour, which filled the whole cavity of the pelvis, and was found to be the uterus. A catheter, when passed into the vagina, could be made to lift up the latter viscus and the upper part of the tumour. This portion of the swelling, on which the bladder lay, consisted of the cervix uteri, while the fundus of this organ was situated downwards towards the os coccygis and anus. The uterus was so large, that it could not be taken out of the pelvis, until the symphysis pubis had been divided, and the two ossa innominata pulled asunder. The same thing was exemplified in another instance. (See *Perfect's Cases*, vol. i. p. 349.) It was found impossible to assign any cause for the displacement of the uterus, as the patient had been making

no exertion, and had met with no fall, though she is said to have been frightened at something just before the complaint commenced. (See *Med. Obs. and Surg.* vol. i.)

Dr. Hunter, struck with the singular nature of the case, thought it deserving of the attention of medical men, and he made it the subject of a lecture, which he delivered in 1754. He was afterwards consulted by several persons, who were afflicted with retroversio uteri; but not in so acute a way, as in the above instance. All the patients were in the third month of pregnancy, and first suffered a difficulty of making water, succeeded by retention of urine, and afterwards by tenesmus and constipation. Dr. Hunter always emptied the bladder and rectum by means of a catheter and clysters, which measures sometimes effected a cure, the uterus spontaneously resuming its natural position. In every instance, the accident disappeared when pregnancy was more advanced, and the uterus had acquired larger dimensions. In some cases, in which Dr. Hunter was consulted too late, the trials to empty the bladder and replace the uterus proved fruitless, and the women died. Dr. Hunter was so firmly convinced of the impossibility of saving patients, circumstanced in the above manner, unless extraordinary means were resorted to, that he thought, that an endeavour should be made to diminish the size of the uterus, by introducing a trocar into the body of this viscus, through the posterior parietes of the vagina, so as to let out the water of the amnios, the relative quantity of which is known to be greater in the early, than in the advanced, stage of pregnancy. (See *Jourel, in Bulletin de la Faculté de Méd.* p. 173. an. 1832.)

Such a puncture might certainly be the means of bringing the uterus back into its natural position; but not without considerable danger of abortion being produced. No risk of this kind would be encountered by puncturing the bladder above the pubes. In this manner, a free passage would be afforded for the escape of the urine, and the reduction of the uterus might then be effected. The suggestion of puncturing the uterus, I believe, has only been put in practice in one example in this country; and, I believe with Mr. Weir, that it is not likely to be often adopted, because, a safer mode of discharging the fluid, must generally be that of opening the membranes through the os tincæ, if such evacuation were deemed prudent. (*Glasgow Med. Journ.* vol. i. p. 268.) At all events, we must let the expedient of puncturing the uterus only be deemed applicable, as Mr. Baynham observes, "to cases in which the replacement shall be found impracticable, after the bladder has been emptied." (*Edinb. Med. Journ.* No. 103. p. 261.)

Mr. Ingleby, in his valuable paper on Malposition of the uterus, lays it down as a maxim, that if, in retroversion, the continued pressure should occasion inflammation of the bladder, or render the introduction of the catheter impracticable; or should a formidable obstruction arise to the passage of the feces, the evacuation of the liquor detached through the os uteri; or, if this is not admissible, the puncture of the inferior part of the uterus, through the vagina (not the os uteri), should be essential to the preservation of life. This operation has once been adopted in Eng-

land, in the dispensary practice of my colleague, Mr. Baynham, and I had the gratification of being associated with him in consultation upon it. The situation of his patient, who was six months advanced in pregnancy, was in every respect desperate; and since it was impossible to pass any instrument through the os uteri, as a last resource, the uterus was punctured *per rectum*, the liquor amnii drawn off, and rectification then speedily effected. Recovery most fortunately took place; and a more creditable and instructive case is not on record. (See *Edinb. Med. Journ.* for April, 1830.) Boyer cites an instance very similar, both in its nature and result. (*Mal. Chir.* t. x. p. 531.) (See *Ingleby, in Edinb. Med. Journ.* for January, 1835, No. 122.)

Mr. Lynn, a surgeon in Suffolk, knew an instance of the bladder bursting, and the urine becoming fatally extravasated in the abdomen, in a case of retroversion of the uterus, in consequence of the patient's refusal to submit to paracentesis of the bladder.

Retroversio uteri does not often happen, except in the third or fourth month of pregnancy, and in women whose pelvis is very wide, while the brim is much contracted. If the uterus, in a pelvis of this conformation, be pushed back by a distended bladder, and pressed against the sacrum, while the soft parts yield, it becomes, as it were, wedged, and is incapable of changing its position. In this immoveable state, it presses upon the surrounding parts, and these upon it, so that a very serious train of bad symptoms is the consequence.

It must not be supposed, however, that retroversion of the womb occurs only in pregnant women. Sweighauser and Schmidt had even seen it more frequently in unimpregnated females.

Although in the case related by Mr. Baynham, the puncture of the uterus was performed from the rectum, he states, that he does not consider this an eligible situation. "It was selected, because the uterine tumour may be said to have pointed most distinctly in the rectum. Perforation of the uterus, through the vagina, is preferable, since, without an equivalent advantage, even this small wound of the intestine ought to be avoided. Moreover, there will be less probability of injuring the placenta, which is usually attached to the fundus; and trifling as the chance is of preserving the foetus, it is entitled to consideration."

"The uterus, which in the case detailed by Mr. B., had become displaced about the end of the fourth month of pregnancy, continued in a state of retroversion at least six weeks, during which time the development of the ovum advanced, until it occupied the whole cavity of the pelvis, the child being fixed beneath the pubes and the angle of the sacrum. The extent to which an uterus may become immovably packed in the pelvis is shown by Dr. Hunter, who, in a *post mortem* examination, found it in a retroverted state, grown so large, and thence so wedged, that he could not take it out until he had cut through the symphysis of the ossa pubis, and torn those bones asunder to enlarge the space within the bones of the pelvis. (*Med. Obs. and Inq.*, vol. iv., also a similar instance in *Wilmer's Cases*, p. 144.) This unnatural position of the uterus does not materially, if in any degree, impede the growth of the child, so long as the capacity of the pelvis exceeds the bulk

of the uterus; and, before these proportions are likely to be reversed, a remedy must be applied, or the patient will be lost from mischief done to the bladder. The distension of the bladder (two gallons of urine having by the use of the catheter, been obtained in six hours) may seem incredible. A still larger quantity was drawn off by Dr. Hunter, who, after retention had existed five days, procured at one time seven quarts, and nearly half that quantity in the afternoon of the same day. The further use of the instrument was impracticable; and, after death, the bladder was found amazingly distended, being as large as the womb in the ninth month of gestation, and filling the whole cavity of the abdomen." (See *M. Baynham, Edinb. Med. Journ.* for April, 1830, p. 261. *Richter's Chir. Bibl.* h. v. p. 132; h. ix. p. 310.) As Mr. Weir has remarked, pregnancy is not always necessary for the production of this affection, although he conceives, that the womb must be in a certain degree enlarged, either by pregnancy, or disease, before it can become retroverted. "Desault," he observes, "relates an instance produced by a polypus, and I have seen a case, where there was chronic enlargement of the uterus, but no impregnation. Sir Charles Bell mentions a fatal case of obstruction of urine, as having occurred in the practice of Mr. Cheyne, where, on examination of the body after death, the womb was found enlarged by disease, which had produced the same effect, as if enlarged from pregnancy; for its fundus had fallen into the hollow of the sacrum, and had formed adhesions to the rectum, while the os uteri, pressing upon the urethra, caused the obstruction. Mr. Pearson (*Obs. on Cancerous Complaints*, p. 113.) mentions a case of retroversion, where the womb was enlarged from cancer. The patient, with the view of curing the cancerous affection, adhered most rigidly to a diet composed of liquids only; and, in the course of four weeks, the severe pains were completely removed, the uterus reduced in size, and restored to its natural position. Dr. Burns mentions, that retroversion may take place, "whenever the womb is enlarged to a certain degree by disease." Dr. Ashwell refers to a case, which occurred in a woman, 30 years of age, the mother of several children, who had been pushed down by two drunken men, one of whom fell across her. (*Guy's Hospital Reports*, vol. i. p. 134.)

"Retroversion may also occur a short time after delivery, when the uterus is of that size, which predisposes it for being thrown out of its true situation." Mr. Weir adverts to a case, reported to him, in which a retroversion happened two days after delivery. The same occurrence is noticed by Callisen, and most of the cases, recorded by Dr. Merriman, are of this description. (See *Glasgow Med. Journ.* vol. i. p. 262.) It is questionable, whether the uterus in a perfectly healthy state can ever become retroverted. Dr. Denman was of opinion, that the case is possible; but this is contrary to what is usually believed, and requires the confirmation of facts. One of Mr. Weir's cases happened in a female 48 years of age, just after the catamenia had permanently ceased; and Dr. Merriman has known of similar examples. At this crisis, the circumstance of the uterus being apt to enlarge and grow heavy, may explain the reason of its displacement. (See *Glasgow Med. Journ.* vol. i. p. 265.)

The first aim of a practitioner, consulted in a case of retroversio uteri, should be to empty the bladder and large intestines, and to relax the parts by every possible means. Then he should immediately proceed to reduce the uterus, by placing the patient in a suitable posture, and making methodical pressure in the rectum and vagina. Should he be so fortunate as to succeed, the patient is to be confined in bed, her bowels are to be kept open, and she is to be advised always to obey the calls of nature the first moment she is conscious of them. She is also to be enjoined to avoid all kinds of exertion, and wait till the gradual enlargement of the uterus removes the possibility of its descending into the pelvis. (*Sebutier, Méd. Opér. t. ii.*)

It seems to Mr. Ingleby that a most important, though neglected part of the treatment, consists in the frequent employment of the catheter. "When the retroversion is complete, and the patient has nearly reached the fourth month, the mere evacuation of the bladder, at distant intervals, may fail to answer our expectations. The introduction of the catheter every fourth hour, is preferable to the plan of retaining the instrument within the bladder. We guard against an accumulation of urine, and thus secure the great object in view. The amount of urine which will collect in the bladder within this period, will be insufficient to maintain the cervix uteri in its unnatural situation." (*J. T. Ingleby, in Edinb. Med. Journ.* No. 122. p. 139.)

Some practitioners rather discourage the manual interference to reduce the uterus, believing that drawing off the urine will generally render such interference unnecessary. (*Croft, in Lond. Med. Journ.* vol. ix. p. 53. *Denman's Midwifery*, 4to. Lond. 1801. *Burns's Midwifery*. S. Merriman, *on Retroversion of the Womb*, 8vo. Lond. 1810.)

This difference of practice arose from the different views taken of the cause of the displacement. Dr. Hunter believed, that the retroversion was the cause of the retention of urine, and of all the other symptoms. On the contrary, Dr. Denman argued, that the retention of urine was the first symptom, and, that the consequent enlargement of the bladder raised the neck and mouth of the womb, and caused the fundus to fall backwards; in which position, its pressure on the urethra and rectum kept up the retention of urine, tenesmus, difficulty of emptying the bowels, &c.

Mr. Ingleby also thinks retention of urine, perhaps, more frequently a cause, than the effect of retroversion. (*Edinb. Med. Journ.* No. 122. p. 262.)

In one case under Mr. Weir, although the urine was repeatedly drawn off by means of a catheter, with some difficulty, the uterus could not be reduced, until an assistant pushed its fundus upwards with his hand passed into the rectum, while Mr. Weir himself cautiously drew down the mouth of the womb. Abortion followed, but the patient recovered.

I have adverted to the case, where Dr. Hunter could not succeed in the reduction; and where, after death, the uterus was so fixed in the hollow of the sacrum, that it could not be replaced until the symphysis of the pubes had been divided. But, as Mr. Weir remarks, the reduction may in general be easily accomplished, when attempted early; and, although it has been asserted, that forcible attempts will be very apt to produce abortion, or even worse consequences, he is not

aware of any case on record, where bad effects were fairly attributable to the manual efforts. Abortion has no doubt occurred; but this, he argues, was the consequence of the disease, or deemed absolutely necessary to effect the reduction. He admits, that violent and unnecessary attempts are not justifiable; but he contends, that, if the retroversion be complete, and dangerous symptoms be present, the uterus must be replaced at every risk. Our efforts, he thinks, should be in proportion to the difficulty to be overcome. He is aware that cases have occurred, in which the uterus could not be moved. Besides the case quoted above from Dr. Hunter, where the fundus of the womb could not be got out of the sacrum, even in the dead subject, until the symphysis of the pubes had been divided, he states that the same thing happened in a patient who had been under Dr. Perfect (*Perfect's Cases in Midwifery*, vol. i. p. 394); and in a singular case related by Mr. White, of Paisley, (*Med. Communications*, vol. xx.) many attempts to replace the womb were made in vain. Here, however, the uterus was enlarged from disease as well as one of the ovaries. The patient recovered after much danger, and the bursting of an abscess of the ovary into the rectum. "The advocates for non-interference have asserted (says Mr. Weir), that the catheter can in general be easily introduced; and that the distension of the bladder, which is the cause of the retroversion, being thus removed, all chance of danger is obviated: and one author mentions, that no case will ever occur where the urine cannot be drawn off. Now, the cases already referred to, clearly show that, in general, there will be more or less difficulty in introducing the catheter; and there are some on record where it was found impossible. In Dr. Cheston's (*Med. Commun.* vol. ii. p. 96.), Mr. Lyan's (*Med. Obs. and Inq.* vol. iv.), Dr. Squire's (*Med. Review*, 1801.), M. Baudelocque's (*L'Art des Accouchemens*, sect. 253.), Doeverius's Case (*Merriman, on Retroversion*, p. 12.), Mr. Combe's (*Med. Comment.* vol. v.), and Dr. Perfect (*Cases*, vol. i. p. 394.), the urine could not be drawn off. In the first, the bladder was punctured above the pubes; and in four the bladder burst.

Mr. Weir doubts the correctness of the doctrine, that the distension of the bladder is the first cause of the retroversion. He admits, however, that a full state of the bladder may tend to increase it, and prevent the reduction of the uterus. He considers Dr. Hunter's opinion as most correct; namely, that some degree of displacement first occurs, and that this brings on the retention. He adverts to cases in which the urine was regularly drawn off for several weeks, and the distension of the bladder removed, yet the uterus did not rise. In Dr. Bell's case (*Med. Trans.* vol. viii.), the urine was drawn off regularly; but the uterus continued retroverted, and was the remote cause of an inflammatory affection of the abdomen, which proved fatal. Sir A. Cooper has also referred to one of Dr. Marcet's patients, from whom the urine was discharged regularly; yet the consequence of allowing the womb to remain retroverted was the death of both mother and child. Another example is also cited (*New York Med. Repository*, vol. xi.), where the urine was never obstructed at all, and where the retroversion continued for some months till the woman died. (See *Weir, in Glasgow Med. Journ.* vol. i.)

I will conclude this article with the following instructive observations made by Mr. Baynham. "There are (says he) but few derangements of the human body, yielding so large a proportion of fatal cases as retroversion of the womb; an event almost uniformly produced by injury of the urinary bladder, which, upon dissection, exhibits the marks of inflammation, effusion of lymph, ulceration, mortification, and rupture; and yet by some the complaint has been ranked under the most innoxious class of female disorders. It has been stated as a guide to practice, "that the uterus will sustain no injury by this displacement; that there is no danger of its being locked in the pelvis; that it will frequently be restored by its own efforts to its natural position; and that neither difficulty nor danger will occur if the catheter be used once or twice daily." (*Dr. James Bell, Med. Pract.*, &c., vol. viii.; *Dennman's Introduction*; *Merriman's Treatise on Retroversion*; *Burn's Midwifery*, &c.) "I have witnessed" (continues Mr. Baynham) "the death of two patients from this cause, and the dangerous situation in which others have been placed. It is very true that an early and frequent use of the catheter affords relief, and sometimes proves a source of recovery; but, though some writers upon this subject place much dependance upon the curative efficacy of simply keeping the bladder empty, it will in general be found expedient, immediately after the employment of the catheter, to effect the reduction of the tumour by manual assistance, since it is only when partial displacement has happened, that spontaneous restoration is likely to occur. The location of the tumour fairly beneath the brim of the pelvis, resting, as it must do, in complete retroversion, within the hollow of the sacrum, seems to obviate the possibility of natural recovery." (*M. Baynham, Op. cit.* p. 262.)

In all cases, after the bladder has been relieved, attention should be immediately directed to the state of the rectum; for the degree of pressure made upon it has been known in some cases to resist the passage even of an injection. (See *Ingleby, in Edinb. Med. Journ.* No. 122, p. 139.)

See *Lynn, W. Hunter, Garthshore, Bird, and Hooper, in Med. Obs. and Inq.* vols. iv., v. and vi. *Cheston and Cleghorn, in Med. Communications*, vol. ii. *Saxtorph, in Collect. Soc. Med. Hafniens.* vol. ii. 1776. *Desgranges, in Journ. de Méd.* t. lxx. *A. Wall, Diss. de Uteri grande Reflectione*, 11al. 1782. *Melitsch, Von der Umbiegung der Gebärmutter*, Prag. 1790. *Lohmeier, in Theden's neuen Bemerkungen*, &c. bd. iii. Berlin, 1795. *John Clarke, Practical Essays on the Management of Pregnancy and Labour*, Lond. 1793. *Murray, in Uteri Retroversionen Animadversiones*, Upsal. 1797. *Dennman's Introduction to Midwifery*, Lond. 1801. *S. Merriman, On Retroversion of the Womb*, &c. 8vo. Lond. 1810. *Jahn, De Utero Retroverso*, Jen. 1787. *Desgranges, in Journ. de Méd.* t. lxxvi. p. 35. *Klein, Chir. Bemerkungen*, p. 235. *Baudelocque, Sur le Renversement de la Matrice*, &c. Paris, 1803. *Cockrell, Essay on Retroversion of the Uterus*, Lond. 1785. *Richter, Chir. Bibl.* b. iv. p. 61—70—235—555; b. v. p. 132—548; b. vii. p. 292; b. viii. p. 715; b. ix. p. 182; b. xi. p. 310—329; b. xii. p. 45—50; and *Weir's Two Cases of Retroverted Uteri*, with Remarks, in *Glasgow Med. Journ.* vol. i. p. 262, &c. *Neggle, Erfahrungen und Abhandlungen aus dem Gebiete der Krankheiten des weiblichen Geschlechtes*, Mannh. 1812. *W. J. Schmitt, Bemerkungen, &c. über die Zurückbeugung der Gebärmutter bei Nichtschwängern*, &c. Wien, 1820. *H. Eichorn, Von der Zurückbeugung der nicht Schwängern Gebärmutter*, 1822. *M. Baynham, A Case of Retroverted Uterus*, treated by Puncture of that Organ, in *Edinb. Med. and Surgical Journ.* No. 103, p. 256. *J. T. Ingleby, On Malposition of the Uterus*, &c. in No. 122, of the same Work, p. 137; and all modern works on Midwifery in general.

UTERUS, CANCER OF. The disease generally first attacks the cervix, and especially the posterior lip or margin of the os tincæ. In the beginning, the symptoms are attended with ambiguity, and cannot be discriminated with any degree of certainty from those arising from various other causes productive of irritation of the womb. Most frequently the disease is ushered in by irregularity of menstruation, a sanious bloody discharge, or a profuse leucorrhœa; together with an annoying sensation of tension, weight, and dragging pains in the lumbar and hypogastric regions, extending frequently to different points of the pelvis and hip; frequent desire to make water; tenesmus; and lancinating pain in the cervix uteri. On examination, the portion of it towards the vagina is perceived to be either hardened at every point, or indurated in some places, and softened in others. The os tincæ is likewise indented, irregular, and half open. When pressure is made with the finger, a sanious bloody matter is discharged.

The disease may continue in this state for several months, or even years; but, at length, the symptoms become more aggravated; the darting pains, which now affect also the groins and thigh, occur with increased violence; and the discharge becomes exceedingly ichorous and fetid, blended with sloughy matter and clotted blood. Sometimes, as I have frequently noticed, profuse hemorrhages come on. At the same time, the constitutional impairment becomes more and more serious, and is accompanied by the carcinomatous hectic, and the pallid sallow appearance of the countenance, so characteristic of organic disease. Ultimately death takes place, either suddenly, from profuse bleeding, or, as more usually happens, the patient dies hectic, in a state of horrible suffering.

If, in this advanced form of the disease, a *post mortem* examination is instituted, the portion of the uterus connected with the vagina is found ulcerated, or more or less destroyed, and fungi, or indurated masses, extend from this point within the cervix. The uterus, or upper portion of the vagina is frequently much hardened; and the ulceration may even be continued into the rectum and bladder, so as to form new communications between one or even both these viscera and the vagina, and account for the involuntary discharge of urine and feces by the latter passage.

When the disease commences in the cavity of the uterus, the cervix remains for a long while unaffected, while the body of the womb enlarges in every direction, and may attain considerable magnitude. In such a case, the swelling is sometimes distinctly perceptible through the parietes of the hypogastrium.

Cancer of the uterus may originate at any period after puberty (*Chelius, Handb. der Chir. b. ii. s. 636.*); but the time of life, between the ages of 40 and 50, is that in which its commencement is most common. I have attended not less than three women, who died under the age of 30, from the effects of the cancer of the womb. Cruveilhier observes, that from the age of 35 to that of 50 is the principal season for this cruel disease, though he has known one woman of the town die of it, whose age was only 26; and has seen it in women as old as 60, 70, 80, and even 83. In University College Hospital, I lately had a case in a woman about 70, in whom it proved fatal,

about two years after its first attack. In this case, the disease had implicated the whole of the vagina and even the labia. One young woman, whom I attended in Great Ormond Yard, for a cancerous womb, of which she died, had an aged mother, who had suffered severely from carcinoma of each breast, but had lately been freed from the disease by a sloughing process; an event which is uncommon, but does now and then happen. (See **CANCER.**) Next to cancer of the breast, cancer of the womb is the form in which the disease most frequently presents itself. Sometimes the disease takes place in the womb and breast together; and Cruveilhier records an instance in which cancer uteri was accompanied by a medullary tumour in the substance of the left hemisphere of the brain, so that, in the latter stages of the case, the patient was attacked with convulsions and hemiplegia. According to this distinguished pathologist, however, notwithstanding the tendency of cancerous diseases in general to affect the whole economy, by extending from the point first attacked, as from a centre, cancer of the womb is but rarely accompanied by this general implication of the system, and especially of the breast.

It appears also, from Cruveilhier's researches, that the vagina is as frequently the seat of cancer, as the neck of the womb. "Its anterior paies is much more frequently attacked than its posterior; and hence it is rare to find instances in which the lower portion of the bladder does not participate in the disease." (*Anat. Pathol. liv. xxiii. pl. 6.*)

Cruveilhier finds, that what he terms the *areolar pulqueous cancer*, is the most frequent of all the forms of cancer to which the uterus is liable. In this the uterus is transformed into a spongy texture, from which a cancerous substance, of greater or less consistence, may be compressed in the shape of small worms; so that, when this texture has been emptied by suitable preparation, a hollow cellular structure remains. Cruveilhier conceives that he has made out the fact, that cancer of the uterus begins in the venous system. However this may be, he notices another fact, which is of greater importance to the practitioner, viz., that the *lymphatic glands in the pelvis are almost constantly affected in cancer of the womb.* He specifies in particular two, situated, one to the right and the other to the left, at the sides of the pelvis, on a level with the highest part of the ischiatic foramen: these, he says, are often the only lymphatic glands implicated. The lumbar glands he finds less frequently diseased than the pelvic; and he states, that they may be enlarged and red without presenting any vestige of cancerous structure. The inguinal glands are only involved when the disease attacks the external pudenda, and the orifices of the vagina. In only one dissection he found the cancerous substance in the thoracic duct, though he examined it at every opportunity; and, in another instance, he traced the same substance in many of the lymphatics, which proceeded from the diseased parts. (*Op. cit. liv. xxvii.*) In one case, dissected by Cruveilhier, one ureter was enormously dilated, and the corresponding kidney wasted. "The relations of the ureters with the lateral and superior part of the vagina, and with the lower part of the bladder, which is often implicated in cancer of the uterus, account for the impediment to the flow of the urine through the ureters, the lower portions of which are often sur-

rounded by cancerous masses, which compress them. This compression may take place in so great a degree, that the lower part of the ureter is completely obliterated; and, what is remarkable, such compression does not produce the fatal consequences, which theoretically might be expected. The urine dilates the ureter (see liv. xxvii. pl. 2. fig. 2.), which, at the same time that it becomes dilated, is lengthened and rendered tortuous or spiral, like a varicose vein. The pelvis and calices in their turn are also expanded, so as to acquire a considerable capacity. The kidney, compressed by the urine, accumulated in the dilated calices, gradually wastes away, and is converted into a mere shell, or husk of a pale yellow, having some resemblance in colour to the changed state of the kidney, known of late by the name of Bright's Disease; and such atrophy may proceed so far that no urine can be secreted, or so little, that any redundancy may be easily prevented by absorption." The possibility of life continuing long, with an obstruction of both ureters, would be, however, a very different case from that described by Cruveilhier.

Gangrene, consequent to cancer of the womb, is found by Cruveilhier to be very common, sometimes destroying the cancerous structure, layer by layer, and, in other instances, attacking the whole mass of it. In both cases, the discharge becomes horribly fetid, and when the finger is withdrawn from the vagina, it brings away a sloughy putrid detritus, which Cruveilhier says can be compared to nothing more like it than the substance into which hospital gangrene transforms the textures invaded by it. The sloughing may advance slowly or rapidly; a difference which has vast influence on the intensity and acuteness of the symptoms. When gangrene attacks the whole of the cancerous mass, and nearly annihilates it, the case might be mistaken for one of primary mortification; and, in many examples, the cancerous state of the pelvic and lumbar absorbent glands is the only criterion of the gangrene having been preceded by a cancerous affection of the uterus. (Cruveilhier, *Anat. Pathol.* liv. xxiv.)

As I have never seen more than palliative relief derived from medicines or local applications, in the treatment of true cancer of the womb, I shall not dwell long upon this part of the subject. So far as my experience goes, temporary relief is to be sought principally in the judicious employment of narcotics and purgatives as occasion requires, the horizontal position, leeches on the hypogastric region in the early stage, fomentations, and frequent ablution with tepid water, or decoction of poppies. I have not generally found the chloride of soda lotion, nor any astringent injection superior to tepid water in the temporary relief afforded; but when the discharge is copious and exceedingly fetid, they may be tried. The tincture of iodine, the hydriodate of potash, the iodide of mercury, the carbonate of iron, the liquor arsenicalis, the aqua laurocerasi, and almost all the medicines specified in the article CANCER, I have seen tried, but without any permanent benefit.

Modern experience proves, however, that when cancer, or rather scirrhus, is confined to the neck of the uterus, it will sometimes admit of being successfully removed by excision. The cervix uteri, in the healthy state, projects from three to

six lines into the vagina; but M. Lisfranc has known it make no projection at all. The vagina around it is thin, and in contact, on one side, with the bladder, and, on the other, with the rectum; while upwards it is continuous with the proper substance of the uterus. The vagina may be detached from the cervix uteri to the extent of more than half an inch, without any risk of opening the cul-de-sac of the peritoneum, which separates it from the bladder; but since the latter viscus adheres very intimately to its anterior surface, it might then be reached by the instrument. Behind, the peritoneum not only covers the corresponding surface of the uterus, but also descends over the vagina, to form what M. Velpeau terms the recto-genital excavation; so that, on this side, the knife, if carried only a few lines would open the peritoneum. M. Velpeau considers it erroneous then to say that there is a space of eight lines in front, and ten behind, between the upper edge of the cervix uteri and the serous membrane of the abdomen. The distance is stated by M. Malgaigne to vary, according to the greater or lesser projection of the cervix. M. Malgaigne also states, that the vagina may always be detached from the cervix to the extent of more than half an inch in front, without hazard of wounding the peritoneum; but, behind, the vagina ascends further, and there is less space between it and the peritoneum. It may be added, that no very large arteries, or veins, are distributed to the neck of the womb. (See *Velpeau, Nouv. Elém. de Méd. Opér.* t. iii. p. 620; *Malgaigne, Man. de Méd. Opér.* p. 747. ed. 2.)

According to Baudelocque, the excision of the cervix uteri was first suggested in 1780, by Iauvariat. M. Tarral even ascribes it to Talpius; but the tumours which the latter took away were, according to M. Velpeau, evidently polypii. Lazzari, who puts in a claim for Monteggia, is also believed to have made a similar mistake; nor has M. Velpeau been able to satisfy himself that the operation was ever performed by André-de-la-Croix and Lapeyronie, as M. Tarral represents. Trosberg recommended it, however, in 1787; and, as a critical writer observes, sometimes the cervix uteri was removed accidentally with the knife by ignorant persons, who mistook it for a polypus. (See *Edinb. Med. and Surg. Journ.* No. 103. p. 377.) Professor Osiander, of Göttingen, first executed the operation in 1801, on a widow, whose vagina was filled by a very vascular fetid fungus, as large as a child's head, growing from the orifice of the womb. By means of Smellie's forceps, the fungus was drawn down; but it broke off, and a tremendous hemorrhage ensued. The operator, without loss of time, introduced several crooked needles, armed with strong ligatures, through the bottom of the vagina, and body of the uterus, until they emerged at the os tincae. These ligatures served to draw down the uterus, and retain it near the mouth of the vagina. Osiander then introduced a bistoury above the scirrhus portion, and divided the uterus exactly in the horizontal direction: for an instant, the bleeding was profuse, but it was quickly stopped by means of a sponge, saturated with styptics. In about a month, the woman recovered. Osiander afterwards performed eight similar operations upon different patients, all of whom are reported to have experienced a cure. The observations of Osiander were no sooner promulgated in France, than M.

Dupuytren adopted the new operation, and made numerous trials of it. M. Recamier followed Dupuytren; so that, by 1815, the excision of the cervix uteri had become in France a common operation. However, it remained for M. Lisfranc to extend the practice, and to convince the most incredulous of the little danger resulting from it. (*M. Velpéau, Nouv. Élém. de Méd. Opér.* t. iii. p. 615.) Dupuytren also performed the operation eight times; but, instead of employing the ligatures and knife, as Oslander did, he drew down the uterus with hook forceps (*les pincés de museux*) and divided it, above the scirrhus part, with curved knives and scissors. One of the patients, on whom Dupuytren operated, had a return of the disease, and submitted to a second operation with no better result; but was afterwards effectually cured by the application of caustic, with the aid of the speculum invented by M. Recamier.

Dr. John Brown, surgeon to St. Mark's Hospital, has published one of the best descriptions of the operation of removing the cervix uteri, as witnessed by him at Paris, in 1826 and 1827. To perform this operation (he observes) the patient must be placed as for lithotomy, with the parts exposed to a clear light. The speculum (that of M. Recamier, or that of Madame Boiven) is then to be introduced by a slight rotatory motion of the hand, its outside having been previously smeared with cerate or butter, in preference to oil, and care being taken to avoid soiling the interior of the tube, which, when clean, serves to reflect in its sides the disease of the cervix, and will of course aid the practitioner in forming his opinion. A lighted candle, held close to the larger end of the instrument, is sometimes employed with a similar view. The condition of the cervix having been ascertained, and the speculum withdrawn, the left forefinger is passed up, and on it the double hooks, which are firmly fixed in the projecting lips of the cervix, one on each side, and given to an assistant for a moment. The operator, then taking both hooks in his right hand, gradually and gently draws down the cervix, till it has been brought nearly on a level with the external parts; he next passes a button-pointed bistoury behind the diseased portion of the uterus (the labia, &c. being held asunder), and removes it. A similar operation is performed in cases of polypi, with this exception, that, in place of the bistoury, a large and strong pair of curved scissors is used, and that the neck of the polypus is in general alone divided. The cut surface of the uterus quickly resumes its natural position on the removal of the hooks, no dressing being commonly applied to the part; and the patient being put to bed, is placed on a strict regimen for several days, venesection and leeching being freely employed, not only to remove, but even to prevent attacks of inflammation. (M. Lisfranc usually bleeds his patients at La Pitié to 3x. or 3xii. soon after the operation, the effect of the excision being considered by him, particularly where there has been preceding menorrhagia, as analogous to a suppression of the menses; repeating the bleeding, leeching the sacral region, and using emollient fomentations and enemata on the least occurrence of abdominal tenderness. Such treatment is generally very successful, although it is not uncommon to bleed three or four times from the arm, besides applying leeches.)

After the simple introduction of the speculum, in

certain cases where an inflammatory diathesis exists (more particularly in young persons, or where the cervix, in addition to other disease, appears gorged with blood), care is to be taken to throw emollient lotions, or those containing the chlorides of lime, or soda, into the vagina several times daily, by means of a syringe; and the wound, if tedious, may require to be touched with the nitrate of silver. Women, so treated, are usually able to go home in three or four weeks. It is not desirable that the patient should go to stool soon after the operation, as the effort might detach the coagulum from the wound. One woman is alleged to have become pregnant fifteen days after the operation, went the usual time, and was delivered in three quarters of an hour, as there was no cervix uteri to resist the passage of the infant. "When we consider (continues Dr. Brown) the high vascularity and great irritability of the uterine apparatus, it might be supposed that the operation just described must necessarily be of an extremely painful nature, and that troublesome hemorrhage would always occur. But no such consequences usually ensue; the drawing down of the organ being commonly effected by very slight efforts; and, as to pain, the patients hardly ever appear to experience any. The bleeding seldom exceeds one or two ounces. There is one consequence, however, which usually follows, and which I need scarcely observe requires to be energetically treated, I mean inflammation of the peritoneum. Whether this arises from the division of the portion of that membrane descending between the rectum and uterus, or from continuous sympathy (as Hunter calls it), or from an extension of the disease from the parenchymatous substance to the membranous covering of the uterus, is not easy to determine. The portion of the cervix removed is usually that which projects into the vagina, and no more; and it will, I imagine, be conceded, that when we consider the general extensibility of the organ, such a portion of it may be safely excised without implicating the important membrane in question; but I do not say that, on occasions where a portion of the body has been removed with the cervix, such an injury may not have been done; an accident which the practitioner should do his utmost to avoid." (See *Dr. J. Brown's paper in Dub. Journ. of Med. Science*, vol. vi. p. 22—27.)

In 1828, M. Lisfranc had performed this operation on thirty-six individuals, as is stated, for cancer uteri; the recognition of which last declaration as a positive fact, I beg to observe, is a matter of great importance in determining the merits of the operation. Of the thirty-six patients thus operated upon, "thirty were then well, three dead, and three in progress of recovery. One female, operated on some years before, had since become pregnant, and recently given birth to twins. Lately, at the Hôtel Dieu, the entire uterus has been removed by M. Recamier; and, in September last, this formidable operation was performed at La Charité, by M. Roux. The patient died in twenty-four hours after the operation." (See *Practical Formulary of the Parisian Hospitals*, by F. S. Katier, p. 17.) Langenbeck's extirpation of the whole uterus, by cutting through nearly the whole of the linea alba, I do not deem it necessary to detail, as it is a proceeding which I would never recommend to be imitated. The poor woman experienced the same fate as the patient of M. Recamier.

Even with regard to the excision of the cervix uteri, it is perfectly manifest to me that many of the cases in which it was performed were not truly cancerous. Doubts may be entertained, I think, whether the enormous tumour removed in the very first instance of such operation by Oslander, was really a cancerous affection. Several of the cases operated upon in Paris were decidedly not of this character. On this point I fully agree with Dr. Brown, an eye-witness, who remarks: "While I admit the facility with which such a measure may be accomplished, I must be permitted to doubt its necessity in some of the cases related. The second and third were, in my opinion, such affections as would have yielded to common local and constitutional measures, and would, I have no doubt, have been so treated by British surgeons, and perhaps by a few of our French brethren." (See *Brown, in Dublin Journ. of Med. Science*, vol. vi. p. 29; and *M. Ricord's Obs. upon Ulcer of the Cervix Uteri*, in *Journ. Hebdomadaire*.) M. Velpeau, who regards the excision of the cervix uteri as an operation so completely established as to render unnecessary any reply to the arguments used against its performance by Wenzel and Zang, acknowledges that the difficult point is to lay down precisely the indications for it. "The elongation from simple hypertrophy of the neck being rather an infirmity than a disease, never requires it. Excoriations, ulcers, syphilitic growths, not being of an incurable nature, are none of them cases for it. The same may be said with respect to the indurations and umps, free from pain, whether attended or not by chronic inflammation, so often met with in females between the ages of thirty and forty. It is only then, a well-marked cancerous disease, that the operation is allowable; but here is the difficulty of the question. In truth, so long as cancer is free from ulceration, or does not present itself in the upper part of the vagina, in the form of a more or less sloated mass, the diagnosis is exceedingly difficult. The firmness, or natural consistence of the cervix, the varieties in its size, protuberance, density and form, according to the age and different conditions in which the female may be, demand, in the first instance, great ability, in order to prevent the relief in affections of which not a vestige exists. Then, how can there be any certainty of a lesion so deeply situated in the midst of so condensed a texture, and composed of elements so changeable? This is not all: when the existence of cancer is uncontested, its limits must still be ascertained. On this point, doubts are seldom quite removed, till the disease is far advanced, and scarcely ever can a guarantee be given that the cervix is the only part diseased, and the body of the uterus not yet attacked." However, encouraged by the fact, that the cancer of the uterus continues longer than that of other parts, without extending to the rest of the system, M. Velpeau would not absolutely renounce the operation. "It is better (says he) to try it than abandon the woman to a certain death, whenever the disease leaves a hope that the whole of it may be removed." (See *Nouv. Elém. de Méd. Opér.* t. iii. p. 616.)

In one instance, Dr. Brown, in the attempt to remove the cervix uteri, tried to draw down the latter part; "For this purpose (says he), Boivin's speculum having been introduced, its blades were separated and held by an assistant; the hooked forceps were then passed through the tube, and

fixed on each side of the cervix. Gentle traction was next exercised (the speculum having been withdrawn) upon the two forceps, which seemed to produce more uneasiness than is usual, till a considerable portion of the excrescence appeared within the blades. It was now found that the excrescence had been torn off from the cervix, and remained attached only by a portion of the lining membrane: this was divided by a blunt bistoury passed cautiously on the finger and the tumour removed. Attempts were next made to fix the hooks into the lower part of the uterus, in order to remove the diseased surface from which the new growth had originated; but the instruments uniformly separated, from the parts being unusually soft. One of the forceps was at length passed into the os uteri, with a view to fix it there, when a discharge of thick pus, to the amount of about one ounce, flowed; and, on passing up the finger, the interior of the uterus appeared so unequal (though not of stony hardness), that further attempts to excise the cervix were considered inadvisable. The vagina was therefore washed out with cold water; and cold compresses applied; about two ounces of blood were lost. The uterus did not appear much enlarged." This woman recovered, and became free from all her previous ailments. The inferences deduced from this case by Dr. Brown are: 1. "That it may not be always practicable to excise the cervix uteri, or even to draw it down for that purpose. 2. That abscess of the uterine cavity may exist as a latent malady, without any decisive symptom to denote its presence. 3. That very great relief, almost amounting to a cure, may be afforded by the evacuation of such purulent depositions." (*Op. et. vol. cit.* p. 37.) The original disease appears to Dr. Brown to have been chronic inflammation of the cervix, ending in the formation of pus within the cavity of the organ, and accidentally complicated by the existence of a small excrescence. The absence of hardness and lancinating pain, he says, denotes that it was not cancer. The whole history of this case and its result confirm this view; and of course the case is another example in which the excision of the cervix uteri was not necessary.

Instead of the excision of the cervix uteri for cancerous diseases, M. Bayle advocated the application of caustic; and his advice was founded upon the fact shown by pathological anatomy, that, in the early stage of malignant ulceration of this part, the texture of the uterus is healthy at the distance of two three lines from the ulcerated surface. The patient having been placed in the right position, and the speculum introduced, the cancer is to be cleansed with dossilis of charpie, introduced by means of a long pair of forceps. If the surface is irregular, or the seat of fungous granulations, they are to be removed with curved scissors, or a sharp edged kind of scoop (Dupuytren). In this manner indeed, such growths may be removed, not only from the cervix, but from the interior of the uterus. After the ulcer has been cleaned, a roll of charpie is placed below the speculum, in order to protect the vagina from the action of the caustic. Then the caustic is applied, either the arsenical paste (Bayle), or the pure potash, scraped to a point, and fixed in a porte-crayon; or the acid nitrate of mercury, with which lint is wetted and conveyed with forceps to the ulcer. The application is continued for one minute; then copious injections of tepid water are employed for the removal of the

uncombined particles of caustic; the charpie and speculum are withdrawn; and the patient put into a warm bath. In about four or six days, the application is to be repeated; and, if no ill consequences follow, it is to be continued at short intervals, but more and more lightly each time, in proportion as the cure advances. (*Lisfranc; also Malgaigne, Man. de Méd. p. 745. ed. 2.*)

Whoever wishes to obtain further information, respecting operations for the removal of the cancerous uterus, should consult *Sabatier, Méd. Opér. t. iii. p. 397. Paris, 1824. Alf. Velpeau, Nouv. Elem. de Méd. Opér. t. iii. M. Malgaigne, Man. de Méd. Opér. 18mo. Paris, ed. 2. 1837. J. Hahn, Mém. sur un Nouveau Procédé pour l'Amputation du Col. de la Matrice, &c. Paris, 1827. Canella, Cenni dell' Estrazione della Bocca et del Collo dell' Utero. Milan, 1821. Ammon, Parallele der Französischen und Deutschen Chir. p. 257, &c. Jörrg, Aphorismen, &c. zur Würdigung Zweier Von Hr. Hofrath Oelsander, in Leipzig unternommen Operationen, Leipz. 1820. Struer, in Hufeland's Journ. b. xvi. at. 3. 1803. Gutberlet, Siebold's Journ. b. 1. at. 2. C. Wenzel, über die Krankheiten der Uterus, Mainz, 1816. Langenbeck, Neue Bibliothek, &c. b. 1. s. 3, p. 551. Lard Wolf, in Archives Gén. de Méd. Janv. 1836, p. 105: case of amputation of scirrhus uterus in the state of prolapsus, the result fatal. *Recaulier*, in *Revue Méd. Dec. 1825*: removal by ligature, followed by cure. Also, in *Archiv. Gén. de Méd.* 1829, t. xxi. p. 78. *M. Roux*, Deux Cas de l'Extirpation de l'Uterus suivis de Mort, *Bulletins des Sciences Méd.* Oct. 1829. *Sauter*, Die gänzliche Exstirpation der Carcinomatösen Gebärmütter, &c. Constanza, 1822: result successful. *Siebold*, Beschreibung einer vollkommenen Exstirpation der Scirrhusen, nicht prolapsirten Gebärmütter, Frankfurt. 1824. *Paletta*, Journ. von Graefe, &c. bd. 5. h. 3. *Hörscher*, 15; *Chelius*, *Handb. der Chir. b. II. Heidelberg. 1827*; and, more especially, the writings and published lectures of *M. Lisfranc*. Also, *James Rhoadell, M. D.*, Case in which the Uterus, in a state of Malignant Ulceration, was successfully removed; and two other Cases, &c., *London Med. Gaz.* Aug. and Nov. 1828. *John M. Bannan*, Case of Extirpation of the Uterus, ib. Oct. 1828. And, above all, before a surgeon makes up his mind to attempt the excision of the Uterus, either in a state of prolapsus, or under any circumstances, I recommend him to read carefully the cases, facts, and reflections, contained in art. 3. p. 376. of the *Edinb Med. and Surgical Journal* for April, 1830, No. ciii.*

UVA URSI, first brought into notice by De Haen, was once considered a powerful remedy in calculus; but, though its virtue, in lessening the irritation of the bladder, is still acknowledged, its claim to utility on any other principle is quite rejected. Dr. Austin recommended it for lessening the irritability of the bladder, and diminishing the secretion of diseased mucus, which, he supposed, greatly contributed to the augmentation of the stone.

Mr. B. Bell also strongly recommended it in gonorrhoea, where the irritability of the bladder was excited in a high degree, and where the urine was loaded with viscid matter. In these cases, he directed a scruple, or half a drachm, of the powder to be taken three times a day.

Dr. Saunders used to order three drachms of uva ursi to be macerated in a pint of hot water, and two or three ounces of the strained liquor to be given three times a day. (*Pharm. Chirurg.*)

UVULA, AMPUTATION OF. The uvula is subject to several kinds of enlargement, in which it becomes both longer and more bulky than natural, or is simply lengthened. In consequence of such changes, it becomes troublesome in deglutition and speaking, and causes a disagreeable tickling at the root of the tongue, frequent retching, and annoying cough.

When things have attained this state, medicines are often ineffectual, and the only plan of relief consists in amputating a portion of the uvula with a pair of scissors. I lately amputated a gentle-

man's uvula on account of an obstinate and deep ulceration, extending nearly through its root, and producing a lateral displacement of the part, attended with a considerable degree of irritation and annoyance.

VAGINA IMPERFORATE. Female infants are often born with imperforate vaginas. Sometimes this passage is not completely shut up, the usual evacuations take place in an uninterrupted manner, and it is a considerable time before the malformation is discovered. Some females are even stated to have become pregnant, notwithstanding such obstruction; and in these cases the membrane, which shuts up a part of the mouth of the vagina, was either torn by the effects of labour or divided as much as was necessary for delivery.

Two membranes, one placed beyond the other, and obstructing the vagina, have also been found. That, which is commonly met with, is only the hymen thicker and stronger than natural. Ruysch describes the case of a woman, who had been in labour three days and could not be delivered. The head presented itself, but was prevented from coming out by the hymen, which shut up the vagina, and was very tense. Ruysch made an incision into the membrane, but to no purpose, since there was another membrane, of a thicker texture, situated more deeply in the passage. As soon as this second membrane had been divided, the child was expelled, and the case ended well.

When the vagina is completely imperforate, and the time of the menses has arrived, many complaints occur, which afflict the patient with more severity in proportion as the blood accumulates in the passage; and they may even lead to a fatal termination when the cause is not understood, or not detected till it is too late. These complaints are similar to those of pregnancy; for instance, rumbling noises in the bowels, loss of appetite, nausea, vomiting, enlargement of the mammae, spasms, convulsions, swelling of the abdomen, &c. Hence girls in this situation have often been supposed to be pregnant, although they were not in a state even to become so; and some young women have been known to die after dreadful sufferings. Frequently there is difficulty in passing the urine, and sometimes even complete retention.

When the malformation consists altogether in the orifice of the vagina being shut up by a membrane, the patient may be easily relieved by a crucial incision, or a single cut, the edges of which are kept apart with a dosail of lint. Instances of the success of such an operation are to be found in numerous writers. Fabricius ab Aquapendente informs us, that a female child was born with a membrane which completely shut up the vagina. The girl experienced no inconvenience from it till she was about thirteen, when the period of her menses began. As the blood was retained she became afflicted with severe pains in the loins, the lower part of the abdomen, and about the upper part of the thighs. She was supposed to be attacked with sciatica, and treated accordingly. Medicines were prescribed, which did no good; and, at length, she became hectic, and reduced to a complete state of marasmus, in which she passed restless nights, lost her appetite, and was delirious. A painful elastic tumour afterwards presented itself in that part of the abdomen which corresponds to the uterus. The pains were aggravated every month, during the period when the

patient ought to have menstruated. She was in a dying condition, when Fabricius ab Aquapendente was consulted, who, after ascertaining the real nature of the case, performed the requisite operation. A prodigious quantity of black putrid blood was discharged from the vagina; the bad symptoms gradually subsided, and the patient recovered. (See also J. C. Loder, *Obs. Imperforationis Vaginae*, *Icone illustrata*, 4to Jenæ, 1800. Case cited in article URINE, RETENTION OF, from *Prov. Med. and Surgical Trans. Dr. O'Reilly's Case in Dublin Journ. of Med. Science*, vol. vi. p. 318., and numerous other cases on record.)

When the malformation is produced by an extensive concretion of the sides of this passage to each other, the cure is sometimes difficult. The result of the operation is doubtful, because it is impossible to reach the confined menstrual fluid, without cutting through a considerable thickness of parts, in doing which there is some danger of wounding the rectum or bladder. A lady twenty-four years of age, after having tried for eight years such remedies as seemed best calculated for exciting the menstrual discharge, became affected with a large hard swelling of the abdomen, and a kind of herpetic affection round the body near the navel. At length it was discovered, that the imperforation of the vagina was the sole cause of all the bad symptoms which the patient had long endured. An incision was made, which enabled the operator to introduce his finger into a large cavity, and which gave vent to a considerable quantity of blood. It was thought that an opening had been made into the vagina; but the patient having died three days afterwards, it was seen that a mistake had been made, as the cavity in which the finger had been introduced was that of the bladder. The vagina was closed below by a substance, one inch in diameter, and half an inch thick. The upper part of this passage, the uterus, and the Fallopian tubes, were exceedingly enlarged, and filled with a dark-brown sanious fluid. A similar fluid was found extravasated in the abdomen, through a rupture, which had taken place in the Fallopian tube. The ovaries were in the natural state. De Haen, who has related this case in the sixth part of his work entitled *Ratio Medendi*, was of opinion that, in order to avoid opening the rectum or bladder, only one oblique cut should be made in the membrane which stops up the vagina, as was advised by Mécquen. As life would be endangered by retention of the menses in the womb, I concur with M. Velpeau in stating, that no difficulties should deter the surgeon from attempting an operation, however great they may be. (See *Alf. Velpeau, Nouv. Elém. de Méd. Opér.* t. iii. p. 575.)

VAGINA, PROLAPSUS, OR INVERSION OF. According to Sabatier and Levret, the lining of the vagina is alone displaced; but Richter, Chelius, and other writers, describe the vagina as liable to two kinds of prolapsus: in one, all its tunics are included in the protrusion; in the other, its lining is merely relaxed. It is only in this last case that the uterus may not be involved. (Chelius, *Handb. der Chir.* b. i. p. 771.)

Occasionally a prolapsus of a very limited portion of the vagina is observed. This case is generally the consequence of vaginal hernia (see *Varicocèle*); though in some cases of dropsy, a circumscribed protrusion of the vagina, in the form

of a cyst or pouch, filled with fluid, is sometimes noticed.

When the prolapsus is recent, the part may be easily reduced, and kept up with a pessary. The use of astringent lotions will then tend to prevent a relapse. But when the case has been of long standing, it is neither easy to effect the reduction, nor to prevent the recurrence of the disorder. In this circumstance the patient should confine herself in the recumbent position, and wear a T bandage, which should be made to support a piece of sponge in the orifice of the vagina.

When the prolapsus has continued a long while, the reduction must be difficult; because the vagina in this state becomes affected with chronic swelling. According to the reports of Hoin and Levret, a large protrusion of this kind, ten inches in length, was so diminished by keeping the patient invariably confined in bed upon her back, that, in the course of a month, the rest of the tumour admitted of being reduced. Indeed, as Richter observes, there can be little doubt that the treatment, which has been advised by some authors for the diminution of very old, enormous, omental ruptures, would here be equally applicable; viz. long confinement in bed upon the back, with the buttocks somewhat elevated; unremitting well directed external pressure; low diet; and repeated mercurial purges.

During pregnancy, a prolapsus of the whole substance of the vagina may cause much embarrassment and even danger. In one case of this description, where the protrusion was five inches in length, it became necessary to turn the child, and the displaced vagina was lacerated. The woman, however, recovered. (*Pietsch, Journal de Méd.* t. xxxiv.) In another instance, where the prolapsus became, at each return of the labour-pains, as large as a man's head, the practitioner succeeded in holding the parts back, while delivery was effected with the aid of the forceps. (See *Loder's Journ.* b. i. p. 490.) When this is impracticable, it may be necessary to make an incision through both sides of the prolapsus; a measure, says Richter, to which the practitioner may the more readily make up his mind, inasmuch as the parts have, in some cases, been lacerated without any ill consequences.

A prolapsus of the inner membrane of the vagina, while small and recent, may sometimes be removed by astringent applications. When, however, it is of long standing, indurated, and of large size, much expectation of success from this treatment cannot be entertained. Richter sees no reason why, in such a case, the superfluous relaxed part should not be cut away, especially if the disease be accompanied with ulceration and other serious complaints. At all events, a prolapsus of the inner membrane of the vagina, when limited to one part of it, may always be safely extirpated. Dieffenbach, instead of reducing the prolapsed vagina, and keeping it up with a pessary, prefers an operation analogous to that resorted to by Dupuytren for the cure of prolapsus of the rectum. (See UTERUS, PROLAPSUS OF.) Richter, *Anfangsgr. der Wundarz.* b. vii. chap. 4. J. C. Loder, *Progr.* 1-3. *De Vagina Uteri Procidencia.* Jen. 1781. M. J. Chelius, *Handb. der Chir.* b. i. p. 770. Heidelb. 1826.)

VARICOCELE (from *varix*, a distended vein, and *κύμα*, a tumour); sometimes called *Circoscèle*

(see this word), is a varicose distension and enlargement of the spermatic vein; and, whether considered on account of the pain which it sometimes occasions, or on account of a wasting of the testicle, which now and then follows, it may truly be called a disease. It is frequently mistaken for a descent of a small portion of omentum. The uneasiness, which it occasions, is a dull kind of pain in the back, and the testicle, which is generally relieved by suspension of the scrotum. One feels, in the course of the cord, an irregular swelling, consisting of several enlarged vessels, which swelling has a pyramidal shape, with the broad part towards the testicle and the narrow part towards the abdominal ring. When the patient lies on his back, the tumour diminishes, or disappears altogether, because this posture promotes the return of the venous blood; but when the patient stands up it reappears, because the column of blood in the spermatic vein has then to ascend against its gravity. Moderate pressure with the hand will make the tumour disappear, not all at once, but gradually; and, when the pressure is taken away, the swelling reappears; not suddenly, but in a slow and gradual manner. It has been fancied to resemble a collection of earthworms; but, whoever has an idea of a varicose vessel, will not stand in need of an illustration by comparison. It is most frequently confined to that part of the spermatic cord which is below the abdominal ring; and the vessels generally become larger as they approach the testis. M. Blandin refers to instances of varicocele of both sides, so large as to conceal the testis and the penis. (See *Dict. de Med. et de Chir.* vol. xv. p. 566.)

In the greater number of cases, the disease occasions no serious inconvenience, and many persons have it without being aware of the circumstance. In other instances, however, it produces a sense of weight, and even acute pain in the testicle. Sir Benjamin Brodie had a patient in whom the pain was very severe, in consequence, as was suspected, of the varicose cluster pressing on some nervous filament. (See *Lond. Cas. Med.* vol. xiii. p. 378.) When a varicocele becomes large and is of long standing, it is apt to produce atrophy of the testicle, in consequence of the imperfect circulation of blood in it, resulting from the diseased state of the spermatic vein and its branches. Pott had seen this organ so wasted as hardly to be discernible; and Mr. S. Sharp noticed the same thing. Pott had also observed the same effect from the injudicious application of a truss to a varicocele; the vessels, by means of the pressure, became enlarged to a prodigious size, but the testicle shrunk to almost nothing. (*Pott's Works*, vol. ii.)

The spermatic veins (M. Velpeau observes) which are tortuous, undulating, very large, and to the number of two, three, four, or even more, are readily distinguishable down to the epididymis, and usually placed in front and at the sides of the other vessels. Long, soft, destitute of valves, continually dragged by the weight of the testicle, lodged in loose cellular tissue, exposed to pressure in the inguinal canal in consequence of the double bend which they make, and being also equally pressed upon in the iliac fossa in front of the muscles, by the end of the ileum, or the cæcum, on the right, and by the sigmoid flexure of the colon on the left, it is not surprising that the spermatic veins should frequently be the seat

of varicose dilatation, and that a varicocele should become sometimes very large. The kind of knotty chain, which they then form, gradually enlarges as they approach the testicle, because their branches increase in number in proportion as they come nearer to the lower end of the cord. This fact proves, that in order to obliterate them by incision or ligature, as anciently practised (*Paul. Eglin. Sprengel*, t. vii.), and in modern times successfully by Delpéch, they should be exposed as high as possible. (See *Alf. Velpeau, Anat. Chir.* p. 199. t. ii. 8vo. Paris, 1838.)

Morgagni remarked that the disease is more frequent in the left, than the right spermatic cord; a circumstance which he refers to the left spermatic vein terminating in the renal. (*De Sediibus et Caus. Morb. Epist.* 43. art. 34.) Mr. Mayo joins J. L. Petit, Callisen, and Richerand, in stating that it is more frequent on the left side than the right, "owing to the position of the sigmoid flexure of the colon over the left spermatic veins. For the same reason (he adds) it is often benefited by purging." (*Outlines of Human Pathology*, p. 562.) M. Blandin also specifies, as one cause of varicocele, the pressure of the large intestine on the spermatic veins. (See *Dict. de Med. et de Chir. Prof.* vol. xv. p. 562.) The circumstances of the spermatic veins having no valves, a long course, and but feeble coats, and the blood in them having to ascend against its own weight in the erect posture of the body, must all give a tendency to a varicose affection of its lower branches. It is sometimes alleged, that even in persons who are not habitually constive, the left spermatic veins are naturally more tortuous and capacious than the right. Cruveilhier also takes into the account the generally larger size and lower situation of the left testicle, as possibly concerned. (*Blandin*, vol. cit. p. 564.) Persons who ride much, are very liable to the disease, and so are residents in warm climates.

Varicocele is, more frequently than any other disorder, mistaken for an omental hernia. When large it dilates upon coughing; and it swells in the erect, and retires in the recumbent posture, of the body. There is only one sure method of distinguishing the two complaints: place the patient in a horizontal posture, and empty the swelling by pressure upon the scrotum; then put the fingers firmly upon the upper part of the abdominal ring, and desire the patient to rise; if it is a hernia, the tumour cannot re-appear so long as the pressure is continued at the ring; but if it is a varicocele, the swelling returns with increased size, on account of the return of blood into the abdomen being prevented by the pressure. (*Sir Astley Cooper on Inguinal Hernia*.)

When the complaint is attended with pain, cold saturnine astringent lotions may be applied. At the same time, blood may be taken away by means of leeches; the bowels kept open; the patient placed in the horizontal posture; and the testicle supported in a suspensory bandage.

In general, nothing more is required than the suspensory bandage, cold applications, purgatives, and sometimes leeches, to remove any temporary uneasiness or pain resulting from varicocele; and then the disease remains stationary, the patient merely wearing the suspensory bandage, without which the uneasiness mostly soon returns. Patients with varicocele should also have recourse to cold bathing

and avoid costiveness; which precautions, if not adequate to effect a radical cure, will generally keep the disease from making progress and becoming troublesome.

Gooch and other writers relate cases, in which the pain was so intolerable and incurable, that castration was the only means of relief. Putting castration out of the question, let us briefly inquire what expedients have been tried when the disease is productive of unusually severe pain, and resists ordinary treatment. Some practitioners, on the authority of Celsus, have cut down upon the varicose veins and put a ligature round them. In one instance, Sir Everard Home, like Paul Cumanio, at Trieste, performed such an operation in St. George's Hospital. "In this case, venous inflammation took place, attended with so much constitutional disturbance, that the patient nearly died." (*Sir Benjamin Brodie, in Lond. Med. Gaz.* vol. xiii. p. 379.) At the present day, this use of the ligature is abandoned; for if not followed by a dangerous or fatal attack of phlebitis, it would certainly be so by atrophy of the testicle.

J. L. Petit in several instances cut away the clusters of varicose spermatic veins, as is stated, with such success, that, in one instance, where the varicocele had been as large as a child's head previously to the operation, the function of the testicle, which had been in a weakened state, was strengthened by this proceeding. More generally, however, atrophy, or sometimes even suppuration of the testis, might be a consequence of the ligature or excision of the veins. It appears that the latter was what happened to the patient operated upon by Delpech, and by whom this distinguished surgeon was assassinated out of revenge. (See *Blasius, Opér.* vol. cit. p. 568.)

In the hope of avoiding both phlebitis and atrophy of the testicle, M. Davot recommended passing, under the vein, through the integuments a pin, over which a thread was twisted so as to make pressure. With the same view, M. Breschet proposed obliterating the vein by punching it up together with the skin, by means of a pair of compressing forceps. Another practice is that of Dr. Fricke, which consists in passing a seton, of three or four threads, through the bundle of varicose veins. In a case of varicocele of such severity as to require an operation, Mr. Mayo would be disposed to recommend the application of potassa fusa to the plexus of veins, having first exposed them by dividing the skin. (*Outlines of Human Pathology*, p. 562.)

The practice advised by Breschet or Fricke have the recommendation of simplicity and mildness. But I believe the necessity for any operation is very rare. In one case, where the pain was excessive, and supposed to arise from pressure of the varix on some nervous filament, Sir Benjamin Brodie divided the skin, and then cut through the varix with a pair of scissors. "A little bleeding took place, but none of any consequence; pressure for a few minutes stopped it. The wound healed; no inconvenience followed the operation, and the patient was entirely relieved of the pain he suffered previously." (See *Lond. Med. Gaz.* vol. xiii. p. 379.) In another case of bad varicocele, in a boy, the same gentleman applied a blister over the tumour, and kept it open, and the varicocele and the pain were considerably lessened.

Mr. Wormald has lately mentioned some cases in which painful varicoceles were relieved by means of a ring, about an inch in diameter, made of soft silver-wire, of a suitable thickness, padded, and covered with wash leather. "Through this (says he) I drew the lower part of the scrotum, whilst the patient was in the recumbent position, and the veins comparatively empty. I then pressed the sides of the instrument, together with sufficient force to prevent the scrotum escaping. The use of this instrument, every morning before the patient rose from his bed, enabled him to walk nineteen miles on the third day after its application; and although he has for six years worn an instrument of this description, he has never experienced the least inconvenience." (*Med. Gaz.*, April, 1838. J. A. Murray, de *Circocele*, Upsal, 1784. *Pott on Hydrocele*, &c. Richter in *Nov. Comment. Goett.* No. iv. and in *Obs. Chir.* fasc. ii. p. 22. Gooch, *Chir. Works*. Most, *Diss. de Circocele*, Halle, 1796.)

VARICOUS, or VARICOSE VEINS. (See VEINS, DISEASES OF.)

VARIX (from *varius*, unequal). The term *varices* is applied to a kind of knotty, unequal, dark-coloured swelling, arising from a morbid dilatation of veins. (See VEINS, DISEASES OF.)

VEINS, DISEASES OF. It was not till the latter part of the last century that any other disease of the veins, than *varices*, or varicose enlargements of them, received particular attention. At that period John Hunter noticed the fact of the veins in horses being sometimes found to be reddened, thickened, and filled with pus. (*Trans. of a Soc. for the Improvement of Med. Knowledge*, 1793.) The observations, which he also made on the local and constitutional effects of the inflammation of the veins in the human subject, drew considerable attention to the disease, on which a great deal of interesting pathological and practical information now exists.

In some points, the diseases of veins resemble those of arteries; but, in others, they differ from them. Thus, as Andral remarks, in the veins no morbid state is observed, corresponding, strictly speaking, to aneurism; because their coats all yield equally to any pressure, to which they may be subjected; whereas, in the arteries, it is only the external coat which is capable of yielding in this way. (*Précis d'Anat. Pathol.* t. ii. p. 392.) The veins are rarely the seat of calcareous concretions, which are very common in the arteries; organised coagulated blood is more frequently met with in the former than the latter; and the same remark is made by M. Andral with respect to pus. "When pus is met with in arteries (says he), it must in the majority of cases be looked upon as having had its source in these vessels; but when met with in veins, it may either have been produced in them, or have been introduced by absorption." (P. 393.)

It is observed by Mr. Hodgson that "the veins are liable to all those morbid changes which are common to soft parts in general; but the membranous lining of these vessels is peculiarly susceptible of inflammation. When a vein is wounded, the inflammation, which is the effect of the injury, sometimes extends along the lining of the vessel into the principal venous trunks, and in some instances even to the membrane which lines the cavities of the heart. This inflammation

sometimes produces an effusion of coagulating lymph, by which the opposite sides of the vein are united, so as to obliterate the tube; in this manner, a great extent of the vessel is occasionally converted into a solid cord. In some instances, the secretion of pus into the cavity of the vessel is the consequence of inflammation of the membranous lining of a vein. Under these circumstances, the matter is either mixed with the circulating blood, or, the inflammation having produced adhesion of the sides of the vessel at certain intervals, boundaries are formed to the collection of pus, which in this manner form a chain of abscesses in the course of the vessel.

When the inflammation of veins is not very extensive, its symptoms are the same as those of local inflammation in general: but when the inflammation extends into the principal venous trunks, and pus is secreted into the vessel, it is accompanied with a high degree of constitutional irritation, and with symptoms which bear a striking resemblance to those of typhus fever. — (*On the Diseases of Arteries and Veins*, p. 511, 512.)

Inflammation frequently produces a thickening of the coats of the veins, as well as adhesion of their sides and obliteration of their cavities. Indeed, in some instances, these vessels have been found to resemble arteries in the thickness of their coats, and in retaining a circular form when cut across. (*Hodgson, Op. cit.* p. 513.)

Ulceration sometimes extends to the coats of veins, and by exposing their cavities gives rise to hemorrhage. In certain examples, it commences in the membranous lining, and destroys the other coats. In general, however, the adhesive inflammation precedes the ulcerative, and by obliterating the cavities of these vessels, prevents the occurrence of hemorrhage. When sphacelation takes place in the vicinity of veins, their cavities, like those of arteries under similar circumstances, are filled with extensive plugs of coagulum, which prevent hemorrhage upon the separation of the mortified part.

Veins are sometimes ruptured without any previous morbid alteration in their structure, and the accident may be induced by muscular exertions, external violence, the sudden effects of the cold bath, &c.

Although a deposition of calcareous matter almost invariably takes place in the arteries of persons advanced in life, it is an extremely rare occurrence in the coats of veins.

Loose calculi have been found in the cavities of veins; and tumours sometimes grow from their lining. In a case of scirrhus pylorus, Mr. Hodgson found a tumour, larger than a hazel nut, growing from the lining of the splenic vein, and resembling, in its appearance and consistence, the disease which existed at the pylorus. (P. 524.)

The venous, like the arterial system, appears to be capable of carrying on a collateral circulation, when any part of it is impervious. Even after the obliteration of the vena cava inferior, the blood has been known to be conveyed with facility to the heart through the lumbar veins and vena azygos. In the case recorded by Dr. Baillie (*Trans. for the Improvement of Med. and Chir. Knowledge*, vol. i. p. 127.), the vena cava was obliterated at the point where the *vena cava hepatica* opened into it, so that not only the blood from the lower extremities, but also that from the

liver, must have passed through collateral channels to the heart.

To inflammation of veins, M. Breschet first applied the very appropriate name of *phlebitis*, which, as M. Cruveilhier remarks, belongs both to medicine and surgery; there being a *traumatic phlebitis* and a *spontaneous phlebitis*, independent of any previous local injury. In France, he believes he has ascertained, that the greater number of individuals, who die in consequence of wounds and surgical operations, perish from phlebitis. (See *Dict. de Med. et de Chir. Prat.* t. xii. p. 638.; and *Anat. Pathol.*) In this metropolis, we find that a certain proportion of persons so circumstanced, are thus destroyed, but not to the same extent, as seems from M. Cruveilhier's account to happen at Paris.

Another division of phlebitis, adopted by this eminent pathologist, is, first — into *phlebitis of free veins*; secondly, *phlebitis of veins contained in the substance of organs*; and, thirdly, *capillary phlebitis*. It is also distinguished into *adhesive phlebitis*, where merely fibrine, or coagulable lymph, is effused within the vessel; and *suppurative phlebitis*, where pus is formed; the latter difference being decidedly the most important in relation to the severity and danger of the affection.

The observations of Mr. Arnott tend to show, that the points at which the inflammatory changes in the coats of veins usually terminate are determined by the passage of a current of blood. Thus, when a trunk is concerned, the boundary is the entrance of a branch; and when a branch is concerned, the boundary is the junction of this with the trunk. (See *Med. Chir. Trans.* vol. xv. p. 47.) It is not meant, however, that the inflammation necessarily stops where a current of blood interferes, but that, at the point where the inflammation does cease, the vein affected either sends off a branch or terminates in a venous trunk.

Besides the example of inflammation of femoral and other large veins, brought on by a ligature round a small aperture accidentally made in the femoral vein in the operation for popliteal aneurism, Mr. Travers reports another case, in which a fatal inflammation of the femoral and external iliac veins, with marks of diffused inflammation up to the right axilla, was apparently caused by the application of a ligature to the mouth of the femoral vein after an amputation. (*Surgical Essays*, p. 227.) And the same catastrophe would appear to be occasionally the result of venous inflammation after amputation, even where the femoral vein is not tied. (See Carmichael, in *Trans. of King's and Queen's College of Physicians*, vol. ii. p. 365.) In short, Mr. Travers's observations, as well as those of Mr. Hodgson and Mr. Carmichael, tend to prove "that the inflammation of the interior tunic of a vein sometimes follows a puncture, sometimes a division, a ligature encircling the tube, or including only a part of it, or arises spontaneously from an inflamed surface, of which the vein forms a part." (P. 238.) Mr. Carmichael relates an instance, in which the appearances after death seem to evince that the patient died, subsequently to an operation for femoral aneurism, of inflammation and suppuration within the femoral vein, and extending both down the saphæna, and upwards through the common iliac vein. The femoral vein had been pricked in the operation, but not tied. (*Trans. of the King's and Queen's College of Physicians*, 4 U 3

Ireland, vol. ii. p. 350, &c.) In order to avoid the danger of wounding the femoral vein, above the edge of the sartorius, Mr. Carmichael recommends "introducing the needle on the pubal side of the artery" (P. 357.); a direction which I have noticed in the article *ANÆSTHESIA*. With respect to the danger of tying a large vein, Sir A. Cooper is so convinced of it, that he says in his lectures, that, if he were the subject of operation, he would rather let his femoral artery be tied than the vena saphæna major.

M. Ribes published an example, in which an inflammation of the veins of the arm arose from a gangrenous chilblain of the hand, and, after death, marks of inflammation were traced into the superior vena cava, and right auricle and ventricle. He also relates a case of mortification of the foot and leg, and a consequent inflammation of the vena saphæna, where appearances of inflammation were also discovered in the right auricle and ventricle, and in the inferior vena cava. (*Revue Med.* Juillet, 1825.) According to the researches of Mr. Arnott, the extension of inflammation to the vena cava and heart, in phlebitis, is a very unusual occurrence, and cannot therefore be considered as the cause of death. The suggestion, he observes, which was made by Mr. Hunter, has been adopted without examination. The facts which Mr. Arnott has adduced tend to prove, that there are considerable differences in the extent of vein occupied by inflammation, in fatal cases of phlebitis. "Sometimes the disease has spread into several, or most of the veins of a limb, from that primarily affected; at others, it has not proceeded beyond the vessel in which it originally appeared. This last circumstance, together with that of the fatal consequences sometimes ensuing from inflammation, limited to a few inches only of a vein, justifies the inference, that the dangerous consequences from phlebitis bear no direct relation to the extent of the vein which is inflamed." (*Med. Chir. Trans.* vol. xv. p. 44.) In his inquiry into the nature of the connexion, between the primary and secondary affections in this disease, Mr. Arnott takes up the question, whether the latter depend upon the secretion of pus by the inflamed vein, and its entrance into the circulation? This leads him to inquire into the contents of the inflamed veins. In several of the cases, which he has collected, in which "an open wound existed in the vein, pus was discharged from it during life. While in 14 cases out of 19, pus, or pus in conjunction with lymph, was present in the vessels after death. In two instances, no mention is made of pus, the contents of the veins being described, in the one, as 'adhesive matter;' in the other, where the vena cava was concerned, as 'flakes of lymph.' In one case only (Mr. Hodgson's), where the inflammation occurred in a vein previously diseased, or in a vein, the branches of which at least were varicose, neither pus, nor lymph, was found in the vessel.

"It results from this statement (says Mr. Arnott), that, although pus is present in the veins in the great majority of fatal cases of phlebitis, and that although it appears from the character of the general symptoms, and the effects produced upon animals by the injection of a similar fluid into their vessels, that the passage of pus into the circulation is probably the principal; yet the circumstances do not justify us in regarding it as

the sole cause of the secondary affection. In addition to the presumed absence of pus in two instances, and to its declared absence in a third, it may be remarked, that the early appearance of the symptoms in some cases, seems scarcely to correspond with the time usually required for the production of pus, as in one, which occurred to Mr. Freer (*Hodgson on Dis. of Art.* p. 551.), where they came on suddenly, four hours after ligature of the saphæna. If, then, the constitutional affection in phlebitis is to be explained, by the introduction of a fluid into the circulation, which contaminates the blood, and operates as a poison, this property must be attributed to inflammatory secretions generally from the vein, although not purulent." (*See Med. Chir. Trans.* vol. xv. p. 45.)

The careful investigations of Mr. Arnott prove, that the secondary affection in phlebitis commonly begins in from two to ten or twelve days after the receipt of the injury, which has made the vein inflame. The following are described as the symptoms: great restlessness and anxiety, prostration of strength, and depression of spirits, sense of weight at the præcordia, frequent sighing or rather moaning, with paroxysms of oppressed and hurried breathing, the patient being at the same time unable to refer his sufferings to any specific source. The common symptoms of fever are present, the pulse is rapid, reaching sometimes to 130 or 140 in a minute, but is in other respects extremely variable. There is often sickness, with violent vomiting, especially of bilious matter. Frequent and severe rigors almost invariably occur. The general irritability and deep anxiety of countenance increase; the manner is quick; and the look occasionally wild and distracted. When left to himself, the patient is apt to mutter incoherently; but, on being directly addressed, becomes clear and collected. The features are shrunk, and the skin of the whole body assumes a sallow, or yellow colour: under symptoms of increasing debility, and, at a time when the local affection may appear to be in a great degree subsiding, secondary inflammation of violent character, and quickly terminating in effusion of pus, or lymph, very frequently takes place in situations remote from the original injury; the cellular substance, the joints, and the eye have been affected; but, it is more particularly under a rapidly developed attack of inflammation of the viscera of the chest, that the fatal issue usually occurs. Whether this is observed, or not, death is always preceded by symptoms of extreme exhaustion, a rapid, feeble pulse; dry, brown or black tongue; teeth and lips covered with sordes, haggard countenance, low delirium, &c. (*Arnott, in Med. Chir. Trans.* vol. xv. p. 52.)

This gentleman considers the resemblance of the secondary affection in phlebitis to the diseases arising from the inoculation of a morbid poison, as particularly striking; and the conclusion to which his facts and arguments bring him, is, that death in cases of phlebitis does not take place from the inflammation extending to the heart, but that the entrance of pus, or even of some other product of inflammation, from the inflamed part of the vein into the circulation, is the source of the alarming and fatal indisposition. (*Op. cit.* p. 61.)

The formation of abscesses in the liver, joints,

lungs, &c. after injuries of the head, parturition, great surgical operations, and suppurating wounds (see *Falpeau*, in *Revue Méd.* Juin, Juillet, et Dec. 1826.; Mai, 1827.; *Rose*, in *Med. Chir. Trans.* vol. xiv.), is also referred by Mr. Arnott to inflammation of the veins of the part primarily affected, and the entrance of pus into the circulation; and (says he) it becomes a question whether the occurrence of phlebitis, and the passage of pus from an inflamed vein into the circulation, are not sufficient of themselves to account for the secondary affections of wounds, without its being necessary to resort to an absorption of the same fluid from their suppurating surfaces. (See *Med. Chir. Trans.* vol. xv. p. 68-122, &c.)

The first effect of every phlebitis is the coagulation of the blood, which becomes adherent to the inner coat of the vessel. Such coagulation is observed, both in *traumatic* and in *spontaneous* phlebitis; and it constantly took place in the experiments which Professor Cruveilhier made in living animals, whether by the introduction of a slender stick, or of a stimulating injection into the veins. In consequence of the interruption of the venous circulation in the inflamed vessel, the blood in it becomes stagnant, and, unless the collateral veins suffice for the circulation, there is an effusion of serum in the neighbouring parts. The painful oedema, the *phlegmasia alba dolens*, of puerperal women, as well as that which follows phlebotomy, or under any other circumstances, may be considered, says M. Cruveilhier, as a characteristic mark of phlebitis, and it is generally proportionate to the interruption of the venous circulation of which it is the consequence. But, besides oedema, external phlebitis is accompanied with a hard, painful, and circumscribed cord, which runs precisely in the course of the vein. *Inflammation of the lymphatics* is readily known from phlebitis, by the minute size of the painful cord; its more superficial situation; the numerous small knots, which are perceptible in it; the rose-coloured redness of the skin in the course of such cord; and other particular circumstances depending upon inflammation of the lymphatic vessels. But, with respect to the diagnostic differences, between inflammation of deep-seated veins, and that of deep-seated lymphatics, M. Cruveilhier is of opinion, that they have not yet been determined.

The greater number of examples of phlebitis, even when abandoned to themselves, do not exceed the degree of inflammation, which has, for its results, the coagulation of the blood with adhesion of the clot to the vessel, and which M. Cruveilhier terms *adhesive phlebitis*. Now (says he) this adhesive phlebitis is as frequent as solutions of continuity in the veins: there is no childbirth without adhesive phlebitis in the uterine veins, corresponding to the placenta; no amputation, no wound, no ligature of the umbilical cord, without adhesive phlebitis in the divided veins. (Cruveilhier, *Op.* et vol. cit.)

The adhesive form of phlebitis cannot be regarded as a very serious disease. The effects, which follow the coagulation of the blood, do not extend beyond the affected vein. The blood gradually becomes deprived, first, of the serum, which it may contain, and, secondly, of the colouring matter, the remaining fibrine either becoming organised or absorbed, and, in both cases, the veins being rendered impervious. In other in-

stances, as M. Cruveilhier observes, several facts and experiments tend to prove, that a passage for the blood may be formed through the coagulum, so that the vessel, that has been the seat of phlebitis, may after a time be restored to its function in the circulation.

The formation of compact adherent clots, constituting adhesive phlebitis, is described by Cruveilhier as productive of no inconveniences; the individual being even unconscious of its existence, except when it occupies a certain extent and causes more or less interruption of the circulation in the corresponding parts. Thus (says he) adhesive phlebitis of the sinuses of the dura mater is mortal, because the venous circulation of the brain is more or less intercepted. Thus, phlebitis of the femoral or external iliac vein occasions a more or less firm oedematous swelling of the lower extremity, and sometimes even an impossibility of the circulation being carried on by the collateral veins; but (adds M. Cruveilhier) phlebitis is positively curable in this first stage, even in uterine phlebitis. (See *Dict. de Méd. et de Chir. Pratiques*, art. *Phlébite*.)

In many cases of phlebitis, neglected, or treated unsuccessfully, the formation of an adherent coagulum is only the first stage of the disease; suppurative is the second; and the phlebitis, which was at first *adhesive*, now becomes *suppurative*.

It would appear, that certain states of the atmosphere, or of particular localities, in short, all those which promote the occurrence of hospital gangrene and typhus, give a tendency to suppuration in veins; and hence, MM. Ribes (*Soc. Méd. d'Emulation*, t. viii. 1817.), Breschet (*Journ. Complém.* t. ii. and iii. 1819.), and Bouillaud (*Revue Méd.* Juin, 1825.) have regarded the symptoms of typhus as more or less directly connected with phlebitis, or the presence of pus in the veins.

According to the investigations of M. Cruveilhier and other pathologists, a frequent cause of the conversion of adhesive phlebitis into the suppurative, is some irritation of parts already in a state of inflammation, as, for instance, that produced either by attempts repeated at short intervals to extract dead bone, or a ball; that, resulting from amputation performed in parts, which are the seat of an inflammatory process; or, still more commonly, the plugging up of an inflamed wound for the stoppage of secondary hemorrhage.

With respect to the local changes, attending the suppuration of veins, the first is the deposit of pus; and according to M. Cruveilhier, this happens, not between the vein and the clot, but in the very centre of the latter. At first, it has the appearance of wine lees, and then it becomes white and opaque. "The presence of pus (says he) in the centre of clots of blood, has led to the idea, that these clots were directly organised, and capable of inflammation and suppuration; in the same manner as it is admitted that the pus, or serum, which, in pleuritic effusions, is circumscribed on every side by a recently formed false membrane, is the product of an exhalation from this membrane itself; but, it seems to me more rational to admit, that the coagulum in phlebitis, and the false membrane in pleuritis, serve, in some measure, as filters, through which the products pass, which are secreted by the internal membrane of the vein, or by the pleura. The presence of pus, then, in the centre of a coagulum would appear, according

VEINS, DISEASES OF.

to my view, to be a phenomenon of the capillary system." (Cruveilhier, *Op.* et vol. cit. p. 641.) I quote this statement, because it presents, in a few words, the opinion of a most distinguished pathologist, on a point which is of some importance in relation to the theory of suppuration. (See SUPPURATION.) There are some examples of suppurative phlebitis, where the disease does not exceed that first stage, in which the pus occupies the centre of the coagulum, and then the purulent deposit is absorbed, and the removal, or the organisation of the coagulum itself may next ensue, without the presence of pus having been indicated by any symptom. But, if suppurative phlebitis continues to make progress, the proportion of the coagulum diminishes; that of the pus augments; and the vein soon becomes distended with this fluid. The pus is very seldom remarked to occupy uninterruptedly a considerable extent of the vessel. The inflammation, as M. Cruveilhier observes, not having the same degree of intensity at different points of the course of the vein, the result is, that adhesive phlebitis, or incipient suppurative phlebitis, are intercepted by completely suppurative ones, and most commonly an adhesive phlebitis is situated at the limits of the suppuration, so as precisely to circumscribe it. All these appearances are excellently depicted in Cruveilhier's great work. (*Anat. Pathol.* liv. xi. pl. 1.)

In a more advanced stage, the distended vein becomes knotty at the points, where the pus accumulates. Such distention may be carried to the degree, in which one might suppose the case to be an abscess, not situated within the vein. After a time, indeed, the coats of the vein may give way, and then the pus becoming effused around, an abscess really follows suppurative phlebitis, and bursts externally; in which abscess, it is sometimes difficult to recognise the vein, a more or less considerable portion of which is destroyed. To this stage of suppurative phlebitis, M. Cruveilhier refers—1. The fact, recorded by Mr. Travers, who found the internal jugular vein perforated, and communicating with a neighbouring abscess. 2. That reported by M. Raikhem, who found the right common iliac vein replaced by a very narrow ligamentous sort of cord, the extremity of which was lost in a large abscess, situated in the cellular tissue of the pelvis, on the right side of the bladder. Nor could the slightest vestige of the femoral vein be detected, its track being occupied down to the ham by a train of circumscribed purulent matter. 3. M. Cruveilhier himself published an instance of suppuration, perforation, and partial destruction of the femoral, popliteal, posterior tibial, peroneal, and other veins, with communications existing between these vessels and abscesses. (See *Nowv. Bibl. Méd.* 1826, t. ii. p. 179.) "In this case (says M. Cruveilhier) I was able to trace all the degrees of phlebitis, from coagulation of the blood to complete destruction of the vessel."

Phlebitis, even in the suppurative forms, produces only local consequences, so long as the pus is circumscribed by the adhesive inflammation, and the portion of the vein, which is the seat of suppuration, is excluded from the circulation of the blood. We find this condition described by J. Hunter. Professor Cruveilhier adduces the following example of it: a woman, soon after delivery, was attacked with phlebitis in one of the

superficial veins of the breast; the vessel formed a large indurated painful cord, extending transversely directly below the nipple: a fluctuation was felt at the inner extremity of this cord. There M. Cruveilhier made a puncture, and was surprised to find that the vein was immediately emptied by pressure made in the direction from without, inwards, and the prominence of it converted into a furrow. Suppuration went on for a fortnight; and the pus frequently collected again in the vein, in consequence of the closure of the small opening. The pus was succeeded by a limpid; serous fluid, the constant precursor of consecutive adhesive inflammation, which was soon manifested. However extensive phlebitis may be, provided the pus collected in the vein does not communicate with the mass of circulating blood, the effects of the disease are entirely local. The pus, like that of other abscesses, may be absorbed; or it may distend and thin the vein, and make its appearance through the ulcerated coats of the vessel, so as to cause an abscess liable to be mistaken for a common one. But, as M. Cruveilhier adds, no sooner is the dyke formed by the clots broken, and secretly removed by absorption, and the stream of fluid around it, than typhoid symptoms immediately begin, preceded by violent shiverings, and soon followed by death. Frequently, the patient, who had been left perfectly free from indisposition on the previous evening, is found in the morning in a desperate state: in some cases, very nearly the precise moment of the entrance of the pus into the circulation may be specified. (Cruveilhier, *Dict. de Méd. et de Chir.* t. xii. p. 643.)

Another fact, particularly explained by the same pathologist, is, that no ordinary mark of inflammation is ever noticed upon the inner surface of the vein in the various stages of phlebitis; that is to say, no injection of capillary vessels can be remarked. The deep red colour, noticed by Cruveilhier and other pathologists, resembles a kind of stain, or imbibition. This, it would seem, is observable in the adhesive stage, and entirely vanishes when pus takes the place of the coagula. These facts, M. Cruveilhier deems of much importance, because the absence of the anatomical phenomena of inflammation from the internal coat of the veins, and more especially of all injection of the capillaries, has served as the principal argument of writers, who contend that pus found in a vein is not formed there, but in some other point of the system, whence it has been conveyed by means of absorption; but, as he observes, there are some membranes, which cannot be injected either in the healthy or morbid state: such are serous membranes; the delicate epidermic pellicle investing mucous membranes; the internal coat of a vein, and also the cellular tissue. When there is no adherent coagulum, and no pus in the vein, it is by the vascularity of the external coat, and the cohesion and brittleness of the cellular tissue on the outside of it, in which a plastic lymph has been deposited, that one may recognise the traces of venous inflammation.

It has sometimes been supposed, that the inflammation of a vein always extends only in one direction towards the heart, or in the course which the venous blood itself takes; but this is a mistake, as any body may convince himself by reading the interesting particulars of a case of phlebitis

following a gunshot wound of the arm, as recorded by Cruveilhier (*Anat. Pathol.* livr. xi.) and the plate representing the appearance of the veins. There it will be seen that phlebitis may extend simultaneously, not only in the direction towards the heart, but in the opposite one, by continuity to the smaller veins.

Professor Cruveilhier has given an excellent description of the general phenomena of phlebitis, which are such as are very usually ascribed to the absorption of pus; namely, exceedingly bad typhoid symptoms, under which the patient sinks with more or less rapidity. "On opening the body, numerous circumscribed collections of purulent matter are found in the lungs, liver, spleen, brain, and muscles; purulent effusions in the synovial and serous membranes; and (what is particularly remarkable) this internal mischief is most frequently unattended with any other local perceptible alterations of the affected organs. For the illustration of this part of the inquiry, M. Cruveilhier adverts to the most common phlebitis, that which is the consequence of wounds and surgical operations. The earliest observers, who endeavoured to detect the cause of death in such cases, did not fail to notice the existence of internal abscesses in the principal viscera, and especially in the liver and lungs. Modern pathologists having become also fully acquainted with the frequency and gravity of these lesions, do not hesitate to regard them as an ordinary cause of death from wounds. Now, as the greater number of the subjects of wounds and surgical operations were known to have been previously in perfect health, the serious mischief in their viscera could not possibly be supposed to have existed prior to their wounds. The question then arises, whence does the purulent matter come from.

The doctrine of the absorption and deposition of pus, says M. Cruveilhier, so long disbelieved, as well as all the other humoral doctrines, has lately been revived, and supported with much talent by M. Velpeau in a series of interesting memoirs, and also by MM. Maréchal and Eugene Legalois. These authors admit that pus, secreted in the deep-seated parts, or on the surface of the body, may be absorbed, circulate with the blood, and be deposited in the substance of this or that organ, without any previous inflammatory process in the seat of such deposit. The facts adduced by these pathologists, M. Cruveilhier acknowledges to be as facts unassailable; but it is their interpretation of them which he conceives may be attacked. "MM. Velpeau, Maréchal, and others, have seen pus in the veins, in the right cavities of the heart, and in the centre of clots of blood. Like them, says M. Cruveilhier, I have seen the same things: all modern observers have likewise done so. Not less frequently also (*Anat. Pathol.* livr. xii.), I have found pus in the lymphatic vessels. Like them, I have seen collections of pus in different organs; the lungs, the liver, the brain, the spleen, the muscles, and the synovial membranes, without any manifest vestiges of inflammation around. The veins, the lymphatic vessels, and the heart, though they contained pus, seemed also to me devoid of the anatomical characters of inflammation." (vol. cit. p. 647.) M. Cruveilhier then offers various reasons, which appear to him to be in favour of the formation of pus in the situations where it is met with. He objects to ex-

planations, in which the metaphorical expression, *sympathy* is substituted for fact. "If the liver is so often affected in wounds of the head, it is, according to Desault and Bichat, because the liver, and gastric organs, are so closely connected with the brain by sympathy. The whimsical and opposite modes of accounting for abscesses of the liver after injuries of the head, adopted by Pouteau and Bertrandi, are well known. M. Richerand suggested the notion, that these abscesses were owing to the simultaneous contusion, or concussion of the liver and the brain; and this view may afford a satisfactory explanation of some hepatic abscesses; but the production of those abscesses, with which are to be arranged inflammations of the synovial and serous membranes, muscles, and cellular tissue, is too general a fact, and, in the majority of instances, too independent of all concussion and contusion, to permit the adoption of so limited an explanation.

Anatomy is invoked in vain to lift the veil that hides these phenomena. The porosity of our textures, which, according to the ancients, allowed fluids to filter from one place to another, as through a sponge; the perviousness and continuity of the cellular tissue, in the cavities of which Borden made so many fluids, and even so many causes of disease, move about; imbibition; endosmosis and exosmosis, substituted of late for the porosity of the ancients; the continuity of the nervous and vascular systems; the sympathetic correspondences; the law of *consensus*; in a word, the whole science of organisation, are all confessedly incapable of accounting for so extraordinary an occurrence. An inflammation, which seemed to have nothing to do with that now under consideration, phlebitis, has filled up the great void, that seemed to separate the suppurating wound from a visceral abscess. A series of numerous experiments which I published in 1826 (*Nouv. Bibl. Méd.* t. iv.), appear to me to have rigorously established this proposition: *Every foreign body, introduced in the living subject into the venous system, occasions, when its discharge by the emunctories is impossible, visceral abscesses, completely resembling those consequent to wounds and surgical operations; and such abscesses are the result of capillary phlebitis in these same viscera.*

"If any irritating fluid, such as ink, for example, is thrown into the femoral vein of a dog (in the direction from the heart), which is practicable after a few of the valves have been destroyed with a probe, and the collateral veins do not convey the liquid into the circulation, in which case the injection proves immediately fatal, the limb in 36 hours becomes swollen, and if the animal then dies, or is killed, innumerable bloody extravasations are found in the substance of the muscles, and in the cellular tissue of the limb. The large veins are distended with coagulated and adherent blood; and the small veins, corresponding to the extravasations, are also full of concrete blood, while those appertaining to the healthy parts are free. If the animal survives the experiment, collections of pus replace those of blood, at the same time, that pus is substituted for the coagulated blood in the veins." M. Cruveilhier, instead of using a chemical irritating means, next employed a mechanical one; he pushed a stick into the femoral vein of a dog, from below upwards, into the ascending vena cava. The dog

died on the sixth day. The lower extremity was anasarcaous, the infiltration extending up to the parietes of the chest. All the veins of the lower extremity were full of pus. When the muscles were divided, small abscesses were seen here and there in them, which proved to be minute veins, swollen with purulent matter, which could easily be pressed out of these vessels." Amongst other effects noticed by Cruveilhier, there was also a collection of pus in the synovial membrane of the knee.

M. Cruveilhier then endeavoured to ascertain what became of the pus of a local phlebitis, when such pus was mixed with the mass of circulating blood; but, since purulent matter cannot be detected, when blended with the blood, he was obliged to employ in lieu of it, mercury, a liquid, the smallest particles of which, however situated, would admit of being traced. Now, he found, that if mercury be introduced into the venous system, whatever be the way of its entrance (excepting through the abdominal system), the mercury is always found again in the lungs. Thus (says M. Cruveilhier), if a large quantity of quicksilver be injected into the jugular, or femoral vein, the animal will become exceedingly oppressed, and perish, in twelve, eighteen, or twenty-four hours, in a state very analogous to that observed in asthma, or suffocative catarrh. The whole of the mercury will be found again in the lungs, which will not be inflamed, but gorged with serosity, that may be compressed out of them. But if the quantity of quicksilver is smaller, the animal will survive the experiment a longer time, and then there will be perceived an induration around each globule of the mercury; in a later stage, collections of pus, and, at a still more advanced period, a mixture of pus and tubercular matter. Lastly, if the animal survives for two or three months, tubercles are found with a globule of quicksilver in the centre of each of them.

M. Cruveilhier submits to the contemplation of physiologists the following experiment, which he has varied in a thousand ways, and always with the same result. He destroyed the medullary texture of the femur, and substituted quicksilver for it. The dogs, experimented upon, lived four or five days, and, on opening them, he found all the quicksilver scattered through the lungs, and each globule encompassed by a degree of inflammation. The quicksilver was lodged in the ramifications of the pulmonary artery, which, we know, perform in the lungs the office of veins.

The liver being the seat of a particular system of veins, which are destitute of valves, and have numerous ramifications in the mesentery, M. Cruveilhier drew out a knuckle of intestine, and injected quicksilver into one of the mesenteric veins. In a dog, which survived this operation twenty-four hours, he found the liver studded with red, superficial, and slightly prominent patches, of the colour of wine lees; and its texture, when cut into on a level with these patches, presented the same colour, to the depth of four or five lines. In the centre of each small red induration, was a globule of quicksilver; a certain quantity of which had penetrated into the small veins, which ramify on the coats of the intestines. Opposite these small intestinal veins, the mucous membrane was of a bright red colour, and lined with a fine membrane, and bloody mucus. The cor-

responding subperitoneal cellular tissue, and the muscular coat itself, were also of a crimson hue.

In another experiment on a dog, which had an umbilical epiplocele, M. Cruveilhier injected quicksilver into a small vein of the omentum. In about ten weeks, the animal was destroyed. The omentum was found adherent to the cicatrix of the abdomen; and, through its whole extent, a great many semi-transparent, very firm tubercles, scattered, or agglomerated. The liver was studded with innumerable yellowish tubercles, some of which lay near its surface; others in its substance; and each having in its centre one or more globules of quicksilver. Some of them presented two distinct strata; one of a tubercular substance at the circumference, the other of puriform matter in the centre, in the middle of which were the mercurial globules. The preceding facts seem to M. Cruveilhier to prove, that all extraneous bodies, introduced into the general circulation, are inevitably conveyed to the lungs, and such as enter the abdominal venous system, as certainly proceed to the liver; these viscera constituting a barrier, which they cannot pass beyond except in certain cases.

The experiments, quoted by Cruveilhier, solve one difficulty, which clinical observation alone could never have solved: how, in the hypothesis concerning phlebitis, is the pus conveyed from the general venous system into the capillary system of the liver? Should not the pus stop in the capillary vessels of the lungs? It seems as if abscesses should only take place in the latter organs; yet experience proves, that abscesses of the liver are very common after wounds and surgical operations, and this, notwithstanding the capillary system of the liver, only communicates directly with the vena portæ and the hepatic veins. But this objection is at once reduced to its proper value by the demonstration of that subtle liquid, quicksilver, passing completely through the capillary system of the liver, when injected into the branches of the vena portæ; and, in other cases, passing through the general and pulmonary capillary systems; or, what is still more convincing, pervading several times the different orders of capillary vessels.

Professor Cruveilhier, therefore, considers it to be proved, with all the exactness of physical experiments, that pus, introduced into the circulation with the blood, is stopped in different departments of the capillary system; that it every where excites capillary phlebitis, or circumscribed inflammations, which advance more or less rapidly to the state of abscesses; that pus, like quicksilver, is most frequently stopped in the lungs, and next in the liver and spleen; and that, like quicksilver, it may pervade the capillary system several times in succession, and occasion circumscribed inflammations in all parts of the body.

The next questions, which M. Cruveilhier considers, are, why do not multiplied visceral abscesses take place in cases of copious accumulations of pus, for instance, in those from chronic pleurisy and peritonitis? Is it necessary that there should be a traumatic phlebitis in some part of the system to produce a capillary phlebitis in the viscera. All observers, and Quesnay in particular, he says, have noticed the vast difference, in relation to consecutive effects, between abscesses of long standing, and the suppuration from recent wounds. To what is this difference ascribable? Is

there absorption of pus in one instance, and not in the other? The following is the explanation immediately derived from the facts:—Whenever a fluid, capable of being imbibed, is in contact with a suppurating surface, whether such fluid be secreted by the textures of the body, or be extraneous to the economy, it is absorbed. The absorption of pus is continually taking place. "I will not cite (continues M. Cruveilhier) the numerous facts, which prove the occasional presence of pus in the lymphatic vessels and glands, because pus, so situated, might be regarded as the product of their inflammation; but I will cite the very sudden, and repeatedly observed disappearance of large abscesses, the opening of which has been deferred." Yet, the constitution undergoes no disturbance from this cause, and the heterogeneous matter is eliminated by the emunctories. It appears to M. Cruveilhier, that there is immense difference between pus which is transmitted into the circulation by absorption, and pus which is directly introduced into it, without having undergone any modification, or preparation, by the act of absorption, or which is produced immediately within the veins themselves. (See *Anat. Pathol. Phlébité Utérine*, liv. iv.; *Inflammation des Sinus de la Dure Mère*, liv. vii.) "Pathological, as well as physiological absorption, does not act upon substances in a mass, but successively on their different elements, which are thereby modified. Pus, in particular, would appear to be in the first instance deprived of its most fluid part; its solid parts not absorbed till a later period, and frequently not till it has acquired a caseous consistence; but pus, in its natural condition, directly blended with the blood, alters its crisis (as the ancients would say) embarrasses its course, promotes its coagulation, stops it in the capillary vessels, and, at the same time, gives rise to inflammation at numerous points." (Cruveilhier, *Dict. de Méd. et de Chir. Pratique*, t. xii. p. 657.)

It may be objected that, if the foregoing theory were true, multiplied abscesses in the viscera ought always to be preceded by phlebitis in some part, or another; yet, frequently, they are met with, and no traumatic suppuration can any where be detected. It is to no purpose, that all the veins are inspected, not only those which adjoin a wound, but others remote from it; nowhere can any marks of phlebitis be traced. Now, on this fact, which excited Mr. Arnott's notice, M. Cruveilhier argues that, unless the state of the medullary canal, or spongy texture of the bones be examined in such cases, the inference is of no value, because incomplete. M. Dance seems to have been the first pathologist, who gave a correct explanation of the cause of abscesses of the liver from wounds of the head, viz. the inflammation of the deep veins, not merely of those which ramify in the brain and its membranes, but also of those which penetrate the bones of the cranium—the veins of the diploe. Pus formed in the diploe, or the meningeal veins, may reach the liver as well as the lungs, and, indeed, every part of the venous capillary system; for the liver is not exclusively affected in wounds of the head, and, as M. Cruveilhier remarks, if many observers have only specified the liver, it is because they were mostly satisfied with the inspection of that viscus. "What M. Dance proposed as a conjecture, has been completely established. In several cases of wounds of the head, the veins of the

diploe have been found purulent, and this state coexisting with abscesses of the liver and lungs. Several convincing specimens of this were presented to the Anatomical Society; and, at the present time, it may be announced (says M. Cruveilhier) as a demonstrated truth, that, in cases of wounds of the head, the visceral abscesses, whether of the liver, the lungs, or spleen, &c. are the consequence of phlebitis, and more especially of phlebitis of the diploe; but the observation, that inflammation of the veins of bones, as a cause of visceral abscesses, applies, not only to the veins of the diploe, but to all the veins of bones; and I lay it down as a general proposition, that *phlebitis of bones is one of the most frequent causes of visceral abscesses, after wounds and surgical operations implicating the bones.*" (Op. et. vol. cit. p. 660.)

Traumatic phlebitis comprehends—1. Phlebitis from venesection. 2. From the division, excision, or ligature of veins in the treatment of varices; plans, which Cruveilhier is surprised are not the subject of universal reprobation, considering the fatal consequences frequently occasioned by them. 3. Phlebitis from wounds of the head, gunshot wounds, compound fractures, various surgical operations, lithotomy, the extirpation of ulcerated polypi, the excision of hemorrhoids, the prolonged continuance of a catheter in the bladder, &c. Phlebitis has been known to follow incisions for the extraction of balls, the removal of fatty tumours, a meliceris of the head, and even a mere contusion of the leg. (Cruveilhier.) The last case of phlebitis which I met with, arose from a severe contusion of the elbow, where abscesses formed, communicating with the joint, attended with severe constitutional disturbance, and soon followed by abscesses in both legs, and pus in the synovial membranes of the ankle joints. No suppuration could be traced in the lungs or liver; but the medullary texture of the bones of the arm was not examined. Phlebitis may indeed come on in the suppurative stages of many diseases. I have known it arise as a consequence of an enormous carbuncle, and lead to the formation of numerous abscesses, several of which occurred in different synovial cavities.

Uterine phlebitis is known to be one of the worst forms of puerperal fever. Next to traumatic phlebitis, one of the most frequent cases is phlebitis of the lower extremities, consequent to uterine and hypogastric phlebitis. This form of it, however, may take place under two distinct conditions: 1. After parturition. 2. In cases of cancer of the womb. But, for information on these topics, I must refer to the writings of Dr. D. Davis, Dr. Robert Lee, Professor Cruveilhier (*Anat. Pathol.* liv. xxvii.) and others.

With regard to the treatment of phlebitis, this must vary according as the affection happens to be in the adhesive, or the suppurative stage. Or rather, I might say with Professor Cruveilhier, the only period, when any means are likely to avail, is that very early one of the coagulation of the blood within the vessel; for when suppuration has taken place, and pus has actually entered the circulation, medicine is generally ineffectual. Just as an external phlebitis is daily seen to be checked by bleeding, cold applications, the free administration of calomel, and the application of numerous leeches in the course of the inflamed vein, so may internal phlebitis, whatever be their

situation, be stopped by early recourse to copious bleeding, and to the free use of leeches and mercury. I believe all the best practical writers on uterine phlebitis give their testimony in favour of rigorous antiphlogistic treatment, adopted in the earliest stage of the case. Dr. Robert Lee is an advocate for it, and Professor Cruveilhier, in his practice at the *Hôpital de la Maternité*, believes, that he has often subdued uterine phlebitis by means of general and local bleeding; resorted to early, and practised with freedom, but, as he observes, no sooner is the first stage over, and the constitutional derangement begins, than bleeding and leeches have no beneficial effect. Doubtless, he remarks, this may take away, with the blood, a portion of the material cause of the disease, but such cause continues to be incessantly reproduced, and the patient, together with his blood, is deprived of the power of reaction. Under these circumstances, bark, sulphate of quinine, carbonate of ammonia, æther, wine, brandy, and opium, or the preparations of morphia may be tried, with or without two, or three grains of calomel every night, and with repeated blisters, and warm applications. However, it is attested by all who have seen much of suppurative phlebitis, attended with the effects resulting from the direct entrance of pus into the circulation, that no treatment, hitherto suggested, appears to possess any great power over this form of the disease.

VARICOSE VEINS. The term *varix* is applied by surgeons to the permanently dilated state of a vein, attended with an accumulation of dark-coloured blood, the circulation of which is sometimes materially retarded in the affected vessel. When veins are varicose, they are not only dilated, they are also evidently elongated; for, besides being irregular, and in several places studded with knots, they make a variety of windings, and, coiling themselves, form actual tumours.

Modern pathologists make a distinction between veins affected with simple *hypertrophy*, and veins in the *varicose state*. "Hypertrophy of veins (says Cruveilhier) is observed in all cases, where a great normal or morbid nutritive action takes place in an organ; as exemplified in the uterine veins during pregnancy, and in cases of considerable fibrous, or medullary tumours, or other growths in the substance of that viscus." Another cause of hypertrophy is some impediment to the course of the blood in the veins, &c. Whatever may be the cause, venous hypertrophy is characterised, not only by dilatation of the veins, but by an increase of their length, so that those which are rectilinear, become at first tortuous, and afterwards curiously twisted on themselves, attaining at last four or ten times their natural length, and not recognisable, &c. When the dilatation occurs uniformly at every point of the circumference of the vessel, the blood circulates freely, *there is no varix*; but, if one point of the circumference undergo a change of structure, it yields, and then the blood is detained in it; and a small, spherical, thin pouch is formed. In this, the blood coagulates, adheres to its interior, loses its red colour, and in the centre of the pale fibrine, calcareous concretions are produced. Sometimes the coats of the varicose cyst inflame, burst, and give rise to hemorrhages, always easily stopped, but which may prove fatal. There is then the great difference between dilatation and *varix*; that, in one there is integrity of the venous

coats, in the other an alteration of them; in one, the vein fulfils all its functions in relation to the circulation; while, in the other, there is a stagnation of the blood and disease." (Cruveilhier, *Anat. Pathol.* liv. xvi.) Certain facts, however, noticed in this article, prove that the kind of distinction, specified by Cruveilhier, is not always applicable, inasmuch as the blood is not invariably stagnant in varicose veins, and calcareous formations are only occasionally met with in them. M. Andral identifies not less than six varieties of *varix*:—

1. Simple dilatation of veins without any other change, such dilatation affecting either their whole length, or occurring at intervals.
2. Dilatation, either uniform, or at intervals, with a thinned state of the vein at the dilated points.
3. Uniform dilatation, with thickening of the venous coats.
4. Dilatations at intervals, with thickening of the dilated points. In these two last, at the same time that the vein increases in diameter, it increases also in length, and becomes bent and tortuous.
5. Dilatation, with the addition of septa within the vein, whereby the cavity is divided into little cells, in which the blood lodges and coagulates.
6. A similar disposition, combined with perforations in the parietes of the vein, which communicates with the surrounding cellular tissue, in a more or less diseased state, by numerous small apertures. "In dissecting a great number of true hemorrhoidal swellings (says M. Andral), never will any thing else be detected, but one or the other of these six varieties of phlebectasiae (varices); but this is not merely the case with veins about the verge of the anus. I once met with the disposition, constituting the sixth variety, in the external jugular vein." (See Andral, *Précis D'Anat. Pathol.* t. ii. p. 400.)

Varices are most commonly observed in the lower extremities, reaching sometimes even as far up as the abdomen. They have, however, been noticed in the upper extremities, and it is probable that the whole venous system is susceptible of the affection. As a well informed writer observes, "the great venous trunk sometimes becomes varicose. When the disease is situated near the heart, it is attended with pulsation, which renders it liable to be mistaken for aneurism. Morgagni observed, that the jugular veins were occasionally very much dilated, and possessed a pulsation. (Letter viii. art. 9, 10, 11.) He also relates a case, in which the vena azygos, for the length of a span, was so much dilated that it might be compared with the vena cava. The patient died suddenly in consequence of the rupture of this varix into the right side of the chest. (Letter xxvi. art. 29.) A similar case is related by Portal, who also mentions an instance in which the right subclavian vein was excessively dilated and burst into the chest.—(*Cours d'Anatomie Médicale*, tom. iii. p. 354—373.) Mr. Cline described in his lectures the case of a woman, who had a large pulsating tumour in her neck, which burst and proved fatal by hemorrhage. A sac proceeded from the internal jugular vein; the carotid artery was lodged in a groove at the posterior part of this sac. The veins of the upper extremity very rarely become varicose. Excepting cases of aneurismal varix, the only instance of this disease with which I am acquainted, is mentioned by Petit. (*Traité des Maladies Chir.* tom. ii. p. 49.) In this case a varix was situated at the bend of the arm; the patient was so fat that no other vein could be found for the purpose of venesection,

which operation Petit repeatedly performed by puncturing this varix. The superficial epigastric veins sometimes become varicose, but the most frequent seats of this disease are the vena saphena, the spermatic and hemorrhoidal veins." (See Hodgson, on the *Dis. of Arteries and Veins*, p. 538—539.) The deep seated veins of the extremities seldom become varicose.

Professor Cruveilhier has recorded the particulars of a man in whom there was an enormous dilatation of the subcutaneous abdominal veins, which freely communicated with the vena portæ, through the intervention of the umbilical vein, the size of which was equal to what it usually presents in the fœtus. (See *Anat. Pathol.* liv. xvi. pl. 6.) The disease rarely occurs before the adult period of life, and its progress is extremely slow. It is very frequently remarked in pregnant women, who have passed a certain age; but it is particularly unusual for it to happen in young women, even during a series of repeated pregnancies. Surgeons have not hitherto made out any very precise information, respecting the kinds of constitution which promote the occurrence of a varicose enlargement of the veins. Nor has it been well proved, that the disease often proceeds from swellings of the abdominal viscera, or any other species of tumour capable of mechanically obstructing the venous circulation. One or more veins of the same limb are at first most commonly affected with a slight degree of dilatation, without pain or any sensation of uneasiness. This beginning change ordinarily advances with great slowness, except in cases where it accompanies pregnancy, in which circumstance, one or both the lower extremities, as early as the first months, are frequently seen covered with largely dilated veins, or even with tumours formed by an assemblage of varices. The veins gradually become more and more distended, lengthened, coiled up, and tortuous. The patient then begins to complain of a sense of heaviness, numbness, and sometimes of very acute wandering pain through the whole of the affected limb. In a more advanced age, in proportion as the varices increase, and especially when the dilated veins actually form tumours, the limb swells and becomes more or less œdematous, according to the extent of the disease, and the time which it has existed. Delpsch thinks, however, that the œdema in this case is not such as to justify the conclusion, that the increased size of the veins, and the way in which they distend the integuments, produce a mechanical interruption of the function of the absorbent system. For, says he, enormous varices are sometimes, though not often, met with, which are not attended with any swelling of the cellular substance; and cases are still more frequently seen in which there is a considerable degree of œdema, while the varices are scarcely remarkable. When the latter have prevailed a long while, and made much progress, the coats of the affected veins are not unfrequently thickened, swelled, and indurated, forming a sort of half canal or solid tube. As Mr. Hodgson remarks, "the blood occasionally deposits strings of coagulum in varicose veins; when this is the case, the vessel is incapable of being emptied by pressure, and is firm to the touch. The deposition does not in general fill the vessel, but by diminishing its calibre, it retards the flow of blood, and causes the dilatation to increase in the inferior portion of the vein, and in the branches which open into it."

(On *Dis. of Arteries and Veins*, p. 541.) This gentleman has seen four cases, in which the coagulum accumulated to such an extent, that the canals of the dilated vessels were obliterated, and a spontaneous cure was the consequence. The excessive distension of the coats of a superficial vein produces an inflammatory irritation, at first in the adjoining cellular membrane, and afterwards in the integuments. These textures become at first connected together by the adhesive inflammation; and if the distension continue to operate, they may at length ulcerate, and burst, and hemorrhage be the consequence. In such cases, the effusion of blood is sometimes considerable; but the syncope following it, or a moderate compression, generally suffices for its stoppage.

M. Velpeau cites one case, in which the bleeding from a varix of the leg proved fatal; and I have heard of other similar occurrences. In varix of the extremities, accompanied by chronic ulceration of the integuments, as Dr. Carswell observes, extensive hemorrhage may be the result of perforation of a vein, not larger than a common quill. "I had (says he) an opportunity of examining the vein in an example of this kind, the morbid condition of which, and of the surrounding cellular tissue, afforded a satisfactory explanation of the fatal extent of the hemorrhage. The walls of the vein were much thicker than those of any artery of the same size, and were so firmly united with indurated cellular tissue, that a considerable degree of pressure was required to approximate their internal surface. The consequence of this condition of the vein was, that its capacity would undergo no diminution during the hemorrhage, the blood continuing to escape, as through an inanimate tube, by the opening which had been effected by ulceration. This patient, who was about 40 years of age, expired in the space of little more than 10 minutes." (See *Carswell's Illustrations of the Elementary Forms of Disease; First, on Hemorrhage.*) A more common occurrence, than bleeding, is the coagulation of the blood in the cavity of a varicose vein. The vessel then becomes hard and incompressible, and it loses that elastic yielding softness, which renders it capable of being diminished by gentle pressure. If the parts be already inflamed, Delpsch conceives, that the clot in the diseased vein may act as an extraneous body, and bring on ulceration, by the effects of which it is at last brought into view. In this sort of case, it is extremely uncommon for hemorrhage to occur; for, in general, the vessel is already obliterated by the preceding inflammation. But, the ulcer itself is very difficult to heal, and may be kept up a long while by the œdematous swelling of the limb. Varices, or rather the œdema, which is the consequence of them, has the same effect upon every other species of ulcer, and even upon the most simple solution of continuity. While the swelling of the limb cannot be dispersed; while the edges of a solution of continuity are kept asunder by the tense state of the skin; and while the divided parts are irritated by this painful tension, every thing is unfavourable to cicatrisation. Thus, we see the most simple wounds, which have been allowed to suppurate, and ulcers, which should have healed rapidly, continue uncured a great many years, merely because the limbs on which they are situated, are affected with an œdematous swelling, the consequence of varices. Such is the condition of

things in this case, which has been improperly named the *varicose ulcer*. (*Delpech, Précis des Maladies, Chir.* t. iii. sect. 8. art. 3.)

In the investigation of the causes of varices, it is usual to dwell very much upon the mechanical obstructions, which may affect the circulation of the blood in the veins. Surgeons have thought themselves justified in regarding this as the only cause, because a circular moderate compression incontestably retards the course of the blood in these vessels, and produces a temporary dilatation of them. The opinion seems also to derive confirmation from the knotty appearance of varicose veins, a circumstance, which has been accounted for by supposing, that the distension is greatest in the situation of the valves. Lastly, the idea is further supported by the well-known fact of the frequent occurrence of varices during the state of pregnancy. But it has not been remembered, that the use of garters, for example, is extremely common, yet varices of the legs are infinitely less frequent; that very large varices are met with in persons, who have never employed any kind of ligatures, to which the origin of the complaint can be imputed; that when the dilatation of the veins extends to the thighs and parietes of the abdomen, no causes of this description even admit of suspicion; that varicose veins are observable round several kinds of tumours, especially scirrhi, where there is no possibility of pointing out any mechanical obstruction to the circulation of the blood; that varices sometimes make their appearance at the commencement of pregnancy, and long before the enlargement of the womb can impede the free return of the blood through the veins in the pelvis; that nothing is more unusual than a varicose dilatation of the veins of the lower extremities in consequence of swellings of the abdominal viscera; and, lastly, it has been forgotten, that the knots of the dilated veins are far too numerous to admit of being ascribed to the resistance of the valves. It cannot be denied, that pressure applied in the track of the vessels tends to promote their dilatation; but it can neither be considered as the only cause, nor as the principal one. The foregoing observations, made by Delpech, render it probable, that some unknown general cause is concerned in producing varices, the formation of which may also be facilitated by the impediments to the free return of the blood, occasioned by certain attitudes and particular articles of clothing.

Mr. Hodgson conceives it probable, that in some instances, the valves are ruptured in consequence of muscular exertions or external violence, in which cases the pressure of the column of blood is the first cause of the dilatation of the veins. Sometimes also the disease appears to arise from preternatural weakness in the coats of the veins, as in those instances in which, without any evident cause, it exists in various parts of the same person. — (*Treatise on the Diseases of Arteries and Veins*, p. 537.)

Experience proves, says Delpech, that there is no certain mode of curing varices, strictly so called, which he thinks cannot be wondered at, since the nature and causes of the disease are completely unknown. The same source of knowledge, however, also proves, that the increase in the dilatation of varicose veins may be retarded, and that the ~~sedulous~~ swelling attendant on the complaint may be beneficially opposed by methodical and

permanent compression. When the whole of a limb affected with varices is subjected to this last mode of treatment, the dilated veins subside, the circulation is more regularly performed, and the oedema and pain cease. There is not (says Delpech) any better method of healing the solutions of continuity in the soft parts, produced or kept up by the varicose state of the limb and its consequences. But sometimes, as soon as the compression is discontinued, the varices make their appearance again, the pain recurs, the oedema returns, and the ulcers which were healed break out afresh.

Inflammation of the integuments, covering a varix or varicose tumour, cannot invariably be prevented by compression, nor will this treatment always succeed even in removing the intolerable pain which sometimes attends numerous clusters of varicose veins. In the first case, rest and relaxing applications will often succeed; and in the second, the topical use of sedatives frequently gives relief. It has been proposed to puncture and empty varicose veins; but if a temporary emptiness and relaxation of these vessels were to remove the pain for a time, things would fall into the old state again in the course of a few days. If the plan were adopted, it would be necessary to make a very free opening in the dilated vein, and extract the coagulum. The vessel would then need no ligature above and below the opening, for the slightest compression would afterward stop the bleeding, and the vessel be obliterated by the subsequent inflammation. Graefe's plan, indeed, consists in making an incision, two inches long, through the integuments and coats of the largest knotty part of the vein, stopping the bleeding by pressure with the finger, filling the exposed cavity of the vein with lint, and then applying a compress and roller. When the varices are confined to the leg, one incision of this kind is set down by Graefe as sufficient; when they reach to the middle of the thigh, he practises one incision above the ankle, and a second a little above the knee; and if the whole of the thigh be affected, he makes a third incision in the upper part of the limb. A bandage and cold lotions are to be applied for a few days. The result is, that an inflammation follows, which spreads from the large varicose veins to the surrounding ones in a sufficient degree to bring about their subsidence. (See *Graefe's Preface to the German Transl. of C. Bell's Surgery*.) Chelius deems this plan of treatment preferable to that of exposing the venous trunk and injuring its coats. (*Handb. der Chirurgie*, b. i. p. 888.)

We learn from Celsus that the ancients were accustomed to remove varices by excision; or destroy them with the cautery. (*De Re Medica*, lib. vii. cap. 3.) When the vein was much convoluted, extirpation with the knife was preferred; but, in other cases, the dilated vessel was exposed by an incision, and then cauterised. Petit, Boyer, and many British surgeons have also sometimes cut out clusters of varicose veins.

Delpech remarks, that the extirpation of tumours, composed of numerous varices, has been practised, either for the purpose of removing the pain in the situation of the disease, or other inconveniences. This operation has been successfully performed; but it appears not to have constantly had the effect of preventing the formation of new varices, and it has sometimes proved tedious, difficult, and

severely painful in its execution. In fact, an erroneous judgment must necessarily be formed of the extent of these swellings, when they are judged of only from the appearance which they present under the skin. Varices are not always confined to the superficial veins; and when they extend deeply, the operation must be ineffectual. The opinion of Delpech is, that it should never be undertaken unless the disease be accompanied with perilous symptoms, or the patient nearly deprived of the use of his limb.

It has been thought, that one of the established principles in the treatment of aneurisms might be advantageously extended to the cure of varicose veins. By tying the principal venous trunk above the point to which the varicose branches proceed, it was believed that the flow of blood through them might be so retarded and impeded, that they would afterwards become filled with concrete blood, and then gradually subside. The operation of tying the venous trunk with two ligatures, and cutting through the vessel in the interval, has been accurately described by some of the old writers. Sir Everard Home related several cases of varicose veins in the leg, some of them accompanied with tedious ulcers, which after the vena saphæna major had been tied, as it passes over the inside of the knee, were readily healed, and the dilatation of the veins of the leg relieved.

This practice has sometimes answered, but it has also frequently failed, or even proved fatal.

Amongst other evils, an inflammation of the tied vein has been observed, extending very far in the vessel, and succeeded by great constitutional disorder, symptoms very analogous to those of typhus fever, and death. Sir A. Cooper in his lectures strongly deprecates it; he says that he has seen it twice prove fatal in the borough hospitals, and refers to at least a dozen other examples, which had a similar end. In some of these cases, previously to their termination, abscesses form in the direction of the vessel either below or above the ligature; in others, such collection of matter are not observed. (See *Travers's Wounds and Ligatures of Veins, Surgical Essays*, part i. p. 216. and *Oldknow*, in *Edinb. Med. and Surg. Journ.* vol. v.; *R. Carmichael* in *Trans. of the King's and Queen's College of Physicians*, vol. ii. p. 345., &c.) Indeed, the dangers arising from an inflammation of the internal coat of the veins, are now generally acknowledged, and every endeavour should be made to avoid them. A case which happened in Guy's Hospital, in 1816, fully proves them: the femoral vein happened to be pricked in an operation for aneurism, and a ligature was applied round the aperture. Inflammation of its internal coat took place, extending up into the vena cava, and the patient died of the indisposition resulting from it. (See *Travers's Surgical Essays*, part i. p. 222.) After the account of the perils of suppurative phlebitis, as already given in this article, it is unnecessary for me to offer any further comment on the unjustifiable nature of this operation. In England it is now universally abandoned.

It is fully established by the experience of modern surgeons, that a mechanical injury, inflicted on the trunk of one of the larger veins, is liable to be followed by inflammation of its internal membrane, and a fever of a very serious nature; and the occasional occurrence of these symptoms, after

the ligature, or even the simple division of the vena saphæna, has made surgeons less confident than formerly of the propriety of attempting such operations for the relief of a varicose state of that vessel in the leg. Certain reflections induced Sir Benjamin Brodie to think, that the same ill effects would not follow a similar operation performed on the branches themselves. "Where the whole of the veins of the leg are in a state of morbid dilatation, and the distress produced by the disease is not referred to any particular part, there seem to be no reasonable expectations of benefit, except from the uniform pressure of a well applied bandage. But not unfrequently we find an ulcer, which is irritable, and difficult to heal on account of its connection with some varicose vessels; or, without being accompanied by an ulcer, there is a varix in one part of the leg, painful, and perhaps liable to bleed, while the veins in other parts are nearly in a natural state, or, at any rate, are not the source of particular uneasiness. In some of these cases, I formerly applied the caustic potash, so as to make a slough of the skin and veins beneath it; but I found the relief, which the patient experienced from the cure of the varix, to afford but an inadequate compensation for the pain to which he was subjected by the use of the caustic, and the inconvenience arising from the tedious healing of the ulcer, which remained after the separation of the slough.

"In other cases, I made an incision with a scalpel through the varix and skin over it. This destroyed the varix as completely as it was destroyed by the caustic, and I found it to be preferable to the use of the caustic, as the operation occasioned less pain, and as, in consequence of there being no loss of substance, the wound was cicatrised in a much shorter space of time. I employed the operation, such as I have described it, with advantage in several instances; but some months ago, I made an improvement in the method of performing it, by which it is much simplified; rendered less formidable, not only in appearance, but also in reality; and followed by an equally certain but more speedy cure.

"It is evident (Sir Benjamin Brodie observes) that the extensive division of the skin over a varix can be attended with no advantage. On the contrary, there must be a disadvantage in it, as a certain time will necessarily be required for the cicatrization of the external wound. The improvement, to which I allude, consists in this:—the varicose vessels are completely divided, while the skin over them is preserved entire, with the exception of a moderate puncture, which is necessary for the introduction of the instrument with which the incision of the veins is effected. Thus the wound of the internal parts is placed under the most favourable circumstances for being healed, and the patient avoids the more tedious process, which is necessary for the cicatrization of a wound in the skin above.

"For this operation, I have generally employed a narrow sharp-pointed bistoury, slightly curved, with its cutting edge on the convex side. Having ascertained the precise situation of the vein, or cluster of veins, from which the distress of the patient appears principally to arise, I introduce the point of the bistoury through the skin on one side of the varix, and pass it on between the skin and the vein, with one of the flat surfaces turned for

wards, and the other backwards, until it reaches the opposite side. I then turn the cutting edge of the bistoury backwards, and, in withdrawing the instrument, the division of the varix is effected. The patient experiences pain, which is occasionally severe, but subsides in the course of a short time. There is always hemorrhage, which would be often profuse if neglected, but which is readily stopped by a moderate pressure, made by means of a compress and bandage carefully applied."

Sir Benjamin Brodie particularly enjoins the necessity of keeping the patient quietly in bed for four or five days after the operation, and removing the bandage and first dressings with the utmost care and gentleness. He also cautions surgeons not to make the incision more deep than absolutely necessary. Inflammation of the coats of the veins has not occurred in any of the cases in which Sir Benjamin Brodie has adopted this method of treatment. This gentleman wishes it to be understood, however, that he does not recommend the practice indiscriminately, but with a due attention to the circumstances of each individual case. "The cases for which it is fitted, are not those in which the veins of the leg generally are varicose, or in which the patient has little or no inconvenience from the complaint, but those in which there is considerable pain referred to a particular varix; or in which hemorrhage is liable to take place from the giving way of the dilated vessels, or in which they occasion an irritable and obstinate varicose ulcer." (See *Med. Chir. Trans.* vol. vii. p. 195. et seq.)

Mr. Ferrall has published an interesting paper, in which he notices the occasional suppuration of the wound after this operation. Such an event took place in some of Mr. Carmichael's cases, notwithstanding every precaution. Between the years 1824 and 1829, Mr. Ferrall performed the operation four times. In three of these, suppuration occurred; this he imputes to a degree of laceration of the cellular tissue in turning the knife, proposed by Sir Benjamin Brodie, which was also sometimes found to bend. On this account, Mr. Ferrall recommends another knife with a straight back, and made as thin as possible for about a quarter of an inch from its point, without forming there a cutting edge. Previous to the operation, Mr. Ferrall surrounds the limb with straps of soap plaster, nearly as high as the situation of the cluster of varicose veins, and a roller is applied in the same course, ready to be continued up the limb, when the division is complete. The object of this is to lessen the flow of blood through the tortuous vessels, and consequently their distension and irritation below the point of incision, when the current is interrupted. Mr. Ferrall deems it advantageous to let the bleeding go on for a little while. After the operation, a compress is laid on the part, and the roller, wetted with an evaporating lotion, continued up the limb. The patient is then put in bed, with his limb on a pillow, and the heel higher than the knee. For additional details, I refer to Mr. Ferrall's paper. (See *Dublin Journ. of Med. Science*, vol. ii. p. 230—234.)

On the subject of cutting through veins affected with varix, it is proper to observe, that even this plan has been known to bring on severe and fatal symptoms. Cases confirming this fact are recorded in a valuable modern work, which should be in the hands of every practical surgeon. (See *Hodg-*

son, on the Dis. of Arteries and Veins, p. 555. et seq.) Even when the vein was divided, and the skin left untouched, Bécclard saw sometimes phlebitis, and sometimes phlegmonous erysipelas, produced by the operation. (*Malaigne, Man. de Méd. Opér.* p. 164. ed. 2.) Some cases in favour of Sir Benjamin Brodie's method are detailed by Mr. Carmichael. (See *Trans. of the King's and Queen's College of Physicians*, vol. ii. p. 369. &c.) A few months ago, however, Sir Benjamin Brodie informed me, that he now rarely or never adopts the plan, as he believes that much of the relief, which he formerly imputed to the operation, is the effect of quietude in the recumbent position observed after its performance.

Cases of spontaneous varix in the veins of the arm are rarely observed. When these vessels become varicose, it is almost always in consequence of a communication being formed, in the operation of venesection, between the brachial artery and one of the veins at the bend of the arm. The superficial veins in this situation then become more or less dilated, by the impulse of the stream of arterial blood, which is thrown into them. There is, however, a good deal of difference between these accidental varices, actually induced by a mechanical cause, and those which originate spontaneously, or from causes not very clearly understood. The former never acquire the size which the latter often attain; they never exceed a certain magnitude, whether pressure be employed or not; they never form tumours composed of an assemblage of varicose veins; they are never filled with tough coagula of blood; their coats are never thickened, nor constitute the solid half-obiterated canal remarked in the other species of varices; the skin, which covers them, is not disposed to inflame and ulcerate; they are not subject to occasional hemorrhage; and the limb is not affected with any oedematous swelling. (*Delpech, Maladies Chir.* t. iii. p. 261.)

The actual and potential cautery are ancient means for the cure of varices. Of late years, Mr. Mayo has in a considerable number of cases applied caustic, or caustic paste, over the trunks of the subcutaneous veins of the leg affected with varix. In some few instances, on the healing of the ulcer, left by the separation of the eschar, no effect on the vein was observable; but, in much the greater proportion, the vein became firm and hard, and its cavity was obliterated at the part where the issue had been made. "I have little doubt (says he) that in the successful cases, the irritation upon the vein has caused local subacute inflammation, as a consequence of which the blood has coagulated in its cavity, and plugged it. The vein is often tender during several days, for the extent of three or four inches above the place at which the caustic is applied. The obstructed part does not exceed more than half an inch to an inch in length. I have never known acute phlebitis supervene in employing this practice. In one case, occurring in a young woman, an inexperienced dresser made a circular eschar, two inches in circumference, and deep in proportion over the saphenic vein immediately below the knee; it opened the saphena, and within six hours there was violent venous hemorrhage; this, of course, stopped on pressure being applied. During the next few days, there was tenderness of the saphena, extending half the length of the thigh, over which leeches

were applied ones." The case ended well. (See *Mayo's Outlines of Human Pathology*, p. 433.)

Instead of dividing the skin, and tying, or cutting through the trunks of varicose veins, or the excision of clusters of them, or the obliteration of them with caustic, another practice has arisen, viz. that of raising up the vein, together with the skin covering it, and then passing under the vessel, a long needle, or pin. The vein being elevated by means of the pin, is pressed down upon it, and then firmly constricted with thread twisted round the two projecting portions of the pin in the manner of the twisted suture. The subjacent pin, and the thread over the vein, press and flatten it; stop the flow of blood through it, and produce local inflammation in it, which is at first adhesive, then ulcerative, and terminates in the obliteration of the cavity, and the division of the venous coats. In about eight or twelve days, the pin is withdrawn, the threads removed, and the slough formed in the seat of the compression, left to separate of itself. The remaining sore soon heals up. This method, which was first tried on animals by M. Davat, has been practised by M. Velpeau on 25 patients for varices, and with almost constant success. (See *Malgaigne, Man. de Méd. Opér.* p. 161. *Dict. de Méd. et de Chir. Pract.* t. xv. p. 545.) It appears never to have been followed by any of the bad consequences too frequently occasioned by the simple ligation of the vein. In the treatment of varicose veins, M. Sanson adopted M. Brechet's plan for the relief of varicocele (see this word); while Dr. Fricke, has, in not less than 30 instances, extended the use of the seton to the cure of varices, as well as varicocele, and with successful results. M. Velpeau tried the method twice; transfixing the vein from before, backward, and then bringing out the needle again from behind, as Dr. Fricke recommends; but, as a good deal of phlegmonous inflammation followed, M. Velpeau thinks, that if this plan be selected, the needle should be passed only in one direction in making the seton, as in Dr. Fricke's operation for the cure of varicocele. (See *Malgaigne, Op. cit.* p. 163.)

The application of tincture of iodine to the skin covering varicose veins has been suggested. I have seen it tried in University College Hospital, but without any benefit, except what might be ascribed to quietude in the recumbent position, adopted in conjunction with it.

In surgical operations, when large veins are divided, air may enter them; and, in considerable quantity, the patient is suddenly destroyed. I believe, that the first instance, in which such a catastrophe was particularly noticed, and accounted for, took place in the practice of Dupuytren. The experiments, made by M. Poiseuille, led him to infer, that air can only insinuate itself into such veins as are unprovided with valves (*Journ. Hebd. de Méd. et de Chir.* 1831): but wounds of veins, in so many different situations, have sometimes been followed by this occurrence, that the foregoing inference is not admissible; nor, as the air takes the course of the blood, is it likely that the presence of valves would make such a difference. Thus, patients are stated to have been suddenly destroyed, or brought into most imminent danger, from the rush of air into veins, in operations performed by Dupuytren and Bouchène, about the neck and shoulder (*Piedagnel, Thèse*, Paris, 1827;

and *Archiv. Gén. de Méd.* t. v. p. 424.), on the thyroid gland, by Graefe (*Journ. de Physiq. et de Magendie*, 1829.); on the shoulder, by Castara (*H. Saucerotte, Thèse*. Strasburg, Mars, 1829.); and Delpach (*Mém. des Hôpitaux du Midi 2de Année*, p. 654.); on the breast and axilla, by Dr. Warren (*Gaz. Méd. de Paris*, Mars, 1833.); Sir Astley Cooper, and M. Goulard (*Thèse*. Paris, 1834.); above the clavicle, by M. Roux (*Journ. Hebdom.* t. xi. p. 165.); in the armpit and on the chest, by M. Clemot (*Lancette Franç.* 1831.); and on the face, by Dr. Mott (*Amer. Journ. of the Med. Sciences*, Nov. 1828.). (See *Alf. Velpeau, Anat. Chir.* t. i. p. 105. 8vo. Paris, 1838.)

Some of the cases here referred to, however, I think, will not be generally acknowledged, as clear and unequivocal examples of death or urgent peril, from the entrance of air into the veins, though others seem to admit of no question. These seem to me to leave no doubt of this being the occasional cause of death; but did any ambiguity exist upon the subject, it would be dispelled by the experiments instituted on animals in relation to this point, by MM. Magendie and Piedagnel.

In the article TUMOUR, I have given some account of a case, in which a patient would have been lost from this cause in an operation on the neck, by Professor Stevens, of the New York Hospital, if, on hearing the sound of the rush of air into the vein, he had not immediately closed the orifice with his finger, and then passed a double ligature under the internal jugular vein, one of which ligatures was tied below, the other above, the point at which the wounded vein entered the latter vessel.

The greater number of examples of death, or imminent peril from the admission of air into the veins, have certainly occurred in operations about the neck. Hence, even in opening the external jugular vein, Baron Larrey's advice, not to discontinue the pressure on that vessel below the opening, until a compress has been applied, is well deserving of being attended to. for otherwise a slight operation might be converted into a suddenly fatal wound. (See *Alf. Velpeau, Anat. Chir.* t. i. p. 491.)

As Professor Alden March, of Albany, New York, was dissecting a largish tumour out of the neck, "the external jugular vein was divided very near the point at which it unites with the internal jugular. At this moment a phenomenon occurred which was most alarming. It was the noise of a strange rushing of air, as though the trachea or cavity of the thorax had been cut into, and seemed to threaten the instant dissolution of the patient: a noise resembling the sudden pouring a liquid from a junk-bottle. The patient was instantly seized with tremors and convulsions, became pulseless, the lips livid, frothed at the mouth, and the pupils dilated to the greatest possible extent. The moment the occurrence happened, the finger was placed on the mouth of the wounded vein; and the operation being suspended, the patient seemed to revive from the effects of diffusible stimuli, and partially roused. The operation was then resumed, and very soon completed. The patient, however, expired without a struggle, before he could be removed from the operating table.

That this patient died by the introduction of air into the cavity of the heart there can be little doubt; and this candid narration of the facts

should teach us the imminent danger of opening veins in the vicinity of the heart; and the knowledge of this danger may save many lives, which might otherwise be lost by a similar casualty. It is unfortunate that the case reported by M. Dupuytren, of a similar operation, with the like result, has not been noticed in our standard works, else still greater caution might have been used in this case. Dr. March informs me, that Professor Stevens of this city had well-nigh lost a patient from the same cause, while operating on the neck; and Professor Mott had to abandon an operation in consequence of this occurrence, the convulsions were so alarming. This patient, however, as well as that of Professor Stevens, recovered.

Dr. March, the operator in the unfortunate case here detailed, has since tried some experiments on inferior animals; and among others, he introduced a blow-pipe into the jugular of a cat, and a single puff of the breath resulted in convulsions and death; and, on dissection, the right side of the heart and larger veins were found filled with air. His experiments on this subject may be of the highest practical importance; and the explanation of the remarkable phenomena which followed the wounding of the vein in this and other cases, is a physiological problem, the solution of which, if accomplished, will be of the deepest interest to the profession and to humanity." (See *Reese's American Dictionary*.)

The particulars of a similar disastrous accident, which happened in the practice of M. Roux, may be read in a modern work. (See *Dubl. Journ. of Med. Science*, vol. iv. p. 475.) The patient in this case revived, however, and lived seven days afterwards. (See other cases detailed by Dr. Warren, in *Amer. Cyclop. of Pract. Med. and Surgery*, ed. by Dr. Hays.) In one of these, the temporal artery was opened, and the patient, after being insensible for two hours, recovered. In another, where the air had entered a vein divided in the axilla, the patient, a woman aged 33, was lost, notwithstanding the use of external and internal stimulants, and even laryngotomy, as a last resource.

J. Hunter, in *Trans. for the Improvement of Med. and Chir. Knowledge*, vol. i. 1793. *Abernethy's Works*, vol. ii. J. Hodgson, *On the Diseases of Arteries and Veins*. Longuet, *Dis. sur l'Inflammation des Veines*, Paris, 1815. B. Travers, in *Surgical Essays*, part i. 8vo. Lond. 1818. F. A. B. Puchelt, *Das Venensystem in Seinen Krankhaften Verhältnissen*. 8vo. Leipz. 1818. R. Carmichael, in *Trans. of the Association of Fellows, &c. of the King's and Queen's College of Physicians in Ireland*, vol. ii. 8vo. Dublin, 1818. Thomas Ross, in *Med. Chir. Trans.* vol. xiv. J. M. Arnott, *A Pathological Inquiry into the Secondary Effects of Inflammation of Veins*, in *Med. Chir. Trans.* vol. xv. Junce, *De la Phlébite Uterine, et de la Phlébite en Général*, &c., *Archives de Méd.* 1828-29. F. Blandin, *Mém. sur Quelques Accidens, &c. à la Suite des Amputations*, *Journ. Hebdom. de Méd.* 1829. L. H. E. Legallou, *Mém. sur les Maladies occasionnées par la Résection du Pus*, op. cit. t. iii. p. 166. J. Cruveilhier, *Anat. Pathol. du Corps Humain*, Paris, 1833. t. i. Livr. 4. 7. 11. 13. and t. ii. Livr. 23. and 27.; also in *Dict. de Méd. et de Chir. Pratiques*, art. *Phlébite*. G. Andral, *Précis. d'Anat. Pathol.* t. ii. p. 406. chap. 3. James Copeland, *M.D. On Pathology, &c. of Veins*, *Med. Gaz. Nos.* 559-60. Robert Carswell, *M.D. Illustrations of the Elementary Forms of Disease; fasc. inflammation; solid*, Lond. 1838. J. R. Carmack, *On the Presence of Air in the Organs of Circulation*; 8vo. Edinb. 1837. M. Roulland, *Sur les Expériences relatives à l'Introduction de l'Air dans les Veines par M. Amussat*, in *Ann. du Mus. d'Hist. Nat. de Paris*, t. ii. *Ann. de Méd.* 26 Fevr. 1838; also *British and Foreign Med. & Surg. Rev.* vi. p. 485. art. 12.

VENEREAL DISEASE. (*Lues Venerea*, *Morbus Gallicus*, *Syphilis*.) About the year 1494 or 1495, the venereal disease is said to have made its first appearance in Europe. Some writers believe that it originally broke out at the siege of Naples; but most of them suppose that, as Columbus returned from his first expedition to the West Indies, on March 13th, 1493, his followers brought the disorder with them from the new, to the old world. Other authors, however, among whom are Mr. Beckett (*Phil. Trans.* vols. xxx. and xxxi.) Mr. B. Bell, and Dr. Swediaur, maintain the opinion, that the venereal disease was well known upon the old continent, and that it prevailed among the Jews, Greeks, and Romans, and their descendants, long before the discovery of America. Another doctrine, not entirely destitute of ingenious arguments, and even containing many valuable truths, is, that the venereal disease, as it is considered in modern times, has no real existence as a distinct affection, arising from any particular virus, but is a name given to an assemblage of disorders of different kinds to which the human race has always been subject, from time immemorial. (See a tract entitled "*Sur la Non-existence de la Maladie Vénérienne*," 8vo. Paris, 1811.) One writer of high reputation believes that, though syphilis was brought to Europe by the followers of Columbus, there existed previously to that event throughout the old continent venereal disorders, both local and constitutional, which strongly resembled the newly imported disease, and were, for more than three centuries confounded with it. (R. Carmichael, on *Venercal Diseases*, p. 33. 8vo. Lond. 1825. ed. 2.) My friend, Mr. Bacot, has bestowed great pains on an examination of all the passages in old works affording any ground for the opinion, that syphilis existed in ancient times: he finds in them allusion to many local complaints of the genitals, warts, discharges, ulcers, pustules, &c., sometimes clearly ascribed to impure coition, but no distinct reference to any constitutional symptoms. "Surely," says he, "I may be allowed to say, that if there is any historical fact that can be said to be proved, it is that of the origin of syphilis being referrible to the latter years of the fifteenth century; for I cannot understand, otherwise, why, at that precise period, we all at once hear of ulcers on the parts of generation in both sexes, followed speedily by excruciating nocturnal pains, by corroding ulcers over the whole body, by affections of the throat and nose, and very frequently by death; when, not one word, that can be construed into any similar affection, is to be met with distinctly stated by any writer before that period." (J. Bacot, in *Med. Gazette*, vol. ii. p. 100.) But, while this writer will not admit the truth of the existence of the venereal disease in times of antiquity, he allows, that a disorder resembling gonorrhoea, has been known from the remotest periods of history.

Although many considerations lead me to coincide with Hunter, Sprengel, Pearson, and Bacot, in rejecting the common history of syphilis as fabulous, I mean that account which refers its origin to America, or the French army in Italy, it does not appear to me, that any utility would be likely to result from agitating this question in modern times; because, if it be true, as the most candid and intelligent surgeons of the present day

generally acknowledge, that they cannot precisely define what the venereal disease is, nor always point out the exact circumstances in which it differs from some other anomalous complaints, even when the cases are before their eyes, how can such discrimination be attempted from a mere review of old descriptions, not accompanied with the advantage of a view of the living patients themselves? But, so far as the nature of the venereal disease has been unravelled, and it is allowable to judge from such comparisons, I may be permitted to remark that, in degree of severity, acuteness of symptoms, rapidity of propagation, and extent and quickness of fatality, no forms of disease, now ever conjectured to be venereal, bear the least resemblance to the destructive malady, with which the army before Naples was afflicted, at the close of the fifteenth century: nor will any ignorance of the uses of mercury, as will be presently noticed, explain differences so strongly marked. With reference to the contagious disorder, which scourged a great part of Europe at the close of the fifteenth century, there is a decree of the parliament of Paris, dated 1496, in which the disease is mentioned to have been then prevalent in that city, two years: consequently, it was known there in 1494: yet, the conquest of Naples by Charles the Eighth, was not effected till 1495. It is clear, therefore, that the disease, here alluded to, could not have been derived from America. It appears to have been communicated from one person to another by the mere touch, residence in the same chamber, &c.; and, in fact, unless some other mode of propagation, besides coition, be supposed, its extension throughout Europe, in two years, would imply a depravity of manners quite extraordinary, and beyond all credibility. Another fact is, that whatever the disorder might be, it was not of long continuance; and Guacardini, the historian, who wrote a few years after its breaking out, assures us, that it had already become much milder, and undergone of itself, a change into kinds different from the first. With some dissentients (see *Bru, Méthode Nouv. de Traiter les Mal. Vén. t. i. chap. 3. p. 45. Paris, 1789; J. B. F. Caron, Nouv. Doctr. des Mal. Vén. Paris, 1811. Jourdan, Traité des Mal. Vén. 2 vols. 8vo. Paris, 1826.*) the venereal disease is believed to arise from a specific morbid poison, which when applied to the human body, has the power of propagating or multiplying itself, and is capable of acting both locally and constitutionally. Whoever wishes to be fully acquainted with the arguments for and against the existence of a venereal poison, will find them considered by the late Mr. Wallace, (*On the Venereal Disease, chap. 1. 8vo. Lond. 1833.*); and still more fully by M. Ricord (*Mal. Vén. 8vo. Paris, 1838.*)

Mr. Hunter was of opinion, that the effects, produced by the poison, arise from its peculiar or specific irritation, joined with the aptness of the living principle to be irritated by such a cause, and the parts so irritated, acting accordingly. Hence, he considered, that the venereal virus irritated the living parts in a manner peculiar to itself, and produced an inflammation peculiar to that irritation, from which a matter is produced, peculiar to the inflammation.

The venereal poison is capable of affecting the human body in two different ways; locally, that is, in those parts only to which it is first applied;

and, constitutionally, that is, in consequence of its absorption.

In whatever manner the venereal disease was first produced, it began, says Mr. Hunter, in the human race, as no other animal seems capable of being affected by it. In the Venereal Hospital of Paris, experiments were publicly made by M. Ricord on dogs, rabbits, guinea-pigs, cats, and pigeons; and, on all these animals, the results were negative. "All the experiments, repeated in every possible mode of inoculation, and infection, and with every requisite precaution, were made in every instance with pus, which, in the human subject, had given positive results, so that from these experiments, joined with others previously known, the conclusion may be drawn, that the inoculable principle of syphilis is restricted to the human subject, and cannot be transmitted to the brute creation." (See *Ph. Ricord, Mal. Vén. p. 78.*) Mr. Hunter conceives, that the parts of generation were those first affected; for, if the disease had taken place on any other part, it would not have gone further than the person, in whom it first arose. On the contrary, if the disease, in the first instance of its formation, be presumed to have attacked the parts of generation, where the only natural connection takes place, between one human being and another, except that between the mother and child, it was in the most favourable situation for being propagated; and Mr. Hunter infers, also, that the first effects of the disease must have been local, since none of the constitutional effects seemed to him infectious, or communicable to other persons; a point, on which certain practitioners entertain a different opinion. Amongst them, is Dr. Colles, who adduces some facts and arguments in support of the view he takes of this important question. (See *Abr. Colles, on the Ven. Dis. p. 13.*)

I will remark, however, that one of the cases, brought forward by Dr. Colles, may not be altogether conclusive. "A surgeon (says he) deservedly of the highest character in Dublin, deposes on oath, before a commission of legally appointed arbitrators, that this accoucheur had, two years previously, been afflicted with a primary ulcer on the finger, contracted in the practice of his profession; that he had undergone a complete course of mercury, and used even a larger quantity than usual; and that a window-sash, having fallen on his finger, it produced a sore, which proved also to be venereal, as it infected several females before he was aware of its real nature. I can feel no hesitation in saying, that the ulcer on each side of the finger-nail, was most decidedly a secondary venereal ulcer, and that the eruption was as strongly marked a syphilitic eruption as any I had ever seen." (*On the Ven. Dis. &c. p. 18.*)

The circumstance, which seems to render this case inconclusive, is the want of information, whether the accoucheur in question, after he had hurt his finger with the window-sash, had practised midwifery on any other women, previously to his attendance on those, to whom he communicated the disease. If he did so, of course, he might have inoculated his own finger a second time, and the sores would of course have been capable as primary, and not as secondary ones, of communicating the disease. Another source of doubt respecting the point, whether these sores were truly secondary, is the fact, that wounds, leech-bites,

&c. in persons labouring under syphilis, are known to heat up very well, and not to assume the venereal character, unless the virus be applied so as to inoculate them. For some experiments, in relation to this circumstance, which is so familiarly known in the profession, I refer to another modern publication. (See *Ph. Ricord Mal. Ven.* p. 81.)

I have attended several cases of chancre on the fingers, contracted in midwifery, and not even suspected to be such, till secondary symptoms began, and led to the recollection of the finger's having had some trivial abrasion at the time of professional attendance on women, who were afterwards found to have venereal complaints.

In one calculation, then, the numberless cases of the venereal disease, afflicting generation after generation, and observable in all the known parts of the world, are supposed to be originally derived from the amours of some unfortunate individual, in whom the poison was first formed, from causes beyond the reach of human investigation. But, that any statement of this kind is more valuable, than unsupported conjecture, is a proposition, to which my mind is not prepared to assent, particularly when it is considered, that sores on the genitals, giving rise to such constitutional symptoms as puzzle the most discerning practitioners, are often of a very diversified character, so as hardly to admit of reference to one common origin. And, as I have already hinted, every modern speculation, about the origin of the distemper, promises but little instruction or success, because the question relates to a disease, the diagnosis of which is still very unsettled, and the complete definition of which has hitherto baffled men of the greatest genius and experience.

According to Mr. Hunter, the venereal poison is commonly in the form of pus, or some other secretion. In most cases it excites an inflammation, (which, to use his language) is attended with a specific mode of action, different from all other actions attending inflammation, and accounting for the specific quality in the matter.

The formation of matter, though a general, is not a constant attendant on this disease; for, inflammation, produced by the venereal poison, sometimes does not terminate in suppuration. But, if Mr. Hunter's sentiments are correct, it is the matter produced, whether with or without inflammation, which alone contains the poison. Hence, a person, having the venereal irritation in any form, not attended with a discharge, cannot communicate the disease to another. In proof of this doctrine, he states, that though married men often contract the disease, and continue to cohabit with their wives, even for weeks, yet, in the whole of his practice, he never once found that the complaint was communicated under such circumstances, except when connection had been continued after the appearance of the discharge.

The late Mr. Hey, of Leeds, however, gave it as his opinion, that a man might communicate *Jus venerea* after all the symptoms of the disease had been removed, and he was apparently in perfect health. (See *Med. Chir. Trans.* vol. vii. p. 547.) This sentiment is not only repugnant to the authority of Mr. Hunter, but to common observation and all sound reasoning. The very case, which Mr. Hey adduced, in proof of the occurrence, is decidedly inadequate to the purpose, in consequence of the impossibility of trusting to the

accounts which patients, under circumstances involving their honour, are apt to give of themselves. In the case recited by him, the patient might have had some venereal affection at the period of, or subsequently to, his marriage; and yet his feelings, and a sense of the disgrace of infecting a virtuous woman, might have compelled him to conceal the real truth from his surgeon. Again, it is to be remembered, that the lady herself might have deviated from the path of chastity, and exposed herself to infection; and, if she had done so, she would have informed neither her husband nor Mr. Hey. I confess, that it is at all times painful to suspect the veracity of individuals whose situations in life are respectable; but, whenever an occurrence takes place, decidedly contrary to the evidence of general experience, every possibility is to be recollected, in order to avoid the necessity of admitting doctrines not founded upon truth.

Mr. Hey, with more reason, joins in the belief of the possibility of the venereal disease being communicated to the fœtus in utero, though, in what manner the infection is transmitted, is a question not yet entirely settled. An universal desquamation of the cuticle; a hoarse, squeaking voice; copper-coloured blotches; a scaly eruption upon the chin; an unnatural redness of the anus; are the common symptoms which he sets down as proofs of syphilis in very young infants. As these complaints yield to small doses of the chloride of mercury, or of hydrargyrum cum creta, and either the nurse, or parent, has had some venereal disease at no very distant period, the cases are now usually admitted to be syphilitic.

The venereal poison would appear to be very irregular in its effects, different persons being variously affected by it; and hence, probably, one cause of a great deal of the uncertainty yet prevailing about its distinguishing characters. Thus, as Mr. Hunter mentions, two men sometimes have connection with the same woman; both catch the disease; but one may have very severe, the other exceedingly mild, symptoms. He knew of an instance, in which one man gave the disease to different women, some of whom had it with great severity, while the others suffered but slightly. On the same point, I find an interesting statement, made by Dr. Hennen, in his *Obs. on Syphilis in the Military Hospitals in Scotland*:—"We have had (says he) frequent opportunities of remarking two or more sores of different kinds, existing at the same time: an irregularly shaped diffused sore; an elevated sore, covered with a light-coloured slough, as if a bit of shamoy leather had been stuck on by some tenacious substance; a groove, or streak along the glans, as if made by a scraping instrument, filled with purulent matter; and the true and perfect chancre, according to Mr. Hunter's definition; or the true syphilitic ulcer, according to Mr. Carmichael. This last has, in some cases, occupied the glans; in some, the prepuce; while the sores of another description have been on the same part close beside it, or on another part at a distance. Three of these cases I particularly selected for examination and public demonstration, at the Castle Hospital; in one, the Hunterian chancre was on the glans, and a sore, without any hardness on the prepuce; in another, it was on the prepuce, and a simple ulcer on the glans; in the third, a most perfect specimen of Hunterian chancre occupied the in-

ternal prepuce, close to the corona glandis; and, at about half an inch from it, nearer the frænum, but farther from the glans, was an elevated ulcer. In all these cases the Hunterian chancre healed (without mercury) several days before the others.

"Soldiers (says Dr. Hennen) are gregarious in their amours, and we have frequently several men at the same time in hospital infected by the same woman, with whom they have had connection in very rapid succession; some of them have had one kind of sore, some another, and some both." (*Principles of Military Surgery*, ed. 2. p. 525.) But, if these facts, which agree with my own observations, be decidedly adverse to the theory of a plurality of venereal poisons (see *Carmichael's Essays on the Venereal Disease*, &c.), they still leave difficulties, which cannot be entirely solved by reference to peculiarities of constitution and different states of the health, because no explanation, on this principle, would account for a man having at the same time, upon the penis, two or three different kinds of ulcers, apparently excited by one cause. Neither will any difference of texture afford the needed explanation, though the utmost latitude be given to the doctrine, that the appearance and progress of sores are considerably modified by the nature of the parts. It is only necessary to consider the above passage from Dr. Hennen's work, to perceive, that the particular texture, whether prepuce, skin, glans, or corona glandis, does not always communicate to sores one invariable character, even when they arise, as the evidence would incline one to suppose, as nearly as possible under the same circumstances, and from the same source of infection.

Authors of high reputation still entertain the conviction, that the same woman, having connection with several men, may communicate to some of them chancres, to others gonorrhœa, and again buboes to others. This belief was adopted by Fabre, Pressavain, the late M. Cullerier, and has been subsequently professed by MM. Capuron, Lagneau, Gibert, &c. From this view, the inference has been also arrived at, that these several affections are identical in their nature, the principle being the same in all, and the differences depending only upon the form, which is determined by the seat, and the greater or lesser intensity in the mode of action of the cause. "If (observes M. Ricord) such reasoning could once be admitted, and continue without a peremptory refutation, it is, at the present day, no longer tenable. In fact, since I have made use of the *speculum uteri* in the investigation of venereal diseases (see *Mém. sur Quelques Faits observés à l'Hôpital des Vénéreux*, par P. Ricord, *inséré dans le 2me. fasc. t.ii. des Mém. de l'Acad. Royale de Méd.*), the enigmas, which, until then were inexplicable, have been reduced to ordinary and simple facts. With the assistance of this instrument, I have seen that a woman may be affected at the same time with gonorrhœa, and deep chancres in the vagina or uterus, the gonorrhœa alone manifesting itself externally. Under these circumstances, though the woman be regarded as a gonorrhœal patient; she is very capable of communicating both chancre and gonorrhœa at the same time, or only one of these affections, according to the predisposition of the persons exposed to contamination. But, what we can affirm, and the observations have been numerous, is, that when-

ever we have had the opportunity of examining women who had communicated the disease, we have never found, that a chancre arose from a discharge unaccompanied by ulceration in the genital organs of the person who had communicated such sore." (See *Ph. Ricord, Traité Pratique des Mal. Vén.* p. 117, 8vo. Paris, 1838.)

But whether the statements of M. Ricord be confirmed by the investigations of others, or not, and be capable of accounting for the exact cause of the diversity of effect, produced in different persons, and even on different parts of the same individual, seemingly, but not really, by one kind of virus, not a doubt can be entertained, that generally climate and constitution have vast influence over the venereal disease. In all warm countries, the disorder, so far as regards the natives, and those who have been long settled there, is not only much milder in its symptoms, but far more easy of cure. In the West Indies, the Brazils, &c., it has for a long period of time been very commonly cured by means of sarsaparilla, guaiacum, mezereon, &c. without a grain of mercury. It is alleged, however, that this mildness of syphilitic complaints, and their facility of cure, in warm climates, do not extend to strangers recently arrived there, who are said even to suffer more from the virulence of the disease than in their native climate. In Portugal, during the late war, the dreadful ravages of the venereal disease amongst the British soldiers, and its comparatively milder phenomena amongst the inhabitants of the country, were particularly noticed. "In the British army, (says Dr. Fergusson) it is probable that more men have sustained the most melancholy of all mutilations, during the four years that it has been in Portugal, through the disease, than the registers of all the hospitals in England could produce for the last century; while venereal ulceration has not only been more intractable to the operation of mercury, than under similar circumstances at home; but the constitution, while strongly under the influence of the remedy, has become affected with the secondary symptoms in a proportion that could not have been expected. With the natives, on the contrary, the disease is very mild; curable for the most part by topical treatment alone, or wearing itself out when received into the constitution, after running a certain course, not always a very destructive one, without the use of any adequate mercurial remedy, &c. The bulk of the people, and of all the military at the hospitals, even though a general order has been given out, enjoining the use of mercury, cure themselves, or get cured, by other means. I have now been upwards of two years at the head of their hospital department, and I can declare, that it never occurred to me, amongst all the venereal patients whom in that time I have seen pass through the hospitals, to meet a single one under the influence of mercury, excepting those cases wherein I myself have personally superintended its administration. They go out cured by topical remedies alone: and I have lived long enough amongst them to ascertain, that their return to hospital under such circumstances for secondary symptoms is far from being an universal, or even a frequent occurrence." (*Med. and Chir. Trans.* vol. iv. p. 1, 2.)

The inference at which Dr. Fergusson arrives is, that in Portugal the disease is exhausted, and has lost much of its virulence, in the same man-

ner as the natural small-pox, unresisted by inoculation, appears to have changed, in the same country, into a very mild disease, which does well under any mode of treatment.

"Yet (says Dr. Fergusson) I have no doubt, that were this mild disease, or the mildest that was ever produced from the improved inoculation of England, communicated to a tribe of Indians, or to a plantation of negroes, or any other class of people, who had never before known the small-pox, it would desolate with all the fury of pestilence, destroying wherever it could find victims, and never ceasing until it had destroyed the whole." And on the same principles, Dr. Fergusson attempts to explain the severe effects of the inoculation of the exhausted syphilitic virus of Portugal into the constitution of the British or other stranger, and the impossibility of curing the disease by the same treatment which answers for the natives themselves. (*Med. Chir. Trans.* vol. iv. p. 7. 10.) On the other hand, Mr. Guthrie does not admit that the disease, which the troops contracted in Portugal was more violent than the same complaint in England; or rather he admits the fact, but gives a different explanation of it from that of Dr. Fergusson; and refers the severe effect of the disease upon the soldiers in Portugal to the operation of the climate upon their northern constitutions, and their irregularity and intemperance, vices to which the natives are not addicted. (See *Med. Chir. Trans.* vol. viii. p. 563.)

The opinion, that the venereal disease was continually changing in its nature, and that, in the end, it would entirely cease, is one that has been brought forward at various periods ever since its supposed importation into Europe. Von Hutten would lead us to suppose, that its original violence did not last more than about seven years from the assumed period of its birth: "*Qui nunc vagatur fœditate tolerabilior qui nunc grassatur via illius generis esse putetur.*" J. Benedictus also writes: "*Tempore isto, non reperiuntur gallicantes cum tam ævis accidentibus sicut apparuerunt ante aliquot annos.* (*De Morb. Gallicis*, cap. iii. anno 1508.) The idea, that syphilis would at some period be extinguished, is as ancient as the times of Fracastorius:—

*Cum fata dabunt labentibus annis
Tempus erit, cum nocte atra sopita Jaccebit interitu data.*

From the testimony of these and other writers, especially that of A. T. Petronius (lib. i. cap. 3.) and B. Tomitani (lib. ii.), no doubt can be entertained that the severe, rapidly spreading, and frequently fatal disease, which broke out in Italy at the close of the fifteenth century, did not continue many years with its original violence; but changed so much, as even to justify the opinion, defended by many able men, that it was a totally different disorder from any complaint now reputed to be venereal. And the historical fact of the gradual change in the nature of the disease, which broke out in the French army before Naples, at the close of the fifteenth century, might be taken as an argument against its having been syphilis, by those who will not admit that the latter disease has undergone any alteration of character. Amongst the moderns, Peyrilhe has denied the correctness of the doctrine, that the nature of the venereal disease is changed: he treats of two sorts change, or degeneration as it was termed; one of the other particular. He denies the first,

and maintains, that the venereal disease is as destructive now as in past times. As for the degeneration of the poison in an individual, he admits it: "Perhaps (says he) *spontaneous cures* will be doubted: *numerous facts attest them* to those who know how to see, and we have tried to demonstrate them to others. For our own part, we cannot doubt, that the venereal poison becomes weaker and weaker in the infected person, becomes milder, and as it gets older, loses its principal character, its property of communicating the disease." (See *Remède Nouveau*, &c. Montp. 1786.)

It has been a contested question, whether the venereal disease and gonorrhœa arise from the same poison? Mr. Hunter acknowledges, that the opinion of their originating from two distinct poisons seems to have some foundation, when the difference, in the symptoms, and method of cure, is considered. But, he asserts, that if this question be taken up on other grounds, and experiments be made, the result of which can be safely depended upon, this notion will be found to be erroneous. As the arguments of Mr. Hunter, in support of the doctrine, that both diseases are produced by the same virus, are noticed in the article GONORRHOEA, I shall not here repeat them.

On the other hand, Mr. B. Bell relates experiments, from which the conclusion is made, that the poisons of the venereal disease, and gonorrhœa, are entirely different and distinct.

Matter was taken upon the point of a probe, from a chancre on the glans penis, before any application was made to it, and completely introduced into the urethra. For the first eight days, the gentleman who made this experiment felt no kind of uneasiness; but, about this period, he was attacked with pain in making water. On dilating the urethra, as much as possible, nearly the whole of a large chancre was discovered, and, in a few days, a bubo formed in each groin. No discharge took place from the urethra, during the whole course of the disease; but, another chancre was soon perceived in the opposite side of the urethra, and red precipitate was applied to it, as well as to the other, by means of a probe previously moistened for the purpose. Mercurial ointment was at the same time rubbed on the outside of each thigh, by which a profuse salivation was excited. The buboes, which, till then, had continued to increase, became stationary, and, at last, disappeared entirely; the chancres became clean, and, by a due continuance of mercury, a complete cure was at last obtained. If this case, and another, to which I shall presently advert, could be entirely depended upon, they would tend to disprove the part of Mr. Hunter's theory, accounting for the different effects of the same poison, by its application in the case of chancre to a non-secreting surface, covered with cuticle, and that of gonorrhœa to a secreting mucous membrane. The occasional formation of chancre just within the orifice of the urethra, is now recognised as not a very uncommon event.

The next experiment was made with the matter of gonorrhœa, a portion of which was introduced between the prepuce and glans, and allowed to remain there without being disturbed. In the course of the second day, a slight degree of inflammation was produced, succeeded by a discharge of matter, which, in the course of two or three days, disappeared.

The same experiment was repeated; but no chancre ever ensued from it.

Two medical students were anxious to ascertain the point in question; and with this view, they made the following experiments, at a time, when neither of them had ever laboured under either gonorrhœa, or syphilis; and both in these and in the preceding experiments, the matter of infection was taken from patients, who had never made use of mercury.

A small dossil of lint, soaked in the matter of gonorrhœa, was by each of them inserted between the prepuce and the glans, and allowed to remain on the same spot for the space of twenty-four hours. From this it was expected that chancres would be produced; but, in one, a very severe degree of inflammation ensued over the whole glans and præputium, giving all the appearance of what is usually termed *gonorrhœa spuria*. A considerable quantity of fetid matter was discharged from the surface of the inflamed parts, and for several days there was reason to fear that an operation would be necessary for the removal of a paraphymosis. By the use of saturnine poultices, laxatives, and low diet, however, the inflammation abated, the discharge ceased, no chancre took place, and the case got entirely well. In the other gentleman, says Mr. B. Bell, the external inflammation was slight, but in consequence of the matter finding access to the urethra, he was attacked on the second day, with a severe gonorrhœa, with which he was troubled for more than a year.

The next experiment was made by the friend of the latter student: he inserted the matter of gonorrhœa, with a lancet, beneath the skin of the præputium, and, likewise, into the substance of the glans; but, although this was repeated three different times, no chancres ensued. A slight degree of inflammation was excited: but it soon disappeared, without any thing being done for it. His last experiment was attended with more serious consequences. The matter of a chancre was inserted on the point of a probe to the depth of a quarter of an inch or more, in the urethra. No symptoms of gonorrhœa ensued; but, in the course of five or six days, a painful inflammatory chancre was perceived on the spot, to which the matter was applied. To this succeeded a bubo, which ended in suppuration, notwithstanding the immediate application of mercury: and the sore that was produced proved both painful and tedious. Ulcers were at last perceived in the throat, nor was a cure obtained, till a very large quantity of mercury had been given, and the patient kept in close confinement for thirteen weeks. (*On Gonorrhœa Virulenta and Lues Venerea*, vol. i. edit. 2. p. 438, &c.) Mr. Evans, it appears, has also several times inoculated with the matter of gonorrhœa, but, in every case, it failed to produce any effect. (*On Ulceration of the Genital Organs*, p. 81. 8vo. Lond. 1819.)

Some other facts on record have been thought to support Mr. Hunter's inference, if any conclusion can be ventured upon without the aid of the most minute details. Such inference is indeed be invalidated, if the statements of M. Ricord respecting the information, which he derived from the use of a speculum uteri in his investigation of the venereal disease, prove to correspond with the observations thus made by other inquirers.

M. Ricord's statements in fact interfere with the deduction that otherwise might be made from occurrences of the following kind: M. Vigaroux mentions an instance in which six young Frenchmen had connection with the same woman, one after the other. The first and fourth in the order of connection had chancres and buboes; the second and third gonorrhœa; the fifth chancre; and the sixth bubo. (*Œuvres de Chir. Pratique*. Montp. 1812. p. 8.) And Dr. Hennen, who refers to this case, mentions a similar one in which the first person escaped; the second had true chancres and elevated sores; and the third gonorrhœa. The connection took place within an hour. (*Military Surgery*, ed. 2. p. 526.) These facts would indeed be much more interesting, if the disease with which the women were affected had been ascertained, in M. Ricord's manner; and one could securely calculate upon the men not having exposed themselves, within a given time, to any other sources of infection. In short, without a perfect history and description of cases of this kind, from their beginning to their end, no light is thrown by them on the question about the venereal and gonorrhœal poisons. Nor does Dr. Hennen quote them with this view; but for the purpose of exemplifying the variety of effects produced on different individuals apparently by the same infection; though the same considerations which prevent any certain inference from such observations, in regard to the identity of the venereal and gonorrhœal poisons, seem also to interfere with the other conclusion. In the experiments detailed both by Hunter and B. Bell, there is also one point assumed by both parties, though it is far from being determined; viz., that the matter discharged from the urethra is always of one kind in respect to its infectious principle, whatever this may be; and that the secretion from every chancre contains one, and only one, species of infectious matter. From the candid and very practical work of Mr. Evans, it would appear, that some ulcerations on the penis, such as would usually be called chancres, though they have of late years been sometimes named elevated ulcers, arise from an altered secretion, without any breach of surface, or discernible disease in the female organs. The same gentleman was also frequently present at the examinations of the public women in Valenciennes, and always surprised at the small portion of disease to be found amongst them: "At one which I attended (says he) no less than 200 women of the lowest description, and of course the most frequented by soldiers, were examined, and not one case of disease was found among them: nevertheless the Military Hospitals had, and continued to have, their usual number of venereal cases (ulcerations)."

"At an inspection I have since attended, where 100 women were examined, only two were found with ulcerations: I noticed several with increased secretions, and one with purulent discharge, but these were taken no notice of by the attending surgeons, as they did not come sufficiently under the head of virulent gonorrhœa.

"That the two women above-mentioned as having ulcers, infected the whole of the men diseased in garrison during the preceding fifteen days, no one can for a moment admit even as likely; but if it be allowed, that an altered secretion be sufficient for the production of this disease (the ulcer

elevatum), we shall at once have an explanation of how it happened, that the military hospitals continued to have their usual number of venereal cases, &c.* (Evans, *On Ulcerations of the Genital Organs*, p. 72, 73, &c.) From the investigations of the same author, the *ulcus elevatum* is the most frequent of all the sores met with on the genitals, and besides being excited by diseased secretions, and gonorrhœal matter, is capable of being transferred by inoculation, and even of originating spontaneously. (P. 67—81, &c.) Yet, with regard to these accounts, M. Ricord might remark, that the speculum uteri not having been employed for ascertaining the state of the interior of the vagina, Mr. Evans's inferences are not to be depended upon.

Mr. Travers considers it possible that, in some cases, women are merely passive instruments of infection, and that a sound female after having had connection with a man that has disease about his genitals, may for a time retain within the pudenda some of the venereal matter received from him, and that such matter may come into contact with her next visitor, who may contract the disease, though she herself may entirely escape. (See Travers, *On the Pathology of the Venereal Disease*.) The same idea is entertained by M. Ricord, who declares that he has known it verified. He adds another case which lately came under his notice. "A young man had connection with a woman who had chancres; on the same day, he cohabited with his usual mistress, who contracted the disease, though he himself was not attacked by it. The young man, it is to be observed, had not washed himself after coition, and his prepuce was very long." (See Ph. Ricord, *Mal. Ven.* p. 98.)

Lagneau admits that gonorrhœa may not always proceed from the same poison as the venereal disease; but he believes that, in the greater number of instances, the virus is of the same quality. He is led to this opinion by the consideration of several women having been infected by the same man with both complaints, and of the two diseases having been communicated to several men who had cohabited with one woman, and as is presumed with her alone, at least, inasmuch as may relate to the possibility of any other infection weakening the conclusion attempted to be drawn from the case; a point which has only been assumed, and by no means ascertained. Mr. Guthrie also expresses his belief that the evidence adduced on the point under consideration, justifies the opinion "that ulcers will arise on the penis from the matter of gonorrhœa; that gonorrhœa will in its turn be caused by the matter of these same ulcers; and that both occur in consequence of promiscuous or uncleanly intercourse. That many of the ulcers produced in this manner will occasionally assume every character of chancre, and cannot be distinguished from it, I am perfectly satisfied of from repeated observation; but, I am equally certain, that a gonorrhœa in men, with the worst appearances and symptoms, can, and often does arise from irritating causes common to parts free from any specific disease, or poison, is not distinguishable from one that has arisen from promiscuous intercourse; and that both complaints are curable in the same way, and without mercury." On the question, whether gonorrhœa, or the ulcers resulting from the matter of gonorrhœa, can produce

constitutional symptoms, Mr. Guthrie believes that they generally do not, although he does not affirm that they cannot under particular circumstances of constitution; and he is further of opinion that if such symptoms ever really arise, they become serious only in consequence of the exhibition of mercury. (See *Med. Chir. Trans.* vol. viii. p. 554.) Delpech considers the possibility of a general infection from the effect of what he terms a syphilitic gonorrhœa, completely proved; though he admits, that there are numerous instances in which this consequence does not happen. He owns that the distinction of one class of cases from the other is *à priori*, extremely difficult, and most frequently quite impossible. Yet widely dissenting from established modern practice, he inclines to ancient maxims, and considers it prudent to destroy the first effect of the infection, without delay; his aim being to shorten the duration of the discharge with cubebs, or copaiva, and then to introduce mercury into the system, through the same channel as conveys the virus into it, by rubbing the ointment on the integuments of the penis. (*Chir. Clinique*, p. 292.) The late Mr. Wallace had so complete a conviction that one species of gonorrhœa depended upon the syphilitic poison, that he actually proposes to denominate it *catarrhal primary syphilis*; and, with respect to this and the ulcerating forms of primary syphilis, he asserts (what is much disputed) "we know that they are capable of reciprocally producing each other, and of causing analogous secondary effects in the constitution." (See Wallace, *On the Ven. Dis.* p. 240.)

This interesting question, whether the gonorrhœal virus is identical with that of syphilis, has been investigated by M. Hernandez, of Toulon, who first inoculated three healthy men in the vigour of life with gonorrhœal matter taken from three galley slaves. The inoculation was repeated several times on the glans and the prepuce. Slight ulcerations regularly ensued without any chancreous appearance, and these were easily cured by simple dressings. Two other individuals, with strong disposition of scurvy, were then inoculated, and rebellious ulcers were the consequence, which resisted all local remedies, and did not yield till stimulants combined with acids were given. One of them had wandering pains; and the pus of his ulcer was sanious, and the granulations fungous. In three out of four other young scrofulous subjects, the ulcers were very obstinate; in two, they had almost all the syphilitic characters, and were followed by herpetic eruptions. In these two, calomel was required to effect the cure, yet M. Hernandez expresses his conviction that there was nothing venereal about them. In another young man of gouty constitution, the sore continued troublesome till warm weather began, and was attended with wandering pains, and debility of the digestive organs. In another, the sore put on a venereal appearance, but soon healed on the return of bleeding from some hemorrhoids. After mentioning the particulars of some other cases, M. Hernandez observes, "My experiments are a proof that ulcers, which are produced by inoculation with gonorrhœal virus, are not syphilitic, and they explain, at the same time, the sources of errors likely to render experiments of this kind, which appear so simple and decisive, far from being conclusive. The same circumstances may change the nature of ulcers, and give

them such a masked character as is calculated to deceive those who are inattentive, and do not advert to these cases of complication." (See *Hernandez, Essai Analytique sur la non Identité des Virus Gonorrhéique et Syphilitique* Toulon, 1812; and *Ph. Ricord, Mal. Vén.* p. 110, &c.) The objections which many would make to some of these inferences, would of course be founded on the fact, that a venereal ulcer cannot always be known by its appearance; nor is the spontaneous cure of a sore without mercury, even though followed by no secondary symptoms, now regarded as any proof of its not having been venereal.

Dr. Tongue, of Philadelphia, was inoculated in the right arm by Dr. Barton, with virulent gonorrhœal matter; but the result was not even any inflammation. Inoculation with the same matter was repeated on three others, without effect. Lint, wetted with fresh gonorrhœal matter, was laid behind the glans under the prepuce, and left there two days and a half; but neither chancre nor inflammation was produced. The prepuce and glans of a young man were also inoculated, without effect. On the other hand, cases are detailed in which inoculation with venereal matter taken from chancres, undiluted, or diluted with an equal quantity of gum water, gastric juice, or a solution of one scruple of sulphate of copper or sulphate of iron in an ounce of water, were all followed by the formation of chancres. Dr. Harrison also inoculated with the matter of chancres, and found an ulcer and constitutional symptoms ensue. These and other particulars are noticed by M. Ricord. (*Op. cit.* p. 114.)

Much of the incongruity of the results of inoculations with what is termed gonorrhœal matter, would certainly be accounted for, if gonorrhœa were frequently associated, as is sometimes asserted, with chancres within the urethra. Indeed, M. Ricord infers, that whenever a discharge from the male urethra communicates a chancre to a woman, there is something more than a clap, and that the urethra is the seat of ulceration in some point of its course. "The existence of every kind of ulceration (he observes) has been denied; and what has led to this denial of the liability of the urethra to ulcerate, under the influence of causes which produce this result in other mucous membranes, is, that Morgagni never observed ulcerations in gonorrhœa—that very Morgagni, who, however, had seen chancres in the meatus urinarius and cicatrices in the urethra, which must have proceeded from previous destruction; that Hunter, in the dissection of two executed criminals who had gonorrhœa, found no ulcerations in the urethra; and that M. Cullérier and Ph. Boyer, each of them in a single examination, also met with no ulceration." M. Ricord afterwards notices cases, where the introduction of the pus of chancre into the urethra produced blennorrhagia: here (says he) it is certain, "one of two things must have occurred; either the matter of chancre acted as a simple irritant in exciting the discharge, or else, operating specifically, it caused an urethral chancre, which, in consequence of its situation being what I call *un chancre larvé*, only occasioned the symptoms of blennorrhagia." (*Op. cit.* p. 121—124.)

In support of the doctrine, that mere gonorrhœal matter produces chancre, M. Ricord adverts also to the fact that the muco-purulent

secretion of gonorrhœal ophthalmia never occasions chancres by inoculation or otherwise, although the eyelids are susceptible of being infected by chancre. (P. 131.) Amongst other points, he has also ascertained, that the pus of a sympathetic bubo, or of an abscess of the testicle, from inflammation of this organ, in consequence of gonorrhœa, may be used for inoculation without any venereal effects being the result. (P. 132.)

I need not repeat, that many controverted doctrines and opinions will be much affected, if the observations made by M. Ricord with the speculum uteri, and supported by the results of inoculations with gonorrhœal matter, and the pus from chancres, be found to agree with general experience.

One of the greatest obstacles to our arrival at a satisfactory knowledge of the nature of lues venerea, is the fact that, under this denomination, various diseases are comprised and confounded, the particular distinctions of each of which are not yet sufficiently made out to enable surgeons to form a well-founded and practical classification of them, satisfactory to every impartial observer, and agreeing with general experience. But, though such progress has not yet been made, the attention of several practitioners, and especially that of John Hunter, Abernethy, and Mr. Carmichael, has been directed to the subject. In fact, notwithstanding some mysterious circumstances in particular syphilitic cases may not admit of complete and satisfactory explanation by the doctrine of a plurality of poisons, no intelligent surgeons, I believe, now suppose that the diseases, frequently communicated by sexual intercourse, always proceed from one peculiar poison. As Mr. Rose has observed—Long before syphilis is supposed to have commenced its career in the world, some of these diseases were frequently met with; and Mr. Pearson thinks that, in addition to those formerly known, new forms of disease have occasionally arisen, "which are succeeded by a regular series of symptoms nearly resembling the progress of lues venerea." (*Obs. on the Effects of various Articles of the Materia Medica in the Cure of Lues Venerea*, 2d. ed. Introd. p. 53; and *Rose, in Med. Chir. Trans.* vol. viii. p. 418.) Mr. Hunter also, in the seventh chapter of his Treatise on the Venereal Disease, speaks of many examples of new-formed diseases, arising from peculiar poisons, quite different, he supposes, from every other virus previously known, or judged of by its effects. But though Mr. Rose appears to join in the belief of a plurality of poisons, he is very far from considering it settled how far the variety in the symptoms of venereal cases is to be attributed to different poisons, or how far the symptoms of the same poison may be modified and altered by constitution, climate, and habits of life. He remarks, that we seldom have an opportunity of tracing different cases to the same source of infection, and of comparing their progress with each other. (*Vol. cit.* p. 419.) And, I may add, that so far as observations of this nature have been made, and can be trusted, or are not invalidated by the researches of M. Ricord and his mode of explaining the facts, they rather tend to prove, as already noticed in the foregoing columns, that different individuals, when infected nearly at the same time and by the same woman, are very far from having any uniformity in their complaints; some having one

kind of sore, some another, and others chaps, &c. And the tenor of the remarks made likewise by Mr. Evans, so far as he has entered into the subject, lead equally to the conclusion, that one primary complaint, when it produces another, does not always occasion one resembling itself. Thus the ulcus elevatum on the penis, though capable of being communicated by inoculation, appeared sometimes to be the effect of one kind of infection, sometimes of another, and sometimes even to have a spontaneous origin. Who shall unravel all these intricacies, I know not, whether he bring to his assistance plurality of poisons, or states of the parts and constitution, climate, neglect, intemperance, wrong treatment, or any other circumstance which can possibly be conceived to have influence over the appearances, progress, and consequences of the disease? Nay, it would appear from some of the curious and perplexing histories mentioned in the preceding pages, that one kind of primary complaint in an individual may impart to other persons primary complaints of a different nature; so that even the hope of elucidating parts of this abstruse subject, by adverting to a plurality of infections, and a vigilant observation of their characteristic effects, meets with discouragement almost at its very birth; and though the doctrine of several kinds of poisons being concerned in the production of venereal diseases is still partially entertained, an absolute proof of its correctness can hardly be said to have been yet afforded; nor indeed could it be obtained unless the inoculation of healthy individuals with the matter of the different forms of disease were justifiable for the elucidation of the question. And, as this is not the case, I think, with Mr. Carmichael, that it might be a benefit to society if criminals were sometimes permitted to commute a heavier punishment by submitting to such experiments, without which the inquiry into the reality, number, nature, and effects of the morbid poisons under consideration, can perhaps never be brought to a satisfactory termination. "I am perfectly aware (says Mr. Carmichael) how much the state of the human constitution will modify local diseases, and am willing to attribute, to a certain extent, the great variety of appearances we witness daily in venereal complaints, to this cause alone. But, we observe, that many of those primary ulcers evince, from their very commencement, such peculiar and distinct characters, that it would be quite an absurdity to believe that the virus is always the same, and the variety of characters dependent alone upon constitution. Thus, nothing can be more opposite from the commencement than the common chancre, with its hardened base, like a piece of cartilage under the skin, and the sloughing ulcer. The first is slow and chronic; the latter begins with a mortified spot, extends by alternate sloughing and phagedenic ulceration, and makes more progress in three days, than the former in as many weeks.

"The phagedenic ulcer is equally distinct from chancre, as it does not evince at any period, a hardened base, but gradually creeps from one part to another of the penis, leaving those parts to heal, which, in the first instance, it attacked; so that when the disease has existed for some months, the glands are seen to exhibit its entire surface, furrowed over with ulcerations and cicatrices.

"There is a raised ulcer also with elevated

edges, approaching the nature of the phagedenic ulcer, yet, whose characters are sufficiently distinct to be considered as a separate species. But the most common venereal primary ulceration presents such various appearances in different individuals, that until a more exact knowledge is obtained, it is better described by its negative than its positive qualities; and it may be designated an ulcer without induration, raised edges, or phagedenic surface.

"If (continues Mr. Carmichael) the plurality of venereal poisons is supported by the variety of primary ulcers, it is equally so by the multiplicity of constitutional eruptions. A primary ulcer, which was not phagedenic, or sloughing at first, may afterwards, like any other ulcer, become so by irritation, neglect, or inflammation. But, I do not conceive that we have grounds for supposing, that the state of the constitution can so modify morbid poisons as to cause the same virus to produce in one person the chronic scaly lepra and psoriasis, and to assume in another a decided pustular form, each pustule spreading rapidly into a deep ulcer." (*On the Symptoms and Specific Distinctions of Venereal Diseases*, p. 6., &c. 8vo. Lond. 1818.)

The same gentleman, in another earlier publication, gives his reasons for believing, that certain primary appearances are followed by a corresponding train of constitutional symptoms. 1st. That the syphilitic chancre gives rise to scaly eruptions, lepra, and psoriasis; an excavated ulcer of the tonsils, and paps and nodes of the bones. 2dly. That the ulcer, without induration, raised edges, or phagedenic surface, gonorrhœa, virulenta, an excoriation of the glans and prepuce, are followed by a papular eruption, which ends in desquamation, pains in the joints resembling those of rheumatism, soreness of the fauces, and frequently swelling of the lymphatic glands of the neck; but without any nodes of the bones. 3dly. That the ulcer, with elevated edges, in the few instances in which it was traced by Mr. Carmichael to its constitutional symptoms, was followed by a pustular eruption, which terminated in mild ulcers, pains in the joints, and ulcers in the throat, but no appearance of nodes. 4thly. That the phagedenic and sloughing ulcers are generally attended with constitutional symptoms of peculiar obstinacy and malignity; viz. pustular spots and tubercles, which form ulcers, generally spreading with a phagedenic edge, and healing from the centre; extensive ulceration of the fauces, particularly of the back of the pharynx, obstinate pains of the knees, and other joints, while nodes are frequently present, and the bones of the nose are occasionally affected. (*Sec Carmichael's Essays, and his Obs. on the Symptoms, &c. of Ven. Diseases*, p. 9.)

The observations of other writers coincide with those of Mr. Carmichael, respecting the great variety of character in primary venereal sores; but, the hypothesis of various kinds of venereal poisons, or infectious matter, is perhaps, rather losing ground. Indeed, on some of the principal points, connected with the latter subject, little similarity of opinion prevails between him and other gentlemen who have entered into the disquisition. And, in the first place, without adverting again to certain statements already premised, which render it probable that differences of the virus, or, at all events, differences in the forms of

the primary complaints in the contaminating individuals, would not always explain the reason of the diversified appearances and nature of the primary forms of disease in the contaminated, I shall lay before the reader other evidence, having an immediate relation to Mr. Carmichael's sentiment, that each kind of primary venereal sore is followed by a peculiar and corresponding train of constitutional symptoms. In the cases recited by Mr. Rose, "most of the papular eruptions followed ulcers which were not very deep, and which healed without much difficulty. Several of them had a thickened, but not a particularly indurated margin. This corresponds with the observations of Mr. Carmichael: — *I could not, however, discover any decidedly uniform character in such sores*; and the 16th case I should have considered as a well-marked instance of chancre." (*Med. Chir. Trans.* vol. viii. p. 399.) In another place, it is stated, that the appearances of sores can seldom be relied on in parts of such vascular structure, and in the midst of sebaceous glands. (P. 419.) With respect to the phagedenic ulcer, Mr. Rose expresses his belief, that it is rarely followed by secondary symptoms, though he inclines to the opinion, that it arises from the application of some morbid matter, acknowledging, however, the great difficulty of deciding "whether the great degree of erythema, excited by the local affection, should be attributed to any peculiarity in that matter, or to the peculiar state of the constitution." (*Med. Chir. Trans.* vol. viii. p. 372.) And he then refers to the case reported by Dr. Ferrusson, where "the infection was communicated by an opera dancer at Lisbon, apparently in perfect health, who continued on the stage for several months afterwards, occasionally infecting others, without any thing extraordinary, as far as he could learn, in the nature of the symptoms." (*Op. cit.* vol. iv. p. 12.) And, on the same subject, Mr. Guthrie does not think "that Mr. Carmichael's opinion as to the secondary symptoms, peculiar to the phagedenic and sloughing ulcer, receives any support from what occurred to the troops in Portugal; because it did not appear, that either of them, following sexual intercourse, were dependent on the cause which produced the ulcer. Where many men have had intercourse with the same woman (and with no others?), they have not all had the same complaint, although one of the ulcers, so originating, has become phagedenic or sloughed; neither has the same woman herself suffered from this distemper: indeed, the nature of an ulcer of either kind must, after a short time, effectually prevent any intercourse; and we often find that its peculiar characters only appear after the ulcer has existed for several days. I firmly believe also, that, in the greater number of cases of sloughing ulcer, where mercury is not given, no secondary symptoms would appear: and, in those cases in which they did appear, I apprehend, they would be equally dependent on the state of the constitution, as to the mode of cure, and their destructive characters. In other words, my observations lead me to conclude that these ulcers do not depend upon a specific poison, but on the state of the constitution, under particular excitement; and that, when secondary symptoms occur, they are not dependent on the state of the ulcer; although I am ready to admit, that, in a constitution where an ulcer will readily become phagedenic, the secondary symptoms, when they

occur, may be different to a certain extent from those that follow more simple ulcers, in a healthier habit of body." (*Med. Chir. Trans.* vol. viii. p. 664.) Repeated and careful observations make me also believe, that primary sloughing ulcers do not depend upon any peculiar poison; and I am also disposed to join in the opinion, that, when hurtful local treatment is out of the question, they are chiefly owing to the state of the constitution. According to my experience, all kinds of ulcers on the genitals may, from particularity of constitution, impairment of health, and sometimes from the pernicious effects of the immoderate and indiscriminate employment of mercury, assume in their progress a sloughing disposition, and even have it from their very commencement. Mr. Rose mentions a case, in which a healthy young man was affected with a sloughing sore on the penis, in consequence of a suspicious connexion. It was not attended with any constitutional disturbance, and yielded readily to mercury. The same patient, twice afterwards, at a very considerable interval, had a fresh infection, and the sores each time had precisely the same character as the first. This, says Mr. Rose, is no uncommon occurrence, and it is not probable, that the sloughing and appearance of the sores arose from the peculiarity of the poison. (*Med. Chir. Trans.* vol. viii. p. 420.) And another intelligent surgeon, who has particularly attended to this investigation, declares his conviction, that "many varieties of sore, independently of the sloughy chancre, mentioned by Mr. Carmichael, lead to constitutional symptoms, differing in no respect from those he has described, and admitting of the same mode of cure." Nor does he believe, with Mr. Carmichael, that only one particular species of sore is capable of producing the true secondary symptoms of lues. (*J. Bacot, On Syphilis*, p. 61.)

From these observations, I think, we may safely infer, that, with respect to the sloughing ulcer, it neither arises from the application of any one specific poison to the part, nor is it connected with any regular train of secondary symptoms.

Dr. Hennen frequently had occasion to observe that eruptions of the same nature and character succeeded to the foul indurated, excavated ulcer, and to the simple excoriation. "In fifteen cases of eruptions unaccompanied by any other symptoms, which succeeded the Hunterian sore, six were tubercular, five exanthematous, two pustular, one tubercular and scaly, and one tubercular and vesicular.

"In four cases, following the same sore, but in which the eruptions were complicated with sore throat, two were tubercular, one was tubercular and scaly, and one was tubercular and exanthematous.

"In twelve cases, following the non Hunterian sore, and in which eruptions were the only symptoms, six were pustular, three were exanthematous, and one was tubercular and scaly.

"In seven cases, where the eruption was accompanied with sore throat, three were exanthematous, two were tubercular, one was papular, scaly, and tubercular, and one was pustular and tubercular." Dr. Hennen also recites an instance in which a Hunterian chancre was, at the distance of ten weeks, succeeded by a papular eruption, which, in the course of a month, was removed by low diet, purgatives, and the decoction of sarsaparilla. In two months afterwards, an eruption of a similar nature appeared without any fresh infection. This was treated with mercury, which was administered

five weeks, so as to excite a moderate salivation. Under this treatment, the eruption faded, having, during its progress, assumed the appearance of *vesicles* and *pustules*, and at length falling off in amber-coloured *scabs* with livid bases. Notwithstanding this mercurial course, the patient was a third time admitted, ten weeks afterwards (without any intervening primary affection), with a *pustular* eruption, which was finally cured without mercury, and the *pustules* falling off in *squamulæ*. In another month, without any fresh infection, he was a fourth time taken into hospital with a very thickly dispersed *pustular* eruption, somewhat different from the former, the *pustules* being more numerous, smaller, and acuminate. They yielded to non-mercurial treatment. During all these attacks, there was apthous sore throat, and occasional flying pains in the joints. The inference drawn from this case is, that even a full and judiciously conducted mercurial course does not prevent the reappearance of venereal eruptions, and that they assume at different times, different characters, notwithstanding the interruption they receive in their natural progress by the use of that remedy. (*On Military Surgery*, ed. 2. p. 528—530.) After these accounts, I can have no hesitation in coming to another conclusion; which is, that, with the exception of the partial confirmation of Mr. Carmichael's doctrine by Mr. Rose, so far as relates to the frequency of papular eruptions after superficial primary ulcers, the regular connexion of particular forms of secondary symptoms with any given descriptions of primary sores, is so far from being supported by the testimony of other observers, that one kind of primary ulcer may lead, in the same patient, to eruptions of several different sorts, either existing together on various parts of the body, or breaking out in succession; and no regular connexion can be traced between any one species of primary sore and any determinate class of secondary symptoms. These truths, I believe, must be admitted, disad vantageous as they are to the prospect of bringing the diagnosis of syphilis to a final settlement, so as to enable the writer to describe the disease with accuracy, and the practitioner to recognise and treat it with certainty. The first essential step to the elucidation of this subject, however, is undoubtedly the subversion of every doctrine relative to it, which is repugnant to general experience. The same facts, which may render it necessary for Mr. Carmichael to retract some of his inferences, and which facts were first established beyond all doubt or possibility of successful contradiction, by the very impartial, disinterested, and extensive investigations, made in the hospitals of the British army, would have obliged even Hunter himself, had he been alive, to confess the mistaken views which he sometimes took of the nature of the venereal disease.

In opposition to Mr. Carmichael's theory, Mr. Bacot brings forward several arguments:—"Mr. Carmichael (he says) gives us an example of a phagedenic sore, followed by those appearances which should attach to the raised ulcer; he admits that the papular and pustular diseases are sometimes mixed; in some of his phagedenic cases, we find that that character has been given to the ulcer by the action of mercury; in still more of them, the original character of the sore is not preserved, so that the form of secondary symptoms ought to succeed to the classification,

is very difficult to divine; in short, he frequently departs from his own arrangement. His description of a phagedenic ulcer includes, unless I am much mistaken, two very distinct kinds of sore; and, in more than one instance, a phagedenic surface and elevated edges are united in the same description of ulcer. Nay, more, he tells us, that occasional difficulty is encountered in distinguishing the phagedenic ulcer from the other primary ulcers. It displays, however, its character of phagedæna so early, that, he thinks, it cannot often be confounded with an ulcer that becomes phagedenic from irritation; and, he adds, that neglect, local irritation, and even constitutional irritability, will cause any ulcer to become phagedenic. What, then, should prevent me from assuming, that an early irritation may produce an early change in the character of the sore? And then what becomes of the phagedenic ulcer and its appropriate, consecutive, constitutional symptoms?" (*J. Bacot, in Med. Gazette*, vol. ii. p. 422.) Notwithstanding this reasoning, however, if it were proved that the primary phagedenic ulcer, not made so by irritation, neglect, &c. always, or even generally, was followed by one train of secondary symptoms, and not by another, Mr. Carmichael's researches would have materially contributed to enlighten this obscure subject. As I do not believe that sores, which are originally phagedenic, necessarily depend upon any one peculiar virus, of course much difficulty presents itself to my mind in the adoption of this part of Mr. Carmichael's views.

As this part of the inquiry into the nature of the venereal disease is one of the most interesting, I will here notice the objections of Mr. Wallace to the hypothesis of a plurality of venereal poisons, who reduced to the following heads all the arguments used in support of it.

1. Some of the diseases which result from venereal intercourse, require mercury for their cure or removal, while other are curable without this remedy. Therefore, the former class of diseases must be of a totally different species from the latter, and produced by distinct poisons.

2. Historical evidence demonstrates, that certain forms of venereal diseases existed from the earliest ages, and that to these was added, after the discovery of America, a new and peculiar disease.

3. Certain diseases, nearly allied in their general characters to each other, and to venereal diseases, have been observed in Canada, Scotland, and the West Indies, &c.; yet they are considered the product of different morbid poisons; and as these diseases do not differ more widely from one another, than the varieties of venereal diseases differ from each other, we have the same reason for supposing that the varieties of venereal diseases result from poisons specifically distinct, as we have for supposing that the diseases in question arise from different poisons.

4. The symptoms of all diseases which are caused by morbid poisons, are regulated by laws so fixed or determined, that they are always uniform in their appearance and progress; but the diseases which result from venereal intercourse, if considered as the consequence of one morbid poison, exhibit the most dissimilar characters, and must, therefore, be owing to the action of dissimilar poisons.

5. The symptoms of venereal diseases, though

numerous and varied, form certain determinate groups, in which we observe peculiar forms of primary symptoms, followed by corresponding forms of constitutional disease; and the primary and constitutional symptoms of each group resemble one another in their general character or in their degrees of mildness and severity; while the primary and secondary symptoms of any one group are, in their origin, as well as in their progress, altogether different from the corresponding symptoms of the other groups; and these circumstances cannot be explained except by the supposition, that each group is produced by its own peculiar specific cause.

Mr. Wallace examines each of these arguments separately.

1. The results of modern experience seem to him evidently to refute the first argument, by demonstrating that *every form of venereal disease with which we are acquainted, has been cured without mercury*: hence, says he, we have no proof, that there are two classes of venereal disease distinguishable from each other by the one requiring mercury for its cure, while the other is curable without this remedy.

2. "Let it be admitted (observes Mr. Wallace, as if demonstrated by satisfactory evidence), that many forms of venereal disease have existed from the earliest ages, and that a new disease was introduced from America by the followers of Columbus, what proof have we that this new disease at present exists? Those (says he) who support the doctrine, that a new disease was introduced into Europe, after the discovery of America, are compelled to admit that it is impossible to distinguish the symptoms of this new or real syphilitic disease, as they denominate it, from those of other forms of the venereal disease; and they affirm that a line of distinction can be drawn between them only by the influence which mercury exercises over their progress. Thus, Mr. Abernethy says, that 'the fictitious disease in appearance so exactly resembles syphilis, that no observation, however acute, seems to be capable of deciding on its nature.' (*On Dis. resembling Syphilis*, p. 44.) And at p. 54. he admits, that all his reasoning is founded 'upon the presumption that diseases, which spontaneously get well, are not syphilitic.' 'It is true (adds Mr. Wallace) that Mr. Carmichael has attempted a diagnosis of these diseases, founded upon their symptoms, but he has not succeeded. We must therefore conclude, that, as we know of no disease incurable without mercury, we cannot admit that the disease, imagined to have been introduced into Europe by the followers of Columbus, at present exists."

3. Mr. Wallace deems it unnecessary to examine the third argument, because, supposing yaws, siven, and some other diseases to exist in other countries, and that each of them arises from a specific and distinct morbid poison, no argument can be deduced from these circumstances of the plurality of venereal poisons.

4. In relation to the fourth argument, Mr. Wallace observes, that it does not follow of necessity that, because the disease produced by one morbid poison exhibits great uniformity of character, that produced by another should follow a similar course. Waiving, however, the consideration of this question, and granting to the advocates of the doctrine of a plurality of venereal

poisons every advantage afforded by the analogy of other diseases produced by morbid poisons, Mr. Wallace proceeds to inquire whether diseases caused by morbid poisons, are as stated in the argument, always uniform in their appearances and progress. He begins with noticing the admitted truth, that impressions, which result from causes exactly similar, produce upon different persons very dissimilar consequences, as illustrated in the effects of punctured wounds. In cow-pox and small-pox, which depend upon specific morbid poisons, he points out the numerous varieties and anomalies to which these diseases, as well as the venereal, are liable. Amongst other inferences made by Mr. Wallace are the following:—1. The effects of the morbid poison which produces the vaccine disease are subject to numerous varieties; and therefore analogous varieties in the appearance of the symptoms, which result from the syphilitic virus, cannot be considered as any proof of the existence of different venereal poisons.

2. However various the eruptions may be which are caused by the venereal poison, they do not exhibit greater varieties than those produced by the variolous poison; and as this poison, influenced by extrinsic circumstances, is sufficient to produce all the varieties of small-pox, one poison, if influenced by similar circumstances, may produce analogous varieties of syphilis. "Should it be urged against the above conclusion, that remarkable varieties of vaccine and variola are seldom to be met with, but that remarkable varieties of syphilitic diseases are of daily occurrence, I would answer, that this circumstance will be easily explained to the reflecting reader by the number of modifying causes, which influence venereal maladies, being much greater than those which influence variola or vaccine.

"To adduce one illustration: when the matter or lymph of small-pox or cow-pox is used for inoculation, the greatest care is in general taken, not only to obtain it at a certain age, and from a vesicle or pustule, possessed of what are considered the specific characters, but also to insert it into a healthy subject; whereas the venereal infection is applied during various states of the health of the recipient, and the poison is taken during every stage, and from every possible form of disease."

This last remark may not, however, strengthen Mr. Wallace's views, as it implies differences and modifications of the virus itself, which is, in reality, an approximation to the doctrine of a plurality of poisons. The same idea was long ago suggested, and especially by Mr. Wellbank, as will be presently seen.

5. The assertions in the fifth argument, for the doctrine of Mr. Carmichael, Mr. Wallace sets down as not having been verified by the experience of other practitioners. (*See W. Wallace, On the Ven. Dis.* p. 14—24.)

In a very ingenious paper by Mr. Wellbank, I find several observations well deserving attention. Amongst other things, he suggests a plan of investigating venereal diseases, which, if carefully followed up, might throw considerable light on their diagnosis. "Instead of recording with laboured minuteness the resemblance or dissimilarity confessedly sometimes fallacious, of primary sores, of eruptions, or of other really or seemingly consecutive diseases, in the cases of *different individuals*, we should (says he) faithfully chronicle the dyer-

city of disease existing at the same time in the same person. We should note, for instance, the various character and progress of a phagedenic sore, as it attacks different tissues, or the phenomena of several of these sores, when they have occurred at the same time, in different situations, from the same infection. Let us also record the multiform secondary effects of the same disease, contemporaneous in their appearance or coexistent in the same system, and various as they are manifested in absorbents, mucous membrane, skin, cellular tissue, fibrous membrane, or in the bones. From repeated observation of collective phenomena, we shall soon arrive at the inference, that many affections, often noticed in conjunction, but various in their apparent characters, are in reality the constant result of one or other distinct stimulus, acting upon a diversity of organisation. By a patient and unbiassed prosecution of this mode of inquiry, we cannot fail soon to acquire diagnostic data, which will enable us to solve some of the most difficult problems in the distinction of venereal complaints." (*Med. Chir. Trans.* vol. xiii. p. 566.) Mr. Welbank refers to various instances of sores, resulting from connection with women apparently healthy; venerola, phagedæna, &c. He considers one source of the great variety in the effects of morbid poisons to be the various degree of power, which is ascertained by direct experiments to be proportionate to the temporary activity of the disease from which the contagious matter is taken. On this various degree of virulence, he conceives, the circumstance may depend whether an eruption in the same texture of the skin shall be papular, vesicular, or pustular; or a phagedenic sore be deep or superficial, stationary or disposed to extend its ravages. Another source of complexity in the multiform phenomena of the same poison, he suspects, may lie in many adventitious circumstances, influencing the character of primary venereal sores by their stimulant or sedative effect. The occasional coexistence of distinct primary diseases, he sets down as the possible origin of much complexity in the secondary phenomena. (*See Med. Chir. Trans.* vol. xiii. p. 578., &c.) Many of these circumstances are of course only suggested as possibilities, to which further attention should be directed.

Amongst other doctrines, Mr. Hunter inculcates, that "the venereal matter, when taken into the constitution, produces an irritation, which is capable of being continued, independent of a continuance of absorption, and the constitution has no power of relief; therefore a *lues venerea* continues to increase." The same criterion was proposed by Mr. Abernethy, who states, that the "constitutional symptoms of the venereal disease are generally progressive, and never disappear unless medicine be employed." (*Surgical Obs.* p. 137.) And notwithstanding some dissent may be traced in both old and modern writers, from the belief, that mercury was absolutely essential to the cure of the venereal disease, and an opposite conclusion might easily have been drawn from the whole history of this subject, including the practice of former and present times, the contrary hypothesis was that always taught in all the great medical schools of this country, even down to so late a period as twenty years ago. But the error no longer prevails, and no facts are more completely established, than that mercury, however useful it

may frequently be in the treatment of the venereal disease, is not absolutely necessary for the cure either of the primary or secondary symptoms; and that the disease, so far from always growing worse, unless mercury be administered, ultimately gets well without the aid of this, or any other medicine. If any man yet doubt the general truth of this statement, let him impartially consider the many facts and arguments brought forward in proof of it in the anonymous tract "*Sur la Nonexistence de la Maladie Vénérienne*," and in the writings of Mr. Carmichael, Dr. Fergusson, Mr. Rose, Dr. Hennen, Dr. Thomson, Mr. Guthrie, Mr. Bacot, and other practitioners. Perilhe, as I have already noticed, distinctly admitted the frequency of spontaneous cures, and so does Delpech. "Observation seems to prove (says he) that there are some individuals, in whom the lymphatic system appears to be endued with the fortunate property of extinguishing the syphilitic principle, so that merely primary symptoms occur." (*Chir. Clinique*, t. i. p. 341.) In short, if there be such a sceptic now living in this country, let him peruse the returns made by the surgeons of the whole British army; documents which will be noticed in the sequel of this article; let him consider the evidence of the surgeons of other countries, especially that of Cullerier, who used annually to demonstrate to his class of pupils the cure of venereal ulcers without mercury; and the testimony and practice of the German surgeons who were attached, during the war, to regiments of their countrymen in the British service. The fact is therefore indisputable, that the venereal disease in all its ordinary and diversified forms, is capable of a spontaneous cure, and consequently that the question, whether the disease is syphilitic or not, can never be determined by the circumstance of the complaint yielding, and being permanently cured without the aid of mercury. Yet, as Mr. Rose has observed, the supposition that syphilis did not admit of a natural cure, and that mercury was the only remedy that had the power of destroying its virus, was of late so much relied upon, that where a disease had been cured without the use of that medicine, and did not afterwards return, such fact alone, whatever might have been the symptoms, was regarded as sufficient proof that it was not a case of syphilis. And, as the same writer judiciously remarks, the refutation of these notions is of considerable importance, "not so much in reference to the treatment of syphilis, under common circumstances, for the strikingly good effects of mercury will probably not render it advisable in general to give up the use of that remedy, but from the change it will produce in our views of the diagnosis of the disease. The distinction, which has engaged such a share of attention of late years, and which is evidently so important between syphilis and syphilitoid diseases, has been made to depend so much on the former admitting of no cure, except by mercury, that, if this principle should be found to be erroneous, the difficulties which have attended it will in a great measure be explained." (*Med. Chir. Trans.* vol. viii. p. 350, 351.) That it is erroneous, will appear more clearly when the treatment of syphilis falls under consideration.

Excluding from present attention, works of ancient date, it is curious to find how very nearly several writers, within the last thirty or forty years, arrived at the same point to which modern

investigations have led. Thus, Mr. B. Bell observes that "a chancre might frequently be cured with external applications alone, and as we know from experience that the virus is not always absorbed, the cure would in a few instances prove permanent; but, as we can never with certainty know whether this would happen or not, while, in a great proportion of cases, there would be reason to think that absorption would take place, we ought not in any case to trust to it." (*On Gonorrhæa Virulenta, &c.* vol. ii. ed. 2. p. 325. 8vo. Edinb. 1797.) And, in some reflections upon a case of doubtful nature, Dr. Clutterbuck long ago remarked: "Supposing even that the diseased appearances had after a time got well of themselves, I should deem even this no absolute proof of their not being of a venereal nature. I have seen cases which induce me to believe, that the venereal disease, in some of its stages, and in certain circumstances, may get well without mercury or any other remedy. But this is contrary to the doctrine of Mr. Hunter, who supposed that venereal actions go on increasing, without any tendency to wear themselves out. That lues venerea is much modified by climate and other circumstances, is generally allowed; that it has been cured by other means than mercury, we have also very sufficient evidence in the older writers on the subject: not to mention the late successful trials with acids, and other substances. Many of the appearances on the skin go off spontaneously. When purple spots appear on the skin (Mr. Hunter observes, p. 319.); giving it a mottled appearance in this disease, many of the spots disappear, whilst others continue and increase." (*H. Clutterbuck, On some Opinions of John Hunter*, p. 27. 8vo. Lond. 1799.) If Dr. Clutterbuck had advanced one step further, and declared that the venereal disease might be cured without mercury, or any other remedy, in all, or nearly all, its forms, and not merely in some of them, he would actually have anticipated the most important fact, recently established chiefly by the meritorious labours of the army surgeons, whose opportunities of going through the investigation were better, on several accounts, than those of private practitioners, who generally soon lose sight of their patients, and never have them sufficiently under their control and observation to render a full perseverance in any method a matter of certainty. At all events, Dr. Clutterbuck may justly claim the merit of having distinctly marked the fact, that the circumstance of a disease giving way, and being cured without mercury, is no proof that the case is not venereal.

One of the most ingenious theories, ever devised for explaining all the perplexities and irregularities of syphilis, is unquestionably that of the late Mr. Hunter; for it accommodated itself almost to every thing, and every believer in it fancied he could account satisfactorily for many puzzling occurrences, which admitted of no good explanation on other principles. Mr. Hunter inculcated, that the parts contaminated by the absorption of the venereal poison, do not immediately begin to be palpably diseased, but only acquire a disposition to take on the venereal action. He further believed, that when this disposition was once formed in a part, it necessarily changed into action, or manifest disease, at some future period. That mercury can cure the disease when positively formed, but not the disposition to it. That al-

though mercury cannot destroy the disposition already contracted, yet that it can prevent it from being formed at all. That the disposition never becomes the real disease, or, in Mr. Hunter's language, goes into action during the use of mercury. That the action having once taken place, always increases, never wearing itself out. That parts, once cured, never become again contaminated from the same stock of infection; And, that the matter of secondary ulcers, or those which break out in consequence of absorption, is not infectious. What Mr. Hunter meant by the term disposition, I think, is better explained, than the ground for the adoption of the theories connected with it: viz. the presumption of its being formed in all the parts, capable of contamination; the certainty of its future change into actual disease; the impossibility of curing it by mercury, previously to such change; but the possibility of preventing its formation at all by the timely use of that remedy.

Dr. Clutterbuck has well observed, that the only foundation for all these hypotheses, connected with the phrase disposition, is the fact, that secondary symptoms sometimes arise, notwithstanding a full use of mercury. If, says this gentleman, we were to suppose, with Mr. Hunter, that all the parts, which are susceptible, become at once contaminated, and mercury has no influence over them in this state, the constitution should become affected in almost all cases: for, absorption probably always precedes the application of remedies. Either, therefore, mercury does prevent the future action, or a more frequent absence of susceptibility to the disease must be supposed, than there are grounds for imagining. (*Remarks on the Opinions of Mr. Hunter*, p. 9—12.) But surgeons of the present day, enlightened by many new facts, unequivocally determined since Mr. Hunter's time, know very well, that a disposition to the disease is in many instances not produced at all, even though the matter of a chancre be supposed to be absorbed; since in a large proportion of cases of chancres, which had all the characteristic appearances of such ulcers, according to Mr. Hunter's own description, no secondary symptoms followed, though the patients were treated and cured without any mercury. Yet, if Mr. Hunter's theory were true, the disposition must have been produced, the action or disease itself, in the form of secondary symptoms, must have ensued, sooner or later, and no cure could have been ultimately effected without mercury. Fortunately for mankind, unsound as some of the theories seem, which are attached by Mr. Hunter to the supposed disposition of the venereal disease, or its latent form, there was one piece of advice given by him, which may be said to have had a beneficial effect in practice, though founded upon these very doctrines; and it was this: "that we should push our medicine no farther, than the cure of the visible effects of the poison, and allow whatever parts may be contaminated to come into action afterwards." (*On the Venereal Disease*, p. 334.) This maxim, I know, has been regarded by some admirers of long salivations, as the cause of many relapses, and imperfect cures; but, when I advert to the dreadful mischief, which formerly attended protracted courses of mercury for latent and imaginary complaints, my mind regrets, that Mr. Hunter himself should not have strictly adhered in practice to his

own principle, from which he undoubtedly deviated with his patients, and even in certain other parts of his writings. However, the effect has been to discourage long courses of mercury; and perhaps, in this way, the world has been benefitted by the counsel, though not rigorously adopted by him who gave it.

Chancres.—The penis, which in men is the common seat of a chancre, is, like every other part of the body, liable to diseases of the ulcerative kind, and on some accounts is rather more so than other parts. When attention is not paid to cleanliness, excoriations, or superficial ulcers, often originate. The genitals, also, like almost every other part that has been injured, when once they have suffered from the venereal disease, are very liable to ulcerate again. Since, therefore, the penis is not exempted from common diseases, every judgment of the nature of ulcers upon it, as Mr. Hunter truly remarks, should be formed with great attention, particularly, as all diseases upon this part are suspected to be venereal. But, for a particular description of the many ordinary complaints which are apt to occur on the genitals, either preceded or unpreceded, by sexual intercourse, I refer to Mr. Evans's treatise. (*On Ulcerations of the Genital Organs*, 8vo. Lond. 1819.) From facts, already mentioned however, it would appear, that primary syphilitic ulcers, or chancres, by which I imply sores, capable of giving rise to the secondary symptoms of the venereal disease, have no determinate external character, are extremely diversified in their appearance, and absolutely cannot always be distinguished by their mere look from sores, which are of a common, or, at least a very different nature. This is another important fact, for which every man in the profession who seeks only truth, and the expulsion of errors from the doctrines of surgery, must feel obliged to the army surgeons. Nor is their merit lessened by the consideration, that the detection of mistake on this point, like the discovery of the error, concerning the invariable progress of the venereal disease from bad to worse, unless medicine be given, has taken place in opposition to the tenets of Mr. Hunter. "*Venereal ulcers* (says he) *commonly have one character, which, however, is not entirely peculiar to them; for many sores, that have no disposition to heal (which is the case with a chancre), have so far the same character. A chancre has commonly a thickened base, and, although in some, the common inflammation spreads much further, yet the specific is confined to this base.* (P. 215.) And elsewhere, he observes, a chancre first begins with an itching in the part. When the inflammation is on the glans penis, a small pimple, full of matter, generally arises, without much hardness, or seeming inflammation, and with very little tumefaction; for the glans penis is not so apt to swell, in consequence of inflammation, as many other parts are, especially the prepuce. Mr. Hunter also explains, that chancres, situated on the glans, are not attended with so much pain and inconvenience, as sores of this nature on the prepuce. When chancres occur on the frænum, or particularly on the prepuce, a much more considerable degree of inflammation soon follows, attended with effects more extensive and visible. These latter parts, being composed of very loose cellular tissue, afford a ready passage for the extraneous fluids. The itching is gradually converted

into pain: in some cases, the surface of the prepuce is excoriated, and afterwards ulcerates; while, in other examples, a small pimple or abscess appears on the glans, and then turns into an ulcer. *The parts become affected with a thickening, which at first, while of the true venereal kind, is very circumscribed; not diffusing itself, as Mr. Hunter observes, gradually and imperceptibly into the surrounding parts; but terminating rather abruptly. Its base is hard, and the edges a little prominent.* When it begins on the frænum, or near it, that part is very commonly wholly destroyed, or a hole is often made through it by ulceration.

When venereal matter is applied to the body of the penis, or front of the scrotum, where the cuticle is thicker than that of the glans, penis, and prepuce, the chancre generally makes its appearance in the form of a pimple, which commonly forms a scab, in consequence of evaporation. The first scab is generally rubbed off, after which a second, still larger one, is produced.

When the disease is more advanced, it is often attended with inflammation peculiar to the habit, becoming in many instances more diffused, and often producing phymosis, and paraphymosis. However, according to Mr. Hunter, *there is yet a hardness around the sores, which is peculiar to such as are caused by the venereal virus, particularly those on the prepuce.*

Mr. Carmichael also, in his arrangement of primary ulcers on the penis, considers the true chancre as being particularly distinguished by its hardened base, which he compares to a piece of cartilage under the skin. It is to be observed, however, that, by the true chancre, or primary syphilitic ulcer, he does not signify that it is the only sore from which secondary symptoms may arise; but his observations lead him to regard it as the cause of such constitutional effects, as belong to what he deems the true form of syphilis, or that in which the use of mercury is the most decidedly indicated. It would give me sincere pleasure to find any agreement on this part of the subject, amongst other observers. The reader, indeed, must already know, that the hardened base, which both Hunter and Carmichael have regarded as a distinguishing character of a true chancre, is not found to be so by other gentlemen, who have most impartially investigated this point. Thus, Dr. Hennen observes, "*We are not in possession of the knowledge of any invariable characteristic symptoms, by which to discriminate the real nature of the primary sore, and we are equally at a loss in many of the secondary symptoms.* I am well aware, that some practitioners have assumed to themselves the possession of a 'tactus eruditus,' by which they can at once distinguish a chancre or a venereal ulcer, or eruption, in which mercury is indispensable, from one of a different nature; but I have seen too many instances of self-deception to give them all the credit that they lay claim to. It would be by no means difficult to show, that the high round edge, the scooped, or excavated sore, the preceding pimple, the loss of substance, the hardened base and edge, whether circumscribed or diffused, and the tenaciously adhesive discharge of a very fetid odour, are all observable in certain states and varieties of sores, unconnected with a venereal origin. The hardened edge and base, particularly, can be produced

artificially by the application of escharotics to the glands, or penis, of a sound person, and, if any ulceration, or warty excrescence, previously exists on these parts, this effect is still more easily produced." (*On Military Surgery*, ed. 2. p. 517.) Now, if it be asked, whether the chancre with a hardened base, and prominent edge, is distinguished by its not admitting of cure, without mercury; and by any regularity or peculiarity in the nature of secondary symptoms, when they originate from such an ulcer? modern experience denies the validity of both these criteria. If Mr. Rose's excellent paper be consulted, the reader will find, that this gentleman certainly cured, without the aid of mercury, ulcers, which had a decidedly marked induration of the margins and bases, by which the syphilitic chancre, according to Mr. Carmichael, is easily distinguished. (*Med. Chir. Trans.* vol. viii. p. 421, &c.; also *Guthrie*, vol. cit. p. 576.)

Sufficient evidence has already been detailed to satisfy any impartial mind, that, so far as the eye can teach us, no kind of primary sore has yet been satisfactorily proved to be the cause of only one set of peculiar constitutional symptoms; but, on the contrary, that a great variety of appearances in the skin, throat, &c. may follow sores, which, inasmuch as their external character are concerned, seem exactly alike. The only partial exception to this remark, is the great frequency of papular eruptions after superficial sores; a point, on which both Mr. Carmichael and Mr. Rose agree, though the latter gentleman does not represent even this connection as constant.

Dr. Colles joins several other modern writers in the statement, that "*primary venereal ulcers present an almost endless variety of character. I would define a primary venereal ulcer (he observes) to be one, which is remarkably slow in yielding to ordinary, mild, local treatment, but which is curable by mercury, and which, if not so cured, is likely to be followed, in two or three months, by secondary symptoms, which again are also curable by mercury.* If then there be, as I affirm there is, an almost endless variety in chancres, how can we decide on the nature of primary ulcers, so as to pronounce some to be syphilitic, and others to be mere common sores, or simple excoriations? I reply, that we are to be guided in our decision, by observing, First, that *many of these suspicious ulcerations cannot be referred to any class of common ulcers, as they strikingly differ from them*; and, Secondly, *by attending to the course which these take, when not interfered with by any stimulant, or caustic application, and when treated only with some mild ointment, or cold water.* If, under these circumstances, we find, that, *after eight or ten days, such ulcers show no disposition to heal, and, if, at the same time, there be a total absence of any cause, such as defect in the general health, to account for this obstinate condition of the local disease, we may then pronounce them to be syphilitic.* But I repeat, that the local applications must have been of the mildest kind; for, almost any primary venereal ulcer may be made to heal by the use of stimulating applications, even for so short a time as one or two days." (*Dr. Colles, On Ven. Dis.* p. 75.)

These remarks of Dr. Colles, appear to me judicious, though they involve some questions at which we shall presently arrive.

On this part of the subject, Mr. Wallace took great pains to throw useful light, and especially by attempting a classification of primary phagedenic venereal ulcers. For some forms of these diseases, he may, however, have been too partial to mercury, as it was one of his maxims sometimes to aim at bringing the patient as rapidly as possible under its influence. "When (says he) a phagedenic form of syphilis, wherever seated, is presented to us, our first object should be to ascertain whether it spread by ulceration, or slough; and, if by slough, the colour of the slough. If that colour be white; if the disease be making a rapid progress in parts of much importance; and, above all, if the patient be not in a state of mercurial excitement, or cachexia, produced by the irregular, or injudicious employment of mercury, which is not infrequently the case, we may instantly employ this medicine, not only by local fumigation, but also at the same time, in any other manner the case may dictate, so as to bring the patient, as rapidly as possible, under its constitutional influence; and this practice should be adopted, whether there be much inflammation or not. If there be inordinate inflammation, antiphlogistics and evacuations, proportioned to the nature of the case, are to be combined with mercury, just as in cases of iritis; and having put a stop, by these combined measures, to the further extension of the disease, which is sometimes done almost in a few hours, the mercurial treatment should be intermitted, and the patient allowed time to recover from the excitement produced, on the one hand, by the disease, and on the other, by the mercury. But, as soon as the system and part are tranquillised, the mercurial treatment may be again resumed, without fear, but in a milder form, and continued with caution as long as may be necessary." (*Op. cit.* p. 171.) Whenever Mr. Wallace gave mercury, in cases of inflamed, white phagedæna, he particularly directed his attention, throughout the treatment, to the character of the slough at its junction with the living parts; and if it changed from white to black, in consequence of the intensity of the inflammation, or from any other cause; and if the inflammation increased, while the patient was under the influence of mercury; or if the sore became free from slough, without any diminution of the inflammation and irritation; or lastly, if the system became deranged, while he found extraordinary difficulty in exciting the mercurial action; — Mr. Wallace directly discontinued the mercury. (*P. 173.*) I introduce Mr. Wallace's view of the usefulness of bringing the patient quickly under the influence of mercury in certain states of phagedenic ulceration; not with any intention, however, of joining in its praise; for such is my conviction of the fatal mischief, which I have repeatedly seen result from mercury in such cases, that I have long abandoned it, and find every reason to be satisfied with the results.

Mr. Hunter computed that chaps occur more frequently than chancres, in the proportion of four or five to one: I am not prepared to offer any opinion on this calculation, in reference either to chancres, as defined by that interesting writer, or under the more comprehensive view of them, to which the results of modern investigations would lead. One intelligent writer, however, has observed, that present experience does not justify Mr. Hunter's conclusion respecting the infe-

quency of chancre compared with gonorrhoea. (*J. Bacot, Obs. on Syphilis*, p. 54.) Yet, in Dublin, if Mr. Carmichael's statement be correct, the frequency of gonorrhoea, as compared with that of what is sometimes termed the true venereal chancre, must be so great as to defy all computation; for he informs us, that since the descriptions of the success of the non-mercurial practice fell into his hands, he has been anxious to ascertain, by personal observation, whether true syphilitic chancres did really admit of being cured without mercury; but, says he, "This disease, as described by Hunter, has diminished in so extraordinary a degree in this country, that, strange to say, I have, from that period, met with only one case of true chancre." (*Obs. on the Symptoms, &c. of Venereal Diseases*, p. 14.) As this chancre remained stationary a month, it was thought proper to employ mercurial frictions, and it then soon healed, leaving a callosity which continued two months longer. However, after the above passage was written, Mr. Carmichael met with two cases of "well-marked chancre," each of which was attended with psoriasis syphilitica, scaly from its commencement. No mercury was given. For five weeks, the disease gained ground; but, in the end, both cases were cured, merely by the administration of sarsaparilla. The following observations, contained in the appendix to Mr. Carmichael's work, do him infinite credit. "Although (says he) these two cases cannot fail to make a due impression, yet, if they stood alone, their evidence could not be deemed sufficient to establish a belief, that true syphilis, like the papular disease, is capable of yielding to the powers of the constitution, or to remedies in which mercury does not form an ingredient. But this deficiency seems to be in a great measure supplied by the testimony of Mr. Rose, Dr. Hennen, and other equally intelligent surgeons, who had the advantage of serving with our army on the Continent; and if, in the preceding pages, I appear to be sceptical, with respect to the accuracy of their observations, and doubted that it was true chancre, and true syphilitic eruption, which yielded to their prescriptions unaided by mercury, these two cases have satisfied me, that every attention is due to the exactness and discernment of these respectable individuals; and, if I hesitated until I saw with my own eyes, and judged with my own understanding, I claim for my own observations no larger a measure of faith from others." And he afterwards adds, "In thus relinquishing my opinion, that true syphilis differs from other venereal complaints, by always requiring mercury for its cure, it is necessary to reduce the doctrine I hold to this proposition: that, with respect to the use of that medicine, it differs from them only in not being injured, but decidedly benefited by it in all its symptoms and stages." (P. 218. 219.)

According to Mr. Hunter, there are three ways, in which chancres may be produced: First, by the poison being inserted into a wound; Secondly, by being applied to a non-secreting surface; and, Thirdly, by being applied to a common sore. A wound, it seems, is much more readily infected than a sore. To whichever of these three different surfaces the pus is applied, it produces its specific inflammation and ulceration, attended with a secretion of pus. The matter, produced in consequence of these different modes of application, he

says, partakes of the same nature as the matter which was applied; because, he observes, the irritations are alike. How the alleged examples of very different primary sores, being sometimes communicated by the application of the matter of chancre, are to be reconciled with the Hunterian doctrines, it is difficult to suggest, unless Mr. Carmichael's observation about the present excessive rarity of the true syphilitic chancre can furnish the explanation. However, so far as I can believe my own eyes and judgment, I now see in London the same forms of chancre, which used to prevail during my apprenticeship at St. Bartholomew's Hospital, more than thirty years ago. And if any difference can be particularised, it is only that which depends upon their being less rarely converted into worse diseases than mere syphilitic ulceration, by the dreadful effects of immoderate courses of mercury.

With respect to the three modes in which Mr. Hunter speaks of the venereal poison being applied and taking effect, I know not why he should have altogether excluded secreting surfaces; for of this nature (as Mr. Bacot remarks) are the glans penis and corona glandis (*On Syphilis*, p. 55.); and of a similar kind are the insides of the labia, the surfaces of the nymphæ, &c., where sores are common enough. Whatever may be the truth of the impossibility of the formation of chancres within the urethra, the latter considerations certainly tend to prove, that the secreting nature of its membrane is not the only reason for the alleged fact.

I shall not here detain the reader with descriptions of the primary ulcer with elevated edges, the phagedenic, and the sloughing chancre; nor with the statements of Mr. Carmichael respecting the train of constitutional symptoms appertaining, as he believes, to each form of ulcer. It is an interesting disquisition; but, so far as my observations and inquiries go, it has not yet reached any degree of certainty or precision; and, as I have already explained, the reports published by other gentlemen, engaged in this investigation, do not by any means confirm the much-desired intelligence, that such progress has been made in the knowledge of all the diversified symptoms of the venereal disease, that its varieties can now be classed, both in regard to the primary ulcers, and the secondary symptoms connected with each description of chancre.

I firmly believe, that, with respect to all the appearances of this disease, both in its primary and secondary forms, a vast deal depends upon constitution, independently of the nature of the virus. On this point, I feel much more certainty, than on the disputed question, whether syphilitic diseases depend upon a variety of poisons, and whether some of the perplexity of these cases can be thus explained.

The varieties in the appearances of chancres, badly comprehended, or wrongly interpreted, are noticed by M. Ricord, as sometimes taken up as argument against the identity of the venereal poison, and sometimes as a proof of the plurality of venereal poisons; but (says he) "If a chancre be rightly studied, with reference to its cause, which is always the same, and to its mode of development and consequences, in regular and uncomplicated examples, the apparent differences are easily accounted for, and all contradictions cease;

or, whatever may be the actual form of chancre, from which the pus is taken, provided it be only taken at the right period, already specified, a regular characteristic pustule is the result, when the infectious matter is conveyed under the cuticle or epithelium; an ulcer at once when it is applied to denuded textures; or an abscess, when it is introduced into the cellular tissue, or a lymphatic vessel or gland. Allowance being always made for the difference depending upon the situation and the particular tissues affected, the same identical aspect, the same regular and characteristic appearance, always attend the ulcer at its commencement; and this, whether the sore follows the rupture of the pustule, the opening of a virulent abscess of the cellular tissue, or of the lymphatic system, or whether the ulcer is formed at once. *The deviations, or particular forms only happen, or are developed afterwards, and under the influence of conditions foreign to the specific cause; such as the peculiar constitution of the individual,—his prior or concomitant diseases,—the great or little care he may take to preserve his general health; or the constitutional or local treatment to which he is subjected. Hence, patients are seen with phagedenic chancres, who caught the disease from persons whose sores were mild; and hence the absolute falsehood of the notion, that an aggravated form of the disease is contracted by connection with a person who has it severely.* (Ph. Ricord, *Mal. Vén.* p. 135.)

The local or immediate effects of the venereal disease are seldom wholly specific; but are usually attended both with the specific and constitutional inflammation. Hence, Mr. Hunter advises particular attention to be paid to the manner in which a chancre first appears, and to its progress. If the inflammation spreads in a quick and considerable way, the constitution must be more disposed to inflammation than natural. When the pain is severe, he would infer, that there is a strong disposition to irritation. Chancres, also, sometimes, soon begin to slough, there being a strong tendency to mortification. Here he adverts to what are now usually called phagedenic venereal sores; of which the reader may find a minute description, and an attempted classification of them, in Wallace's treatise, chap. iv.

It is observed by Mr. Hunter, that when there is a considerable loss of substance, either from sloughing or ulceration, a profuse bleeding is no uncommon circumstance, more especially when the ulcer is on the glans. The adhesive inflammation does not appear to take place sufficiently to unite the veins of this part of the penis, so as to prevent their cavity from being exposed; and the blood escapes from the corpus spongiosum urethræ. The ulcers, or sloughs, often extend as deeply as the corpus cavernosum penis, and similar bleedings are the consequence.

With respect to chancres in women, the labia and nymphæ, like the glans penis in men, are subject to ulceration; and the ulcerations are generally more numerous in females than males, in consequence of the surface, on which the sores are liable to form, being much larger. As Mr. Hunter observes, chancres are occasionally situated on the edge of the labia, sometimes on the outside of these parts, and even on the perineum. When the sores are formed on the inside of the labia or nymphæ, they can never dry, or scab;

but, when they are externally situated, the matter may dry on them, and produce a scab, just as happens with respect to chancres situated on the scrotum, or body of the penis.

Mr. Hunter remarks, that the venereal matter from these sores is apt to run down the perinæum to the anus, and excoriate the parts, especially about the anus, where the skin is thin, and where chancres may be thus occasioned.

Chancres have been noticed in the vagina; but Mr. Hunter suspected that they were not original ones, and that they had spread to this situation from the inside of the labia. M. Ricord, (who assures us that, with the aid of a speculum, he has frequently detected them in this situation, in women who had also gonorrhœa,) believes that this combination accounts for those otherwise perplexing facts, to which I have already adverted as taking place in individuals who contract venereal complaints by intercourse with one woman, and, as is assumed, with no others.

Before any of the virus has been taken up by the absorbents, and conveyed into the circulation, a chancre is entirely a local affection. From the Hunterian doctrines, however, it would appear that absorption must generally soon follow the occurrence of the sore; though it may be remarked, that as the first effect of such absorption, the production of a bubo does not usually take place in the early or ulcerating stage of a chancre, and not till granulations have formed, such doctrines may not be correct. This is a point, however, which I have noticed in speaking of the nature of the process of ulceration, and one, on which I have introduced the opinions of Mr. Aston Key, and the late Mr. Wallace of Dublin. (See ULCERATION.) I know, however, that rather an opposite conclusion has been arrived at by M. Ricord, as will appear from the latter part of the following passage:—"A chancre (says M. Ricord) which is, in relation to constitutional syphilis, what the bite of a rabid dog is in relation to hydrophobia, does not, however, produce a specific pus, except at a certain epoch of its duration, and it is certainly from so simple a fact not being recollected, that the results of inoculation have been disputed, or rendered uncertain. It is very manifest, that a primary venereal sore cannot be the same in all its stages, and that, if it did not pass into the state of a simple ulcer by the destruction of the cause which tended to keep it up, it would never heal. Similar character, and similar results cannot be expected from these different phases: it is at the period of progress, or of the statu quo of ulceration, when there is no work of cicatrization going on, that the chancre secretes the venereal virus." (Ph. Ricord, *Mal. Vén.* p. 85.)

Notwithstanding the admitted fact, that a chancre frequently loses its venereal character, and becomes a simple ulcer before it heals, so that the pus secreted by it, after a certain time, does not contain the venereal poison, there would appear to be exceptions, unless we are to set down certain accounts as incorrect; and, so far as the absorption of the poison is concerned, I believe, with Mr. Aston Key and Mr. Wallace, that the production of a bubo from this cause rarely, or never, occurs, until at least some points of the chancre have begun to granulate. (See ULCERATION.) Another experienced surgeon informs us, that he has known some young men led to suppose, that "when a

chancre had lost its venereal characters, and had got into the state of a granulating ulcer, it was devoid of all venereal virus, and therefore incapable of conveying infection. In the early part of my professional life, I have known more instances than one which proved the fallacy of this notion. I had once an opportunity of learning that a chancre, even when recently healed, was still capable of communicating the venereal disease, if the cuticle chanced to be rubbed off. A young man whom I was treating for a chancre, had the imprudence to marry privately in a day or two, after his chancre had healed; the cuticle was rubbed off, and I was called upon, in a fortnight after, to treat his wife for a chancre and bubo." (*Abr. Colles, M.D., On the Ven. Dis. p. 80.*)

When no secondary symptoms take place after the cure of chancre without mercury, I believe few surgeons of the present day would attempt to account for the fact by the hypothesis of the matter not having been absorbed; and this observation is made with every disposition on my part to express my assent to the truth of another circumstance, viz., that some persons appear much more susceptible of the effects of the venereal disease, than other individuals. It is remarked by Mr. Hunter, that the interval, between the application of the poison and its effects upon the parts, is uncertain; but that, on the whole, a chancre is longer in appearing than a gonorrhoea. However, the nature of the parts affected makes some difference. When a chancre occurs on the frænum, or at the termination of the prepuce in the glans, the disease, in general, comes on earlier; these parts being more easily affected than either the glans penis, common skin of this organ, or the scrotum. He adds, that, in some cases, in which both the glans and prepuce were contaminated from the same application of the poison, the chancre made its appearance earlier on the latter part. Mr. Hunter knew of some instances, in which chancres appeared twenty-four hours after the application of the matter; and others, in which an interval of seven weeks, and even two months, elapsed, between the time of contamination and that when the chancre commenced.

It was one of Mr. Hunter's opinions, that the ulceration arising from venereal inflammation generally, if not always, continues till cured by art; and his theoretical reason for this circumstance was, that, as the inflammation in the chancre spreads, it is always attacking new ground, so as to produce a succession of irritations, and hinder the disease from curing itself.

It was, no doubt, the foregoing opinion of Mr. Hunter, which formed the authority for the position which was always forcibly insisted upon in the surgical lectures of Mr. Abernethy, which I attended many years ago, viz. that all truly venereal complaints, when not counteracted by remedies, invariably grow progressively worse, which is not the case with pseudo-syphilitic diseases. But modern experience apprises us, that this doctrine is completely erroneous; that truly venereal complaints will get well without mercury; and consequently that the phrase *pseudo-syphilitic* has, in this respect, no foundation. As I have noticed in the foregoing pages, Dr. Ferguson assures us, that, in Portugal, the disease, in its primary state amongst the natives, is curable without mercury, and by simple topical treatment; that the antisyphilitic

woods, combined with sudorifics, are an adequate remedy for constitutional symptoms; and that the virulence of the disease has there been so much mitigated, that, after running a certain course (commonly a mild one) through the respective orders of parts, according to the known laws of its progress, it exhausts itself and ceases spontaneously. (*See Med. and Chir. Trans. vol. iv. p. 2--5.*) In the third edition of the *First Lines of the Practice of Surgery*, it was sufficiently proved, from several conclusions drawn from the writings of Mr. Pearson (*Obs. on the Effects of Various Articles in the Cure of Lues Venerea*), that venereal sores might be benefited, and even healed, under the use of several inert insignificant medicines. And, as I have previously explained, the possibility of curing chancres and other venereal complaints, without mercury, was long since remarked by Dr. Clutterbuck, who thence very justly inferred, that the healing of a sore, without this remedy, was no test that it was not venereal. (*See Remarks on the Opinions of the late John Hunter, 1799.*)

But, although the whole history of the venereal disease, and of the various articles of the materia medica, if carefully reflected upon, must have led to the same conclusion, the truth has been only of late years placed in such a view as to command the general belief of all the most experienced surgeons in this and other countries of Europe. I do not mean to say, that the truth was not seen and remarked by several of the older writers; for, that it was so, any man may convince himself by referring to several works quoted in the course of this article. But it is to be understood, all indecision could never be renounced, so long as prejudices interfered with the only rational plan which could be adopted, with the view of bringing the question to a final settlement; I mean experiments on a large and impartial scale, open to the observation of numerous judges, yet under such control, as insured the rigorous trial of the practice. Nor could such investigation be so well made by any class of practitioners as the army surgeons, whose patients are numerous, obliged to follow strictly the treatment prescribed, without any power of going from hospital to hospital, or from one surgeon to another, as caprice may dictate, or of eluding the observation of the medical attendants after a seeming recovery. And here I must take the opportunity of stating that, as far as my judgment extends, the most important and cautious document yet extant, on the two questions of the *possibility and expediency* of curing the venereal disease without mercury, is the paper of Mr. Rose. For let it not be presumed that, because the army surgeons find the venereal disease curable without mercury, they mean to recommend the total abandonment of that remedy for the distemper, any more than they would argue that *possibility and expediency* are synonymous terms. At the time when Mr. Rose published his observations, he had tried the non-mercurial treatment in the Coldstream Regiment of Guards, during a year and three quarters, and had thus succeeded in curing all the ulcers on the parts of generation, which he met with in that period, together with the constitutional symptoms to which they gave rise. "I may not be warranted in asserting (says this gentleman) that many of these were venereal, but, undoubtedly, a considerable number of them had all the appearances of

primary sores, produced by the venereal virus, and arose under circumstances, where there had been at least a possibility of that virus having been applied. Admitting that there is nothing so characteristic in a chancre as to furnish incontrovertible proof of its nature, it will yet be allowed that there are many symptoms common to such sores, although not entirely peculiar to them; and whenever these are met with, there are strong grounds to suspect that they are the effects of the syphilitic virus. In a sore, for instance, appearing shortly after suspicious connection, where there is loss of substance, a want of disposition to granulate, and an indurated margin and base, there is certainly a probability of that poison being present. Amongst a number of cases of such a description, taken indiscriminately, the probability of some being venereal is materially increased, and must at last approach nearly to a certainty. On this principle, some of the sores, here referred to, must have been venereal. They were also seen by different surgeons, on whose judgment I would rely, who agreed in considering many of them as well-marked cases of true chancre." (*Rose, in Med. Chir. Trans. vol. viii. p. 357, &c.*) The men thus treated were examined almost every week, for a considerable time after their apparent cure, "both that the first approach of constitutional symptoms might be observed, and that any deception from an underhand use of mercury might be guarded against." (P. 359.) Sixty cases of ulcers on the penis were also cured by Mr. Dease in the York Hospital, by means of simple dressings, the only general remedy being occasional purgatives. The practice was likewise extensively tried by Mr. Whympster and Mr. Good, surgeons of the Guards, with the same kind of success. In Mr. Rose's practice, all idea of specific remedies was entirely laid aside. The patients were usually confined to their beds, and such local applications were employed as the appearances of the sores seemed to indicate. Aperient medicines, antimony, bark, vitriolic acid, and occasionally sarsaparilla, were administered. (P. 363.) "Upon an average (says Mr. Rose), one out of every three of the sores thus treated, was followed by some form or other of constitutional affection: this was in most instances mild, and sometimes so slight, that it would have escaped notice, if it had not been carefully sought for. The constitutional symptoms were evidently not such as could be regarded as venereal, if we give credit to the commonly received ideas on the subject. Caries of the bones, and some of the least unequivocal symptoms, did not occur. In no instance was there that uniform progress, with unrelenting fury, from one order of symptoms and parts affected to another, which is considered as an essential characteristic of true syphilis." (*Med. Chir. Trans. vol. viii. p. 422.*) The constitutional symptoms also yielded without the aid of mercury; and frequently primary sores, corresponding to what had been called the true chancre, with indurated base, were cured in this manner, yet were followed by no secondary symptoms. We are also informed, that "several cases occurred of a cluster of ill-conditioned sores over the whole inner surface of the prepuce; and behind the corona glandis; and also of a circle of small irritable sores, situated on the thickened and contracted ring at the extreme margin of the prepuce. These occasionally produced buboes,"

None of the sores of this description met with by Mr. Rose, were followed by any constitutional affection. (Vol. cit. p. 370.) He bears testimony to the ill effects of mercury and stimulants in cases of phagedenic ulcers, and confirms a not uncommon opinion, that they are seldom followed by secondary symptoms; which opinion should be qualified with the condition mentioned by Mr. Guthrie (*Med. Chir. Trans. vol. viii. p. 565.*), that no mercury be given. Lastly, as I have already stated, Mr. Rose observed, that most of the cases of papular eruptions followed ulcers which were not very deep, and healed without much difficulty. (P. 399.)

Although the fact of the possibility of curing every kind of ulcer on the genitals, without mercury, has been fully confirmed by the statements of Mr. Guthrie (*Med. Chir. Trans. vol. viii. p. 558 and 576.*), Dr. J. Thomson (*Edin. Med. and Surg. Journ. for January, 1818*), Dr. Hennen (*Op. cit. Nos. 54. and 55.*; and *Principles of Military Surgery*, ed. 2.), Mr. Bacot (*On Syphilis*, p. 26, &c.), and by what is seen every week in University College Hospital; and, although it is of great importance in relation to the removal of an erroneous doctrine concerning the diagnosis; yet the expediency of the practice must evidently be determined by other considerations, the principal of which are the comparative quickness of the cures effected with and without mercury; the comparative severity and frequency of secondary symptoms; and the generally acknowledged fact, that a syphilitic primary sore is not indicated with any degree of certainty by its mere external character, or, indeed, any other criterion hitherto discovered.

Respecting the comparative quickness of the cures of chancres, or reputed chancres, without the aid of mercury, much disagreement prevails in the different reports, even those collected by the same individuals, whose statements must therefore be deemed perfectly impartial, though inconclusive. (See *Hennen's Military Surgery*, ed. ii. p. 536, &c.) Some of Mr. Rose's best marked cases of chancre, that is to say, such as were distinguished by the indurated base and circumference, healed in a very short time. But even respecting these or any other kinds of chancre, no regularity on this point can be found. Mr. Guthrie observes, if the "ulcers were not without any marked appearance, and did not amend in the first fortnight, or three weeks, they generally remained for five, or seven weeks longer; and the only difference in this respect between them and the raised ulcer of the prepuce, was, that this often remained for a longer period, and that ulcers, possessing the true character of chancre, required, in general, a still longer period for their cure, that is, from six, eight, to ten, and, in one case, even twenty-six weeks healing up and ulcerating again on a hardened base. Those that required the greatest length of time, had nothing particular in their appearance that would lead us to distinguish them from others of the same kind, which were healed in a shorter time." (*Med. Chir. Trans. vol. viii. p. 558.*) The same writer afterwards expresses his belief, that almost all the protracted cases would have been cured in one half, or even one third of the time, if a moderate course of mercury had been resorted to.

In relation to the question before us, one of the

most important documents which I have met with, is an official circular, signed by Sir James M'Grigor and Sir Wm. Franklin, from which it appears, that in 1940 cases of primary venereal ulcerations on the penis, *cured without mercury*, between December 1816, and December 1818, (including not only the more simple sores, but also a regular proportion of those with the most marked characters of syphilitic chancre), the average period taken up by the treatment, when bubo did not exist, was 21 days; with bubo, 45 days. (See *Hennen's Military Surgery*, ed. ii. p. 545.) And it further appears, that during the period above specified, 2827 chancres, a more considerable proportion of which were probably Hunterian chancres, were treated with mercury, and that the average period required for the cure when there was no bubo, was 33 days; with bubo, 50. As far, therefore, as a judgment can be formed from this official estimate, and no calculation is ever likely to be furnished on a larger or more impartial scale, the evidence tends to prove that primary sores may generally be cured rather sooner without, than with the administration of mercury. But as practitioners are not obliged to restrict themselves either to the mercurial, or non-mercurial practice, I am of opinion that the total rejection of mercury is by no means justified by any facts yet before the public, concerning the time requisite for the cure on either plan; because, as it is universally admitted that some cases are very tedious, unless mercury be given, neither reason nor experience will sanction the exclusive adoption of only one mode of practice, whether the backwardness to heal exist or not. On the contrary, so far as the consideration of time has weight, prudence and common sense teach us to diversify the treatment according to circumstances. But it may be inquired, since the backward disposition of a sore to heal cannot be known at first by its mere appearance, should the treatment begin with mercury or not? Now, although late writers dwell very much on the impossibility of judging of the nature of a sore by its look alone, one fact is certain, that some ulcers on the penis have a clean appearance from their very commencement; some cases are simple excoriations; and others, though ill-conditioned, are so small, that a fair chance offers itself of destroying every part of the disease with caustic. In all such cases, I should never commence with mercury. With respect to phagedenic and sloughing chancres, repeated experience has convinced me, that they are cases, in the first stage of which, at all events, mercury should always be avoided; and I believe, with Mr. Guthrie, that when this is strictly done, secondary symptoms are rare. One sore of this kind was long ago pointed out by Mr. Pearson, as not requiring mercury, and the attention of surgeons has been of late particularly directed to it by Mr. Bacot. It is characterised by a great derangement of the general health, by a high state of inflammation of the part, by great local pain, and proceeds rapidly to the destruction of the parts. The situation of this sore is most commonly in the angle between the prepuce and glans penis; and those of a full habit of body, the young and the vigorous, are most liable to its attack. The most prompt and vigorous antiphlogistic means are necessary to arrest the progress of this sore; and the blood taken away in these cases, presents the usual in-

flammatory appearances frequently in a very high degree. The exhibition of mercury in this species of sore is highly mischievous, and productive of the worst consequences; nor does it often happen that secondary symptoms succeed, &c. (*On Syphilis*, p. 57.) Here, according to Mr. Pearson's observations, made many years ago, mercury is not perhaps necessary for the security of the constitution; but I conceive it might be more correct to say, that the safety of the constitution actually requires, that mercury should be strictly avoided, because there is some ground for believing that, in these instances, it is not only injurious to the local disease, but conducive to secondary symptoms. However, if the latter symptoms should arise, notwithstanding mercury has not been administered during the cure of the ulcer, alterative doses of that medicine may still be useful, as Mr. Carmichael observes, when the disease is in the wane, but not until then; previously to which period the best internal remedies are antimonials, sarsaparilla, guaiacum, compound powder of ipecacuanha, hydriodate of potash, liquor arsenicalis, nitrous acid, and the nitro-muriatic bath. (See *Obs. on the Symptoms, &c. of the Venereal Disease*, p. 209.)

With respect to chancres with a hardened base and margin, it certainly appears that many of them healed tolerably fast without mercury; but a proportion of them was tedious when that medicine was not employed. (See three cases recorded in the work last quoted.) It may be thought, however, that the official document, circulated by Sir James M'Grigor and Sir William Franklin, tends to prove, that, at all events, these sores heal sooner without than with mercury. But this conclusion seems hardly allowable, because, as these faithful and impartial reporters have sensibly remarked, the 2827 sores, treated with mercury, may be fairly presumed to have partaken of the character of Hunter's chancre in a greater proportion, than the 1940 primary sores treated without mercury. (See *Hennen's Military Surgery*, p. 545.) Consequently, though the sores treated with mercury seem, on the average, to have healed more slowly than others treated without it; yet it is to be taken into the account, that a larger number of the first cases were ulcers with a hardened base and margin, and that if they had not had the mercurial treatment extended to them, it is possible their complete cure might generally have been still more tedious. As the evidence now stands, therefore, I conceive it right to employ mercury with moderation, for all sores on the penis having the characters of the Hunterian chancre and appearing after a suspicious connection. Yet I know from cases, which have been under me in University College Hospital, that the Hunterian chancre will often heal up quickly, under the use of simple dressings, and the administration of hydriodate of potash and sarsaparilla.

A consideration, however, which ought to have greater influence than the slowness or quickness of the cure of primary sores with and without mercury, is the question, whether, upon the average, secondary symptoms are more frequent after the non-mercurial practice than the other? On this most interesting point the reports vary, as, indeed, they do on almost every matter in the investigation, excepting the facts of the possi-

bility of curing all forms of the venereal disease without mercury, the great rarity of any affection of the bones, and the general mildness of the secondary symptoms when that medicine is not employed. On all these points, the testimonies are strong and convincing. But, while Mr. Rose found secondary symptoms take place in one third of his cases treated without mercury (*Med. Chir. Trans.* vol. viii. p. 422.), the proportion in the York, and some other hospitals, was only about one tenth. (*Vol. cit.* p. 559.) In the 1940 cases of primary sores on the penis, treated without mercury, in the army hospitals, between Dec. 1816, and Dec. 1818, there were only 96 instances of secondary symptoms of different sorts, or not more than 1-20th. But the proportion of cases of secondary symptoms in the cases of primary ulcers treated with mercury, was still smaller, and this in an important degree, being only 51 out of 2827 cases, or about 1-55th. Were it not necessary to make a considerable allowance for the probable circumstance of the Hunterian chancre prevailing most in the cases treated with mercury, a point admitted by Sir James M'Grigor and Dr. Franklin, we should here have a powerful and decisive evidence in favour of the general superiority of mercury for the prevention of secondary symptoms. Nor am I certain, that the conclusion can be much weakened by the probability of the difference here alluded to, because from the evidence of late brought to light, respecting the nature of the class of diseases which go under the name of syphilis, we have no right to infer, that what has been culled the true, or Hunterian chancre, is more disposed than some other primary sores to occasion secondary symptoms. Indeed, Mr. Guthrie declares, in the cases referred to in his paper, that when mercury was not used, these symptoms more frequently followed the raised ulcer of the prepuce, than the true characteristic chancre of syphilis affecting the glans penis. (*Med. Chir. Trans.* vol. viii. p. 577.) On the whole, as the reports now stand, and so far as I can judge from cases which I have seen myself, the secondary symptoms are more frequent when primary ulcers are promiscuously treated without mercury, or without some other medicine believed to possess considerable power over the venereal disease; as, for example, the hydriodate of potash, joined with sarsaparilla. But it by no means follows from this fact, that the way to have the smallest possible number of cases of secondary symptoms is to employ mercury in all instances of sores on the genitals. This both reason and experience contradict, inasmuch as mercury, given in cases which do not require it for the security of the constitution, is frequently itself a source of cutaneous disease, sore-throats, and nodes, which, without its baneful influence, would never have occurred. The prudent course seems here to be to exercise our judgment and discretion, and to be guided, in some measure, by the appearance and progress of the sore, according to principles already suggested; for, though the look of a sore may not, in the present state of our knowledge, always enable us to form a certain inference respecting the risk of secondary symptoms, if mercury be omitted, it cannot be said that the danger would be positively obviated by having recourse at once to mercury in every kind of primary sore; and, notwithstanding every

thing which has been lately published, I still flatter myself, that surgeons, accustomed to see much of venereal cases, can yet distinguish excoriations, herpes of the prepuce, boils, simple healthy sores, and some other common ailments. (See Evans, *On Ulcerations of the Genital Organs*, 8vo. Lond. 1819.), from ulcers by which the constitution is liable to be affected. Until further data exist, I cannot venture to lay down other directions about the treatment of primary sores. It is with pleasure, however, that I subjoin the advice of other gentlemen, whose sentiments and talents deserve respect, though their opinions may not exactly agree with my own. "In every primary ulcer (says Dr. Mennen), I would give up the idea of using mercury at first, treating it as if it were a simple ulceration, by cleanliness, rest, and abstinence, and applying to it the most simple and mildest dressings. If the sore did not put on a healing appearance in a reasonable time, the extent of which must depend upon the circumstances of the patient, I should make use of more active dressings. But if, beyond all calculation, it remained open, I should certainly not sacrifice every consideration to a dislike of mercury, knowing how many persons have been seriously benefited by a judicious and mild administration of that remedy." (*On Military Surgery*, ed. 2. p. 518.) The opinion of Dr. Colles on this point, and the circumstances which he takes for his guidance, I have already noticed. When primary ulcers resist common means a certain time, Mr. Bacoet would also have recourse to mercury. (*On Syphilis*, p. 69.) However, he does not approve of invariably postponing that remedy, until the latter criterion, viz., the backwardness of the sore to be healed by other methods, is afforded.

Whenever the employment of mercury in this work is recommended, I am very far from wishing to be thought an advocate for pushing that medicine, as the phrase is. On the contrary, experience has fully convinced me, that, in no forms of chancre, nor in any other stages of the venereal disease, is it proper to exhibit mercury in the unmerciful quantity, and for the prodigious length of time, which custom, ignorance, and prejudice, used to sanction in former days. Violent salivations, at all events, ought to be for ever exploded.

When I was an articled student at St. Bartholomew's Hospital, most of the venereal patients in that establishment were seen with their ulcerated tongues hanging out of their mouths; their cheeks and gums ulcerated; their faces prodigiously swelled; and their saliva flowing out in streams. The wards being also not sufficiently ventilated, the stench was so great, that they well deserved the appellation of *foul*. Yet, notwithstanding mercury was thus pushed (as the favourite expression was), it was then common to see many patients suffer the most dreadful of mutilations, in consequence of sloughing ulcers of the penis; many unfortunate individuals whose noses and palates were lost; and others, who were afflicted with nodes, necroses, caries, and dreadful phagedenic sores.

Happily, at the present day, this attachment to violent salivations no longer prevails; simple excoriations and common ulcers are more attentively discriminated; and even in what are reputed to be true syphilitic chancres, mercury is seldom given, except in very moderate doses, or

such quantities as only gently affect the gums and salivary glands. The surgeon, now no longer blinded with the continual fear of the rapid and furious progress of syphilis when not duly resisted by mercury, avoids the very mode of practice which was itself the cause of all the aggravated forms of the disease. The consequence is, that very bad instances of the ravages of *lues venerea* are now hardly ever observed, except from the neglect and intemperance of patients themselves; and the few aggravated cases which are met with, even in hospitals, are generally in that state previously to their admission. Another benefit, also resulting from modern investigations, which prove that chancres, and all other varieties of the venereal disease, do not *absolutely* require mercury for their cure, is the safety with which it is now known that the use of such medicine may be postponed, where the patient's present state of health will not well bear its exhibition. I know that the ignorance of this last fact formerly caused the death of many poor sufferers.

The greater present mildness of syphilitic diseases in England, I ascribe chiefly to the more judicious treatment now adopted, and not to any change or modification in the nature of the disorder. There are others, however, who may think, as Dr. Fergusson does with regard to syphilis in Portugal, that the disease has exhausted a great deal of its virulence from long continuance amongst us. But, before we are altogether justified in drawing such a conclusion, we must forget all the bad practice which prevailed in former days; and which, in my opinion, is sufficient to account for the more severe forms in which syphilis then presented itself; though not for the ravages of that acute, quickly spreading, and fatal disorder, which broke out in the French army at Naples, at the close of the 15th century. According to my own judgment, this was decidedly a very different disease from any venereal maladies with which we are now acquainted; too different, indeed, to be accounted for either by any spontaneous alteration of its own, or by any improvements in practice.

According to Mr. Hunter's ideas, the most simple method of treating a chancre is to extirpate it with caustic or the knife, whereby it is reduced to the state of a common sore, or wound, and heals up as such. However, he sanctions this practice only on the first appearance of the chancre, when the surrounding parts are not yet contaminated; for, he says, it is absolutely necessary to remove the whole of the diseased part, and this object is exceedingly difficult of accomplishment when the disease has spread beyond a certain size. Dr. Colles says:—"I have known a chancre completely cut out on the first or second day after its appearance, yet the occurrence of secondary symptoms was not prevented." (*Op. cit.* p. 77.) If this were a very common result, it would indeed not only be a reason for rejecting the plan, but also for doubting the statement, now sometimes advanced, that the poison is not absorbed in the early stage of a chancre, and not till the sore has begun to granulate. (See Key, in *Med. Chir. Trans.*; and Wallace, *On Ven. Dis.*) When the chancre is situated on the glans penis, Mr. Hunter thought touching the sore with nitrate of silver preferable to cutting it away, because the hæmorrhage from the cells of this part would

be considerable after the use of the knife. If caustic be used, it should be pointed at the end, like a pencil, in order that it may only touch such parts as are really diseased; and its application should be repeated till the surface of the sore, after the separation of the last sloughs, assumes a red and healthy appearance, when it will heal like any other sore made with caustic.

When the caustic could not be conveniently employed, Mr. Hunter sometimes recommended the excision of chancres. When a chancre is destroyed almost immediately on its first appearance, Mr. Hunter believes, that there is little danger of the constitution being infected, as it is reasonable to conclude, that there has not been time for absorption to take place. However, on account of the impossibility of being certain on this point, he recommends mercury to be given, from motives of prudence; the quantity of which medicine, he says, should be proportioned to the duration and progress of the sore. When the chancre is large, Mr. Hunter deems mercury *absolutely necessary*; and he conceives that very little good then results from the extirpation.

Amongst modern advocates for the application of caustic to chancres, Delpach was one of the most zealous; and the nitrate of mercury was what he commonly employed; but he abstained from the practice, when much inflammation was present. (*Chir. Clinique*, t. i.)

When the disease is in the ulcerating stage, or when the process of granulation has only partially commenced, the late Mr. Wallace had no doubt of the utility of immediately applying the nitrate of silver, in such a manner as to destroy the diseased surface.—"I have treated, over and over again, primary syphilitic ulcers with this caustic, and others without it, in the same individual, at the same time, and under circumstances as nearly as possible similar in every respect; and the result has uniformly demonstrated the very great advantage of the former over the latter practice." He adds, "It will stop the process of ulceration; and, by preventing in a great measure the necessity of the state of granulation, it will lead directly to cicatrisation. It destroys a surface which seems to have a power of contaminating, for a limited period, continuous parts, &c. (See Wallace, *On Ven. Dis.* p. 93.) Should any portion of the ulcerated surface have entered on the stage of granulation, Mr. Wallace took care not to touch that portion with caustic. He adverts also, to an interesting fact, which was communicated by M. Velpeau to the Acad. Royale de Médecine, viz., the application of the nitrate of silver to the pustules of variola, arrests their further progress; a fact, demonstrating, that the power of caustic to control the action of disease, caused by a morbid poison, is not limited to syphilis. (P. 93.)

In London, the excision of chancres, is now rarely or never performed, though the late Mr. Wallace sanctions the practice "when the case presents itself during the first stage, and while the part is only in the state of circumscribed phlogosis;" he adds, "and for security against the constitutional symptoms, the patient should be treated constitutionally, as if he had not applied, until the disease was more advanced." (Wallace, *Op. cit.* p. 91.)

The attempt to destroy chancres with caustic, though occasionally made, is not resorted to with

the view of superseding the employment of mercury, or some other substitute for it, such as the hydriodate of potash, with sarsaparilla. The applications to chancres, according to my judgment, should be adapted to the different conditions of them, and be regulated very much by the same principles which are recognised in the treatment of ulcers generally. I cannot join, therefore, in restricting my preference either to simple dressings, astringent or stimulating lotions, or to nitrate of silver, or to other caustics. Dr. Colles, who prefers mild bland dressings, observes, with respect to various caustics, and stimulating applications to chancres, that he has not seen that such cases were rendered thereby more manageable, or that the patient was secured from those untoward changes which too frequently occur in the chancre itself, before it is finally healed; nor were such cases less liable to secondary symptoms. (*Abr. Colles, On Ven. Dis. p. 77.*)

With respect to dressings for chancres, Mr. Hunter placed a good deal of confidence in those which contain mercury; but the same attachment to them does not now prevail, which existed twenty years ago. The established fact of mercury not being absolutely necessary in any way for the cure of different venereal sores, must have had the effect of removing some prejudices even relating to local treatment. As common mercurial ointment is always more or less rancid, I have generally found it a bad dressing. In ordinary cases, I believe, the tepid water dressing, with a piece of oil silk over it, or astringent lotions, made with the sulphate of copper or zinc, acetate of lead, alum, &c., answer the best. Some chancres are indolent, and require stimulants, like the hydrargyri nitricooxydum blended with ointment, the unguentum hydrargyri nitratis more or less weakened, or the nitrate of silver, in solution or substance. Mr. Hunter, always partial to mercurial dressings, expresses his preference to a salve, containing calomel, as being more active than common mercurial ointment. In phagedenic and sloughing chancres, the carrot and fermenting poultices, fumigation, with the red sulphuret of mercury, solutions of the extracts of hemlock and opium; but particularly bread and water poultices with opium, and sometimes nitrous acid, diluted or undiluted, according to circumstances, merit trial. In University College Hospital, we commonly and very successfully apply the nitrous acid to phagedenic chancres. Mr. Hugh Carmichael has lately written a paper in favour of pressure made with strips of adhesive plaster; (*See Dubl. Journ. of Med. Science, No. 40.*): but of this plan I cannot speak from experience. When chancres were stationary, Mr. Hunter found, that they might often be cured by touching them slightly with nitrate of silver.

In some of these cases, no cicatrisation seems possible, till the contaminated surface, or the new flesh which grows on that surface, has either been destroyed or altered. When sores are situated under the prepuce, where they are concealed by a phymosis, some emollient, or gently astringent lotion, or the black wash, should frequently be injected under the foreskin, so as to wash out any matter, which might otherwise lodge, and cause irritation.

Mr. Hunter believed that mercury should be given in every case of chancre, however slight, and even when it has been destroyed by caustic, or

other means, on its very first appearance. *The remedy, he says, should be continued for some time after the chancre has healed, in order to hinder the venereal disposition from forming.* Here we find even Hunter himself falling into some inconsistencies; for, in other parts of his work, he seems to approve of the principle of giving mercury only when actual and visible disease exists, because it cannot cure the disposition to it even if it exists. Now, as the chancre is cured, no further absorption of the virus from it is possible, and whatever disposition to the disease can arise from absorption, must have already been formed, and, therefore, cannot be prevented; and though, according to Mr. Hunter's own theory, the virus has been long ago expelled from the system, together with some of the excretions, mercury is recommended with the view of protecting the constitution. However, if Mr. Hunter's explanations are not altogether satisfactory on this part of the subject, I believe the fault is in his theory; because, in cases where mercury is deemed advisable, general experience appears to sanction the practice of continuing its use for some time after the chancre is perfectly healed. Yet many exceptions to this rule present themselves; for, if a chancre is large, and long in healing, its syphilitic character is generally extinct a good while before cicatrisation is completed, and perseverance in mercury; under these circumstances, would be both an absurd and a dangerous practice.

Hence, in a great measure, the cause of the numerous instances of the mercurial disease, as Mr. Mathias has named it, and which, in former days, did far more mischief than syphilis itself. (*See An Inquiry into the History and Nature of the Disease produced by Mercury, 3d ed. 8vo. Lond. 1816.*) This part of the subject is noticed by Mr. Hunter, who states, that in very large chancres, it may not always be necessary to continue either the external or internal administration of mercury till the sore is healed; for the venereal action is just as soon destroyed in a large chancre as it is in a small one; since every part of the sore is equally affected by the medicine, and, of course, cured with equal expedition. But in regard to cicatrisation, circumstances are different, because a large sore is longer than a small one in becoming covered with skin. Hence, according to Mr. Hunter, a large chancre may be deprived of its venereal action, long before it has healed; while, on the other hand, a small one may heal before the syphilitic affection has been destroyed. In the latter case he represents it as most prudent, both on account of the chancre and constitution, to continue the employment of mercury a little while after the sore is healed.

Whenever mercury is employed for the cure of chancre, the patient should first be prepared by one or two purges, quietude for a day or two, and a lowered diet. He should also avoid exposure to damp and cold, put on additional clothing, keep himself at home, and, if he wish to be cured speedily, observe the recumbent position. (*See MERCURY.*) The following advice, I believe, agrees with what is generally said upon this subject by the highest authorities:—"In general, it will be prudent to continue the use of mercury, not only until all hardness be removed, but even for a few days longer. I think we may lay it down as a general rule, that the course of mer-

cure, even when it has been well conducted, and has agreed well with the patient, should be continued for *not less than one month*. I know that some cases have been perfectly cured in three weeks; but I have too frequently seen relapses follow these short courses of mercury, when employed for the cure of primary symptoms. I should wish a *moderate pygalism to be kept up* from the time the mercury comes to act on the system, until it be finally discontinued." (*Abr. Colles, On Ven. Dis. p. 79.*)

The fact of the curable nature of chancres, without the aid of mercury, is exemplified every week in University College Hospital, where, indeed, mercury has hitherto been but little employed in the treatment either of primary or secondary symptoms, the hydriodate of potash, with sarsaparilla, having been very generally substituted for it. Not only do the generality of venereal sores heal expeditiously under the use of these medicines, but, what is still more important, secondary symptoms are certainly not more frequent than in cases where mercury is used with moderation, and they are of a milder description than when it is profusely employed, or under the neglect of all those precautions which should accompany a mercurial course.

As Mr. Hunter has explained, chancres, both in men and women, often acquire, during the treatment, new dispositions, which are of various kinds; some retarding the cure, and leaving the parts in an indolent thickened state, after the cure is accomplished. In other instances, a new disposition arises, which utterly prevents the parts from healing, and often produces a much worse disease than that from which it originated. Such new dispositions may lead to the growth of tumours. They are more frequent in men than women, and generally occur only when the inflammation has been violent from some peculiarity of the parts or constitution. They have sometimes been considered as cancerous.

Among the diseases in question, Mr. Hunter notices those continued, and often increased inflammations, suppurations, and ulcerations, which become diffused through the whole prepuce, and, also, along the common skin of the penis, which becomes of a purple hue, attended with such a general thickening of the cellular membrane, as makes the whole organ appear considerably enlarged. The ulceration on the inside of the prepuce will sometimes increase, and run between the skin and the body of the penis, and eat holes through different places, till the whole is reduced to a number of ragged sores. The glans often shares the same fate, till more or less of it is gone. Frequently, the urethra in this situation is wholly destroyed by ulceration, and the urine is discharged some way farther back. The ulceration, if unchecked, at length destroys all the parts. In this acute case, prompt relief is demanded; but often the proper mode of treatment cannot be at once determined, owing to our ignorance with respect to the exact nature of the peculiar cause of the disease. Mr. Hunter states, that the decoction of sarsaparilla is often of service, when given in large quantities; and that the extract of hemlock and sea-bathing are sometimes capable of effecting a cure. According to my own experience, the action of mercury is here the most essential point. Sometimes, after a chancre has healed, the ci-

atrix breaks out again, and puts on the appearances of the preceding sore. Occasionally, similar diseases break out in different places from that of the cicatrix. Mr. Hunter believes, that they differ from a chancre in generally not spreading so fast, nor so far; in not being so painful, nor so much inflamed; in not having such hard bases as venereal sores have; and in not producing buboes. He is of opinion, that they are not venereal, and he states that they are very apt to recur.

Mr. Hunter does not specify any particular mode of cure for all these cases; but he mentions one instance which was cured by giving forty drops of the liquor potassæ, every evening and morning, in a basin of broth; and he adverts to another case, which was permanently cured by sea-bathing. Sarsaparilla, with hydriodate of potash, I find rarely fails.

In some instances, after a chancre has healed, the parts do not ulcerate again, but become thickened and indurated. Both the glans and prepuce are converted into a tumour or excrescence, shaped like a cauliflower, and, when cut into, showing radii, running from its base or origin, towards the external surface. It is extremely indolent, and not always a consequence of the venereal disease; for Mr. Hunter had seen it arise spontaneously. As no medicine seems likely to cure it, the only plan is to amputate the diseased part, and keep a catheter in the urethra.

Another disposition, induced by the previous occurrence of chancres, is that to excrescences, or cutaneous tumours, called warts. These are frequently considered not simply as a consequence of the venereal poison, but as possessed of its specific disposition, and therefore, says Mr. Hunter, surgeons have recourse to mercury for the cure of them; and it is said that such treatment often removes them. This eminent practitioner never saw mercury produce this effect, although the medicine was given in sufficient quantity to cure recent chancres, and a lues venerea in the same person. (See WART.)

Sometimes, when the original chancre had been nearly healed, Mr. Hunter saw new sores break out on the prepuce, near the first, and assume all the appearance of chancres.

All surgeons are familiar with the following case, which is described by the generality of late writers, especially by Mr. Carmichael and Dr. Colles. The latter observes:—"We sometimes see the edge of the prepuce beset with five or six circular ulcers; these, if left to themselves, will first granulate, then become fungous, and finally heal up spontaneously. The form, as well as the slow and indolent character of these ulcers, might dispose us to conceive that they were syphilitic." Dr. Colles, who sets down mercury as of no service to them, does not regard them as truly venereal. So far as my experience goes, they are generally very slow in assuming a healing state, whatever medicine be given; and I believe mercury, except sometimes in alterative doses, combined with antimony, generally has little effect in expediting the cure. Salivation I consider quite uncalled for. The hydriodate of potash, or the liquor potassæ, with sarsaparilla, is an eligible medicine.

When a bubo arises while the constitution is under the influence of a sufficient quantity of mercury to cure a chancre, which medicine has also been rubbed into the lower extremity, on the

same side as the bubo, Mr. Hunter suspects that the swelling in the groin is not venereal, but is produced by the mercury. In such a case, he always preferred conveying mercury into the system in some other manner. The foregoing criterion of the bubo not being venereal, I think would not be commonly admitted at the present day. Dr. Colles has observed, that, in some cases, "mercury will most unexpectedly take a sudden and severe hold of the system, inducing profuse pyalism within the first three or four days, and, as a consequence, the almost instantaneous healing of a chancre: such *healing of the chancre, however, is not a cure of the venereal disease.* For we shall find that a bubo will now make its appearance, perhaps at the very time that the chancre has thus suddenly healed: *this bubo will proceed with unusual rapidity to suppuration, if we do not at once desist from mercury.* I have not tried by experiment, whether such bubo requires a further use of mercury. I can only say, that I have always acted on the supposition of its being required; and, as soon as the salivation had subsided, I resumed the use of mercury in such a manner as to affect the mouth again, but more slowly and more gently." (*Abr. Colles, On Ven. Dis. p. 81.*)

I have mentioned the tendency of a chancre on the frænum, or in the fossa between the corona glandis and the frænum, to perforate, and frequently to destroy, the latter. The usual plan, directly an aperture is thus formed, has been to divide the remainder of the part completely through, as recommended by Mr. Hunter. To this practice Mr. Wallace strongly objects:—"I affirm (says he) that, in nineteen cases out of twenty, if the patient applies before the ulcer has perforated the frænum, its perforation may be prevented by employing the caustic (nitrate of silver); and I still further affirm, that, if such patient has not applied until after its perforation, we may, if we think it right, still save the remaining portion by cauterising, with the nitrate of silver, the sides of the opening." (*On Ven. Dis. p. 95.*) Dr. Colles differs, however, from Mr. Wallace, and insists upon the advantages of dividing the frænum as soon as it is perforated, and especially because the sore will not granulate till this has been done. (*Op. cit. p. 94.*)

Every surgeon of experience must have seen instances of chancre, seated at the very orifice of the urethra, and become acquainted with the great difficulty of healing them; and, after being healed, a stricture is apt to ensue:—"In treating such a case, (says Dr. Colles), we should use every effort to prevent the extension of the ulceration to the entire circle of the orifice; for unless it entirely encircle the orifice, contraction will not follow. This can with certainty be accomplished by touching the ulcer, as soon as it begins to extend, with the colourless muriate of antimony, or with nitric acid." Dr. Colles is confident that he has seen chancres seated altogether within the urethra: "*Such cases have been frequently mistaken for mild gonorrhœa.*" I introduce this remark by Dr. Colles because it harmonises with that of M. Ricord and some other practitioners, and has an immediate relation to one or two of the most disputed points relating to venereal complaints, as already noticed.

With respect to the treatment of chancres in women, since it is difficult to keep dressings on the parts, the sores are to be frequently washed

with tepid water, or some astringent lotion. Mr. Hunter notices their occasional extension into the vagina, and even suggests the prudence, in such a case, of introducing lint into the passage to prevent its constriction and closure.

Sometimes, after the venereal character of a primary sore has been removed, the prepuce continues thickened and elongated, so that the glans cannot be uncovered. In this case, Mr. Hunter recommends trying the steam of warm water, hemlock fomentations, and cinabar fumigations, as frequently being of singular service. When the thickening and enlargement of the prepuce, however, cannot be removed by these or other means, an operation will become necessary. (See PHIMOSIS.)

One important fact, alleged by M. Ricord to be fully established, not only by his own investigations, but by those of Dr. Fricke, of Hamburg; Professor Lallemand, of Montpellier; M. Ruef, of Strasburg; and M. Blandin, surgeon to the Hôtel-Dieu, is, that the number of secondary symptoms is not at all in relation to that of the primary symptoms developed at one and the same period. There will not (he asserts) be more constitutional symptoms, after two, three, four, or five chancres, contracted at the same time, than after one. (*Op. cit. p. 85.*)

Bubo. The immediate consequence of a chancre, which is called a bubo, and also the remote effects, implied by the constitutional or secondary symptoms, arise from the absorption of recent venereal matter from some surface, where it has either been applied or formed.

We are already aware, that Mr. Hunter believed the matter of gonorrhœa to be capable of communicating the venereal disease. Hence, he explains, in the following terms, the three ways in which he thought a bubo might arise in consequence of absorption. He observes, that the first and most simple manner is when the matter, either of a gonorrhœa or chancre, has only been applied to some sound surface, without having produced any local effect on the part, but has been absorbed immediately after its application. Mr. Hunter affirms, that he has seen instances of this kind, though he confesses that they are very rare; and that, in most cases, apparently of this nature, a small chancre may have existed. M. Ricord deems these *bubons d'emblée*, as they are termed by the French, very rare; and, if his statement, that the venereal disease can never be produced by the matter taken from them, and that secondary symptoms never follow them, doubt, I think, must be entertained about the Hunterian account of their production. (*Op. cit. p. 149.*)

Mr. Wallace had frequently met with and treated buboes, neither accompanied nor preceded by primary symptoms, but which had followed suspicious intercourse, as if they had been caused by the absorption of the venereal poison; and he never had occasion to regret the practice:—"On the other hand (says he), I have known buboes, which were not preceded by primary symptoms, to be followed by secondary symptoms, when mercury had not been used in their treatment." (*Op. cit. p. 346.*) This, we see, disagrees with the investigations of M. Ricord.

The second mode of absorption, or that taking place in a gonorrhœa, Mr. Hunter represents as more frequent. That secondary symptoms do occasionally follow gonorrhœa, is now commonly admitted, though, whether they differ essentially

from those which follow true chancres, is a point not yet completely settled. Delpéch describes them as of the same nature (*Chir. Clinique*, t. i.); but his facility of belief in the multiplied effects of syphilis and gonorrhœa is almost unbounded. On a point of this kind, therefore, I should not attach much importance to his opinion. However, so far as Mr. Carmichael's experience goes, there is a difference, a part of which consists in the eruption being of the papular kind, as it is also after many instances of simple primary ulcers. (See *Obs. on the Symptoms, &c. of Venereal Diseases*, 8vo. Lond. 1816.) Other writers only admit the possibility of secondary symptoms, when chancres are situated within the urethra, in cases supposed to be merely gonorrhœa; and this view, of course, leads to the recognition of secondary symptoms, not essentially different from those presenting themselves, in consequence of chancres, in their more usual situations. (*Ph. Ricord*.)

The third mode is the absorption of matter from an ulcer, which may either be a chancre or a bubo. This mode is by far the most common, and it proves, with many other circumstances, that a sore, or ulcer, is the most favourable for absorption. Mr. Hunter believed that absorption was more apt to take place from sores on the prepuce, than those on the glans.

A fourth mode of absorption is from a wound; a case, which, according to Delpéch, is almost constantly followed by an eruption on the face, soon extending all over the body, and very quickly followed by sore-throat, periostoses, and pains in the bones. In short, his idea is, that when the poison is absorbed from a wound, especially one that has not suppurated, its operation is peculiarly rapid and violent. (*Chir. Clinique*, t. i. p. 334.)

Mr. Hunter notices, that what is now commonly understood by a bubo, is a swelling, taking place in the absorbing system, especially in the glands, and arising from the absorption of some poison, or other irritating matter. When such swellings take place in the groin, they are called buboes, whether they proceed from absorption or not.

The matter is taken up by the absorbent vessels, and is conveyed by them into the circulation. In its passage through these vessels, it often affects them with the specific inflammation. The consequence is, the formation of buboes, which are venereal inflammations, or abscesses of the lymphatic glands or vessels. The sores resulting from their being opened, or spontaneously bursting, are exactly similar to a chancre in their nature and effects, the only difference being in regard to size. As the lymphatic vessels and glands are irritated by the specific matter, before it has undergone any change in its passage, the inflammation produced, the matter secreted, partake of the specific quality.

Whenever a bubo has arisen from any other cause than a chancre, if the swelling suppurate, and a person be inoculated with the matter, the experiment has no effect, whatever may be the period and the conditions in which the pus has been taken. (See *Ph. Ricord, Mal. Vén.* p. 140.) This author believes, however, that it does not necessarily follow that the matter must *always* be specific, when the bubo has been preceded by a chancre; for, in order that the pus be of this quality, the bubo must not be the result of simple inflammation, sympathetic or contiguous, but of absorption.

In men, inflammation of the lymphatics, in consequence of chancres upon the glans or prepuce, generally appear like a cord, leading along the back of the penis from the sores. Sometimes they inflame, in consequence of the thickening and excoriation of the prepuce in gonorrhœa. The indurated lymphatics often terminate insensibly near the root of the penis, or near the pubes; while, in other instances, they extend further to a lymphatic gland in the groin. Mr. Hunter believed, that this affection of the absorbent vessels is truly venereal. The formation of a hard cord, he conceived, arose from a thickening of the coats of the absorbents, and from an extravasation of coagulable lymph on their inner surface. A cord of the above kind often suppurates, sometimes in more places than one, so as to form one, two, or three buboes, or small abscesses, in the body of the penis.

Inflammation much more frequently affects the absorbent glans, than the vessels. The structure of the former parts appears to consist of the ramifications and reunion of the absorbent vessels. From this structure, observes Mr. Hunter, we may reasonably suppose that the fluid absorbed is in some measure detained in the glands, and thus has a greater opportunity of communicating the disease to them, than to the distinct vessels.

Swellings of the absorbent glands may originate from other diseases, and should be carefully discriminated from those which arise from the venereal poison. With this view, Mr. Hunter advises us first to inquire into the cause, in order to ascertain whether there is any venereal complaint at some greater distance from the heart, such as chancres on the penis, or any preceding disease in this situation. He recommends us to inquire, whether any mercurial ointment has been at all applied to the leg and thigh on the diseased side; for mercury, applied to those parts for the cure of a chancre, will sometimes cause glandular enlargements, which are occasionally mistaken for venereal buboes. This irritation of the inguinal glands by the mechanical action of mercurial ointment, has also been particularly noticed by Professor Assalini, who states, that he has had frequent opportunities of convincing himself of the fact. (See *Manuale di Chirurgia*, p. 67.) Mr. Hunter reminds us to observe, whether there has been any preceding disease in the constitution, such as a cold, fever, &c. The quick or slow progress of the swelling is likewise to be marked, and the tumour must be distinguished from femoral hernia, lumbar abscesses, and aneurism of the crural artery. In particular cases, it would appear that some time elapses before venereal matter produces its effects on the absorbent glands after its absorption. Mr. Hunter notices, that sometimes at least six days transpire first; a circumstance which can only be known by the chancres having healed six days before the bubo began to appear. However, as the last matter of a chancre is probably not venereal, he infers that, in cases of this kind, absorption must have taken place earlier than other considerations would lead one to suppose. In general, only the glands nearest to the seat of absorption are attacked. Thus, when the matter is taken up from the penis in men, the inguinal glands are affected; and when from the vulva in women, those glands swell, which are situated between the labium and thigh, and the round ligaments.

It was one of Mr. Hunter's opinions, that only

one gland at a time is commonly affected by the absorption of venereal matter. If this statement be correct, the circumstance may be considered as a kind of criterion between venereal and other buboes. M. Ricord is also of opinion, that when absorption takes place from a chancre, the matter is conveyed only to the superficial glands, and, for the most part, only to one at a time, although several glands, both superficial and deep, may be at the same time swollen; so that according to this experienced surgeon, one gland may present all the characters of virulent bubo, while the neighbouring glands, in which the inflammation may also advance to suppuration, as well as the surrounding cellular tissue, may present only characters of simplicity and non-virulence. On this principle, he accounts for the opposite and seemingly contradictory results of inoculations with the matter of buboes. (*Mal. Vén.* p. 140.)

According to Mr. Wallace's view, it is because the venereal poison is deprived of its power of irritating the lymphatic system, by passing through a lymphatic gland, that we generally find one gland only affected. "We are not, however, to suppose that a bubo cannot be syphilitic if more than one gland be diseased; for should the absorbents, which arise from the surface to which the poison has been applied, be so distributed as to pass in different directions, and, consequently, through the separate glands, a plurality of these bodies may be affected." (*On Ven. Dis.* p. 345.)

The second order of lymphatic vessels and glands are never affected; as, for instance, those along the iliac vessels or back. Mr. Hunter also observed, that when the disease was contracted by a sore, or cut upon the finger, the bubo occurred a little above the bend of the arm, by the side of the biceps muscle, and no swelling of this sort formed in the armpit. However, he had heard of a few cases, in which a swelling in the axilla was also produced. Buboes in the armpit may occur, not only from a wound of the fingers or hand, but from ulcers on the nipple; and they may form in the neck, or under the jaw, when produced by absorption from ulcers on the lips. (See *Wallace, Op. cit.* p. 344.)

When buboes arise from a venereal disease on the penis, they are situated in the glands of the groin: if from a gonorrhoea, either groin may be attacked; if from a chancre, the bubo most frequently takes place in the nearest groin.

The situation of the absorbent glands, however, is not always exactly the same, and the course of the lymphatics, therefore, is subject to some variety. Hence, Mr. Hunter has seen a venereal bubo, produced by a chancre on the penis, situated a considerable way down the thigh: he has also often seen buboes as high as the lower part of the belly, before Poupart's ligament, and sometimes near the pubes. At the present day, swellings of the femoral glands are rarely considered to be venereal.

The seat of absorption is more extensive in the female sex, and the course of some of the absorbents is also different. Hence, buboes in women may occur in three situations, two of which are totally different from those in men.

When chancres are situated forwards, near the meatus urinarius, nymphæ, clitoris, labia, or mons veneris, the absorbed matter is generally conveyed along one or both of the round ligaments; and the buboes are formed in those ligaments just before

they enter the abdomen. Mr. Hunter suspected such buboes not to be glanular, but only inflamed absorbents.

When chancres are situated far back, near or on the perineum, the absorbed matter is carried forward along the angle between the labium and the thigh, to the glands in the groin, and often, in this course, small buboes are formed in the absorbents, similar to those abscesses which occur on the penis in men.

Owing to the difficulty of being sure that women are quite free from infection, it is often more difficult to decide in them, than in men, whether a bubo is venereal or not. In men who have had no local complaint, the bubo can only be venereal when direct absorption from the surface of the skin has taken place.

A bubo commonly begins with a sense of pain, which leads the patient to examine the part, where a small hard tumour is felt. This increases, like every other inflammation that has a tendency to suppuration, and, unless checked, pus forms, and ulceration follows, the matter commonly making its way to the skin very fast. Mr. Hunter remarked, however, that some cases were slow in their progress. This circumstance he imputed either to the inflammatory process being kept back by mercury, or other means, or to its being retarded by a scrofulous tendency. The inflammation, he says, is at first confined to the gland, which may be moved about in the cellular membrane; but, when the part has enlarged, or when the inflammation and suppuration are more advanced, the surrounding parts become more inflamed, and the tumour is more diffused. Some buboes become complicated with erysipelas, or oedema, by which they are rendered more diffused, and less disposed to suppurate.

Mr. Hunter allows, that to distinguish, with certainty, the true venereal bubo from other swellings of the glands in the groin, may be very difficult. He represents the true venereal bubo, in consequence of a chancre, as being most commonly confined to one gland. It generally preserves its specific distance till suppuration has taken place, and then becomes more diffused. It is rapid in its progress from inflammation to suppuration and ulceration. The suppuration is commonly large, considering the size of the gland, and that there is only one abscess. The pain is very acute, and the inflamed part of the skin is of a florid red colour. As I have stated, however, this description does not agree altogether with that of M. Ricord, who represents some venereal buboes as being combined with other abscesses not of a specific nature.

Mr. Hunter describes such buboes as arise without any visible cause, as being of two kinds. One sort inflame and suppurate briskly. These he always suspected to be venereal, although he allows there was no proof of it, and only a presumption deduced from the quick progress of the disease.

The second kind are generally preceded and attended with slight fever, or the common symptoms of a cold, and they are, for the most part, indolent and slow in their progress. If quicker than ordinary, they become more diffused than venereal buboes, and they are often not confined to one gland. When very slow, they give but little sensation; but when quicker, the sensation is more acute, though not so acute as in venereal

cases. They usually do not suppurate, and often become stationary. When they do suppurate, it is in a slow manner, and, frequently, in more glands than one, while the inflammation is more diffused, and not considerable, in relation to the swelling. The matter makes its way to the skin slowly, and the part affected is of a more purple colour. Sometimes the abscesses are very large, yet not painful.

In considering whether the swellings of the inguinal glands are or are not venereal, the first thing to be attended to is, whether or not there are any venereal complaints. If there are none, as Mr. Hunter observes, there is a strong presumptive proof, that the swellings are not venereal. When the swelling is only in one gland, very slow in its progress, and gives but little or no pain, probably it is merely scrofulous. However, when the swelling is considerable, diffused, and attended with some inflammation and pain, the constitution is most probably affected with slight fever; the symptoms of which are lassitude, loss of appetite, want of sleep, small quick pulse, and an appearance of approaching hectic. Such swellings are long in getting well, and do not seem to be affected by mercury, even when promptly applied.

Mr. Hunter mentions his having seen the above affection of the groin, together with the constitutional indisposition take place where there were chancres; and he was puzzled to determine, whether the disease in the groin was sympathetic, from derangement of the constitution, or whether it arose from the absorption of matter. He had long suspected that there was a mixed case, and was at last certain that such a case might prevail. He had seen instances, in which the venereal matter, like a cold or fever, only irritated the glands to disease, producing in them scrofula, to which they were disposed.

In such cases, says Mr. Hunter, the swellings commonly arise slowly, give but little pain, and if mercury be given to destroy the venereal disposition, their progress is accelerated. Some suppurate while under this resolving course; and others, which probably had a venereal taint at first, become so indolent, that mercury has no effect upon them, and, in the end, they either get well of themselves, or by other means.

Another important point in Mr. Hunter's doctrines is, that buboes are local complaints.

When a bubo is judged to be venereal, and only in an inflamed state, an attempt is to be made to resolve the swelling. The propriety of the attempt, however, depends on the progress which the disease has made. If the bubo is very large, and suppuration near at hand, resolution is not likely to be effected. When suppuration has already taken place, the probability of any success attending the endeavour is still less, which now may only retard the suppuration, and protract the cure.

The resolution of these inflammations seemed to Mr. Hunter to depend principally on mercury, and almost absolutely on the quantity which can be made to pass through them. When suppuration has taken place, the cure also appeared to him to depend on the same circumstances. Hence, he recommended the mercury to be applied to such surfaces as allow the remedy, when absorbed, to pass through the diseased gland. In this manner, he conceived, that the disease in the groin might

be subdued, and that the constitution would be less likely to be contaminated. At the same time, he admitted, that the situation of many buboes is such, as not to have much surface for absorption beyond them; for instance, the buboes on the body of the penis, arising from chancres on the glans, or prepuce. This principle was much insisted upon by Delpech. (See *Chir. Clinique*, t. i. p. 301.)

Since venereal buboes are, in effect, a consequence of chancres, or primary venereal sores; and since glandular swellings in the groin may take place from other kinds of sores, or local irritations, and even from various constitutional causes, while modern surgeons profess their incapacity always to pronounce the character either of a primary sore, or a bubo, by its first appearance and progress; it is evident, that the same difficulties present themselves here, as in cases of primary sores, respecting the principles by which the treatment should be guided. It is likewise to be remembered, that buboes, when decidedly syphilitic, are not, as Mr. Hunter imagined, *absolutely incurable without mercury*. The firm confidence, also, which Mr. Hunter had, and Delpech more recently, had in the doctrine of the benefit derived from the practice of rubbing mercury into surfaces, from which it would be conveyed directly to the diseased glands, so as both to resolve the swelling and preserve the constitution, is not now regarded as an unquestionable subject. As Mr. Bacot has judiciously remarked, there is some inconsistency in Mr. Hunter's own statements upon this point; for, in one place, he affirms that mercury, applied to the legs and thighs for the cure of a chancre, will sometimes cause, instead of dispersing, a bubo. (P. 404.) And Mr. Bacot adds his own belief, that mercury as frequently promotes the suppuration of buboes as their dispersion. (*On Syphilis*, p. 74.) With respect to the practice of trying to make the mercury pass through the diseased glands, Mr. Hunter rather contradicts himself in another page, where he confesses his own doubts of its utility in suppurated buboes. However, he admits, that mercury alone is not always capable of effecting the cure of such buboes as are deemed venereal; and, when the inflammation rises very high, he approves of bleeding, purging, and fomentations. When the inflammation is erysipelatous, he has a high opinion of bark; and when it is scrofulous, he praises hemlock, and poultices made with sea-water. He was also aware of the fact of emetics sometimes occasioning the absorption of the matter of buboes, after it is distinctly formed.

If there is generally great difficulty in pronouncing at first the nature of a primary sore, as to the question of its being syphilitic or not, the same difficulty must occur with respect to glandular swellings, excited by it: and, on this account, and from the encouraging circumstances, that all buboes may be cured without mercury, and that the course of the venereal disease, unresisted by that mineral, is not so terrible and incurable as used to be supposed, some surgeons, instead of having immediate recourse to mercury, prefer a little delay, in order to see whether the swelling will subside or not, under the use of common antiphlogistic means. Thus, Dr. Hennen disapproves of using mercury immediately a bubo presents itself; and he states, that the same principles, which guide him in the primary ulcers,

would have the same, if not greater, force, in the case of buboes. "In their irritable state (says he) I consider mercury altogether inadmissible." (*On Military Surgery*, ed. 2. p. 518.)

But, in order to exhibit the contradictory advice delivered by different writers on this point, I may contrast the practice of Mr. Wallace with that of Dr. Hennen. The primary syphilitic bubo, in its first stage, may, according to Mr. Wallace, be resolved, in *ninety-nine cases out of a hundred*, by mercury, assisted by rest, gentle laxatives, abstinence, and cooling lotions. Therefore, says he, as resolution should be our object, we are, without hesitation, to employ mercurial treatment in all such cases, provided there be no contra-indicating symptoms. In the second stage, or when the surrounding cellular tissue is involved, Mr. Wallace is an advocate for putting the patient rapidly under the action of mercury. When the bubo is more advanced, he admits that it is more difficult to bring about resolution; yet it seems to him, that it may still often be accomplished by bringing the constitution, with the greatest possible rapidity, under the influence of mercury, which is joined, in full habits, with general blood-letting, large doses of tartrate of antimony, saturnine lotions, rest, and abstinence. Even when the bubo had suppurated, Mr. Wallace frequently demonstrated to his pupils the power of mercury to effect resolution. The following consideration guided him in selecting cases in which the attempt to resolve the bubo might be judiciously made:—"Should the process of suppuration have begun early; should the tumour be attended by considerable pain and heat, and should it exist in a plethoric or sanguineous habit; I despair (says he) entirely of causing the matter to be absorbed, or of resolving the bubo. But, on the other hand, should the process of suppuration have advanced more slowly, having been long in commencing; should the bubo be attended with comparatively little pain and heat, or inflammation; should the skin covering it be somewhat flaccid or wrinkled, with a strong propensity to desquamate; and should the habit of the patient be less full or plethoric; I do not despair of causing the resolution of the bubo, particularly if mercury has not been previously used." Here, also, Mr. Wallace enjoins the full and rapid action of mercury; the quantity of which is afterwards to be diminished, lest a very troublesome degree of salivation, or mercurial cachexia be produced; but a mild action of it is still to be kept up for some days. (See *Wallace*, *Op. cit.* p. 356—359.)

When a bubo has already burst, Mr. Wallace lays it down as a general rule, that then mercury should not be employed, until the stage of granulation has commenced; and "for the same reason as we refrain from its employment in the ulcerative stage of a primary ulcer. In fact, if it be used in this period, we run some risk of exciting an increase of the ulcerative process. But great advantage may be obtained from the application of the nitrate of silver to the whole ulcerating surface, for this valuable remedy has the power of stopping the ulcerating process of a bubo, as well as of the primary ulcer." (*Op. cit.* p. 364.)

Although the correctness of some of the principles, by which Mr. Hunter regulated his practice in buboes, must now be questionable, inasmuch as he calculates too much on the absolute

necessity for mercury, and on the usefulness of making it pass through the diseased glands, I conceive that some of his directions are yet too important to be excluded from this work. He says, the quantity of mercury, necessary for the resolution of a bubo, must be proportioned to the obstinacy of the complaint; but *that care must be taken not to extend the employment of the medicine so far as to produce certain effects on the constitution*. When the bubo is in a situation which admits of a large quantity of mercury being rubbed in, so as to pass through the swelling, and when the complaint readily yields to the use of half a drachm of mercurial ointment, every night, the mouth not becoming sore, or, at most, only tender, Mr. Hunter thinks it sufficient to pursue this course, till the gland is reduced to its natural size. In this manner, he suspected that the constitution would probably be safe, provided the chance which caused the bubo healed at the same time. When the mouth is not affected in six or eight days, and the gland does not readily resolve, then two scruples, or a drachm, may be applied every night; and if there should still be no amendment, even more must be rubbed in. In short (says he), if the reduction is obstinate, the mercury must be pushed as far as can be done *without a salivation*, or, (as I suppose, he meant to say) *a violent salivation*.

When there is a bubo on each side, so much mercury cannot be made to pass through each, because the constitution will not in general bear this method. However, Mr. Hunter sanctions the plan of minding the soreness of the mouth less in this kind of case; though he adds, that *it is better to let the buboes proceed to suppuration, than to load the system with too much mercury*.

When the situation of buboes will not allow an adequate quantity of absorbed mercury to pass through them, the frictions must be continued in order to affect the constitution; but, according to Mr. Hunter, in this case more mercury will be requisite, than when the remedy can be made to pass directly through the diseased gland; an assertion, the correctness of which may now be doubted.

Many buboes remain, without either coming to resolution or suppuration; and notwithstanding every attempt to promote these changes, the glands remain very hard. Mr. Hunter conceives, that these cases are either scrofulous at first, or become so, as soon as the venereal disposition has been subdued; and, therefore, he advises the use of hcmlock, sea-water poultices, and sea-bathing.

When buboes are in a very chronic stationary state, the application of nitrate of silver, or of blisters to the skin over them, is often attended with beneficial effects. When such tumours are extremely hard and indolent, it is more advantageous to let the patient have the benefit of the open air, exercise, and his accustomed mode of living, than to confine him in an hospital. (*Asalini, Manuale di Chirurgia*, p. 64. Milano, 1812.) Stimulating the skin with hydriodate of potash ointment, camphorated mercurial ointment, or antimonial ointment, is also sometimes a good practice; and so is compression.

The suppuration of buboes frequently cannot be prevented by any known means. They are then to be treated, in some respects, like any other abscess. Before buboes were opened, Mr. Hunter conceived it advantageous to let the skin become

as thin as possible, because a large opening would then be unnecessary, and no measures requisite for keeping the skin from closing before the bottom of the sore had healed. These reasons do not generally seem to surgeons of the present day, so valid as the arguments in favour of a more early opening.

There has been much dispute, whether a bubo should be opened, or allowed to burst of itself, and whether the opening should be made with a cutting instrument or caustic? On this subject, Mr. Hunter remarks, that there is no peculiarity in a venereal abscess to make one practice more eligible than another. The surgeon, he says, should be guided in some degree by the patient. Some patients are afraid of caustics; others, of cutting instruments. But when the surgeon has the choice, Mr. Hunter expresses a preference to opening the bubo with a lancet, by which method no skin is lost. But when a bubo is very large, and there will be a great deal of loose skin after the discharge of the matter, he thinks that caustic may be better, as it will destroy some of the redundant skin, and occasion less inflammation than what is caused by an incision.

After the bubo has been opened, surgeons usually poultice it, as long as the discharge and inflammation are considerable, and then they employ dressings, which must be of a quality adapted to circumstances; in the mean while, mercury is continued, both to make the bubo heal, and prevent the bad effects which might otherwise arise from the specific matter being absorbed.

The mercurial course is often to be pursued till the sore is no longer venereal. But, in general, since this point is difficult to ascertain, Mr. Hunter advises the continuance of mercury till the part has healed, and even somewhat longer, if the bubo has healed very quickly; for the constitution is apt to become contaminated. However, he did not approve of this long use of mercury in all cases; because buboes often assume, besides the venereal, other dispositions, which mercury cannot cure, and will even exasperate.

Sometimes the sores, when they are losing or are entirely deprived of the venereal disposition, become changed into ulcers of another kind, and, most probably, of various kinds. How far it is a disease arising from a venereal taint, and the effects of a mercurial course jointly, says Mr. Hunter, is not certain. He suspected, however, that the nature of the part, or constitution, had a principal share in the case; and, I believe, few surgeons of the present time entertain any doubt of the abuse of mercury having been a very frequent cause, independently of any other circumstance. (See *Mathias, On the Mercurial Disease*, ed. 8.)

Mr. Hunter observes, that such diseases make the cure of the venereal affection much more uncertain, because, when the sore becomes stationary, or the mercury begins to disagree, we are ready to suspect that the virus is gone; but this (he supposes) is not always the case. He had seen some buboes exceedingly painful and tender to almost every thing that touched them, and the more mild the dressings were, the more painful the parts became.

In some instances, the skin alone becomes diseased. The ulceration spreads to the surrounding parts, while a new skin forms in the centre, paces with the ulceration, so that an irregular scar, which Mr. Hunter compares with a

worm-eaten grove, is formed all round. It appears only to have the power of contaminating the parts, which have not yet been affected; and those which have, readily heal. According to the same author, when buboes become stationary, and are little inclined to spread, attended with a sinus or two, hemlock joined with bark, is the medicine most frequently serviceable. It is to be used both externally and internally. Mr. Hunter also speaks favourably of sarsaparilla, sea bathing, and sea-water poultices. He states, that at the Lock Hospital, gold-refiners' water has been found an useful application; and that, in some cases, benefit has arisen from drinking large quantities of orange juice, and from the use of mezereon. In such cases, the efficacy of hydriodate of potash, the ioduret of mercury, and sarsaparilla in lime-water, is recognised by numerous surgeons of the present time.

In University College Hospital, mercury is employed but very limitedly in the treatment of buboes, as well as chancres; the medicines there more generally resorted to, being the hydriodate of potash, joined with sarsaparilla. Their success has undoubtedly surprised many, who have been taught to regard mercury as an essential means of cure.

Lues Venerea. Surgeons imply, that a *lues venerea* has taken place, when the venereal virus has been absorbed into the circulation. Mr. Hunter does not think the epithet *constitutional* strictly proper in its application to this form of the venereal disease. By *constitutional* disease, he observes, he should understand that, in which every part of the body is acting in one way, as in fevers of all kinds; but the venereal poison seems to be only diffused through the circulating fluids, and, as it were, to force certain parts of the body to assume the venereal action, which action is perfectly local. To use Mr. Hunter's phrase, it takes place in different parts in a regular succession of susceptibilities. Only a few parts are acting at the same time; and a person may be constitutionally affected in this way, and yet almost every function be perfect.

The venereal poison is generally conveyed into the system from a chancre. It may also, according to Mr. Hunter's doctrine, be absorbed from a gonorrhoea, though, if confidence can be placed in M. Ricord's investigations, only where the discharge from the urethra, or vagina, &c., is either wholly, or in part derived from chancres existing in, or upon, such parts. Whether there is a possibility of its getting into the circulation from the surface of the body, without any previous ulceration, is another point already considered. According to Hunter's doctrine, it may also be absorbed from common ulcers, *without necessarily rendering them venereal*; and it may be taken up from wounds, in which cases, it generally first causes ulceration.

Veneral Ulcers. In consequence of the blood being contaminated with real venereal pus, it might be expected that the local effects, thus produced, would be similar in their nature to those producing them. Mr. Hunter believes that this is not the case; and that the local effects, from a constitutional contamination, are all of one kind, viz., ulcers, let the effects make their appearance on any surface whatever, either the throat, or common skin. But Mr. Hunter conceived, that if the matter when in the constitution, were to act

upon the same specific principles as that which is externally applied, a gonorrhœa would arise, when it affected a canal, and only sores or chancres, when it attacked other surfaces.

Mr. Hunter found, that even the sores, which are caused in the throat, are very different from chancres. He says that the true chancre produces considerable inflammation, often attended with a great deal of pain, and quickly followed by supuration. But the local effects, arising from the virus in the constitution, are slow in their progress, attended with little inflammation, and are seldom or never painful, except in particular parts. However, Mr. Hunter allows, that this sluggishness in the effects of the poison depends on the nature of the parts diseased: and he owns, that when the tonsils, uvula, or nose are affected, the progress of the morbid mischief is rapid, and bears a greater resemblance to a chancre, than when it occurs on the skin. Even in those parts, the ulcers seemed to him to be attended with less inflammation than chancres, which were spreading with equal celerity.

Before the time of Mr. Hunter, the matter secreted by sores, which arise from a constitutional infection, was always considered to be of a poisonous quality, like the matter of a chancre. At first, one would expect that this must actually be the case, because venereal matter is the cause; and mercury cures chancres, and also the ulcers proceeding from a lues venerea. Mr. Hunter remarks, however, that the latter circumstance is not a decisive proof, since *mercury is capable of curing many diseases besides the venereal*. He notices, also, that when pus is absorbed from a chancre, it generally produces a bubo; but that a bubo is never occasioned by the absorption of matter from a venereal sore, arising from the virus diffused in the circulation. For instance, when there is a venereal ulcer in the throat, no buboes occur in the glands of the neck; when there are syphilitic sores on the arms, or even suppurating nodes of the ulna, no swellings form in the glands of the armpit, although these complaints occur when fresh venereal matter is applied to a common sore on the arm, hand, or fingers. No swelling is produced in the groin in consequence of nodes, or blotches on the legs and thighs. The correctness of the Hunterian doctrine of the impossibility of communicating the venereal disease by inoculations with the matter taken from any of its secondary or constitutional forms, has been put to the test of experiment by M. Ricord, and the results, he says, conform to the truths established by Hunter. (*Mal. Ven.* p. 161.)

M. Ricord also subscribes to the doctrine adopted by Hunter, Jourdan, &c., that the disease cannot be communicated by inoculating with the blood of a syphilitic patient. "When once the matter is blended with the blood (says he) it is no longer inoculable." (P. 164.) And amongst other inferences, M. Ricord lays down the following one: that whenever a symptom, whatever may be its seat or apparent form, is still inoculable, it must of necessity be the product of direct contagion, and not the result of general infection from absorption established at another point. (P. 166.)

Some very important experiments are related in Mr. Hunter's *Treatise on the Venereal Disease*, in order to prove, that the matter from a gonorrhœa, or chancre, is capable of affecting a man locally,

who is already labouring under a lues venerea; and that the matter from secondary syphilitic sores has not the same power.

Parts most susceptible of Lues Venerea, &c.—Some parts of the body seem to be much less susceptible of lues venerea than others; indeed, Mr. Hunter observes, that, so far as our knowledge extends, certain parts cannot be affected at all. The brain, heart, stomach, liver, kidneys, and several other viscera, have never been known to be attacked by syphilis.

The first order of parts, or those which become affected in the early stage of lues venerea, are the skin, tonsils, nose, throat, inside of the mouth, the iris, and sometimes the tongue.

The second order of parts, or those affected at a later period, are the periosteum, the fibrous textures about joints, the testicle, the larynx, and bones.

Mr. Hunter conceived, that one great reason for the superficial parts of the body suffering from the effects of lues venerea sooner than the deep-seated ones, depends on the former being more exposed to external cold. He remarked that even the second order of parts do not all become diseased at the same time, nor every where at once. But, on the contrary, such as are nearest the external surface of the body are first diseased, as, for instance, the periosteum, bones of the head, the tibia, ulna, bones of the nose, &c. Neither does the disease affect these bones equally on all sides; but first on that side which is next to the external surface. It was Mr. Hunter's belief, however, that the susceptibility of particular bones did not altogether depend upon their nearness to the skin; but, upon this circumstance and their hardness together.

The foregoing account by no means agrees with the results of modern inquiries into the nature of the venereal disease; for unless mercury be given, it appears that the bones are very seldom affected by it. Thus, in the cases which were treated by Mr. Rose without mercury, he observes, that "the constitutional symptoms were evidently not such as could be regarded as venereal, if we give credit to the commonly received ideas on the subject. Cavities of the bones, and some of the least equivocal symptoms, did not occur. In no instance was there that uniform progress with unrelenting fury, from one order of symptoms and parts affected to another, which is considered as an essential characteristic of true syphilis." (*Med. Chir. Trans.* vol. viii. p. 423.) We learn also from Mr. Guthrie, that the bones were not affected in any of the cases cured entirely without mercury in the York Hospital, though there were several other cases admitted, "in which a few mercurial pills had been taken, and the mouth not affected, and in which the primary symptoms were followed by eruptions, both papular and scaly, by ulcers in the throat, by nodes, and, in one case, by inflammation of the periosteum covering the bones of the nose, and ulceration of the septum nasi, although mercury was resorted to for its cure." (Vol. cit. p. 560.) The late Sir Patrick M'Gregor, however, informed me of one or two cases, in which a node took place, though no mercury had been used. The occurrence, at all events, seems to be rare.

In the examples, treated without mercury, under the superintendence of Dr. Hennen, this gentleman did not see "a single case in which the

bones of the nose were affected; some cases of periostitis, and of pains and swellings of the bones of the cranium and extremities, were met with; but, except in two, he never remarked any nodes which could be regarded as unequivocally syphilitic." One of these yielded to blisters and sarsaparilla; the other, after resisting guaiacum and sudorifics, was dispersed by mercury. (*On Military Surgery*, ed. 2. p. 581.) Dr. Hennen's statement on this subject would have been more satisfactory had it comprised his opinion of the characters of an unequivocally syphilitic node. On the whole, it appears tolerably certain that mercury, especially when employed unmercifully, and even when employed in moderation, if the patient exposes himself to damp and cold, tends to promote the frequency of nodes, as a sequel of the venereal disease; though, as the long and abundant use of the same mineral does not cause the same consequence after other complaints, and venereal ulcers, treated altogether without mercury, rarely lead to nodes, it would seem as if these swellings were the product of the combined action of syphilis and mercury together. The infrequency of nodes in the strictly non-mercurial practice, is one of the most important facts yet established in its favour, and it is curious to find, from some quotations made by Dr. Hennen, that it was well known in former days. Fallopius, in his 96th chap. *De Ossium Corruptione*, speaking of the loss of the bones of the nose and palate, says, "et sciatis quod non in omni inveterato gallico hoc fit, sed tantum in illis, in quibus inunctio facta est cum hydrargyro." And Fernelius, in speaking of the injurious effects of mercury, observes, "recidiva ratio similis est radici neque iisdem symptomatis exeret, sed fere distillatione. arthritide tophis, vel ossium carie." (*Aphrodisiacus*, vol. iii. p. 146,) And Palmarius, in considering the affection of the bones, as Dr. Hennen has noticed, uses the following remarkable words:—"sed hoc iis duntaxat contingit, qui olim a lue venerea hydrargyrosi vinctiati putarentur, non qui decocto guaiacino et alexipharmaco curati fuissent." (*De Morb. Contagiosis*, cap. vii. lib. ii. p. 124. Parisiis, 1578.) Dr. Hennen expresses his own conviction, in which I entirely agree, that the carious affections of the bones, which are so common in persons treated by long mercurial courses, proceed not from the disease, but from the remedy rapidly and irregularly thrown in while periostitis exists; and he has not seen a single case of carious bone in the military hospitals since the non-mercurial treatment was adopted, except where mercury had formerly been used. (*On Military Surgery*, ed. 2. p. 505, 506.)

Nor will the results of modern experience and inquiries, made on a very extensive and impartial scale, allow us to consider the venereal disease as regularly and unavoidably leading to any secondary symptoms, even though no medicine at all be employed for their prevention. This is fully exemplified in the official reports of the army hospitals. The particulars of 5000 cases, spoken of by Sir James McGrigor and Sir W. Franklin, lead to the opinion, that "the frequency or rarity of secondary symptoms would seem to depend on circumstances not yet sufficiently understood or explained, although the following fact would tend to the belief, either that the constitutions of the men, or the mode of conducting the treatment without mercury, are the causes that possess the

greatest influence in their production. In one regiment, four secondary cases out of twenty-four treated without mercury, supervened." In another regiment, sixty-eight cases were treated without mercury, all bearing marks of the true venereal disease (and twenty-eight of them, especially selected for their decided characters of chancre), yet no secondary symptoms of any kind had taken place fifteen months after the treatment had ceased. The same document, founded on the above large number of cases, confirms another fact, that no peculiar secondary symptoms follow peculiar primary symptoms; a conclusion which is directly adverse to Mr. Carnichael's opinions, of which I have taken particular notice in another work. (*See First Lines of the Practice of Surgery*, ed. 6.)

According to Mr. Hunter, the time necessary for the appearance or production of the local effects, in parts most susceptible of the disease, after the virus has passed into the constitution, is generally about six weeks; but, in many cases, the period is much longer; while, in other instances, it is shorter. Sometimes the local effects make their appearance within a fortnight after the possibility of absorption.

The effects, on other parts of the body which are less susceptible of the venereal irritation, or slower in their action, says Mr. Hunter, are much later in making their appearance. And when the first and second order of parts are both contaminated, the effects, generally, do not begin to appear in the latter till after a considerable time, and sometimes not till those affecting the former parts have been cured.

Mr. Hunter, however, refers to instances, in which the periosteum, or bone, was affected before any of the first order of parts; but he was uncertain whether the skin or throat would afterwards have become diseased, as the disorder was not allowed to go on.

According to Delpech, the principal morbid effects, produced on the bones by syphilis, are periostoses, exostoses, and necrosis. As for caries, which has been commonly set down as a consequence of the disease, he says, that authors have generally mistaken necrosis for it; and that the pretended examples of caries of the bones of the nose and palate, are, in fact, more or less extensive denudations and mortifications of the maxillary and turbinated bones, the septum nasi, &c. (*See Chir. Clin.* i. i. p. 355.)

Venereal Eruptions.—The whole tenor of various facts, specified in the foregoing columns, tends to prove, that what is usually called the venereal disease is, if not several diseases, at all events one that is infinitely modified by constitution, climate, regimen, and mode of treatment. And hence, perhaps, and partly also from certain circumstances on which the investigations of M. Ricord have now thrown light, the chief source of all the perplexity and uncertainty, which have frequently raised doubts, whether any disease, corresponding to the former notions of syphilis, really exists. Were any proof of the truth of this reflection needed, in addition to the many other proofs of it already premised, the subject of venereal eruptions would at once furnish it; for here no kind of regularity can be traced, neither in the appearances on the skin abstractedly considered, nor in the connection between certain kinds of primary ulcers and particular forms of cutaneous disease. Nay, as I have

noticed in the preceding pages, sometimes, in consequence of a primary venereal sore, different kinds of eruptions form together, or successively on one individual; and, so far as one can judge by the eye, exactly the same kind of chancre may produce very different eruptions in different persons, even though treated on precisely the same plan. These circumstances are truly confusing. In Mr. Rose's paper, however, there is a partial confirmation of one part of Mr. Carmichael's theory, viz. the frequency of papular eruptions after simple primary ulcers, or superficial sores, which readily heal. According to the latter gentleman, this form of eruption may also follow gonorrhoea, and is generally preceded by fever, and ends in desquamation. Whatever may be the degree of truth respecting the relation between this kind of eruption and the alleged primary complaints, the practice recommended by Mr. Carmichael for such cases is judicious. General blood-letting is recommended, when there is fever, and the medicines praised are antimonials and sarsaparilla. Afterwards, when the fever subsides, and the eruption desquamates, an alternative course of antimony and calomel, it is said, will accelerate the cure, though not absolutely necessary. In cases of venereal pustular eruptions, supposed by Mr. Carmichael to be most frequent after chancres with elevated edges, without induration, blood-letting is also advised during the febrile stage, followed by antimonials, sarsaparilla, guaiacum, tar-ointment, baths of sulphuretted potassa, or the nitro-muriatic bath; and after the pustules have terminated in scaly blotches, alterative doses of mercury, conjoined with sarsaparilla or guaiacum. An eruption of tubercles, or spots of a pustular tendency, or of both intermixed, preceded by fever, and terminating in ulcers covered with thick crusts, complaints which Mr. Carmichael considers a sequel rather of phagedenic, than other chancres, he treats at first by blood-letting, followed by antimonials, sarsaparilla, guaiacum, compound powder of ipecacuanha, arseniate of potassa, nitrous acid, and nitro-muriatic bath. Mercury is said to be hurtful, except in the last stage. To scaly blotches, which he conceives to be a sequel of the true chancre or callous ulcer, he applies the same local treatment as to pustular eruptions, and he deems the question whether sarsaparilla and guaiacum might here be substituted for mercury, yet unsettled. (See *Obs. on the Symptoms, &c. of Venereal Diseases, Synopsis*, p. 205, &c.) The investigations, made in the military hospitals, decidedly prove, that all kinds of eruptions, supposed to be venereal, may be cured without mercury; but I believe the great and superior usefulness of moderate quantities of mercury, for the removal of the scaly copper-coloured blotches, is still generally acknowledged. But even in these cases of copper-coloured spots, Mr. Baco's advice may be good, viz. when the general health is much deranged, the tongue loaded and furred, and the appetite gone, to defer mercury. "until, by proper evacuations and attention to the general health," the patient has had the benefit of a delay, "which will, in many instances, render all farther medical treatment unnecessary. It is undoubtedly true, that, whatever plan be pursued, these eruptive symptoms will eventually disappear; still where they continue to linger for a long time, and are attended with their usual accompaniments of

great languor, debility, and disturbed rest, I neither know, nor can I understand, the advantage of delaying that remedy, which repeated experience has taught me to rely upon," &c. (*Baco, On Syphilis*, p. 99.) Although Mr. Carmichael's practice seems good, his theory, about the connection of certain sores with particular eruptions, and other peculiar secondary symptoms, appears to be nearly refuted by the investigations made in the military hospitals. To some facts relating to this question, I have already adverted.

There is as little certainty about the essential characters of syphilitic eruptions as about the test of every other symptom of the venereal disease. While Mr. Hunter describes the eruption as generally occurring over the whole body, Dr. Bateman states, that syphilitic affections of the skin commonly make their first appearance on the face, where they are usually copious, and on the hands and wrists. (*Synopsis of Cutaneous Diseases*, p. 332. ed. 3.) Their colour, he says, is in general less livid than that of ordinary eruptions, being of a brownish red of different shades; but that this is not universal; for some of the syphilitic ecthymata have a bright red base in the beginning. Exposure to cold accelerates their progress, and increases their extent; while, on the other hand, warmth retards and ameliorates them. (P. 333.) According to Hunter, the discolourations make the skin appear mottled, and many of the eruptions disappear, while others continue and increase with the disease.

In other cases, the eruption comes on in distinct blotches, which are often not observed till the scurf has begun to form. At other times, the eruption assumes the appearance of small distinct inflammations, containing matter, and resembling pimples, not being, however, so pyramidal, nor so red at the base. Mr. Hunter also observes, that venereal blotches, on their first coming out, are often attended with inflammation, which gives them a degree of transparency, which is generally greater in the summer than the winter, especially if the patient be kept warm. In a little time, this inflammation disappears, and the cuticle peels off in the form of a scurf. The latter occurrence often misleads the patient and the surgeon, who look upon this dying away of the inflammation as a decay of the disease, till a succession of scurfs undecieves them.

The parts affected next begin to form a copper-coloured, dry, inelastic cuticle, called a scurf, or scale. This is thrown off, and new ones are formed, which spread to the breadth of a sixpence or shilling; but seldom more extensively, at least for a considerable time. In the mean while, every succeeding scale becomes thicker and thicker, till at last it becomes a common scab. Then the disposition to the formation of the matter takes place in the cutis underneath, and a true ulcer is produced, which commonly spreads, although slowly. When the affected part of the skin opposed by another portion of skin, which keeps it in some degree more moist, as between the nates, about the arms, between the scrotum and the thigh, in the angle between the two thighs, on the red part of the lip, or in the armpits, the eruptions, instead of being attended with scurfs and scabs, are accompanied with an elevation of the skin, which is swollen with extravasated lymph into a white, soft, moist, flat surface, which discharges a white matter. (*Hunter.*)

A venereal eruption often attacks the part of the fingers, on which the nail is formed. Here, the disease renders the surface red, which is seen shining through the nail; and, if allowed to continue, a separation of the nail takes place. When surfaces covered with hair are attacked, the hair falls off, and cannot be reproduced, so long as the disease lasts.

Dr. Bateman remarked how frequently cutaneous eruptions, the result of the venereal poison, are the source of embarrassment to the practitioner. They appeared to him to assume such a variety of forms, that they bade defiance to any arrangement founded upon their external character; and, in fact, he sets them down as possessing no common nor exclusive marks, by which their nature and origin are indicated. It seemed to him, that, perhaps, there is no order of cutaneous appearances, and scarcely any genus, or species of the chronic eruptions, which these secondary symptoms of syphilis do not occasionally resemble. He admits, however, that in many cases there is a difference, which a practised eye will recognise, between the ordinary diseases of the skin and the syphilitic eruptions, to which the same generic appellation might be given. This, says he, is often observable in the shade of colour, in the situation occupied by the eruption, in the mode of its distribution, and in the general complexion of the patient. Hence, to a person conversant with those ordinary diseases, a degree of anomaly in these respects will immediately excite a suspicion, which will lead him to investigate the history of the progress of such an eruption and of its concomitant symptoms. (See *Synopsis of Cutaneous Diseases*, p. 331, 332. ed. 3.)

Dr. Hennen does not pretend to be able to discriminate true syphilitic eruptions from others; and hence, he generally approves of deferring the use of mercury at first, in order to see whether these cutaneous affections will yield to other means; which, by the bye, would, after all, be no test of their not being syphilitic: "but (says he) I should not very long postpone the employment of the mildest mercurial alteratives, aided by warm bathing, and sudorifics." (*On Military Surgery*, ed. 2. p. 518.)

By attending to the history of the case, and the concomitant symptoms, I should say, that the practitioner will have less difficulty in arriving at a correct judgment, than is sometimes represented. In Hunter's time, and until the period of J. R. Willan, we find venereal eruptions all jumbled together, under the general term of copper-coloured blotches. In Hunter's work, "we find (says Mr. Carmichael) no mention of papules, pustules, tubercles, rupia, psoriasis, or lepra; all those forms of eruption, indicative of different forms of disease, and often requiring different modes of treatment, are all classed under one general and undistinguishing term of copper-coloured scaly blotches." Mr. Carmichael argues, indeed, that a classification, grounded on the character of the eruption, is not only in accordance with nature, but the most practically useful for the following reasons:—1. When a practitioner meets with a patient affected with a papular eruption, either in its early stage, when it presents itself in the form of papules, with acuminate heads, containing matter, or in its advanced stage, when the spots have desquamated, and present one of the appearances, Hunter calls copper-coloured blotches, he

may be certain, that he has only a disease of easy management to contend with, and that, under suitable treatment, he may assure his patient with confidence, of a certain and speedy recovery.

2. If we meet with a pustular eruption, which terminates in superficial ulcers, and not in desquamation, we may be certain, that we have a much more formidable disease to manage.

3. If there is offered to our consideration a case of pustular eruption, mixed with tubercles, which terminate in deep ulcers, which spread into a phagedenic margin, and form those crusts termed rupia, we may be certain, that we have the most unmanageable and destructive form of venereal disease to contend with. It is (says Mr. Carmichael) in this form of the disease, that we meet with extensive ulceration, engorging the velum, uvula, tonsils, and back of the pharynx, where it lies upon the bodies of the vertebrae, ulceration of the nares, destruction of the bones of the nose, and also ulceration of the larynx, the usual precursor of laryngeal phthisis. (See *TRACHEOTOMY*.)

4. The scaly eruption, comprising psoriasis and lepra, is a form of disease, which is in general manageable; for, unlike the pustular and phagedenic forms of venereal disease, it yields with certainty and quickness to the influence of mercury. It may, however, as Mr. Carmichael adds, be accompanied, by deep ulceration of the tonsils, and very obstinate nodes; but whether ulceration of the larynx and nares attends it, is more than he is able to state, since he has never witnessed it. Mr. Carmichael believes, that this form of disease, formerly denoted by the phrase copper coloured scaly blotches, is often confounded with other forms of venereal eruptions, because papule and pustules, in their desquamating, declining stage, assume a scaly copper-coloured appearance; and even rupia evinces the same tendency when the disease is on the decline. Mr. Carmichael states, that it is the tendency of all venereal eruptions to become scaly, when the disease is gradually yielding to the power of the constitution; and, says he, "when in this state, no matter in what form the eruption commenced, I never saw mercury do harm, but always observed the most decided and quick amendment to follow its adoption." (See *Dublin Journ. of Med. & Phys. Science*, vol. xii. p. 28.)

Venereal Disease of the Throat, Mouth, and Tongue.—In the throat, tonsil, and inside of the mouth, it seems generally to make its appearance at once in the form of an ulcer, without much previous tumefaction.

A venereal ulcer in the throat was supposed, by Mr. Hunter, to be in general well-marked, though not in every instance distinguishable from an ulcer of a different nature. Several diseases of the throat, he remarks, do not produce ulceration on the surface. One is common inflammation of the tonsils. The inflamed place often suppurates in the centre, so as to form an abscess, which bursts by a small opening, but never looks like an ulcer that has begun superficially, like a true venereal sore. The case is always attended with too much inflammation, pain and tumefaction of the parts to be venereal. Also, when it suppurates and bursts, it subsides directly, and it is generally attended with other inflammatory symptoms in the constitution.

Mr. Hunter notices an indolent tumefaction of the tonsils, peculiar to many persons, whose con-

stitutions are disposed to scrofula. The complaint produces a thickness in the speech. Sometimes coagulable lymph is thrown out on the surface of the parts affected, and occasions appearances, which are by some called ulcers; by some sloughs; and by others, putrid sore throats. The case is attended with too much swelling to be venereal; and, with a little care, it may easily be distinguished from an ulcer, or loss of substance. However, when this difference is not obvious at first sight, it is proper to endeavour to remove some of the lymph, and if the surface of the tonsil underneath should appear to be free from ulceration, we may conclude with certainty that the disease is not venereal. Mr. Hunter has seen a chink filled with coagulable lymph, so as to appear very much like an ulcer; but, on removing that substance, the tonsil underneath was found perfectly sound. He adds that he has seen cases of a swelled tonsil, having a slough in its centre, which slough, before its detachment, looked very like a foul ulcer. The nature of the complaint, he says, is even more puzzling, when the slough has come out; for then the disease has most of the characters of the venereal ulcer. Whenever he met with the disease in its first stage, he always treated it as if it had been of the nature of erysipelas, or a carbuncle. When the complaint is in its second stage, without any preceding local symptoms, he recommends the practitioner to suspend his judgment, and to wait a little, in order to see how far nature is able to relieve herself. If there should have been any preceding fever, the case is still less likely to be venereal. Mr. Hunter has seen a sore throat of this kind mistaken for a venereal case, and mercury given until it affected the mouth, when the medicine brought on mortification of all the parts concerned in the first disease.

Another complaint of these parts, which Mr. Hunter represents as being often taken for a venereal one, is an ulcerous excoriation, which runs along their surface, becoming very ind and sometimes foul, having a regular termination, but never going deep. The substance of the parts, as he believes that it is venereal. No part of the inside of the mouth is exempt from this ulcerous excoriation, on account of Mr. Hunter, the disease most frequently occurs about the root of the uvula, and spreads forward along the palatum molle. He remarks that complaint is evidently not venereal, as it does not yield to mercury. He has seen such ulcerous excoriations continue for weeks without undergoing any change, and a true venereal ulcer make its appearance on the surface of the excoriated part. He says, that such excoriations were cured by bark, after the end of the mercurial course, by which the syphilitic sore had been cured.

The preceding paragraph affords a good specimen of one or two of those doctrines, which led even Hunter himself to make the most untenable inferences respecting the syphilitic, or non-syphilitic character of the disease. If it yielded to mercury, it was venereal; if it got well by any other means, it was not so; if it did not yield to mercury, it could not be venereal: such were the Hunterian maxims. Thanks however, to Mr. Carmichael, Mr. Rose, and others, who led the way in annihilating for ever these erroneous ways of thinking, which, as they were formerly acted upon in practice, I believe, used to cause the most deplorable sacrifice of human life.

Mr. Hunter describes the true venereal ulcer of the throat, as a fair loss of substance, part being dug out, as it were, from the body of the tonsil: it has a determinate edge, and is commonly very foul, having thick white matter like a slough adhering to it, and not admitting of being washed away. According to one writer, the ulceration is attended with little pain at first, and excavates the part deeply, and often in a triangular form, as if the tonsil were split. It slowly acquires a smooth bluffy surface. (Wellbank, in *Med. Chir. Trans.* vol. xiii. p. 569.)

Here, however, as in most other supposed forms of syphilis, some test is wanting, by which the case may be certainly distinguished from other diseases of the throat, presenting similar appearances; for, as Mr. Rose remarked, "the excavated ulcer of the tonsils, as described by Mr. Hunter, is not, as Mr. Carmichael seems to think, a peculiar symptom of the presence of the syphilitic virus. I have repeatedly seen it, as well as the scaly blotch, in cases where mercury had been freely employed for the primary sores, and in which I considered the virus as eradicated; and both have disappeared under the use of sarsaparilla." (*Med. Chir. Trans.* vol. viii. p. 421.) In a recent work, Mr. Carmichael himself acknowledges the justice of the preceding observation, and owns that, since the publication of his *Essays*, he has often noticed the excavated ulcer of the tonsils either attending the primary phagedenic ulcer, or the train of constitutional symptoms which arise from it. (*On the Symptoms, &c. of Venereal Diseases*, p. 17.) In affections of the throat, Dr. Jenner states, that he "would be more guarded than in any others, in the employment of mercury, until all inflammatory disposition was removed." Afterwards he has seen them yield, "as if by magic, so soon as the local effects of mercury, on the parts within the mouth, became obvious." But, when mercury was given earlier, he has seen a vast number of instances, in which irremediable mischief was done. (*On Military Surgery*, ed. 2. p. 518.)

According to Hunter, lues venerea sometimes produces a thickening and hardening of the tongue, but frequently ulceration, as in other parts of the mouth. He describes venereal sores on the tongue, as generally more painful than those on the skin; but less so than common sore throats from inflamed tonsils. They oblige the patient to speak thick, as if his tongue were too large for his mouth, with a small degree of snuffing.

It is a remarkable fact, that Mr. Hunter did not recognise any case of venereal inflammation of the eye; yet the frequency of syphilitic iritis is now a fact, as well as as universally established as any in surgery. It may be enumerated also, as in the early class of secondary symptoms, and as being very often accompanied with a papular eruption, periostitis, and pains and swellings of the fibrous textures about the joints. Its treatment has been considered in the article OPHTHALMIA.

Of the later class of secondary symptoms, the periosteum, fasciæ, tendons, ligaments, and bones, are the parts which Mr. Hunter enumerates, as liable to be affected in the second stage of lues venerea, to these should be added the testicle and the larynx. It would appear, however, from the evidence both of ancient and modern writers that true nodes, or venereal swellings of the bones, and particularly caries, rarely take place from syphilis, unless mercury

be employed. This is an observation of very great importance, and one that ought to be well recollected, because it has an interesting relation to the question, whether some of the worst ravages of the disease may not have been rather promoted than prevented by mercury. It is an observation of Mr. Hunter, that we cannot always know with certainty what parts may become affected in this stage of the disease. He has known the distemper produce a total deafness, sometimes followed by suppuration, and great pain in the ear and side of the head. I have already explained, that it was one of his doctrines, that the second order of parts was generally deep-seated. When these become irritated by the poison; he observes, that the progress of the disease is more gradual than is the first order of parts. It assumes very much the character of scrofulous swellings, or chronic rheumatism, only it affects the joints less frequently than the latter affection does. A swelling sometimes makes its appearance on a bone, when there has been no possible means of catching the infection for many months; and, in consequence of the little pain experienced, the tumour may be of considerable size, before it is noticed. Sometimes a great deal of pain is felt, but no swelling comes on till after a long while. According to Mr. Hunter, these remarks are also applicable to swellings of the tendons and fasciæ. As tumours of this kind only increase by slow degrees, they are not attended with symptoms of much inflammation. When they attack the periosteum, they seem like an enlargement of the bone itself, in consequence of being very firm, and closely connected with the latter part. In these advanced stages of the disease, the inflammation can hardly get beyond the adhesive kind, in which state, it continues to become worse and worse, and when matter is formed it is not true pus. Some nodes, he says, both of the tendons and bones, last for years, before they form any matter at all. These cases, he considered, as not being certainly venereal, though commonly considered as such. Mr. Hunter found it difficult to explain the reason why, when lues venerea attacks the bones, or the periosteum, the pain should sometimes be considerable, and sometimes but trivial. Venereal pains in the bones are described by him as being of a periodical kind, generally most severe in the night-time.

At the present day, when many cases, formerly supposed to be syphilitic, are treated without any mercury, and even those, which are reputed to be venereal, are cured by much smaller doses of that medicine than were given in Mr. Hunter's time, or by means of the hydriodate of potash and sarsaparilla, nodes have become much less frequent; and I have already, in a previous part of this article, expressed my decided belief in the justness of the opinion given by Fallopius and others, that a disposition to nodes is often occasioned in venereal patients by the abuse of mercury.

Treatment of Secondary Symptoms.—In Mr. Hunter's opinion, the first order of parts, or those most susceptible of being affected in lues venerea, are also the most easy of cure; while the second order of parts takes more time to be remedied.

In the class of complaints, arising in the second stage of the lues venerea, Mr. Hunter believed, that it was unnecessary to continue the employment of mercury till all the swelling had disappeared, because such complaints cannot contami-

nate the system by absorption. Whatever may be decided concerning the superiority of mercury as a general remedy for many secondary symptoms, one thing appears already well made out, viz. that it should always be employed with moderation, lest it produce worse effects and more terrible diseases, than those which it is designed to relieve; and here, indeed, the same ordinary rules and principles apply with reference to a mercurial course, or the mere alternative exhibition of mercury, which are applicable in other forms of syphilis. (See MERCURY.)

To the following ingenious reasoning on the operation of mercury, and the principles by which its administration should be regulated, surgeons of the present day will not give more credit than facts warrant, because some of Mr. Hunter's opinions are manifestly influenced by the supposition; that mercury is absolutely necessary for the cure of the venereal disease.

In curing lues venerea, by which Mr. Hunter signified particularly the constitutional forms of it, mercury seemed to him to be capable of only two modes of action, one, on the poison; the other, on the constitution. If, says Mr. Hunter, mercury acted on the poison only, one might conceive it did so, either by destroying its qualities, by decomposing it, or else by attracting it and carrying it out of the circulation. If mercury acted in the first of these ways, one would expect that the cure would depend on the quantity of the medicine taken into the system. If it acted in the second manner, one would infer, that the progress of the cure would be proportionate to the quantity of evacuation. But, observes Mr. Hunter, if it act upon the principle of destroying the diseased action of the living parts, and of counteracting the venereal irritation, by producing one of a different kind, then neither quantity alone, nor evacuations, will avail much. He states, that the quickness of the cure depends on quantity, joined with visible effects. However, it is added, that although the effects, which mercury has upon the venereal disease, are in some degree proportioned to the local effects of the medicine on some of the glands, or particular parts of the body, as the mouth, skin, kidneys, and intestines, yet such effects are not altogether proportioned to these other circumstances. When mercury disagrees with the constitution, so as to produce great irritability and hectic symptoms, this action of irritation, as Mr. Hunter explains, is not a counter-irritation to the venereal disease.

It was also another Hunterian theory, that the effects of mercury on lues venerea are always in proportion to the quantity of the remedy exhibited in a given time, and the susceptibility of the constitution to the mercurial irritation. These circumstances seemed to Mr. Hunter to require the most minute attention. However, it appeared to him, that mercury should not be exhibited too quickly; because, when the local effects are produced too quickly, they prevent a sufficient quantity of the remedy from being taken into the system to counteract the disease.

Mr. Hunter had seen cases in which mercury acted very readily locally, and yet the constitution was hardly affected by it, for the disease would not give way. He states, that he has met with other cases, in which the mere quantity of mercury did not answer, till it was given so quickly as to affect the constitution in such a manner, as to

produces local irritation, and, consequently, sensible evacuations. This, he observes, is a proof, that the local effects of mercury are often the sign of its specific effects on the constitution at large, and it shows, that the susceptibility of the diseased parts to be affected by the medicine, is in proportion to its effects on the mouth. Its effects, he contends, are not to be imputed to evacuation, but to its irritation. Hence he inculcates, that mercury should be given, if possible, in such a manner as to produce sensible effects upon some parts of the body, and in the largest quantity that can be given to produce these effects within certain bounds. Mr. Hunter also remarks, that those sensible effects should be the means of determining how far the medicine may be pushed, so as to have the greatest effect on the disease, without endangering the constitution. The practice must vary according to circumstances; and if the disease be in a violent degree, less regard must be had to the constitution, and mercury must be thrown into the system in larger quantities; a very dangerous precept, so far as I can judge from the results of many cases in which I have seen it acted upon.

When the disease is in the first order of parts, a smaller quantity of mercury appeared to Mr. Hunter necessary, than when the second order of parts is affected. For the purpose of curing the venereal disease, whether in the form of chancre, bubo, or lues venerea, Mr. Hunter was of opinion, that probably the same quantity of mercury is necessary. He represents, that one sore requires as much mercury as fifty sores in the same person, and a small sore as much as a large one. He thought, that the only difference, if there is any, must depend upon the nature of the parts affected, that is, on their being naturally active or indolent. He conceived, however, that, on the whole, recent venereal complaints are generally more difficult to cure, than the symptoms of lues venerea, and that this may make a difference in regard to the quantity of mercury required.

Having now delivered these theories on the exhibition of mercury, as laid down by Mr. Hunter, I must not quit this subject without remarking, that even this eminent surgeon appears, on the whole, too partial to the long use of mercury, and sometimes to the introduction of immoderate quantities of it into the system. In general, however, his observations tend to condemn all violent salivations. It is to be recollected, that, in his days, nobody had a suspicion, that truly syphilitic sores would in the end spontaneously heal; and he himself had no dependence upon any medicine, except mercury, for the cure of any form of true venereal disease. But modern experience proves, that the disorder seldom now presents itself in shapes so bad and intractable as formerly; that it is even capable of spontaneously ceasing; and that we hardly ever see cases, in which it is requisite to give mercury, except in moderate quantities. Indeed, such is the change, that many surgeons suspect, that the very nature of the disease must have undergone a material alteration, or modification. In England, in my opinion, every thing is to be referred to the improved manner of employing mercury, with a great deal of limitation and restriction; sometimes giving the preference to other means; and discarding it on account of its

well-known pernicious effects on particular cases, as, for instance, those in which the disease is phagedenic, or the bones are attacked with necrosis. In other instances, where its use is preferred, many judicious surgeons give it only in moderate doses, and never push its exhibition till the constitution is so impaired, that horrible forms of disease ensue, which are the compound effect of mercury and syphilis together.

I may say that mercury will generally expedite the cure of secondary symptoms; but that, in some states of the constitution, even when true syphilitic affections are present, or when ulcers, which were originally of this nature, have assumed the phagedenic or sloughing character, and are accompanied by considerable inflammation, or much derangement of the health, mercury will prove the worst medicine that can be employed.

When the eruption consists from the first of scaly copper-coloured blotches, presenting the characters of psoriasis or lepra, unattended with much febrile disturbance, but preceded by, or associated with, other venereal symptoms, the great majority of experienced surgeons prefer the use of mercury, so as to bring the constitution moderately under its influence; but not with the view of exciting profuse and violent salivation, or producing severe derangement of the health. If either of these states unexpectedly occur, mercury is to be immediately discontinued, and sarsaparilla, or such other medicines as circumstances dictate, prescribed.

Dr. Colles admits, that one and the same treatment will not prove equally successful in all the various forms of syphilitic eruptions. The scaly eruption, the copper-coloured blotch, and the papular eruption, seem to him to be those which yield most readily, and are most certainly and perfectly cured by the action of mercury, given in the ordinary doses. "But the pustular eruption, and especially when of larger size than ordinary, requires a very particular treatment. No fact can be more established than this; that if mercury be used too largely in cases of pustular eruption, the latter will quickly degenerate into venereal ecthyma, or rupia, or spreading venereal ulcers. This form of eruption is one of those venereal affections which, while it is materially aggravated by large doses of mercury, can be certainly and safely cured by small doses. If we watch with care the progress of the pustular eruption, we must be struck with the strong disposition which it betrays of running into, or of being converted into, ulcers; sometimes the pustules, spreading widely, and still keeping superficial, forming ulcers, covered with thin, soft, yellowish crusts; while, in other cases, each pustule, without enlarging much, forms a deep ulcer covered with a brown scab, which is depressed below the level of the skin. Now, in either of these cases, mercury, administered in very minute doses, and with extreme caution, will effect a cure, and that too in a very short time." (*On Ven. Dis.* p. 178.)

When the eruption is papular, and has been preceded by a great deal of fever, I have often known blood-letting employed with advantage in the beginning, followed up by the compound calomel pill and saline antimonial medicines, or small doses of the hydriodate of potash with sarsaparilla. Mr. Carmichael entirely differs from Dr. Colles, with regard to the treatment of this eruption, for

he completely disapproves of the use of mercury in the commencement; and he does not resort at that period even to small doses of it, which, however, he pronounces to be superiorly useful, as soon as the papular eruption begins to desquamate.

Mr. Carmichael abstains from the employment of mercury for eruptions of the pustular kind, unless the pustules change into scaly blotches, and he chiefly confides in sarsaparilla and guaiacum, with small doses of James's powder, or pulv. ipec. comp. In such cases the hydriodate of potash, with sarsaparilla, cascarrilla, or other light tonic, is often very efficient. Sulphurous and nitro-muriatic baths are also frequently of service.

I was glad to meet with the following observations in the writings of a gentleman, whom Mr. Carmichael considers as too great a worshipper of the god Mercury. (See *Dublin Journ. of Med. Science*, No. xl.) "The scabs and ulcers of rupia appear to be very little under the influence of mercury. I have seen this medicine administered, in cases of this affection, to patients of pretty vigorous habits; and although it acted in a most kindly manner, and produced a full and healthy pyalism, yet it had not any effect in causing the scabs of rupia to dry up, and fall off; nor did it induce in those ulcers, which had been exposed by the previous removal of the crusts, any disposition to heal; the only change, induced by it on these, was to convert them into ulcers; which, though florid, presented one uniform smooth surface, sunk below the level of the skin, and totally devoid of granulations, which proved very slow and difficult to heal. But the administration of mercury to patients afflicted with rupia, is worse than useless, in all instances where the patient is naturally delicate, or has been much reduced or lowered by previous disease; for in all such it proves almost invariably fatal, by increasing the weakness, and generally by inducing an uncontrollable diarrhoea." (*Abr. Colles, Op. cit. p. 179.*)

In University College Hospital, I have seen various examples of rupia yield to small doses (3 grs.) of the hydriodate of potash given thrice a day, with sarsaparilla. In some instances, however, the cure required other means for its completion, as nitrous acid, the nitro-muriatic bath, the liquor arsenicalis, the sulphate of quinine, and a dose of comp. powder of ipecacuanha, every night at bed time.

With respect to syphilitic disease of the throat, I have already noticed Mr. Hunter's description of what he considered as its appearance, viz. "a fair loss of substance, part being dug out, as it were, from the body of the tonsil, with undermined edges. This is commonly very foul, having white thick matter adhering to it like a slough, which cannot be washed away." Dr. Colles, and others, also regard this as the type of genuine venereal sore-throat; but, as he observes, "however strongly the characters of the ulcer may be marked, we must not rely solely on the present appearances; we should trace back the history of the present disease, look to the interval which has elapsed, inquire into the premonitory symptoms, as also into the treatment employed for the cure of the primary disease." (*Op. cit. p. 121.*)

It is well ascertained that the genuine venereal ulcer of the throat will heal without mercury; and I have cured it, in many instances, merely with sarsaparilla, and hydriodate of potash, or nitrous

acid. Entertaining a firmer reliance, however, in the efficiency of mercury, the greater number of surgeons have recourse to it as the favourite remedy in the case before us. Here Dr. Colles deems it necessary, in general, to keep the system under the influence of mercury for eight or ten weeks; "and (says he) I would abstain from local applications to the ulcer, as the changes which the latter undergoes will, in various instances, assist us in discovering when mercury is beginning to disagree with the system. Besides, we must be guided in our opinion, as to the proper duration of the mercurial course, by a reference to the period of the healing in the throat." (*P. 122.*) A venereal ulcer of the throat is sometimes so placed as to be concealed. The most common situation of such hidden sore is on the back of the pharynx, where it is prevented from being seen by the interposition of the velum pendulum palati. "We should, therefore, desire the patient to inspire as fully as he can; in attempting this, he raises the velum, and if we then look into the pharynx, we shall then generally discover the lower part of an ulcer. This, of course, leads us to make a more full examination, and to effect this, we must depress the tongue, and, with a curved probe, raise up the velum. The ulcer, which now becomes more fully exposed to view, is of a circular form, is sunk deep in the substance of the pharynx; the surface is rather foul, but not at all sloughy; and the surrounding inflammation extends a very short distance beyond the margin of the ulcer." Under these circumstances, Dr. Colles is an advocate for rubbing the entire surface of the ulcer with muriate of antimony, which is to be applied by means of a little lint, rolled pretty firmly on the eye-end of an aneurism needle, and dipped in the liquid. (*Abr. Colles, p. 124.*) I have usually employed, for the same purpose, the diluted or undiluted nitrous acid, and sometimes strong solutions of creosote, and nitrate of silver.

Frequently a venereal ulcer of the throat is situated below the level of the base of the tongue, and, if not detected and treated properly, it may spread to the sides and top of the larynx, and cause mischief, too often ending fatally.

According to Dr. Colles, "the ulcer, low down in the back of the pharynx, generally presents a foul, and sometimes a sloughy, surface, seldom assuming the venereal characters described by Hunter; and has this remarkable feature, that its lower edge is very deep, while the upper part of the ulcer is very superficial. A pretty constant symptom complained of by the patient is, that, when he attempts to take any food, the morsel stops at a certain point, and can only be got down by his taking after it a sip of liquid." (*Op. cit. p. 125.*) Dr. Colles rubs this ulcer also with the muriate of antimony.

Another position, specified by Dr. Colles as one where an ulcer may be placed, is close to the insertion of the anterior palatine arch into the tongue; and the sore is detected in attempting to depress the tongue with a spatula. The ulcer is deep and foul, but not at all sloughy; and "whether it be seated on the dorsum, or near the edge of this fold, its exquisite sensibility should be immediately destroyed by touching the surface with a strong solution of nitrate of silver, or with muriate of antimony."

"In a few instances, the voice of the patient is

rendered very nasal, and this, sometimes, even on the first appearance of the venereal sore throat and eruption; and yet, neither the situation, nor the condition of the ulcer visible in the fauces, will enable us to account for this symptom. In this form of the disease, we find that the patient not only suffers severe pain in any attempt to swallow, but he is also teased by frequent desire to draw down the mucus from the back of the nares; and this secretion, when coughed out, is often found slightly tinged with blood. A smart degree of fever also generally attends. The ulcer, in this case, is seated behind the velum, high up in the angle between the upper and back part of the pharynx, or at the junction of its occipital and vertebral portions." Dr. Colles recommends rubbing such ulcer with a solution of $\frac{1}{2}$ j. of nitrate of silver in $\frac{3}{4}$ j. of water, by means of lint, wrapped round the end of a silver aneurism-needle; care being taken to pass one end of the lint through the eye, in order to prevent it from slipping off the needle.

When the ulcer is situated on the posterior surface of the velum (rather an uncommon case), Dr. Colles observes, that we are informed of it, not only by an appearance of thickening, together with a flush of redness on the anterior surface of the velum, which appearance corresponds to the seat of the ulcer, but by carrying behind the velum an aneurism-needle, wrapped round with lint, and rubbing it on the suspected point; when, if there be an ulcer, the lint on being withdrawn will be found covered with the discharge. Here, also, Dr. Colles deems the immediate application of liquid caustics to the ulcer indispensable.

Every surgeon of any experience must have repeatedly seen a condition of the mucous membrane of the back of the pharynx, in which it is covered with a thin crust of whitish or yellow hardened mucus. The nature of the case is readily ascertained by rubbing off the mucous crust with a probe wrapped round with lint, and then the membrane is seen perfectly free from ulceration. Like Dr. Colles, I have seen this affection sometimes continue for an extraordinary length of time, and this notwithstanding every variety of treatment. Dr. Colles has known some cases much relieved by gargling the throat with sea-water, and sometimes apparently cured by sea-bathing; but he has known both means very frequently fail. Patients, who have venereal sore throats, not only suffer pain and difficulty in swallowing, and have a thickness of speech, but are sometimes annoyed with an almost incessant flow of saliva, which, falling back on the larynx when they lie down, interferes with respiration, and hinders sleep.

Another distressing symptom, adverted to by Dr. Colles, is the regurgitation of the patient's drink through the nose. "This alarms the patient excessively; we can, however, relieve his anxiety, by assuring him, that this will cease when the ulcers have healed." (*Colles, Op. cit. p. 129.*)

It seems to this experienced surgeon that this kind of treatment has more influence than scrofula, or other cachectic states of the constitution, in modifying the appearances of venereal sore throats. At the same time, he admits that, if mercury be used injudiciously, and in a manner unsuited to the general health and condition of a patient, it will cause more mischief, and more strange changes in venereal ulcers of the throat, if the patient be of a highly scrofulous, or very delicate habit, than

if he were of a vigorous and healthy constitution. Yet, as Mr. Carmichael has explained, we meet with a great variety of venereal sore throats where not a grain of mercury has been used. (*See Dublin Journ. of Med. Science, vol. xii. p. 39.*) "In a case (says Dr. Colles) where a genuine syphilitic ulcer of the throat has been treated by an irregular, or excessive course of mercury, and has healed under this treatment, we shall often find the patient suffer a relapse of sore throat. The new ulcer, whether it appear in the site of the former one, or whether it occupy some new position, will be found to differ most strikingly from the original ulcer. This appearance, which may be very frequently observed, is that of a superficial ulceration, of rather a whitish colour, with a good deal of surrounding redness, and some slight degree of swelling: in fact, it presents many of those characters which might lead some to call it an aphthous ulcer. If we watch the course of this ulcer, we shall frequently see that it creeps along from place to place; that, unless it be seized by phagedæna, or sloughing, it appears to be rather indolent in its nature; and mild in its character. Thus, it admits of being healed, or almost healed, by various topical means, assisted, perhaps, by some tonic, or alterative medicines." (*Id. Op. cit. p. 131.*)

For many years I have relinquished the employment of mercury in all the phagedenic forms of syphilis; being convinced by experience that, in such cases, it is the most dangerous and pernicious of all medicines. I prefer in such cases sassa-parilla, with hydriodate of potash, and a nightly dose of the muriate or acetate of morphia, or of the compound powder of ipecacuanha; and in some, bark, and nitrous acid; care being taken to apply to the phagedenic ulceration itself lint dipped in the same acid, or a strong solution of nitrate of silver, creosote, or Labarraque's liquor of chloride of soda. The nitrous acid, however, generally answers best. This case is particularly noticed by Dr. Colles. "On inspecting the fauces (he observes), we find the entire of the velum, and both tonsils, in a state of sloughy ulceration; and the back of the pharynx appears converted, as it were, into a soft pulsatious mass: indeed, sometimes we see all parts of the throat covered with this soft slough. By rubbing these parts with lint, wrapped round the end of a probe, we ascertain that this covering adheres tenaciously to the surface. The patient is scarcely able to swallow even a sip of the most bland fluid. By day, a constant flow of ropy saliva issues from his mouth, and he complains that, by night, he is not only deprived of sleep by the pain of his throat, but that he is prevented from lying down; for in that position he is in danger of being suffocated by the viscid saliva passing down his throat. His general health is completely broken up; he is emaciated to an extreme degree; his strength is quite prostrate, pulse extremely quick; and skin hot. In fact, he is in a very high state of fever, which is of the hectic type. When we inquire into the history of such a case, we learn that this unfortunate man had undergone repeated slight courses of mercury, or one or two very severe ones, for the cure of the venereal disease; that these for a time relieved the symptoms; but that, on desisting from the use of mercury, the disease of the throat had relapsed, and assumed the present appearances." Dr. Colles maintains, rather

in opposition to general belief, that this is precisely one of those cases in which very small doses of mercury will be found of signal service. (*Op. cit.* p. 133.) With respect to the case brought forward to justify this advice, I join Mr. Carmichael in thinking, that the amendment cannot be fairly attributed to merely rubbing in ten grains of mercurial ointment, for a few nights, while sarsaparilla, nitrous acid, and strong local remedies, were also employed. (See *Dubl. Journ. of Med. Science*, vol. xii. p. 40.) The ten grains of blue ointment, I calculate, were fortunately too small a quantity to do harm. I have never known of any case, in which venereal ulceration of the throat occasioned death by producing hemorrhage from the carotid arteries; but such occurrences are alluded to by Dr. Colles, who also gives an interesting case, in which a portion of the ring of the atlas exfoliated and was voided in a fit of coughing, the patient surviving this event five or six years. (*On Ven. Dis.* p. 139.)

When venereal ulceration of the throat is making alarming progress, and by sloughing, or by phagedæna, threatens to destroy some important portions of the throat, or to extend to the larynx, Dr. Colles recommends, as the best means of arresting the ulceration, the application of the muriate of antimony, or other equally powerful liquid caustic: mercurial fumigation, he says, will not produce sensible effects in less than two or three days, and then are apt to excite profuse salivation. My experience will not allow me, however, to believe with him, that such salivation is almost certain to arrest the further ravages of the ulceration: on the contrary, I have seen the disease mostly aggravated by it, and this sometimes in a fatal degree. Perhaps, however, Dr. Colles admits enough on this point, when he states, that "all those cases, which have been profusely salivated by fumigations, and in which a relapse has occurred, requiring a fresh use of mercury, will be found very difficult of cure." (*Op. cit.* p. 140.)

Many ill-conditioned venereal ulcerations of the throat are benefited by fumigating the part itself with the red sulphuret of mercury, or the grey oxide, by means of a proper apparatus; but phagedenic ulceration, according to my experience, is more effectually checked by touching it with nitrous acid, than by any other local application.

Ulcers of the Tongue.—Dr. Colles acknowledges the difficulty of distinguishing a venereal from a cancerous ulcer of the tongue. Both, he says, are attended with considerable hardness, but the hardness around the cancerous sore appears to him to be more of the stony kind. If there be a slightly elevated narrow ring of considerable hardness, including an ulcer, with a surface so clean as at first view to resemble an ulcer, which is about to granulate, Dr. Colles would declare it to be unequivocally cancerous. In all doubtful cases, he recommends giving the patient the chance of benefit from slight pyalism. (See *TONGUE*.) A venereal ulcer on the dorsum of the tongue, anterior to its base, is generally of a circular form, as large as a fourpenny piece, and has the characters of a secondary venereal ulcer of the skin. (*Colles, Op. cit.* p. 159.)

According to my experience, by far the greater number of ulcers of the tongue in venereal patients are effects of immoderate salivations. Dr. Colles notices the superficial ulcerations of this

organ sometimes met with after a course of mercury. They may be known by the history of the case; "for those ulcers, which are not venereal, will be found to make their appearance in 12 or 18 days from the time the mercury has been laid aside,—indeed before we can be assured that the action of this medicine on the mouth has entirely ceased." (*P.* 160.)

Ulcers of the Nose.—According to the observations of Dr. Colles, ulcers of the *alæ nasi* sometimes begin in the angle between the nose and cheek from a cluster of papular eruptions. Whenever such an ulcer shows a tendency to phagedæna, or sloughing, it should be treated with some active caustic. I believe all practical surgeons will agree with Dr. Colles, that the characters of a venereal ulcer in the nostril, distinguishing it from scrofulous *ozæna*, are unknown, unless it be said, that the latter is often preceded by scrofulous sore throat, which has terminated in the formation of tense silvery cicatrices. This gentleman does not regard as a venereal affection "those instances of ulceration of the nose in which we discover in the septum nasi, about a quarter of an inch from its anterior extremity, an opening through the septum," of a circular form, and having slightly ulcerated edges. It may remain for years precisely in the same state. The latter seems to be Dr. Colles's chief reason for not considering the case venereal. I agree with him, that we should not pronounce an *ozæna* to be venereal, unless we find it combined with some other decidedly syphilitic symptoms, and its history interwoven with other secondary effects of the disease. Lotions of creosote, chloride of soda, or of the nitrate of silver, and the exhibition of hydriodate of potash and sarsaparilla, constitute generally the most successful practice for these affections of the septum nasi.

Venereal Iritis.—For a description of this affection, and the treatment of it, I refer to the article OPHTHALMY.

Secondary Venereal Ulcers of the Skin are well known generally to assume a circular shape, and to present a foul tawny, or yellow appearance. When such a sore begins to prepare for the healing process, it usually becomes clean first in the centre; "then granulations arise in that situation, and extend towards the circumference, where the skin forms a deep edge, between which and the granulations is a ring of the same yellow ulceration as appeared when first the surface of the ulcer was uncovered. In proportion as the ulcer proceeds, the granulations encroach on this yellow ring, until at length they reach the edge of the ulcer. The central granulations, to a large extent, will have actually cicatrised before the entire surface of the ulcer is clean and healthy. These ulcers are also remarkable for the strong tendency which the central granulations have to assume a fungoid character; so that, unless particular care be taken to prevent it, they will leave when healed a very high and prominent cicatrix. The ulcers also often heal from one side only, so as to resemble a kidney-bean or horseshoe." (*Abr. Colles, Op. cit.* p. 167.)

We meet with secondary venereal ulcers of the skin very commonly in persons who have undergone repeated salivations; and then the question arises whether mercury should be resorted to again, or not. If the patient be in very reduced and deranged health, I should say, let mercury at all

events be postponed, and try other means. I have cured hundreds of these secondary ulcers with the hydriodate of potash and sarsaparilla, aided by judicious local treatment; but, when the health has been improved by these or other remedies, then mild doses of mercury may be employed, if necessary, and will often be found to complete the cure with great facility; whereas, if they had been resorted to at first, they would have converted some of the sores into phagedenic diseases. When disease of the osseous system accompanies secondary ulcers, I should feel very reluctant to administer mercury at all.

In general, mild dressings answer best; but, in obstinate cases, creosote, nitrous acid, or nitrate of silver; lotions, fumigations, with the red sulphuret of mercury; a solution of the chloruret of soda, or of the extract of henbane or opium, may be tried.

A secondary venereal ulcer sometimes forms on the edge of the eyelid, and extends down some way along the mucous surface of the part. In order to check the extension of such a sore, with as little delay as possible, caustic should be freely applied.

Although I have advocated only the moderate use of mercury in the treatment of secondary venereal ulcers, many practitioners aim at producing what is termed a full mercurial action. Dr. Colles asks, "Is it not generally the case, that, about the seventh or eighth day, when mercury ordinarily begins to act sensibly on the system, that we see a change apparently for the worse in the condition of the ulcers? This continues for two or three days longer, viz. until the mercurial action comes to be fully established; and then we find a decided improvement take place in the ulcers. Let us not, therefore, determine upon laying aside the use of mercury in cases of venereal ulcers, until we have seen what effect this medicine shall have when it has come into full action." (*Op. cit.* p. 172.) I introduce this remark, as affording a view not uncommonly entertained and acted upon; but which I have often seen lead to fatal results. I should say, let the maxim here inculcated be at all events the last for adoption, and only when other plans, less injurious to the health, fail in curing the ulcers.

Nodes, and Venereal Affections of the Periosteum, Fasciæ, and Ligaments.—The bones are amongst the parts which constitute the second order, or those which are attacked by secondary syphilis later than the skin, throat, and iris. The bones nearest the surface are most liable to nodes, as the tibia, clavicle, cranium, and the superficial portion of the ulna. It is a remark made by Mr. Carmichael, that when the deeper parts are affected, the progress of the disease is more gradual than in the superficial. "Swellings of the testes, tendons, and fasciæ, are in general very indolent, do not excite any pain, and have very much the character of scrofulous swellings." The true syphilitic node is described by the same author as a solid enlargement of the bone, and as not being at its commencement, nor for a considerable period afterwards, accompanied by any discoloration of the integuments. In most cases, it is a very indolent swelling, increasing by slow degrees, and exciting but little pain and inflammation, until an advanced stage. (*Carmichael, On Ven. Dis.* p. 318. ed. 2.) Whatever pain is experienced, is well known to be greater in the night than the day. In some instances, Dr. Colles has observed the tumour to be

for a few days soft and very painful; then it became firm, and, at the same time, almost totally free from pain. All nodes may in time proceed to suppuration; but this is a slow change, and only happens in nodes of long standing. Dr. Colles has seen it take place more frequently in nodes of the cranium than of other parts. True nodes are not often met with in individuals, who have been treated entirely without mercury. So far as my experience goes, this fact, which is attested by several impartial and accurate observers, is founded upon truth, and is one of high importance in relation to the mercurial and non-mercurial practices.

The bones are subject, as Dr. Colles remarks, to some diseases, which simulate venereal nodes; and one of them is periostitis. The distinguishing of one from the other, he deems practicable only by a close attention to the history of the case, and to other accompanying symptoms. Many surgeons do not consider the swellings which occur near the heads of bones, as true venereal nodes. A great proportion of them are certainly swellings of the fibrous textures; cases in which mercury generally does more harm than good. Dr. Colles does not adopt this view; for he observes, "the condition and seat of a node afford us some criterion by which we can judge whether it be easily curable or not, &c. The node in the centre, or in the hard part of a bone, will be more easily cured than one on the cancellated structure. The former node will bear, and it also requires, pretty active and full doses of mercury for its cure; while that on the cancellated structure will require mercury to be used in moderate doses, administered with much judgment." (*Op. cit.* p. 185.) In the treatment of venereal nodes, Dr. Colles looks to the operation of mercury for the final cure; but he observes, that until mercury acts upon the system, the part should be repeatedly blistered. Frequently, mercury and blisters remove the pain; but the swelling continues, and cannot be removed by these or any other means. With respect to the practice of making an early incision into a node, Dr. Colles objects to it, because it is sometimes followed by painful suppuration, and even by caries, necrosis, and tedious exfoliations.

Dr. Colles has no doubt, that nodes are sometimes excited by the injudicious use of mercury, or by the irregularities of the patient. "I have known cases (says he) in which mercury having been largely and repeatedly employed for the cure of other symptoms, and the patient having been again subjected to a fresh course of mercury, has complained, even while his system was decidedly under the influence of this medicine, of a swelling and tenderness of one or more of the long bones. The tubercles of the tibia are frequently the seats of this affection: when thus attacked, they are not seen to become much enlarged, but are rather soft, and exquisitely tender to the touch; and not unfrequently the integuments covering them assume a reddish tint. Nodes, which form, from the above cause, on other parts of the long bones, are, from their commencement, very painful, and of different size in different individuals; but in all cases they are rather soft. The pain attendant on all these is more widely spread along the limb, than in cases of purely syphilitic nodes. Of course, patients under such circumstances are not fit subjects for the use of mercury." I was glad to find Dr. Colles giving his testimony on this important point. Tem-

porary relief, he says, may be derived from blisters, and he recommends an endeavour to be made to repair the mischief caused in the constitution by the injudicious use of mercury. I was also particularly pleased to read his statement, that the swelling of the knee and elbow, met with in patients labouring under secondary syphilis, is not truly venereal, and that it will often yield to blisters and sarsaparilla. "It is not benefited (he adds) by putting the patient immediately under a second course of mercury, although it is found to yield *pari passu* with the truly venereal symptoms to the powers of this medicine, when employed with judgment and under favourable circumstances." (*Op. cit.* p. 190.) For my own part, I do not remember a case, in which it seemed to me that mercury ever acted usefully on these swellings of the knee and elbow in patients whose constitutions had already been subjected to one or more venereal courses for other previous symptoms. I avoid mercury, apply blisters, give sarsaparilla and hydriodate of potash, and a dose of the compound powder of ipecacuanha every night. The warm bath is also frequently of great service.

Venereal pains in the limbs are probably often seated in the cancellous texture of the bones, the ligaments, and the fibrous texture about joints. The incorrectness of the opinion, that nocturnal exacerbations are pathognomonic of them, is noticed by Dr. Colles, the pain of gout and rheumatism being also worst at night.

Syphilis in Infants.—The venereal disease is sometimes communicated to the *fetus in utero*, through the medium of the blood of the mother, or the placental intercourse between the two beings. The effects of the syphilitic poison, thus developed in the *fœtus*, or new-born infant, may be said, therefore, to be secondary ones, as they arise from the introduction of the poison into the constitution, such poison not having been applied directly to the parts affected. "Whether we inquire into the circumstances under which the diseased parent, or parents, can infect their offspring, or the form in which the disease affects the child, or the appearance and nature of those diseases which are communicated by the infant to the nurse, or of those communicated to its other attendants, and the further propagation of the disease by the nurse to her husband, and, perhaps, to a large family of children, — I say, in investigating any one of these points, we must be struck with the fact, that we find in each a striking deviation from those laws which regulate the venereal disease, as communicated by the adult to the adult. Indeed, this is so much the case, that some authors have not hesitated to deny that these affections are venereal; while others, admitting the possibility of a venereal disease in infants, have yet made use of those very deviations from the regular laws of syphilis to prove that, in particular instances, the disease was not venereal, because it did not strictly square with the progress of syphilis in adults." (*See Colles, Op. cit.* p. 262.)

For reasons, however, already specified, I should here put out of consideration the supposition which Dr. Colles entertains, with the late Mr. Hey and others, "that a newly married man, who is himself free from every appearance of syphilis and every other disease, shall yet infect his wife in such a manner that secondary symptoms shall appear in her a few months after marriage, and these not

preceded by any primary symptoms, or by any discharge whatever from the genitals." Perhaps, however, there may not be anything extraordinary, nor any remarkable deviation of the disease from its usual course, in the fact of its being transmitted from the mother to the *fœtus* through the medium of the placental intercourse between them, in the form of secondary symptoms, because the maternal and *fœtal* systems may be regarded in some points of view as identified and blended together; yet some authors imagine, that the child can only become infected by coming in contact, during parturition, with ulcers in the vagina of the mother. This doctrine, as Dr. Colles justly observes, is at once overthrown by the following facts: — 1st. It has been ascertained, that no such ulcers existed at the period of parturition. 2d. Many infants have the symptoms of the disease at the moment of birth. The latter consideration is, of course, the most important of the two; the existence of sores or discharges in women, being a point sometimes left in doubt, notwithstanding an ordinary examination. Whether the infant is ever primarily infected, that is, whether, at the time of birth it contracts the disease, in consequence of the direct application of the virus of a chancre, which the mother may happen to have, is another consideration; but certainly this cannot be the common mode of infection. In some instances, the child comes to its full time, or nearly so; but is born in so weak a condition, that it dies in a few hours, exhibiting a copper-coloured eruption about the anus and genitals, or even over the whole body. Another way, in which the disease makes its appearance, is the following:—The child is born, to all appearance, healthy and well-nourished, and continues to thrive for about a week. Then copper coloured spots appear about the anus and genitals, or on the inside of the thighs, or about the groins, where they may degenerate into ulcers. The voice of the child is now observed to change, and the cry to be hoarse. Superficial ulcers next appear on the angles of the mouth, with cracks and fissures about the neighbouring skin, which sometimes bleed. The tongue, palate, and throat, are also affected with white superficial aphthous ulcerations; the nose becomes obstructed; a sharp thin discharge flows from the nostrils, but sometimes dries into a scab, which blocks up the nose, and impedes the freedom of respiration: hence there is a snuffling noise in the child's breathing. If the disease advance further, ulcers and fissures form in different folds of the skin; great emaciation ensues; the flesh is flabby; the edges of the eyelids red; the conjunctiva muco-purulent; and, unless proper treatment be adopted without delay, the little sufferer soon perishes.

It is occasionally suspected, that an infant may contract the disease by sucking a nurse affected with secondary symptoms; but this is a disputed point, and Dr. Colles expresses a doubt whether the diseased nurse could infect the child, unless she had ulceration of the nipple. If the ulcer of this part were a secondary one, then one might infer, from the Hunterian doctrines, and the inoculations instituted by M. Ricord with the matter of such a sore, that it would not be capable of imparting the disease.

The best method of treating syphilis in infants is to prescribe calomel in very small doses, or else

the hydrargyrum cum creta in the quantity of four or five grains at a time. The disease may be also cured by putting the mother under the influence of mercury, which, however, can only be right, where she, as well as the infant, labours under syphilitic complaints.

Whether the infant can transmit the disease to others, as is so often asserted, is another interesting topic; because, if this be decided in the affirmative, it is contrary to the doctrine of Hunter, M. Ricord, and others, who maintain that no secondary symptoms can be the means of transmitting the disease to another individual.

With respect to the implication of the testicle in syphilis, I need add nothing to what is stated on the subject in the article *TESTICLE, DISEASES OF*. For other matter relating to the venereal disease, see *NITROUS ACID, GUAIACUM, MEZEZEON, GONORRHOEA, IRRITIS, &c.*

Some years ago, the nitric acid was introduced as a remedy for syphilis. (See *NITROUS ACID*.) To the position of its efficacy being as great in venereal cases as was first alleged, many surgeons have not acceded, though, as a sensible writer has observed, it has certainly been allowed, with some other medicines, to remain in a kind of copartnership with mercury, and admitted to be useful in venereal cases under certain circumstances. A great deal of this want of agreement on the effects of remedies in syphilitic cases, is now explained by the imperfection of the diagnosis, and the important fact, that the disease may generally be cured in time, without any medicines whatsoever; though this time is sometimes long. Dr. Scott, who first suggested the use of nitrous acid, has attempted to account for its alleged occasional failures, by observing, that the acid which he employed was not pure nitric acid, but an impure acid containing an admixture of muriatic acid. He, therefore, some time ago, recommended the use of a compound acid, containing three parts of nitric acid, and one of muriatic, which he administered internally, and also applied externally, largely diluted as a bath, until the gums were affected and pyalism produced; and he conceived every trial as quite inconclusive, unless these constitutional effects occurred.

"The acid that I have used of late (says Dr. Scott) is the nitro-muriatic; and it is formed by mixing together equal parts of the nitrous, or nitric acid, and muriatic acid. If these acids be in the state of concentration that they usually possess in the shops, and if the quantities be considerable, a great volume of gas is developed on their coming into contact, which taints every part of a house, is extremely hurtful to the lungs, and disagreeable to the smell. To avoid this inconvenience, I put a quantity of water, at least equal in bulk to both the acids, into a bottle, and I add the acids to it separately. This method does not only prevent the unpleasant odour, but it tends to retain the chlorine, on which its effects depend. It is well known that the nitro-muriatic acid acts very readily on the metals and earth; nothing, therefore, but glass, or extremely well-glazed vessels of porcelain, should be used to contain it. Wooden tubs for bathing answer very well, and they should always be made as small as possible, compatible with their holding the body, or the limbs that we wish to expose to the bath. From their being small, we save acid, and are

able to heat the bath with ease. *In India I have often exposed the whole body below the head to this bath; but here I have been satisfied, in general, with keeping the legs and feet exposed to it. In order to warm the bath after the first time, I have commonly made a third or a fourth part of it be thrown away, and the loss replaced by boiling water and a proportional quantity of acid. To save the expenditure of acid, I have occasionally warmed a portion of the bath in porcelain vessels, placed near the fire; but I fear this may diminish its effects.

"It is no easy matter (continues Dr. Scott) to give directions with regard to the degree of acidity of the bath. I have commonly made it about as strong as very weak vinegar, trusting to the taste alone. The strength should be regulated by the degree of irritability of the patient's skin. I may say, that although I like to know that it is strong enough to prick the skin a very little, after being exposed to it from fifteen to thirty minutes, yet I believe that even such an effect as this is unnecessary.

"The time too of remaining in the bath, in order to produce the greatest effect, is a matter of doubt. I have kept the legs and feet exposed to it for half an hour or more; but with more delicate people, not above one-half or one-third of that time. I have repeated these baths daily, or even twice or thrice a day." (See *Med. Chir. Trans.* vol. viii. p. 181.) Dr. Scott adds, that the mere sponging the skin with nitro-muriatic acid, sufficiently diluted with water, gives rise to the very same effects as bathing, and is more easily adopted. Fifteen or twenty minutes may be employed in the sponging, though a much less time produces very material effects.

Dr. Scott found the nitro-muriatic acid particularly useful even in this country in that description of syphilis which was absurdly termed *pseudo-syphilis*; and he attributes the beneficial effects to the chlorine, which is loosely combined in this compound. (See *Journal of Science and the Arts*, vol. i. p. 205—211.; *Lond. Med. Reps.* vol. vii. p. 59.; and *Med. Chir. Trans.* vol. viii. p. 173, *et seq.*)

The only important conclusion which I venture to draw from Dr. Scott's observations, is a confirmation of the fact of the generally curable nature of syphilitic diseases, without the aid of mercury. And I further believe that, though the nitro-muriatic bath is sometimes useful, the sure way of bringing it into discredit is to represent it as applicable to all forms of syphilis, for which neither this remedy, nor even mercury itself will ever suffice. The muriates of gold and platinum have been much commended of late years; but after the facts detailed in this article, more especially the general curability of the venereal disease without mercury; the frequently noxious influence of this mineral, so as to derange the health, and impede the cure; and the marked benefit which often then follows its discontinuance, and the substitution of the other means for it; the alleged superiority of new remedies must be received with suspicion, and, in particular, the idea of their specific power over the venereal disease.

I have already said, that, in University College Hospital, the hydriodate of potash, with sarsaparilla, is more employed than mercury in the treatment of venereal complaints, both primary and

secondary. Where the latter implicate bones, and mercury has been already tried, the surgeon will generally act wisely who decides in favour of not resorting to it again.

I will conclude with the following observations of Dr. Reese, the learned editor of the American edition of this Dictionary:—

“The preceding article is an elaborate, and, upon the whole, an able exposition of the present state of our knowledge of the venereal disease, though, in the existing condition of conflicting opinions concerning the identity of the poison capable of inducing such a variety of results as are to be observed in syphilitic affections, we are yet left in doubt as to some of the most important principles, which ought to govern us in our treatment of specific disorders of the genital system. To Mr. Carmichael the profession is in an especial manner indebted for much interesting matter on the subject; and the facts, which the more recent occurrence of the disease among the peninsular army has furnished us, are also to be cherished as of great practical utility. (See *Hennen, Ferguson, Guthrie, &c.*)

“The writers on mercury, and on syphilitic complaints, who have appeared in the United States, deserve also to be studied with some care, inasmuch as not a few of them, from ample opportunities, have set forth many interesting views on these intricate questions. (See *Rousseau*, in *Philadelphia Medical Museum*, vol. iv.; *Holyoke*, in *New York Medical Repos.* vol. i.; see in *do.* vol. iv.; *Rush*, in *do.* vol. v.; *Ogden*, in *do.* vol. v.; *Harris*, in *North Amer. Med. Journal*, vol. i.; *Warren's View of Mercurial Practice*, in *Mass. Med. Communications*; *Francis's Dissertation on Mercury*; *Chapman's Therapeutics, &c.*)

“Medical observers of the present day seem to place less confidence in the authoritative opinions of Mr. Hunter than formerly, and his doctrine of the identity of the poison of gonorrhoea and syphilis, of his infallible diagnostics of chancre, and, further, his precept of the necessity of excessive salivation, have probably few advocates in America. Moreover, the latest investigations by British and continental writers seem to have removed the little of partiality, that was cherished until recently in behalf of these Hunterian principles.

“That gonorrhoea and syphilis originate from distinct poisons, and that moderate salivation only or the merely subjecting the system to the influence of mercury, is all that is necessary, is, perhaps, maintained by nine tenths of the intelligent prescribers of this country; and the sweeping anathemas of Mr. John Pearson, of the London Lock Hospital, in relation to the inefficiency of the corrosive sublimate, have been disproved innumerable times by most decided clinical illustration. I shall here insert an extract from an elaborate essay on mercury, by my friend Prof. Francis, written some time since, when the advocates for the corrosive sublimate were not so numerous as at present. The entire paper may be seen in *Hosack's and Francis's American Med. and Philosophical Register*, vols. iii. and iv. To the interrogatory, what are the changes effected in the system by the influence of mercury? Dr. F. observes, ‘Little is indeed known concerning the peculiar nature of the virus of specific diseases; the action which takes place upon the application of the smallest particle of morbid matter to the

human body, and the process by which it generates disease, converting a local into a general disorder, and thus producing an altered and vitiated state of the whole system; it must be admitted are neither very obvious to the senses, nor very clear to the reasoning powers of man. The effects themselves, however, have been long and familiarly known, and, from duly considering these, a rational theory may, perhaps, be formed of the manner in which they are produced.

“That the poison of specific diseases, as that of lues venerea, small-pox, &c., diffuses itself through the whole constitution, and assimilates into its own nature the general mass of circulating fluids, seems to be most consonant to all that is understood of their peculiar character. Upon the introduction of a particle of variolous matter into the system, an inflammatory action of the part into which it is inserted is excited; by which action new morbid matter of the same nature is generated. This process may be carried on to a greater or less extent, in a longer or shorter time, in different persons, before the specific material enters the absorbents; and hence local inflammation is in some cases considerably advanced before the system becomes affected, while in others the eruptive symptoms supervene when it appears to have made very little progress. The morbid poison, modified in its action by its degree of acrimony, the condition of the part, and habit of body, is taken up by the absorbents, and enters the blood-vessels, whence it is received into the general circulation, and produces its peculiar effects upon the constitution. The fluids themselves are therefore necessarily first affected; and, as a consequence of their morbid condition, the solids themselves next become vitiated. Hence the multiplication of the matter of variolous contagion in inoculated small-pox; and hence, on the same principle, the generation of morbid matter from a similar action, arising from the introduction of the other specific contagions. By the introduction of a specific morbid matter into the body, its condition is changed from a healthy to a diseased state; the local is converted into a general disorder; the fluids, and ultimately the solids, become affected; and, according to the peculiar virus introduced, the whole constitution partakes in a greater or less degree of its peculiar nature, whether it be small-pox, lues venerea, measles, &c.’ The theory of Mr. Hunter, that mercury induces its salutary changes, by creating a new specific action; and that thus it destroys the specific disorder lues venerea, in conformity to the law that no two specific actions can exist at the same time, is shown by Dr. F. to be untenable and unsatisfactory, from the well-known fact, that it often happens that two specific diseases prevail simultaneously in the human constitution; as we find recorded in the cases of Pearson, Jenner, Haygarth, and others in the small-pox, and by other authors on various diseases of an acknowledged specific character.

“But the theory of Mr. Hunter is attempted to be overthrown by other facts concerning the changes induced by morbid action, for which I must refer the reader to the essay of Dr. F. (*Amer. Med. and Phil. Register*, vol. iv. p. 488—492.)

“In relation to the curative action of mercury in the treatment of lues venerea, he remarks, ‘The action of mercury, though primary on the nervous

system, is communicated to every fibre of the body, and produces a degree of restlessness, anxiety, and debility. When taken into the system, it manifests itself by a quickened circulation, gives the blood the disposition to show the buffy coat when drawn, renders the pulse frequent and harder, increases the respiration, excites the temperature of the body, occasions a whitish fur on the tongue, and other symptoms of general inflammatory action. Its effects upon the secretions are still more apparent, producing a preternatural flow of saliva, an increased action of the mucous vessels of the trachea, lungs, digestive organs, chylopoietic viscera, and whole intestinal canal. It excites a copious discharge of urine, and, in the smallest quantity, operates on the skin. In its extensive influence on the body, it produces an increased action of the absorbent vessels. These may be considered the more ordinary effects of mercury, when its action is not particularly modified by the morbid condition of the constitution. Dr. F., therefore, concludes, that, from the very general stimulant operation of mercury in promoting the excretions of the whole system, depends its curative action. We farther conclude from these views, that from those preparations of mercury which are best calculated to secure this general action, our most approved means of relief are to be drawn; and hence the corrosive sublimate and the blue pills are to be preferred as possessing this character. We are still farther strengthened in this view by observing the effects of climate on the venereal disease, and are enabled, also, better to appreciate the valuable facts furnished us by Mr. Carnichael. Accordingly, the preposterous practice of Mr. Howard, and of the older writers, who advocate profuse salivation long continued, and say that the humours ought to 'flow like a river,' will find few or no advocates in the present enlightened state of knowledge. Indeed, it seems to be well established, that where salivation is early excited by a too free use of mercury, our chances of a prompt and efficacious cure are actually lessened, and sometimes entirely cut off.

"There is another circumstance connected with the action and effects of mercury on the human constitution, which, though it does not strictly come under our consideration here, may nevertheless be mentioned. I allude to a peculiarity in the influence which a mercurial salivation produces, involving a point of interest in juridical medicine as well as in practice. It seems to be well established on practical authority, that salivation, having been arrested, after an interval of weeks, nay months, may be renewed by the slightest doses of mercury. Bromfield and Howard, of the Lock Hospital, give us facts of this sort. Mead mentions a case where the interval was six months, and Hamilton, of Edinburgh, relates a case of a like nature. In his lectures on forensic medicine, Dr. Francis informs me he has recorded two instances of a similar sort in his own practice, in which a few grains of mercury renewed a salivation which had been suspended for several weeks in one case, and in the other for more than four months. The inference to be deduced from occurrences of this nature renders it necessary for us always to institute the inquiry, whether the patient about to submit to mercury for the cure of venereal disorder has or has not been previously under the operation of

salivation, lest pyalism unexpectedly occur, and thus protract or defeat our curative indications. The action of mercury, to prove satisfactory in syphilis, ought to be directed on a constitution properly prepared for the purpose; the powers of the system often require to be renovated by tonics before we commence with this active agent. Hence we shall find that bark or other tonics will often be indicated before commencing with minerals in constitutions impaired by intemperance and other causes. Dr. F. informs me, that in some instances he has given, as a suitable preparative, charcoal or quinine, especially in cases of long protracted syphilis, where mercury had been previously mal-administered.

"The muriate of gold has not been attended with that success in the treatment of syphilis in this country, which might have been expected from the reports of its efficacy abroad. In my own practice in Baltimore, and in this city, it has proved inefficient; and, in those cases where scrofula was combined with lues, I was compelled wholly to abandon the gold, and administer the corrosive sublimate, occasionally conjoined with cicuta. The learned Dr. Mitchell, however, affirms, of the practice of the New York Hospital, in which institution he introduced the method of Chrestein in 1811, that that article was capable of affecting salutary results. 'Without presuming to affirm,' says he, in his letter to Dr. Dyckman (*Edin. Dispensatory*, Amer. ed. of 1818), 'that it is capable of eradicating the distemper in every instance, my opinion upon the whole is, that the muriate of gold will effect all that is achieved by muriate of quicksilver.' Still more recently, Neil has endeavoured to substantiate the claims of auriferous preparations as adequate to the cure of venereal diseases; and this author of 1823 is almost as enthusiastic in his praises of gold, as an anti-venereal remedy, as was Salmon of 1699, when he pronounced it capable of radically driving all noxious humours and matters out of the human body, elephantiasis, and the French pox, because it purified the blood, and *strengthened the marrow of the bones*. I feel assured, however, in the testimony of American physicians and surgeons was impartially examined into, that their decision would coincide with that of the Academy of Paris, who, with the venerable Percy at their head, have reported unfavourably on the subject, and declared the remedial powers of this favourite remedy with some to be exaggerated and equivocal.—(See farther, *American Med. Rev.* vol. i. article by Dr. Eberle.) For a detail of experiments with the muriate of platinum in syphilis, by Collerier, I must refer to the *Dict. des Sciences Méd.* art. *Platine*, 1820. I am not aware that this article has ever been used by American physicians.

"Our author has made reference to the excellent paper of the late Mr. Hey, in the *Medico-Chirurg. Trans. of London*, vol. vii. That paper is a valuable contribution to our stock of knowledge on venereal diseases. Mr. Hey is one of the eminent authorities who support the opinion, that the venereal disorder is capable of affecting the foetus in utero; nor do the discussions of Mr. John Pearson lessen our confidence in what the venerable Hey has advanced.—(See *Pearson's Life of Hey*.) That cases of this kind occasionally occur under the observation of the medical practitioners, cannot be denied: I have repeatedly seen the disease thus

imparted. Mahon seems to have given no proofs sufficient on this head: several cases of this nature are also furnished us by Professor Hosack in his *Medical Essays*, vol. ii.; and I might also set forth in some detail those given by Professor Francis in his revised edition of Dr. Denman's *Midwifery*. 'I have had under my own care,' says Dr. F., 'six cases of the venereal disease communicated to the fœtus in utero; two of these cases occurred where the genital system appeared in a perfectly sound state; in another there were ulcers of the labia, and constitutional disease. In two the disease was apparent immediately after birth, and in one four months had elapsed before the disease manifested itself distinctly.' Cases, thus contracted, are doubtless best treated by the internal use of the corrosive sublimate, and to the newly-born infant we can most conveniently give the solution. See also Dyckman, *On the Pathology of the Human Fluids*, who contends that an infected nurse by lactation may communicate lues venerea. 'A valuable paper embracing cases illustrative of the use of mercury in venereal complaints, by Dr. Darach, has recently appeared in the *North American Med. and Surgical Journ.* vol. vii.' (Reese.)

J. de Vigo, De Arte Chirurgica, fol. Lugd. 1518. *N. Montesaurus*, Del Dispositioibus, quas vulgo Mal Franzos appellant, in 1536, auctori 1563. *Nic. I. conerius*, Liber de Epidemia quæ Itali Morbum Gallicum, Galli vero Neapolitanum vocant, fol. Pavie, 1506. *Gabr. Fallopius*, De Morbo Gallico, 4to. Patav. 1653. *Nir. de Blegny*, Zodiacus Medicæ Gallicæ, 4to. Genevæ, 1680. *Hieron. Fracastorius*, Syphilis Poema; et Tractatus de Syphilide, Voronæ, 1530. Also, De Contagione et Contagiosis Morbis. Venet. 1546. *Cass. Torrella*, Tractatus cum Consiliis contra Pudentiam. Romæ, 1497. Also, Dialogus de Dolore et de Ulceribus in Pudentia. Romæ, 1500. *Ant. Francantianus*, De Morbo Gallico, 8vo. Pavæ, 1563. *Jul. Palmarius*, De Morbis Contagiosis, 4to. Paris, 1578. *Gul. Rondelietus*, De Morbo Gallico, 1576. *J. Ferrelinus*, Universa Medicina, 4to. Venet. 1564. p. 584. 593, &c. *Ulrich von Hutten*, De Morbo Gallico, Mogunt. 1531. *R. Rostanus*, Trattato di Mal. Francese, 12mo. Venet. 1536. *Al. Lussinus*, Aphrodisiacus. Venet. 1556, & in 2 tom. fol. Lugd. Bat. 1725: one of the most valuable collections of the Works of ancient writers on Syphilis. *Diniz de Isla*, Tratado contra las Bhasas, 1527. *Wm. Clowes*, A new and approved Treatise, concerning the Cure of the French Pox, by the Unctions, 8vo. Lond. 1575: said to be the earliest English book on Syphilis. *J. Astruc*, De Morbis Venericis. Lutet. Paris, 1740. *L. Camæus*, Descriptio sur la Pèvre Jaune, chap. 4. *Leo Africanus*, Descriptio Africæ, l. i. p. 86. The last two authors mention the fact of the Venereal Disease getting well spontaneously in hot climates. *Dan. Abercrombly*, Luta ex officio Lues Venerea, sæpe absque Mercurio, ac semper absque Salivatione Mercuriali, Curande Medicis, Lond. 12mo. 1684. *J. Sincleur*, The Scourge of Venus and Mercury, represented in a Treatise on the Venereal Disease, giving a succinct Account of that dreadful Distemper, and the fatal Consequences arising from Mercurial and the fatal Consequences arising from Mercurial Cures, &c., with the true Way of curing the Mercurial Pox, found to be more dangerous than Pox itself. Lond. 1709. *Morgagni*, De Sedibus, &c. Morborum. *Jean Douglas*, Dissertation on the Venereal Disease, wherein a Method of curing all the Stages of that Distemper will be communicated, without the Help of any Mercurial Drenches, Vomits, or Fumigations, &c., and, above all, a Salivation in all Cases will be avoided, 8vo. Lond. 1737. *Lindoff*, Demonstratio, quod atrocissima Lues Venerea Symptomata non sint Alitius Morbi, sed Cura Mercurialibus Instituta. Brf. 1747. *C. Willoughby*, The Practice of Salivation shown to be of no Use. Lond. 1723. *J. Proffly*, An Easy and Exact Method of Curing the Venereal Disease, &c.; to which are added, Experiments publicly made of an effectual Method of Cures without Salivation or Confinement, 8vo. Lond. 1748. *Wm. Bromfield*, Account of the English Night-Shade, &c. and Osberg, on the Use of Corrosive Sublimato, and Sparilla, and Mercury. Also of the Cure by the decoction of Urine. 8vo. Lond. 1759. *N. de Jansen*, Traité des Maladies Vénériennes, considéré par

Rapport aux différentes Manières de les traiter; avec une nouvelle Méthode de les guérir, exempté de Salivation, &c. 8vo. Paris, 1745. *Amst. 1738.* *J. Gronow*, A Treatise for the Service of Chemistry, &c.; and Considerations on the Lues Venerea, with its Cure without Mercury, 4to. Lond. 1766. *Astruc*, Traité des Tumeurs et des Ulcères, et sur la Nature des Nouveaux Remèdes Antivénériens, 2 tom. 12mo. Paris, 1759. *Gataker*, On Venereal Complaints, 1754. *C. Hales*, Salivation not necessary for the Cure of Venereal Diseases, 8vo. Lond. 1764 and 1772. *Dan. Turner*, Aphrodisiacus, containing a Summary of the Ancient Writers on the Venereal Disease, 8vo. Lond. 1738. *Wm. Becker*, History and Antiquity of the Venereal Disease. Lond. 1740. *Fordyce*, On the Venereal Disease, 1777. *Plencé*, Doctrina de Morbis Venericis. Vienne, 1779. *Chr. Goldfr. Gruber*, Aphrodisiacus, sive de Lue Venerea, in duas Partes divisus; quarum una continet ejus vestigia in veterum auctororum monumentis obvia; altera, quos Aloysius Lussinus tamen enisist scriptores, fol. Jenæ, 1789. Also, Programmatum Specimen, Scripturum de Morbo Gallico, Jenæ, 1779, &c. *J. Arneemann*, De Morbo Venereo Analectæ ex Manuscriptis Musæi Britannici Londinensis, Goët. 1789. *M. Gautier Dagoty*, Exposition Anatomique des Maux Vénériens, fol. Paris, 1773. *Christ. Girtanner*, Abhandlung über die Venerische Krankheit, 8vo. Gitt. 1788. *H. Clutterbuck*, On some of the Opinions of the late John Hunter, &c. 8vo. Lond. 1799. *S. Chapman*, A Treatise on the Venereal Disease, being chiefly designed as an Abridgement of Dr. Astruc's work, 2d ed.; to which are added, the Improvements, with regard to the Use of Sarsaparilla, Mazerion, and Sublimato; as also an Account of Plencé's Method of Cure, 8vo. Lond. 1770. *W. Dease*, On the different Methods of treating the Venereal Disease, 8vo. Dublin, 1783. *P. Clark*, A New Method of curing Lues Venerea by the Introduction of Mercury through the Orifices of the Absorbent Vessels on the Inside of the Mouth, 3d ed. Lond. 1780. *Jesse Foote*, Obs. on the New Opinions of John Hunter, 8vo. Lond. 1780-87; also, Complete Treatise on the Venereal Disease, 8vo. Lond. *C. B. Trye*, A Review of Jesse Foote's Obs. on the New Opinions of Hunter, 8vo. Lond. 1787. *B. Bell*, Treatise on Gonorrhœa Virulenta, and Lues Venerea, ed. 3. *Lafouette*, Nouvelle Méthode de traiter les Maladies Vénériennes par la Fumigation, &c. Paris, 1776. *John Hunter*, A Treatise on the Venereal Disease, ed. 2d; also with Dr. Adams's Commentary; or Palmer's ed. with notes by Babington. *S. Sauney*, An Inquiry into some of the Effects of the Venereal Poison, 8vo. Lond. 1802. *Jos. Adams*, On Morbid Poisons, ed. 2. *J. Pearson*, On the Effects of various Articles in the Cure of Lues Venerea, ed. 2. 8vo. Lond. 1797. *J. Abernethy*, On Diseases resembling Syphilis, in Surgical Obs. 8vo. Lond. 1804. *P. A. O. Mahon*, Recherches sur la Maladie Syphilitique, 1801. *P. H. Martens et Alstus*, Tableaux des Symptômes de la Maladie Vénérienne, dessinés d'après Nature, 4to. Leipz. 1801. *P. Siechenau*, Traité Complet sur les Symptômes chez les Femmes enceintes, les Enfants nouveaux-nés, &c. des Maladies Syphilitiques, 2 tomes, 7me ed. Paris, 1801. *Ferguson*, Obs. on the Venereal Disease in Portugal, as affecting the Constitutions of the British Soldiers and Natives, in Med. Chir. Trans., vol. iv. *Wm. Hey*, On the Effects of the Venereal Disease on the Fœtus in Utero, Op. cit. vol. vii. p. 511, &c. *Wm. Blair*, Essay on the Venereal Disease, and the Effects of Nitrous Acid, and other analogous Remedies, lately proposed as Substitutes for Mercury, 8vo. Lond. 1808. *T. Rostanus*, A Collection of Testimonies respecting the Treatment of the Venereal Disease by Nitrous Acid, 8vo. Lond. 1799. *Allyn*, Essai sur les Propriétés Médicinales de l'Oxygène, et sur l'Application de ce Principe dans les Maladies Vénériennes, &c. 8vo. Paris, an 7. *C. Platt*, An Inquiry into the Efficacy of Oxygen in the Cure of Syphilis, 8vo. Lond. 1802. *Bertholin*, Traité de la Maladie Vénérienne chez les Enfants nouveaux-nés, les Femmes enceintes, et les Nourrices, &c. 8vo. Paris, 1810. *G. Recz*, On the Primary Symptoms of Lues Venerea; with a concise, critical, and chronological Account of all the English Writers on this Subject, 8vo. Lond. 1802. *J. Rollo*, Cases of Diabetes, with the Results of the Trials of certain Acids, and other Substances, 8vo. Lond. 1806. *Lagnave*, Exposé des Symptômes de la Maladie Vénérienne, 4mo ed. 8vo. Paris, 1816. *Balcanova's* Synopsis, ed. 5. *H. Scott*, On the internal and external Use of the Nitro-muriatic Acid, in Med. Chir. Trans., vol. viii. p. 173; also, in Journ. of Science and the Arts, vol. i. p. 205, &c. *Schweigger*, On the Cure of Syphilis by Abstinence, vid. *Dugland* and *Haile's Journ.* *R. Carmichael*, On the Venereal Diseases, which have been confounded with Syphilis, &c. 4to. 1814; also, Obs. on the Symptoms and specific Distinctions of Venereal Diseases, &c. 8vo. Lond. 1818; and an Essay on Venereal Diseases, and the Uses and Abuses of Mercury, ed. 2. Lond. 1825. *T. Rose*, Obs. on the Treatment of Syphilis, with an Ac-

count of several Cases, in which a Cure was effected, without the use of Mercury, in Med. Chir. Trans. vol. viii. G. J. Guthrie, On the Treatment of the Venereal Disease, without Mercury, vol. cit. A. Mathias, The Mercurial Disease, ed. 3. 8vo. Lond. 1816. J. Thomson and J. Hennen, in Edin. Med. and Surgical Journ. vol. xiv.; also, J. Hennen, in Principles of Military Surgery, edit. 2. 8vo. Edin. 1820. J. Bucot, Obs. on Syphilis, principally with reference to the Use of Mercury, 8vo. Lond. 1821; and Essays on Syphilis, in Med. Gazette, vol. ii. 8vo. Lond. 1828. James Evans, On Ulcerations of the Genital Organs, 8vo. Lond. 1819. F. G. Sarfass, De Methodis atque Medicamentis Antisyphiliticis, 4to. Berol. 1816. Anonym. Sur la Non-existence de la Maladie Vénérienne, &c. 8vo. Paris, 1811. Despech, Chir. Clinique, t. i. 4to. 1823. R. Welbank, in Med. Chir. Trans. vol. xiii. 8vo. Lond. 1827. Dr. N. Barbantini, Del Contagio Venereo Trattato, vol. iv. 8vo. Lucca, 1820-1821. Professor Barbantini was so kind as to send me a copy of this work, which abounds in valuable information. J. M. Tilley, On Dis. of the Genitals, &c. 1829. Benjamin Travers, On the Pathology of the Venereal Disease, 8vo. Lond. 1830. Wm. Wallace, On the Ven. Disease, 8vo. 1833. Abraham Colles, M. D., On the Ven. Disease, 8vo. Lond. 1837. Ph. Ricord, Traité Pratique des Maladies Vén. 8vo. Paris, 1838. Richard Carmichael, Obs. on Dr. Colles's Work, in Dubl. Journ. of Med. Science, vol. xii. art. 3. Hugh Carmichael, On the Efficacy of Pressure in certain Cases of Venereal Phagedenic Ulceration, Op. cit. vol. xiv. art. 1. H. M. J. Desruelles, Mém. sur le Traitement sans Mercure, &c. 8vo. Paris, 1827.

VENESECTIONS. (PHLEBOTOMY.) The mode of bleeding, most frequently practised, is that of opening a vein; and it may be done in the arm, ankle, jugular vein, frontal vein, veins under the tongue, on the back of the hand, &c. In whatever part, however, venesection is performed, it is always necessary to compress the vein, between the place where the puncture is made and the heart. Thus the return of blood through the vein is stopped, the vessel swells, becomes conspicuous, and, when opened, bleeds much more freely than would otherwise happen. Hence, according to the situation of the part of the body where the vein is to be opened, with regard to the heart, the bandage, or other means for making the necessary pressure, must be applied, either above or below the puncture.

All the apparatus essential for blood-letting, on the part of the patient, is a bandage or fillet, two or more small pieces of folded linen for compresses, a basin to receive the blood, and a little clean water and a towel. The bandage ought to be about a yard in length, and about an inch and a half broad, a common riband or garter being frequently employed. The compresses are made by doubling a bit of linen rag, about two inches square. On the part of the surgeon, it is necessary to have a good lancet, of proper shape. He should never bleed with lancets, with which he has been in the habit of opening any kind of abscesses, as very troublesome complaints have been the consequence of doing so. The shape of the instrument is also a matter of some importance. If its shoulders are too broad, it will not readily enter the vein, and when it does enter, it invariably makes a large opening, which is not always desirable. If the lancet be too spear-pointed, an incautious operator would often run the risk of transfixing the vein, and wounding the artery beneath it. More, however, certainly depends on the mode of introducing the lancet than on its shape.

In blood-letting, the patient may lie down, sit down, or stand up, each of which positions may be chosen according to circumstances. If the patient be likely to faint from the loss of a small quantity of blood, and such fainting can answer no surgical purpose, it is best to bleed him in the recumbent

posture. But when the person is strong and vigorous, there is little occasion for this precaution, and a sitting posture is to be preferred, as the most convenient both for the surgeon and patient. This, indeed, is the common position. In some cases, however, particularly those of strangulated hernia, it is frequently an object to produce fainting, in order that the bowels may be more easily reduced. In this circumstance, the patient may be bled in an erect posture, and the wound made large, as a sudden evacuation of blood is particularly apt to bring on the wished-for swoon. For the same reason, if we wish to avoid making the patient faint, we should then make only a small puncture.

Every operator should be able to use the lancet with either hand, and thus bleed the patient in the right or left arm, as circumstances may render most eligible.

At the bend of the arm there are several veins in which a puncture may be made, viz. the basilic, cephalic, median basilic, and median cephalic. The median basilic vein, being usually the largest and most conspicuous, is that in which the operation is sometimes performed; but surgeons should never forget that it is under this vessel that the brachial artery runs, with the mere intervention of the aponeurosis sent off from the tendon of the biceps muscle. In very thin persons, indeed, the median basilic vein lies almost close to the artery, and nothing is then more easy than to transfix the first of these vessels and wound the last. Hecco Richerand advises all beginners to prefer opening the median cephalic, or even the trunk of the cephalic itself, to puncturing the median basilic, which last are internally situated, and nearer the brachial artery. (Nosogr. Chir. t. iii. p. 38. ed. 2.) Dupuytren also objected to puncture being made in the median basilic vein.

In fat subjects, the large veins at the bend of the arm are sometimes totally imperceptible, notwithstanding the fillet is tightly applied, the limb is put in warm water, and every thing done to make those vessels as turgid as possible. In this circumstance, if the surgeon has not had much experience in the practice of venesection, he will do well to be content with opening one of the veins of the back of the hand, after putting the member for some time in warm water, and applying a ligature round the wrist. In children, a sufficient quantity of blood cannot always be obtained by venesection; and, in this event, the free application of leeches, and, occasionally, the puncture of the temporal artery, are the only effectual methods.

With respect to the choice of a vein in the arm, the most experienced operators give the preference to one which rolls least under the skin. Such a vessel, though sometimes less superficial than another, may commonly be opened with greater facility. The surgeon, however, is always to fix the vein as much as he can, by placing the thumb of his left hand a little below the place where he intends to introduce the lancet.

In bleeding in the arm, the fillet is to be tied round the limb, a little above the elbow, with sufficient tightness to intercept the passage of the blood through all the superficial veins; but never so as to stop the flow of blood through the arteries, which would tend to prevent the veins from rising at all. The veins being thus ren-

dered turgid, the surgeon must choose the one which seems most conveniently situated for being opened, and large enough to furnish as much blood as it may be proper to take away.

Before applying the fillet round the arm, however, the operator should always feel where the pulsation of the artery is situated, and, if equally convenient, he should not open the vein immediately over this part. It is also prudent to examine where a pulsation is situated, on account of the occasional varieties in the distribution of the arteries of the arm. The ulnar artery is sometimes given off from the brachial very high up, and, in this case, it frequently proceeds superficially over the muscles, which arise from the internal condyle, instead of diving under them, in the ordinary manner.

When the external jugular vein is to be opened, the surgeon generally makes the necessary pressure with his thumb. The orifice should be made in the direction of the fibres of the platysma myoides muscle; and the vein is not so apt to glide out of the way when the surgeon makes the puncture just where it lies over a part of the sterno-cleido-mastoides muscle.

When blood is to be taken from the foot, the ligature is commonly applied a little above the ankle.

The fillet having been put on the arm, the operator is to take the blade of the lancet, bent to a somewhat acute angle, between the thumb and forefinger, and, steadying his hand upon the other three fingers, he is to introduce the lancet, in an oblique direction, into the vessel, till the blood rises up at the point of the instrument. Then bringing up the front edge in as straight a line as possible, the wound in the skin will be made of just the same size as that in the vein. The operator next takes away the thumb of his left hand, with which he steadied the vessel, and allows the blood to escape freely, till the desired quantity is obtained. The arm ought to be kept in the same position while the blood is escaping, lest the skin should slip over the orifice of the vein, keep the blood from getting out, and make it insinuate itself into the cellular tissue.

When the blood does not issue freely, most surgeons direct the patient to move his fingers, or turn something round and round in his hand. This puts the muscles of the arm into action, and the pressure which they then make on the vein makes the blood circulate more briskly through these vessels.

The proper quantity of blood being discharged, the fillet is to be untied. The flow of blood now generally ceases; though sometimes, when the orifice is large, and the circulation vigorous, it still continues. In this circumstance, the operator may immediately stop the bleeding, by placing the thumb of his left hand firmly on the vessel, a little below the puncture.

The blood is next to be all washed off the arm, the sides of the wound placed in contact, and a small compress of linen applied, and secured with the fillet, put round the elbow in the form of the figure 8, and regularly crossing just over the compress.

The patient should be advised not to move his arm much till the fillet is removed, which may be taken away in about twenty-four hours.

In order to open the external jugular vein, the

patient's head is to be laid on one side, and properly supported. Then the operator is to press upon the lower part of the vein with his thumb, so as to make the part above it swell, and the lancet is to be pushed at once into the vessel, with the cautions already stated.

There is commonly no difficulty in stopping the bleeding, after the pressure is removed. Some practitioners divide the integuments with a scalpel, before the vein itself is opened; but this is quite unnecessary. In this country, the fashion of opening the jugular vein has considerably declined. In fact, the operation is more troublesome, and less certain of succeeding, than venesection in the arm; while the principle which recommended the practice to the old surgeons, namely, that of more effectually discharging, in this manner, blood from the sinuses of the brain, is erroneous; for it is only the external jugular vein that can be safely opened, and this does not receive the blood from the interior of the head.

Now that the danger of air insinuating itself into the large veins of the neck, is so generally known (see VEINS), it appears to me, that the operation of bleeding in the external jugular vein is likely to become still less fashionable than it is, and that care should always be taken to keep up the pressure, until the compress has been securely fixed over the puncture.

Blood-letting in the feet is executed the same principle as in other parts; but, as the blood from the vein in this situation generally does not flow with much celerity, it is customary to immerse the feet in warm water to promote the bleeding.

In orchitis, or acute inflammation of the testis, a beneficial discharge of blood may often be obtained from the veins of the scrotum. The recollection of this fact may be useful, particularly when leeches are not at hand, and the surgeon has no cupping instruments, by which the blood can be drawn from the loins.

III. CONSEQUENCES SOMETIMES FOLLOWING BLEEDING IN THE ARM.

1. *Echymosis.*

The most common is the thrombus, or echymosis, a small tumour around the orifice, and occasioned by the blood insinuating itself into the adjoining cellular substance at the time when it is flowing out of the vessel. Changing the posture of the arm will frequently hinder the thrombus from increasing in size, so as to obstruct the evacuation of the blood. But, in some instances, the tumour suddenly becomes so large that it entirely interrupts the operation, and prevents it from being finished. In these cases, however, the most effectual method of preventing the tumour from becoming still larger is to remove the bandage. By allowing the bandage to remain, a very considerable swelling may be induced, and such as might be attended with great trouble. If more blood be required to be taken away, it ought to be drawn from another vein, and, what is still better, from a vein in the other arm.

The best applications for promoting the absorption of these tumours, are those containing spirit, vinegar, or the muriate of ammonia. Compresses wetted with any lotion of this sort may be advantageously put on the swelling and confined there with a slack bandage.

2. *Inflammation of the Integuments and subjacent Cellular Tissue.*

Inflammation and suppuration of the cellular substance in which the vein lies are frequent occurrences. On the subsidence of this inflammation, the tube of the vein is free from induration. Sometimes the inflammation is rather indolent, producing a circumscribed and slowly suppurating tumour. Sometimes it is more diffused, and partakes of the erysipelatous nature. On other occasions it is phlegmonous.

When the lancet has been bad, so as rather to have lacerated than cut the parts, when the constitution is irritable, and especially when care is not taken to unite the edges of the puncture, and the arm is allowed to move about, so as to make the two sides of the wound rub against each other, inflammation will most probably ensue. The treatment of this case consists in keeping the arm perfectly at rest in a sling, applying leeches and the saturnine lotion, and giving one or two mild saline purges. If suppuration take place, a small poultice is the best application.

3. *Absorbents inflamed.*

Sometimes, particularly when the arm is not kept properly quiet after bleeding, swellings make their appearance about the middle of the arm, over the large vessels, and on the forearm, about the mid-space between the elbow and wrist, in the integuments covering the flexor muscles. The swelling at the inner edge of the biceps is sometimes as large as an egg. Before such swellings take place, the wound in the vein often inflames, becomes painful, and suppurates, but without any perceptible induration of the venal tube, either at this time, or after the subsidence of the inflammation. Pain is felt shooting from the orifice in the vein, in lines up and down the arm, and upon pressing in the course of this pain, its degree is increased. On examining the arm attentively, indurated absorbents may be plainly felt, leading to the tumour at the side of the biceps muscle.

The pain and swelling often extend to the axilla, where the glands also sometimes enlarge. Cord-like substances, evidently absorbents, may sometimes be felt, not only leading from the puncture to the swelling in the middle of the arm, but also from this latter situation up to the axillary glands, and from the wound in the vein down to the enlarged glands at the mid-space between the elbow and wrist, over the flexor muscles of the hand.

The enlarged glands often proceed to suppuration, and the patient suffers febrile symptoms. It may be suspected that the foregoing consequences arise from the lancet being envenomed, and from the absorption of the virulent matter; but the frequent descent of the disease to the inferior absorbents militates against this supposition.

When the absorbents become inflamed, they quickly communicate the affection to the surrounding cellular substance. These vessels, when indurated, appear like small cords, perhaps of one eighth of an inch in diameter: this substance cannot be the slender sides of the vessels, suddenly increased in bulk, but an induration of the surrounding cellular substance.

The inflammation of the absorbents, in consequence of local injury, is deducible from two causes: one, the absorption of irritating matter;

and the other, the effect of the mere irritation of the divided tube. When virulent matter is taken up by the absorbents, it is generally conveyed to the next absorbent gland, where its progress being retarded, its stimulating qualities give rise to inflammation, though frequently, no evident disease of the vessel through which it has passed can be distinguished.

When inflammation of the absorbents happens, in consequence of irritation, the part of the vessel nearest the irritating cause generally suffers most, while the glands, being remotely situated, are not so much inflamed.

The treatment of the preceding case consists in keeping the arm perfectly quiet in a sling, dressing the puncture of the vein with any mild simple salve, covering the situation of the inflamed lymphatics with linen wet with the saturnine lotion, and giving calomel and saline purgative medicines.

When the glandular swellings suppurate, poultices should be applied; and if the matter does not soon spontaneously make its way outwards, the surgeon should open the abscess. (See *Abernethy's Essay on this subject.*)

4. *Inflammation of the Vein.*

When the wound does not unite, the vein itself may inflame. This affection will vary in its degree, extent, and progress. One degree of inflammation may only cause a slight thickening of the venous tube, and an adhesion of its sides. Abscesses, more or less extensive, may result from an inflammation of greater violence; and the matter may sometimes become blended with the circulating blood, and produce dangerous consequences, or the matter may be quite circumscribed, and make its way to the surface. If, however, the inflammation should fortunately produce an adhesion of the sides of the vein to each other at some little distance from the wounded part, this adhesion will form a boundary to the inflammation, and prevent the entrance of pus into the circulation. The effect of the adhesive inflammation, in preventing the extension of inflammation along membranous surfaces, was originally explained by Mr. Hunter. In one case, Mr. Hunter applied a compress to the inflamed vein above the wounded part, and he thought that he had thus succeeded in producing an adhesion, as the inflammation was prevented from spreading further. When the inflammation does not continue equally in both directions, but descends along the course of the vein, its extension in the other direction is probably prevented by the adhesion of the sides of the vein to each other. (See *Obs. on the Inflammation of the Internal Coats of Veins, in Trans. of a Soc. for the Improvement of Med. and Chir. Knowledge*, vol. i. p. 18, &c.) More information on this subject will be found under the head of *VEINS*.

Mr. Abernethy had seen only three cases, in which an inflammation of the vein succeeded venesection. In neither of these did the vein suppurate. In one, about three inches of the venous tube inflamed, both above and below the puncture. The integuments over the vessel were very much swollen, red, and painful, and there was a good deal of fever, with a rapid pulse and furred tongue. The vein did not swell when compressed above the diseased part. In another instance, the inflammation of the vein did not extend towards the heart, but only downwards, in which direction it passed as far as the wrist.

The treatment is to lessen the inflammation of the vein by the same means which other inflammations require, and to keep the affection from spreading along the membranous lining of the vessel towards the heart, by placing a compress over the vein a little way above the puncture, so as to make the opposite sides of the vessel adhere together.

Mr. Abernethy conceives a case possible, in which the vein may even suppurate, and a total division of the vessel be proper, not merely to obviate the extension of the local disease, but to prevent the pus from becoming mixed with the circulation. Were such a proceeding deemed right, I think that Sir B. Brodie's method of cutting the vessel would be best. However, I have never heard of any case in which the practice has been adopted. As for the scheme of tying the vein above the diseased part of it, the severe effects frequently following this method must, as Mr. Dunn has reminded me, render it less eligible than an incision. In the case of an inflamed vein, Dr. Chapman states that nothing is so efficacious as blisters; a practice said to have been first suggested by Dr. Physick. (See *A fatal Case of Inflammation of the Vein from Venesection*, in *Philadelphia Journ.* Feb. 1824.) Some time ago, I was favoured by Mr. Howship with a view of the state of the parts in a case, where a lady had died, after an inflammation of the vein of the arm, brought on by venesection: they were considerably thickened, and in some places quite solid and impervious. (See the subject of *Phlebitis*, in the article *VEINS*.)

5. Inflammation of the Fascia of the Forearm, or diffuse Inflammation of the Cellular Membrane.

Sometimes, in consequence of the inflammation arising from the wound of the lancet in bleeding, the arm becomes very painful, and can hardly be moved. The puncture often remains unhealed, but without much inflammation of the surrounding integuments. The forearm and fingers cannot be extended without great pain. The integuments are sometimes affected with a kind of erysipelas; being not very painful when slightly touched; but when forcibly compressed, so as to affect the inferior parts, the patient suffers a good deal. The pain frequently extends towards the axilla and acromion; no swelling, however, being perceptible in either direction. These symptoms are attended with considerable fever. After about a week, a small superficial collection of matter sometimes takes place a little below the internal condyle: this being opened, a trivial quantity of pus is discharged, and there is scarcely any diminution of the swelling or pain. Perhaps, after a few days more, a fluctuation of matter is distinguished below the external condyle; and this abscess being opened, a great deal of matter gushes from the wound, the swelling subsides, and the patient's future sufferings are comparatively trivial.

The last opening, however, is often inadequate to the complete discharge of the matter, which is sometimes originally formed beneath the fascia, in the course of the ulna; and its pointing at the upper part of the arm depends on the thinness of the fascia in this situation. The collection of pus descends under the lower part of the detached fascia, and a depending opening for its discharge becomes necessary. This being made, the patient soon gets well.

In these cases the vein is not inflamed; but sometimes the glands of the armpit and just above the elbow swell. The integuments are not much affected, and the patient complains of a tightness of the forearm. Matter does not always form, and the pliability of the arm after a good while gradually returns again.

Mr. Watson relates a case which was followed by a permanent contraction of the forearm. Mr. Abernethy was of opinion, that a similar contraction of the forearm, from a tense state of the fascia, may be relieved by detaching the fascia from the tendon of the biceps, to which it is naturally connected. Mr. Watson seems to have obtained success in his first case by having cut this connexion.

In the treatment of an inflammation of the fascia, or of an extensive quantity of the cellular membrane, in consequence of venesection, general means for the cure of inflammation should be employed, especially numerous leeches, cupping, purgatives, &c. The limb should be kept quiet, and the inflamed part relaxed. As soon as the inflammation abates, the extension of the forearm and fingers ought to be attempted and daily performed, to obviate the contraction which might otherwise ensue.

Sir C. Bell objects to calling the affection an inflammation of the fascia, because he sees no proof of this part being inflamed; and he conceives that the symptoms proceed from the inflammation spreading in the cellular membrane and passing down among the muscles and under the fascia. On this point I believe him to be quite correct, and that the disorder partakes of the character of diffuse inflammation of the cellular membrane so well described by Dr. Duncan. (See *Edinb. Med. Chir. Trans.* vol. i.) To this subject, however, I adverted in the article *ERYSIPELAS*. The fascia acts as a bandage, and from the swelling of the parts beneath it binds the arm, but is not itself inflamed and contracted. When necessary to divide the fascia, Sir Charles Bell thinks it would be better to begin an incision near the inner condyle of the humerus, and to continue it some inches down the arm, rather than perform the nice operation of cutting the fascia at the point where the expansion goes off from the round tendon of the biceps.

When the elbow-joint and forearm continue stiff after all inflammation is over, Sir C. Bell recommends frictions with camphorated mercurial ointment, &c., and the arm to be gradually brought into an extended state by placing a splint on the forepart of the limb. (*Operative Surgery*, vol. i. p. 65.)

* 6. Ill Consequences of a Wounded Nerve.

Mr. Pott used to mention two cases, in which the patients suffered distracting pains, followed by convulsions and other symptoms, which could only be ascribed to nervous irritation, arising from a partial division of the nerve, and he recommended its total division, as a probable remedy. Dr. Monro related similar cases, in which such treatment proved successful.

Hence, it is highly necessary to know the characteristic symptoms of the case, particularly, as all the foregoing cases would be exasperated by the treatment just now alluded to. It is to Mr. Abernethy that we are indebted for several valuable remarks elucidating this subject. He informs us, that the two cutaneous nerves are those which are exposed to injury. Most frequently all their

branches pass beneath the veins at the bend of the arm; but sometimes, although the chief rami go beneath these vessels, many small filaments are detached over them, which it is impossible to avoid wounding in phlebotomy.

Mr. Abernethy thinks the situation of the median nerve renders any injury of it very unlikely. If, however, a doubt should be entertained on this subject, an attention to symptoms will soon dispel it. When a nerve is irritated at any part between its origin and termination, a sensation is felt as if some injury were done to the parts which it supplies. If, therefore, the cutaneous nerves were injured, the integuments of the forearm would seem to suffer pain; if the median nerve, the thumb and next two fingers would be painfully affected.

The extraordinary pain sometimes experienced in bleeding, may denote that a cutaneous nerve is injured. The situation of the nervous branches is such, that they must often be partially wounded in the operation, though they probably unite again, in almost all cases, without any ill consequences. Yet, says Mr. Abernethy, it is possible that an inflammation of the nerve may accidentally ensue, which would be aggravated if the nerve were kept tense, after its partial division. The disorder, he thinks, arises from inflammation of the nerve in common with the other wounded parts. This gentleman supposes, that an inflamed nerve would be very likely to communicate dreadful irritation to the sensorium, and that a cure would be likely to arise from intercepting its communication with that organ.

The general opinion is, that the nerve is only partially divided, and that a complete division would bring relief. Mr. Pott proposed enlarging the original orifice. It is possible, however, that the injured nerve may be under the vein, and if the nerve be inflamed, even a total division of it at the affected part would perhaps fail in relieving the general nervous irritation, which the disease has occasioned. To intercept the communication of the inflamed nerve with the sensorium, however, promises perfect relief. This object can only be accomplished by making a transverse incision above the orifice of the vein. The incision need not be large, for the injured nerve must lie within the limits of the original orifice, and it need only descend as low as the fascia of the forearm, above which all the filaments of the cutaneous nerves are situated. As the extent of the inflammation of the nerve is uncertain, Mr. Abernethy suggests even making a division of the cutaneous nerve still farther from the wound made in bleeding. Perhaps, this surgeon dwells too much on inflammation of the nerve. I have seen neuralgic affections of the arm brought on by venesection, where the pain had endured for years. Surely inflammation was in such cases not concerned.

Examples are recorded in which not only extraordinary pain was occasioned by the prick of the lancet, but erysipelas ending in gangrene of the whole limb, and the death of the patient. (*Richerand, Nosogr. Chir. t. ii. p. 390, ed. 2.*) A case in which the greater part of the integuments of the arm had been destroyed by erysipelas thus produced, I once saw under the care of Mr. Vincent, in St. Bartholomew's Hospital.

In former times, it was customary to refer many of the bad symptoms occasionally following venesection to a puncture of the tendon of the biceps;

but this doctrine is now in a great measure renounced, the experiments of Haller having completely proved that tendons and aponeuroses are, comparatively speaking, parts endued with little or no sensibility.

See *R. Butler's Essay concerning Blood-letting, &c. 8vo. Lond. 1734.* *M. Martin, Traité de la Phlébotomie et de l'Artériotomie, 8vo. Paris, 1741.* *Quercus, Traité des Effets et de l'Usage de la Saignée, 12mo. Paris. G. Vieussac, De la Saignée, et de son Usage dans la Plupart des Maladies, 8vo. Paris, 1815.* *J. J. Walbaum, De Venesectione, Gott. 1749.* (*Haller, Disp. Chir. t. v. p. 477.*) *R. Bell's System of Surgery, Essay on the ill Consequences sometimes following Venesection, by J. Abernethy. R. Carmichael, On Varix and Venous Inflammation, in Trans. of Assoc. Physicians, vol. ii.* *Duncan, On Diffuse Inflammation of the Cellular Membrane, in Edin. Med. Chir. Trans. vol. i.* *Medical Communications, vol. ii. Richerand, Nosogr. Chir. t. ii. p. 416, edit. 2.* *J. Hodgkin, On the Diseases of Arteries and Veins, 8vo. Lond. 1815.* *B. Travers, in Surgical Essays, part i. 8vo. Lond. 1818.* *Chapman, in Philadelphia Journ. Feb. 1824.* *Fretau, Sur l'Emploi des Emissions Sanguines, &c. 8vo. Paris, 1816.*

VERRUCA. A wart. See WART.

VERTEBRÆ, DISEASE OF. The case, here to be considered, is a disease of the spine, sometimes originating in an ulceration of the intervertebral cartilages, sometimes in a morbid condition of the cancellous structure of the bodies of the vertebrae (*Sir B. Brodie on Diseases of the Joints, p. 259.*), often followed by a more or less complete loss of the power of using the legs.

In the true paralysis (says Mr. Pott), from whatever cause, the muscles of the affected limb are soft, flabby, unresisting, and incapable of being put into even a tonic state; the limb itself may be placed in almost any position or posture; if it be lifted up, and then let go, it falls down, and it is not in the power of the patient to prevent, or even to retard, its fall; the joints are perfectly and easily moveable in any direction: if the affection be of the lower limbs, neither hips, knees, nor ankles, have any degree of rigidity or stiffness; but permit the limb to be turned, or twisted, in almost any manner.

In the present case, the muscles are indeed lessened, but they are rigid, and always at least in a tonic state, by which the knees and ankles acquire a stiffness, not very easy to overcome. By means of this stiffness, mixed with a kind of spasm, the legs of the patient are either constantly kept stretched out straight, in which case considerable force is required to bend the knees, or they are, by the action of the stronger muscles, drawn across each other, in such manner as to require as much to separate them. When the leg is in a straight position, the extensor muscles act so powerfully, as to require a considerable degree of force to bend the joints of the knees; and when they have been bent, the legs are immediately and strongly drawn up, with the heels towards the buttocks. By the rigidity of the anklejoints, joined to the spasmodic action of the gastrocnemii muscles, the patient's toes are pointed downward, in such manner as to render it impossible for him to put his foot flat to the ground; which makes one of the decisive characteristics of the distemper.

The majority of those, who labour under this disease, are infants or young children: adults are by no means exempt from it; but Pott never saw it at an age beyond forty; and Haynton never met with more than three instances, which approached

that period of life. (*On Diseases of the Spine*, p. 4.)

In one case, however, recited by Sir B. Brodie, the patient was forty-five years old (*On Diseases of Joints*, p. 268.); and I have had one patient, who could not be younger. By Pott, Baynton, and other writers, a belief is entertained that the disease is most inclined to happen in scrofulous subjects, in which opinion I believe all modern pathologists join.

According to Mr. Pott, if the patient be a child, the account most frequently given is, that for some time previous to the incapacity of using its limbs, it had been observed to be languid, listless, and very soon tired; that it was unwilling to move much, or briskly; that it had been observed frequently to trip and stumble, although no impediment lay in its way; that when it moved hastily, or unguardedly, its legs would cross each other involuntarily, by which it was often and suddenly thrown down; that if it endeavoured to stand stiff, and upright, unsupported by another person, its knees would totter and bend under it; that it could not, with any degree of precision or certainty, steadily direct either of its feet to any particular point, but, that in attempting so to do, they would be suddenly and involuntarily brought across each other; that soon after this, it complained of frequent pains and twitches in its thighs, particularly when in bed, and of an uneasy sensation at the pit of the stomach; that when it sat on a chair or a stool, its legs were almost always found across each other, and drawn up under the seat; and that, in a little time after these particulars had been observed, it totally lost the power of walking.

The same author observes, that if the incurvation be of the neck, and to a considerable degree, by affecting several vertebræ, the child finds it inconvenient and painful to support its own head, and is always desirous of laying it on a table or pillow, or any thing to take off the weight. If the affection be of the dorsal vertebræ, it is soon attended with loss of appetite, hard dry cough, laborious respiration, quick pulse, and disposition to hectic.

Mr. Pott states that an adult, in a case where no violence has been committed or received, will tell you, that his first intimation was a sense of weakness in his backbone, accompanied with what he will call a heavy dull kind of pain, attended with such a lassitude, as rendered a small degree of exercise fatiguing; that this was soon followed by an unusual sense of coldness in his thighs, not accountable for from the weather, and a palpable diminution of their sensibility; that, in a little time more, his limbs were frequently convulsed by involuntary twitches, particularly troublesome in the night; that, soon after this, he not only became incapable of walking, but that his power either of retaining or discharging his urine and feces was considerably impaired, and his penis became incapable of erection.

The adult also finds all the offices of his digestive and respiratory organs much affected, and complains constantly of pain and tightness at the stomach.

The true cause of the disease is a morbid state of the spine, and of some of the parts connected with it; which disordered state of parts will, upon careful inquiry, be always found to have preceded

the deformity some length of time: in infants, this is the sole cause, and external violence has nothing to do with it. "In the adult (says Mr. Pott), I will not assert, that external mischief is always and totally out of the question; but I will venture to affirm, what is equal, as far as regards the true nature of the case, which is, that although accident and violence may, in some few instances, be allowed to have contributed to its more immediate appearance, yet the part, in which it shows itself, must have been previously in a morbid state, and thereby predisposed for the production of it."

For some observations, connected with this point, I refer the reader to Sir C. Bell's *Surgical Observations*, vol. i.

Sir Benjamin Brodie agrees with Pott and other writers on the fact, that the actual curvature must be preceded by a disease of the parts, unaccompanied with any visible deformity, and "cannot take place until the caries has made considerable progress." In the early stage of the case, therefore, when, as Sir Benjamin Brodie justly observes, the diagnosis is of the most importance, no information can be obtained from the appearance of the spine itself, the shape of which is yet unchanged; and frequently the symptoms, which do take place early, are not unequivocal; they are, according to this writer, "a pain, and some degree of tenderness, in that part of the spine where the disease has begun; a sense of constriction of the chest; an uneasy feeling at the pit of the stomach, and of the whole abdomen; a disturbed state of the functions of the alimentary canal, and of the urinary bladder; a sense of weakness and aching, and occasional cramps of the muscles of the extremities." But, as Sir B. Brodie confesses, very similar symptoms may arise from other causes, and sometimes no particular complaints are made previously to the actual discovery of the curvature. (*On Diseases of Joints*, p. 279, 280.)

I have already mentioned Sir Benjamin Brodie's opinion, deduced from dissection, that in many instances, caries of the spine has its origin in an ulceration of the intervertebral cartilages, beginning in their centre, and extending to their circumference, and afterwards affecting the bodies of the contiguous vertebræ; but that, in other cases, the disease has its origin in the bodies of the vertebræ themselves, which are liable to the same peculiar disease of the cancellous structure, which is noticed in the articulating extremities of other bones. (*On Diseases of Joints*, p. 267.) This gentleman suspects that the disease, which begins in the cancellous structure of the vertebræ, is more immediately followed by suppuration, than that which commences in the intervertebral cartilages; and that the first form of the disease seldom occasions so extensive a destruction of the vertebræ as the last. "But (says he) farther than this, nothing, which I have hitherto observed, enables me to point any circumstances, in which the symptoms of these different diseases differ." (P. 276.) When the lumbar vertebræ are alone affected, the symptoms dependent on pressure or irritation of the spinal marrow may be absent. In some examples of caries of the vertebræ, either the intervertebral fibro-cartilage, or the anterior vertebral ligament, have been found in an ossified state; furnishing, in Andral's opinion, a proof of the conversion of such textures into bone, from

the effect of neighbouring irritation. (See *Anat. Pathol.* t. i. p. 301.)

In these cases, as Sir B. Brodie remarks, "the distortion of the spine is usually of a peculiar kind, and such as nothing can produce, except the destruction of the bodies of one or more vertebræ. The spine is bent forward, so as to form an angle posteriorly; and although the destruction of the vertebræ may be the same, it is more obvious in some parts of the spine than it is in others. For example, the spinous processes in the middle of the back being long, and projecting downwards, the elevation of one of these must occasion a greater prominence than that of one of the spinous processes of the neck, which are short, and stand directly backwards.

"Curvature of the spine, in the direction forwards, may arise from other causes, as a weak condition of the muscles, or a rickety affection of the bones. In general, in such cases, the curvature occupies the whole spine, which assumes the form of a segment of a circle. At other times, however, it occupies only a portion of the spine, usually that which is formed by the superior lumbar and inferior dorsal vertebræ." But here, as Sir B. Brodie has found, the curvature is always gradual, and never angular; a circumstance by which it is distinguishable from the curvature produced by caries. The cases, however, he thinks, have often been confounded; and some speedy and complete cures of carious spine on record, he infers, must have been cases of an entirely different nature. (*On Diseases of Joints*, p. 282, &c.; and *Fa. le*, in *Edinb. Med. Journ.* Jan. 1815.)

"Lateral curvatures of the spine are affected generally to incline to the right side; and the fact is referred to the undue power, which is acquired by the more general use of the right arm, and of other muscles, in the performance of the voluntary actions." (*Baynton on Diseases of the Spine*, p. 43.) It is admitted, however, that exceptions are met with, and that the lateral curvature sometimes tends to the left, and occasionally resembles the letter S reversed. On this subject, I have also another rare exception to specify, which is explained by Sir B. Brodie, viz. that though lateral distortions of the spine generally arise from causes independent of caries, a slight degree of lateral curvature is, in some instances, produced by the bodies of the vertebræ having been destroyed on one side, by caries, in a greater degree than on the other. (*Brodie on Joints*, p. 284.)

In general, the lower limbs alone usually feel the effect. Pott, however, had seen two cases, in one of which the arms only were affected; in the other, both legs and arms. Mr. Ford showed him a lad, who had lost the use of both arms and legs from a curvature. An account of two similar examples was also communicated to Pott by Mr. Parke, of Liverpool.

Sir B. Brodie has never known paralysis affect the muscles of the arms, when the disease was at the lower or middle part of the spine; but he agrees with Mr. Copeland, that the symptoms are not always confined to parts below the disease, and that it is not uncommon for pains in the upper extremities to accompany the paralytic affection of the legs and thighs. (*Brodie*, p. 285. *Copeland, Obs. on Diseased Spine*, &c.)

Very soon after the curvature, some patients

are rendered totally and absolutely incapable not only of walking, but of using their legs in any manner; others can make shift to move about with the help of crutches, or by grasping their thighs just above the knees with both hands: some can sit in an arm-chair, without much trouble or fatigue; others cannot sit up with any help: some retain such a degree of power of using their legs as to be able to shift their posture when in bed; others have no such power, and are obliged to be moved upon all occasions.

I have been present at the dissection of many persons who died of lumbar abscesses, and who, while they lived, never suffered the peculiar loss of the use of the lower extremities, so well described by Pott, though the vertebræ were found to be diseased. However, in some instances of such abscesses, attended with caries of the spine, the legs are deprived of their power. But whether the difference is to be explained by the consideration, that, in some cases, the disease of the bone may be secondary, and the abscess itself the primary complaint, I cannot determine. At all events, suppurative is frequently only an effect, the curvature existing long before the abscess; and in such cases the legs are affected. Some time ago, Mr. Dunn, of Scarborough, consulted me about a case, in which the latter facts were exemplified. Sir Benjamin Brodie's opinion, that suppurative takes place at an earlier period, in cases where the disease begins in the cancellous structure of the bones, has been already noticed. In having a tendency to excite suppurative, and in producing the weakness of the lower extremities, the present disease of the spine appears to be materially different from the absorption of the vertebræ, sometimes caused by the pressure of aneurisms, and other tumours. (*Hodgson on Diseases of Arteries*, &c. p. 80.)

Mr. Pott observes:—When a child appears to be what the common people call naturally weakly, whatever complaints it may have are supposed to be caused by its weak state, and it is generally believed, that time and common care will remove them; but when a curvature has made its appearance, all these marks of ill health, such as laborious respiration, hard cough, quick pulse, hectic heat and flushing, pain and tightness of the stomach, &c., are more attentively regarded, and set to the account of the deformity consequent to the curve, more especially if the curvature be of the dorsal vertebræ, in which case the deformity is always greatest; but whoever will carefully attend to all the circumstances of this disorder, will be convinced, that most, if not all, the complaints of children, labouring under this infirmity, precede the curvature, and that a morbid state of the spine and of the parts connected with it, is the original and primary cause of both.

Amongst many other reasons for thinking that an effect was mistaken for a cause, Mr. Pott enumerates the following:—

1. "That he did not remember ever to have seen this useless state of the limbs from a mere malformation of the spine, however crooked such malformation might have made it.

2. "That none of those deviations from right shape, which growing girls are so liable to, however great the deformity might be, was ever attended with this effect."

With respect to the treatment of diseased spine

I think one principle, laid down by Mr. Pott, must receive approbation; viz. that the primary and sole cause of all the symptoms is a distempered state of the parts, composing, or in immediate connection with, the spine, tending to, and most frequently ending in, a caries of the vertebræ. Hence, says he, all the ills, whether general or local, apparent or concealed; the ill health of the patient, and in time the curvature. As the disease does not originate in the limbs, no application to them can be of any use, and the great indication must be to stop the progress of the disease in the affected part of the spine.

The first suggestion of the probability that issues might prove serviceable in this disease, appears to have been made to Mr. Pott by Dr. Cameron, of Worcester, who told him, that, having remarked in Hippocrates an account of paralysis of the lower limbs cured by an abscess in the back, he had, in a case of useless limbs, attended with a curvature of the spine, endeavoured to imitate this act of nature, by exciting a purulent discharge, and that it had proved very beneficial; which was confirmed to Mr. Pott by Mr. Jeffreys, of Worcester, who had made the experiment with the same success.

The practice which Pott recommends, consists merely in procuring a large discharge of matter from the integuments on each side of the distempered bones forming the curvature, and in maintaining such discharge until the patient shall have recovered his health and the use of his limbs. He considers it a matter of very little importance towards the cure, by what means the discharge be procured, provided it be large, that it come from a sufficient depth, and that it be continued for a sufficient length of time. He tried setons, issues by incision, and issues by caustic, and found the last in general preferable.

The caustic, he observes, should be applied on each side of the curvature, in such a manner as to leave the portion of skin covering the spinal processes of the protruding bones entire and unhurt. The issues which modern surgeons usually make, for the relief of the symptoms arising from diseased vertebræ, are larger than such as Pott was in the habit of forming. They now commonly prefer making an issue on each side of the spinous processes, about three or four inches long, and half an inch broad.

The size of the issue intended to be made being determined, the place where it is to be made should be accurately marked out with ink. All the skin immediately around should then be covered with adhesive plaster, in order that it may be protected from the action of the caustic. Let the surgeon next take a piece of caustic potassa, or of potassa cum calce, and wrap a little tow or lint round one end of it, so that he may take hold of it with safety and convenience. The other end of the caustic should then be moistened, and rubbed very quickly on the portion of the integuments which is to be converted into an eschar. The caustic is to be rubbed in this manner till the part turns of a dull brown colour, when the caustic should be carefully washed off with a little wet tow, and a poultice applied.

As soon as the eschars admit of being removed, a row of peas or beans, connected together with threads, should be laid on the sore, and confined there with sticking plaster. A compress, contain-

ing a piece of pasteboard, or sheet lead, is then to be bound over the peas or beans with a roller. In consequence of the continued pressure, the peas or beans soon form little hollows for themselves, in which they should be regularly placed every day. When the pressure is not duly maintained, the granulations are apt to rise so high that the peas cannot be well kept on the part. In this circumstance, the surgeon must try to repress the high surface of the sore, by sprinkling on it a little savine powder and subacetate of copper mixed together in equal proportions. When this plan is unavailing, the re-application of caustic becomes indispensable.

Whatever time may be requisite to restore the health, as well as the use of the limbs, Mr. Pott thinks that the issues should be kept open until these objects are completely fulfilled; and even longer, especially in growing children. He owns that nothing can be more uncertain than the time required for the cure. He has seen it perfected in two or three months; and he has known it require two years: two thirds of which time passed before there was any visible amendment.

After the discharge has been made some time, the patient is found to be better, in all general respects, and, if of age to distinguish, will acknowledge that he feels himself to be better in health; he begins to recover his appetite, gets refreshing sleep, and has a more quiet and less hectical pulse; but the relief which he feels above all others is from having got rid of that distressing sensation of tightness about the stomach: in a little time more, a degree of warmth, and a sensibility, are felt in the thighs, which they had been strangers to for some time; and generally, much about the same time, the power of retaining and discharging the urine and feces begins to be in some degree exerted.

The first return of the power of motion in the limbs, says Mr. Pott, is rather disagreeable; the motions being involuntary, and of the spasmodic kind, principally in the night; and generally attended with a sense of pain in all the muscles concerned.

The knees and ankles, by degrees, lose their stiffness; and the relaxation of the latter enables the patient to set his feet flat upon the ground, the certain mark that the power of walking will soon follow; but those joints, having lost their rigidity, become exceedingly weak, and are not for some time capable of serving the purpose of progression.

An attentive examination of the morbid appearances, and their effects, in different subjects, led Mr. Pott to conclude, amongst other things, that the disease which produces these effects on the spine and the parts in its vicinity, is what is in general called scrofula. That ulceration or caries of the bodies of the vertebræ affected, is the common morbid change. That when the attack is made upon the dorsal vertebræ, the sternum and ribs, for want of proper support, necessarily give way, and deformity additional to the curve is produced. That this kind of caries is always confined to the bodies of the vertebræ, seldom or never affecting the articular processes. Two cases were seen by Pott, in which the bodies of the vertebræ were completely detached from their processes, so as to leave the membrane of the spinal marrow perfectly bare. That without this de-

struction of the bodies of the vertebræ, there can be no curvature of the kind here treated of, although there may be, and that not infrequently, carries without curve. That the caries with curvature and useless limbs is most frequently of the cervical or dorsal vertebræ, the caries without curve of the lumbar; though this is by no means constant or necessary. That, in the case of carious spine, without curvature, it most frequently happens that internal abscesses and collections of matter are formed, which matter makes its way outward, and appears in the hip, groin, or thigh; or is detained within the body. That what are commonly called lumbar and psoas abscesses are not infrequently produced in this manner, and therefore, when we use these terms, we should be understood to mean only a description of the course which such matter has pursued in its way outward, or the place where it makes its appearance externally. That, contrary to the general opinion, a caries of the spine is more frequently a cause, than an effect, of these abscesses. That the true curvature of the spine, from within outward, of which the paralytic or useless state of the lower limbs is a too frequent consequence, is itself but one effect of a distempered spine; such case being always attended with a number of complaints, which arise from the same cause: the generally received opinion, therefore, that all the attending symptoms are derived from the curvature, considered abstractedly, is by no means founded in truth, and may be productive of very erroneous conduct. That when two or more vertebræ are affected, forming a large curve, however perfect the success of the treatment may be with regard to the restoration of health and limbs, yet the curvature will and must remain, in consequence of the union of the bones with each other. That the useless state of the limbs is by no means a consequence of the altered figure of the spine, or of the disposition of the bones with regard to each other, but more of the caries: of this truth there needs no other proof than what may be drawn from the cure of a large and extensive curvature, in which three or more vertebræ are concerned; in this the deformity always remains unaltered and unalterable, notwithstanding the patient recovers both health and limbs.

Pott believed, that a morbid state of the parts, previous to deformity, caries, or curve, must be allowed. All the general complaints of persons afflicted with this disorder, he says, will, upon a careful inquiry, be found to have preceded any degree of deformity, to have increased as the curve became apparent, and to have decreased as the means used for relief took place: the pain and tightness about the stomach, the indigestion, the want of appetite, the disturbed sleep, &c. &c., gradually disappear, and the marks of returning health become observable, before the limbs recover the smallest degree of their power of moving.

On the other hand, it is admitted to be as true, that when from extent, or degree, or inveteracy of the caries, the issues are found to be unequal to the wished-for effect, the general complaints receive no amendment; but increase until the patient sinks under them.

In the generality of cases of scrofulous spine, paralysis of the lower extremities is sooner or later induced; but in ricketty deformities of the spine there is no such effect occasioned, however great

the lateral or spiral curvature may be. Cruveilhier has recorded an instance, which proves how far even scrofulous disease of the vertebræ will sometimes advance, without causing paralysis. In this case, no paraplegia existed, though not less than the bodies of five dorsal vertebræ had been totally annihilated; and the alteration in the shape of the vertebral column was such, that the upper half formed with the lower an extremely acute angle, which would have been still more acute, if it had not been prevented by the eleventh and fifth vertebræ touching one another. The intervertebral foramina were all preserved, though more or less deformed, contracted, or displaced backwards. In those which were most diminished, the corresponding intercostal nerves must have been compressed, and consequently the action of the intercostal muscles impaired, explaining partly the cause of the oppressed breathing which the patient experienced. Cruveilhier's engraving illustrates how nature contrived in this case to maintain the integrity of the vertebral canal, and preserve the medulla from pressure. Notwithstanding the bodies of five vertebræ were destroyed, a cure had been effected by ankylosis. In University College Museum is an equally fine specimen of extensive annihilation of the bodies of the vertebræ, and of ankylosis at as great an angle as that exemplified in Cruveilhier's case. (See *Anat. Pathol.* livr. 4.)

Besides the forms of disease of the spine, treated of in this article, the observations of Mr. Wilson prove that the distemper may sometimes begin within the theca vertebralis, and thence extend to the bones. He also demonstrated, at the College of Surgeons, scrofulous tumours in the spinal marrow. Such diseases would create a loss of power in the parts below them, without any curvature of the spine. (*Lectures on the Skeleton*, &c. p. 397.)

In France, the same indication is followed as that on which Mr. Pott lays stress, viz. to endeavour to arrest the disease of the spine by means applied in the vicinity of the morbid parts. But, instead of employing caustic issues, the moxa has been used, and sometimes repeated cupping; both which means were particularly recommended by Desault.

Another practice, which yet has partisans, though it was strongly disapproved of by Pott, is that of supporting the spine with machinery. Perhaps, the latter author may have carried his objections to this method beyond all reason; and with the exception of Dr. Harrison (see *Lond. Med. and Physical Journ.* Nov. 1820), I believe no modern practitioner now ever advises it on the supposition of there being any dislocation; an error which formerly prevailed. As Sir B. Brodie observes, certainly no machines ought ever to be employed for the purpose of elongating the spine and correcting the deformity; but, if they be used simply to take off the weight of the head, chest, and upper extremities, from the diseased part of the spine, they may sometimes be of service. The late Sir James Earle had a very favourable opinion of their utility. I believe, with Sir B. Brodie, that they ought never in the first instance to supersede the constant maintenance of the horizontal position; but, that they may be advantageous, when circumstances make it desirable that the patient should begin to sit up

a part of the day. (*On Diseases of the Joints*, p. 291.)

From Pott's account, it will be seen that he never pretended that issues, kept open in the vicinity of the disease, were a sure means of relief; and a late eminent surgeon has actually referred the good, which Pott thought accrued from them, to the long observance of the horizontal posture. Mr. Baynton, the gentleman to whom I allude, also mentions, that M. David is the only writer who has suggested that rest would effect the cure of diseases of the spine. On this point, however, Mr. Baynton was mistaken, as, more than forty years ago, Loder wrote some remarks, particularly directed to the object of recommending quietude in the present disease, as the best means of promoting ankylosis. (See *Med. Chir. Beobachtungen*, p. 251. 8vo. Weimar, 1794.) Confining the patient on his back, with machinery applied to it, was carried to a vast extent by Dr. Harrison. About three years ago, I was visiting a patient a little way out of town, when I was requested to see another patient, a young lady in the same house, who had been lying on her back incessantly for three years. Her health seemed to me to be suffering much from this system; and when I last heard of her, she had been five years on this plan, and still continued quite incapable of using her limbs. Now, although I fully concur in the propriety of keeping the patient as quiet as possible in the recumbent position, inasmuch as motion must be hurtful to the diseased part of the spine, it does not follow, because this admission is made, that issues should be rejected, and that rest must do every thing. In one part of Mr. Baynton's reasoning, an error prevails, which I shall here notice, as it seems greatly to have influenced his opinions; and so far as I know, it has not been remarked by the critical examiners of that gentleman's book. The mistake is in supposing, that the process by which the diseased part of the spine is to be restored and united, should be conducted exactly on the same principles as the union of bones free from disease. In fact, there is an additional indication, which is to stop the progress of the disease; for which purpose experience proves, that issues, aided by rest, are the means affording the best chances of success. I have attended several children myself, who, from the effect of issues, recovered the use of their lower extremities, even though they could not be kept constantly at rest. I must also give my testimony to the truth of Sir B. Brodie's statement, that many patients are benefited almost immediately the issues are made, or uniformly find themselves better after each application of the caustic. (*On Diseases of Joints*, p. 292.) In some cases, however, caustic issues fail to afford relief; and when they are of no use, rest in the horizontal posture, below ground, I believe must generally soon be the patient's doom. Whether the occasional failure of issues is to be ascribed to the advanced progress which the disease has made, or to its having begun in the cancellous structure of the vertebrae, as suggested by Sir B. Brodie, future observation must decide. When the diseased vertebrae are accompanied by abscesses, which have burst and are discharging daily a profuse quantity of matter, issues will be of no service, and do harm by weakening the patient still further. I had a patient who lost the faculty of sensation in one leg

and yet retained in it the power of motion; while the other leg was deprived of motion, but not of feeling. By blistering the loins and sacrum, and giving tonics and aperient medicines, I so far succeeded in curing the patient, that he could walk about his room, and the power of feeling in the limb that was deprived of it, was restored.

Consult Pott's *Chirurgical Works*, vol. iii. *G. Gebb*, Select Cases of the Disorder commonly termed Paralysis of the Lower Extremities, 8vo. Lond. 1782. *C. H. Wilkinson*, Essays on Distortion of the Spine, &c. 8vo. Lond. 1798. *Loder*, Med. Chir. Beobachtungen, b. i. p. 247, &c. 8vo. Weimar, 1794. *J. C. Frank*, Oratio de Vertebrae Columnae in Morbis Dignitate. Pavia, 1791. *C. Van Roy*, De Scoliasi, 4to. Lugd. 1774. *Sir J. Earle*, Observations on the Cure of Curved Spine; in which the Effect of Mechanical Assistance is considered, 8vo. Lond. 1803. *Benjamin Maschi*, Osservazioni sulla Inflammazione dello Spinale Medollo e delle sue Membrane, 4to. Pav. 1810. *T. Baynton*, An Account of a Successful Method of treating Diseases of the Spine, 8vo. Bristol, 1813. *H. Earle*, in Edin. Med. and Surg. Journ. for January, 1815. *J. L. Chouart*, Decas Pelvium Spinarumque Deformatarum, 4to. Lips. 1818. *G. Malsch*, De nova Machina Graefiana Distortionis Spinae Dorsi ad Sanandas, necnon Disquisitione Deformatum istarum, 4to. Berol. 1818. *Abercrombie*, in Edin. Med. and Surg. Journ. for January, 1818. *Kapellar*, in Annuaire Méd. Chir. des Hôpitaux de Paris, t. i. p. 300. 4to. Paris, 1819. *T. Copeland*, Obs. on the Symptoms and Treatment of Diseases of the Spine, 8vo. *Sir Benjamin Brodie*, Pathological and Surgical Obs. on the Joints, p. 257, &c. 8vo. Lond. 1818. *James Wilson*, On the Structure and Physiology of the Skeleton, and on the Dis. of Bones and Joints, p. 335. 8vo. Lond. 1820. *W. T. Ward*, Distortions of the Spine, Chest, and Limbs, 8vo. Lond. 1822. *J. Shaw*, On Distortions of the Spine and Bones of the Chest, &c. 8vo. Lond. 1823. *J. Boyle*, On Moxa and Spinal Diseases, 8vo. Lond. 1825.

VINUM OPII. Take of extract of opium \mathfrak{z} j., cinnamon bark bruised, cloves bruised, of each 3 j.; wine, a pint. Macerate for eight days and filter. The thebaic tincture, or liquid laudanum of Sydenham. In surgery, it is often preferred to the common tincture of opium, as an application to the eye.

VIPER, BITE OF. See WOUNDS.

VOLVULUS. (From *volvere*, to roll up.) See INTUSSUSCEPTION.

WART. A wart appears to be an excrescence from the cutis, or a tumour formed upon it, by which means it becomes covered with a cuticle, which is either strong and hard, or thin and soft, just as the cuticle is that covers the parts, from which the excrescence arises. Warts are radiated from their basis to their circumference. The surface of the radii appears to be pointed or granulated, like the surface of healthy granulations, with the exception of being harder and rising higher. The surface, on which a wart is formed, seems only to be capable of producing one; for the surrounding and connecting surface does not throw out a similar substance. Thus, when a wart has once begun to grow, it rises higher and higher, without becoming larger at its basis. Such excrescences seem to have within themselves the power of growing; for, as Hunter remarks, after they have risen above the surface of the skin, on which their basis cannot grow larger, they swell out into a round thick substance, which becomes rougher and rougher. In consequence of this structure, warts are liable to be hurt by bodies rubbing against them, and, from such a cause, they often bleed very profusely, and are rendered sore and painful. (*On Venereal Dis.* p. 250. ed. 2.)

As warts are adventitious substances, and not any part of the original structure of the body,

their powers of life are weak. Hence, when stimulated, they generally become smaller, and at length disappear or drop off. On this principle, warts may frequently be cured by the application of the tinctura ferri muriatis, sulphate of copper, tinctura cantharidum, or a powder, composed of the powder of savine leaves and the subacetate of copper in equal proportions. However, the employment of stronger escharotics, like the nitrate of silver, or the concentrated acetic acid; the removal of such excrescences with a knife or pair of scissors; or tying their necks with a ligature; are plans frequently preferred. The last two methods are eligible, when the wart has a narrow neck; but, after the removal of the excrescence, it is still proper to touch the root with the caustic, or the acetic acid; for, unless the whole be completely destroyed, the wart will grow again. Mr. A. G. Welsh, of Annapolis, informs us, that he once had several warts upon his hands, and having repeatedly tried nitrate of silver, and other caustics in vain, he determined to try electricity. "I therefore commenced (says he) by sending sparks through them, which was repeated for five minutes daily, when, to my great satisfaction, I found that they had entirely disappeared, since which time they have not reappeared, as they did after having been removed with the knife, or caustic." (See *Baltimore Med. and Surgical Journ.* Oct. 1833.)

Warts on the pudenda, and about the anus, scarcely ever withstand the effect of the powder of savine, and subacetate of copper, though they will sometimes resist a course of mercury, adequate to cure lues venerea; a consideration which led Mr. Hunter to believe them not to be syphilitic. In this opinion, I believe, all the best surgeons of the present day concur.

WHITLOW. (*Paranis, Onychia, Paronitium, Paronychia.*) A whitlow is an inflammation at one of one of the fingers, or thumb, exceedingly painful, and strongly disposed to suppurate. The toes are also sometimes the seat of similar inflammation and abscess.

Writers usually divide whitlows into four kinds. In the first, or mildest, a vesicle, filled with matter, commonly arises near the root or side of the nail, after superficial inflammation of trivial extent. The matter is situated immediately under the cuticle. Sometimes the abscess takes place under the nail, in which case the pain is severe, and not unfrequently shoots upward to the external condyle.

The second kind of whitlow is chiefly situated in the cellular tissue, under the cutis, and, for the most part occurs at the end of the finger. In this case, the inflammatory symptoms, especially the pain, are far more violent, than in other common inflammations of not greater extent. Writers usually impute the violence of the pain, and the considerable degree of inflammation attending the complaint, to the hard and unyielding nature of the skin of the finger. To the same cause they also ascribe the difficulty of perceiving any fluctuation, after matter is formed; and the slowness with which the pus makes its way outward.

The third kind of whitlow is distinguishable from the others by the following circumstances. With the most excruciating pain there is but little swelling of the finger, but a vast deal of the hand, particularly about the wrist, and up the forearm. The pain extends to the hand, wrist, elbow, and even the shoulder. When suppuration takes place,

a fluctuation can never be felt in the finger, though it may often be distinctly perceived in the hand, at the wrist, or even somewhere in the forearm. The case is frequently accompanied with considerable fever. The disease is seated in the tendons and their sheaths, and the power of moving the fingers, and even the whole hand, is lost.

Authors describe the fourth kind of whitlow, as arising principally from an inflammation of the periosteum. Suppuration generally follows very soon, the usual consequence of which is a caries, or rather a necrosis, of the subjacent finger-bones.

Whitlows commonly begin on the palmar side of the fingers; but they do occasionally commence on the back of them, and even on that of the hand.

Mr. Wardrop favoured the public with an account of a particular species of whitlow, which, from its severity, he denominated the *onychchia maligna*. "The commencement of this disease is marked by a degree of swelling, of a deep red colour, in the soft parts at the root of the nail. An oozing of a thin ichor afterwards takes place at the cleft formed between the root of the nail and soft parts, and at last the soft parts begin to ulcerate. The ulcer appears on the circular edge of the soft parts at the root of the nail: it is accompanied with a good deal of swelling, and the skin, particularly that which is adjacent to the ulcer, has a deep purple colour. The appearance of the ulcer is very unhealthy, the edges being thin and acute, and its surface covered with a dull yellow, or brown-coloured lymph, and attended with an ichorous and very fetid discharge. The growth of the nail is interrupted, it loses its natural colour, and at some places appears to have but little connexion with the soft parts. In this state (says Mr. Wardrop) I have seen the disease continue for several years, so that the toe or finger became a deformed bulbous mass. The pain is sometimes very acute; but the disease is more commonly indolent, and accompanied with little uneasiness. This disease affects both the toes and the fingers. I have only observed it on the great toe, and more frequently on the thumb than any of the fingers. It occurs, too, chiefly in young people; but I have also seen adults affected with it." (See *Med. Chir. Trans.* vol. v. p. 135, 136.)

The causes of whitlows are generally of a local nature. Writers enumerate the following as the most common: a contusion; suddenly warming the finger when it is exceedingly cold; pricks with needles, or other sharp instruments; and the insinuation of irritating matter into scratches on the finger. A surgeon, in operating for a fistula in ano, has been known to cut his finger, and have, in consequence of the accident, a very severe and dangerous kind of whitlow. Richter also mentions a person, who had a most obstinate whitlow, in consequence of a slight wound on the finger, in examining the head of a horse that died of glanders. Sometimes the cause of a whitlow depends on a splinter, or thorn, which continues lodged in the part. Very often, no particular cause whatever can be assigned for the complaint.

The first case, which occurs about the root of the nail, ought to be opened as soon as possible. When this plan is not adopted, the matter is apt to penetrate more deeply, and occasion a loss of the nail. When an effectual opening is not made, the matter collects again. In general, a detachment of the cuticle takes place, as far as the

abscess extends. When the inflammation has been violent, and the matter has made its way to the root of the nail, the nail itself is in general gradually detached; while the denuded portion of the nail acts on the sore as a foreign body, and hinders it from healing. Hence the surgeon should repeatedly cut away as much of the lower edge of the nail as he can, and insinuate a little soft lint between the margin of the nail and the sore, in order to keep the latter from being irritated by the former. In proportion as the old nail gradually separates, a new one makes its appearance.

When matter lies under the nail, an opening should be made through the part, as speedily as possible, for the discharge of the abscess. In order to perform this operation, Richter advises the surgeon to scrape the nail, till it is as thin as it can well be, when it may be cut through with a bistoury.

In the second species of whitlow, suppuration may sometimes, though very rarely, be prevented by the timely employment of proper means. When the pain is violent, and acute fever prevails, it may be advisable to bleed the patient. In a few severe cases, the application of three or four leeches to the affected finger has been known to procure prompt relief. (*Schmucker.*) Theden thinks, that applying a roller round the finger, hand, and arm, and frequently wetting the first two parts with a lotion, the most certain means of resolving the inflammation. Platner advises the finger to be for some time immersed in water, as warm as the patient can bear. Some recommend the external use of camphorated spirit, or the linimentum ammoniæ; while others advise the affected finger to be plunged in a warm solution of soap, or an alkaline lotion. I have known a few whitlows resolved by blackening the skin over the inflamed part with nitrate of silver. (See *Higginbottom, On Nitrate of Silver*, ed. 2.) When whitlow is occasioned by a prick, particular care must be taken, that no extraneous substance remain in the puncture.

When the symptoms do not abate by the fourth day, Richter recommends an opening to be made. Even when no fluctuation is discovered, he approves of this practice, and states, that although no matter may be discharged, the patient always derives infinite relief from the operation. The benefit, he says, may either be imputed to the bleeding, or to the division of the hard tense skin, which compresses the subjacent inflamed parts. Sometimes, the collection of matter can be plainly felt, and in this case there can be no hesitation about the place where the opening should be made. However, it may be proper to remark, that the opening should always be made sufficiently large. When the surgeon makes a small puncture, it soon closes again, and a repetition of the operation becomes necessary. When opening the abscess is delayed, the theca of the flexor tendons easily becomes affected, or the matter may spread to a considerable extent under the skin. Sometimes it makes its way through the cutis, by ulceration, and raises up the cuticle. In this case, as soon as the cuticle has been opened, a director should be introduced into the aperture in the skin, and the latter opening be enlarged with a bistoury. In the third species of whitlow, Richter enjoins us never to defer making an opening longer than the third day. If we wait till suppuration happens, we shall wait till the tendons are de-

stroyed, and the use of the finger is lost. In the case under consideration, the matter is always of bad quality, and in small quantity. A fluctuation in the finger can seldom be felt. However, in a few instances, the matter is perceptible at the extremity of the finger, or about the finger-joints; but more often, in the palm of the hand, or near the wrists. In these circumstances, the tendons are in general already destroyed, and a stiffness of the finger and hand is to be apprehended. When the complaint is the consequence of a puncture, the best plan is at once to enlarge the wound. It is not enough, however, to cut through the skin; the tendinous theca itself must be laid open.

When a collection of matter forms towards the wrist, attended with violent pain in that situation, an opening must also be made there. If an opening should have already been made in the hand, a probe may be introduced into the wound, and another aperture made in an eligible situation by cutting on the end of the instrument. In the same way, an opening is to be made in any part of the forearm, where great pain, or the symptoms of suppuration, may indicate its propriety.

In the fourth kind of whitlow, early incisions, made down to the bone, are the most certain means of obviating the danger. When such incisions are not made soon enough, suppuration takes place, and the bone perishes. The cut is to be made in the place where the pain is most severe. When the first phalanx is affected, the incision may be made in front of the finger; but when the second or third is the seat of the complaint, the opening should be made on one side. However, in order that the opening may be useful, it is absolutely necessary to make it down to the bone. When the incision is deferred too long, a small quantity of unhealthy matter is usually detected, and the bone is found in the state of necrosis. As an exfoliation can hardly be expected in this situation, it is best to remove at once the diseased piece of bone. When the last phalanx alone is affected, the finger retains its form; with the exception of its end being a little shorter and flatter. When the disease, however, is situated in the third phalanx, Richter thinks it better to amputate the finger, than remove the diseased bone, as the finger, if left, would always remain stiff and unserviceable. (See *Anfangsgr. der Wundarzneykunst*, vol. vii.)

Dr. J. B. Whitridge, of Charleston, South Carolina, in cases of whitlow, when the bone has become carious, has frequently preserved the part by the timely removal of the diseased bone. Persons much in the habit of using the pen, and others, whose livelihood depends on their retaining the use of the thumb and forefinger, are the subjects to whom this operation is peculiarly advantageous. Dr. W. has several times removed the bone of the first phalanx, and twice that of the second, and still preserved sufficient flexibility of the part to enable the patient to use it. (See *Reese, in American Ed. of this Dictionary.*) Such practice is common in England, though, perhaps, oftener deviated from than it ought to be. "Exfoliation of the distal phalanx, which frequently occurs, does not require amputation, as the finger, though somewhat shortened by it, is not materially impaired, either in appearance or utility." (*Syme's Principles*, p. 403. ed. 2.)

With regard to the treatment of the species of

whitlow, named by Mr. Wardrop *onychchia maligna*, all local applications have in many instances proved quite ineffectual, and the part been amputated. The only local treatment, which Mr. Wardrop has ever seen relieve this complaint, has been the evulsion of the nail, and afterwards the occasional application of escharotics to the ulcerated surface. I have myself seen a similar plan occasionally succeed; and the applications which appeared to answer best, were arsenical lotions, Plunket's caustic, or a very strong solution of the nitrate of silver. Nothing, however, will avail till the nail is removed; and its total separation sometimes takes up a good deal of time, unless the patient submit to the great pain of having it cut away.

In four cases of the *onychchia maligna*, Mr. Wardrop tried with success the exhibition of mercury. It was given in small doses at first, and afterwards increased, so as to affect the gums in about twelve or fourteen days. When the system was in this state, the sores in general soon assumed a healing appearance, and the bulbous swelling gradually disappeared. (See *Med. Chir. Trans.* vol. v. p. 138.) I have known of similar cases, which were traced to inoculation of the finger with venereal matter.

WOUNDS. A great deal of the subject of wounds has been already considered in the articles, **GUNSHOT WOUNDS**; **HEAD, INJURIES OF**; **HEMORRHAGE**; **HYDROPHOBIA**; **PAROTID DUCT**; **SUTURES**; **TETANUS**; **THROAT**; &c.

A wound may be defined to be a recent solution of continuity in the soft parts, suddenly occasioned by external causes, and attended at first with more or less hemorrhage.

Wounds in general are subject to considerable variety in their nature, degree of danger, facility of cure, and the consequences which are to be apprehended from them. Some wounds are quite trivial, not extending more deeply than the skin and cellular tissue; while others are very serious and dangerous, penetrating the fascia, muscles, tendons, large blood-vessels, nerves, and viscera. There are also certain wounds, which are not confined to the soft parts, but injure even the bones; such are many sabre-cuts, which frequently separate at once both a portion of the scalp and the subjacent part of the skull. Many wounds of the head, chest, and abdomen injure the organs contained in those cavities. In short, the varieties, and the degree of danger, attending wounds in general, depend very much upon some of the following circumstances: the extent of the injury; the kind of instrument with which it has been inflicted; the violence which the fibres of the part have suffered, in addition to their division; the size and importance of the blood-vessels and nerves which happen to be injured; the nature of the wounded part, in respect to its general power of healing favourably, or not; whether the operations of the system at large, and life itself, can well be supported, or not, while the functions of the wounded part are disturbed, interrupted, or suspended, by the accident; the youth, or old age of the patient; the goodness, or badness, of his constitution; and the opportunities which there may be of administering proper surgical aid and assistance of every kind.

All wounds of considerable size or depth, not producing immediate death, are followed by more or less disturbance of the whole constitution; by

a fever, which, on account of its being an effect of the local injury, is sometimes called *traumatic*, or *symptomatic*, or *sympathetic*, in consequence of its being, as it were, the sympathy of the whole animal economy with the wounded part. It is likewise frequently named *inflammatory fever*, as being a constant attendant on severe inflammation. (See **FEVERS**.)

Wounds, especially lacerated ones of the fingers and toes, and other tendinous parts, are occasionally productive of another form of constitutional disturbance, affecting in a violent degree the muscular system, and well known by the name of *locked-jaw*. Of this, I have fully treated in another article. (See **TETANUS**.)

Profusely suppurating wounds, the cure of which is retarded by any incidental circumstances, invariably bring on great debility, and a particular disturbance of the sanguiferous, secreting, digestive, nervous, and other systems, known by the name of *hætic fever*, of which I have also delivered an account. (See **FEVERS**.)

Another complication of wounds, often met with in crowded military hospitals, is a peculiar species of mortification, frequently supposed to be contagious; and already described in the article **HOSPITAL GANGRENE**.

Besides these consequences of wounds, it is my duty to mention another very common one, which seems to be intimately connected with the patient's temperament, or habit of body. I here allude to *erysipelas*, and particularly phlegmonous *erysipelas*, which may be excited by a wound, instead of healthy phlegmonous inflammation. (See **ERYSIPELAS**.)

I may as well here also briefly advert to another complication of wounds; namely, to the formation of abscesses in the liver, lungs, around or within the joints, or in other important organs, situated at a considerable distance from the wounded part. These occasional suppurations in the liver and lungs, after injuries of the head, have been known to surgeons for the last sixty or seventy years. They have been noticed by Le Dran, Schmucker, and Klein; and they have again been brought under consideration by Mr. Rose, Mr. Arnott, MM. Cruveilhier, Maréchal, Dance, &c. (See *Med. Chir. Trans.* vols. xiv. and xv.) They are now known to depend upon phlebitis. (See **VEINS**.)

Wounds are distinguished by surgical writers into several kinds; viz. *incised*, *punctured*, *contused*, *lacerated*, *poisoned*, and *gunshot wounds*. They also make another equally important division into *Wounds of the Head, Throat, Thorax, Abdomen, Extremities, &c.*

Of gunshot wounds, and wounds of the head and throat, an account has already been given. (See **GUNSHOT WOUNDS**; and **HEAD, INJURIES OF**.) The other cases I shall now proceed to consider.

Incised Wounds.—As a general observation, it may be stated, that, *cæteris paribus*, a wound made with a sharp cutting instrument—a mere incision—is attended with less hazard of dangerous consequences, than any other kind of wound whatsoever. The fibres have only been simply divided; they have suffered no contusion, nor laceration; consequently, they are less likely to inflame severely, or to suppurate, or slough; and they commonly admit of being united again in a very expeditious manner.

Generally, simple incised wounds bleed more freely than contused and lacerated ones, which

at first sometimes scarcely pour out any blood at all, although considerable blood-vessels may be injured. But this circumstance, apparently diminishing the danger of contused and lacerated wounds, is deceitful, and serves rather to render the case in reality more perilous, by inducing the inexperienced practitioner to be off his guard against hemorrhage. Thus, in gunshot wounds, it often happens, that, on their first occurrence, the bleeding is trivial; but, the side of some large artery having suffered great violence at the time of the accident, it may ulcerate, or slough, a week or ten days afterwards, and an alarming, and even fatal effusion of blood be the result.

In simple incised wounds, the bleeding, which at once takes place from all the divided vessels, is a source of very useful information to the surgeon, inasmuch as it enables him to judge what danger is to be apprehended from the hemorrhage, whether the cut vessels are large enough to demand the ligature, or, on the contrary, whether they are such as will cease to bleed, either by slight pressure, or of their own accord.

In a recent simple incised wound, there are three objects, which the surgeon should endeavour to accomplish without the least delay. The first, and that which requires his immediate interference, is the bleeding, which must be checked. The second is the removal of all extraneous or foreign bodies from the wound. The third is the reunion of the opposite sides of the injury.

When the divided vessels are not above a certain size, the bleeding soon spontaneously ceases, and no surgical measures need be taken on this particular account. When the wounded vessels are even somewhat larger, and their situation is favourable for compression with a bandage, it is often advisable to close the wound and apply compresses and a roller, rather than have recourse to ligatures, which always create a certain degree of irritation and suppuration. However, though I have made this observation, I should be exceedingly sorry to appear at all against the general preference to ligatures, whenever the wounded arteries are above a certain magnitude. In this circumstance, tying the bleeding vessels is the only safe mode of proceeding. When the artery is of considerable size, and its mouth can be readily seen, the most proper instrument for taking hold of it is a pair of forceps, or a tenaculum forceps. In applying the ligature, the surgeon must take care to pull its ends in such a manner, that the noose will not rise above the mouth of the vessel; and, for the purpose of adapting the direction of the force employed in tightening the ligature to this object, the ends of the thumbs are generally made use of; though my colleague Mr. Liston, I think, does not follow this plan, and even passes some kind of criticism on it, which seems to me undeserved. The tenaculum is commonly employed for taking up arteries, which are not large and open mouthed.

Fine ligatures, of sufficient strength, are at present often applied, as well to large as small vessels, — an improvement, to the establishment of which the experiments of Dr. Jones, and the practice of Dr. Veitch, in the Plymouth Hospital, materially contributed. One half of each ligature should always be cut off close to the knot, before the wound is closed. The method of cutting off all the ligature, except what forms the noose imme-

diately round the artery — (see *Delpsch, Mém. sur la Pourriture d'Hôpital*, p. 29.; *Lawrence*, in *Med. Chir. Trans.* vol. vi. p. 186.), is advisable only in cases where the wound has no chance of uniting by the first intention. (See *Guthrie on Gunshot Wounds*, p. 94.; *J. G. Crosse*, in *London Med. Repository*, vol. vii. p. 353.) The experiments of Mr. Crosse tend to the following conclusions:—

First, If the wounds do not unite by the first intention, the ligatures may escape with the discharge, without any inconvenience.

Secondly, If common ligatures of twine are cut short, the wound may unite over them, and they may be found in abscesses after an interval of many weeks.

Thirdly, If the finest dentist's silk be employed in the same way, and the wound unite over it, the ligature may be detached from the vessel, and remain buried in an abscess, where it will be found at different periods, from one to seven months; and this may happen, whether the vessel be firmly compressed with a single ligature, or divided between two ligatures, so as to imitate the circumstances under which vessels are tied after operations.

Fourthly, If Indian silk, fine as hair, be put round a vessel, so as to diminish its diameter, or to effect its obliteration, by just compressing its sides together, it may remain in this situation, without exciting abscess, or producing any inconvenience. The ligature may be thus applied to compress an artery for the cure of aneurism, but not to secure vessels divided in operations. If a thin ligature be drawn sufficiently tight upon a vessel on the face of a stump to be secure, Mr. Crosse is persuaded, that the extremity of the vessel, which becomes insulated, as it were, must die. (See *Lond. Med. Reposit.* vol. vii. p. 363.) For further observations on this practice, see ANEURISM, HEMORRHAGE, LIGATURE, &c.

The bleeding having been suppressed, the next object is to remove any extraneous matter, such as gravel, bits of glass or china, clots of blood, &c., from the wound. Were this circumstance neglected, the plan of uniting the opposite sides of the cut by the adhesive inflammation, or by, what is more frequently termed, union by the first intention, would generally fail, and abscesses follow; or, if there were union, it would only confine the foreign bodies, which would keep up pain in the part, and interfere with its functions. Bits of glass left in the hand are often found to produce such consequences; and, if not extracted at first, they sometimes become difficult to find and remove at a later period.

As soon as attention has been paid to the foregoing indications, the surgeon must put the lips of the wound in contact, and take measures for keeping them in this state, until they have grown firmly together. The sides of incised wounds are kept in a state of apposition by means of adhesive plaster, a proper position, the pressure of a roller, and in some instances, by the employment of sutures.

With respect to sutures, as they create pain, irritation, and some degree of suppuration, they ought never to be employed when the parts can be kept steadily in contact without them. However, certain cases require them; and it is admitted by many experienced surgeons, that in sabre-wounds, of the ears, eyelids, nose, and lips, it is proper to use them. (See *Assalini's Manuale di*

Chir. Parte Seconda, p. 10.) They are also commonly resorted to for the wounds produced by flap-amputations, castration, operations for hernia, &c. A description of the several kinds of sutures, with remarks on them, will be found in the article **SUTURES**.

The best, and most common, method of keeping the surfaces of divided parts in contact is by means of strips of adhesive plaster. When they are to be applied, the surgeon should put the wounded limb, or parts, in the position, which is most favourable to bringing the lips of the wound together. With this view, a position should generally be chosen, which relaxes the skin and subjacent muscles. An assistant should then place the edges of the wound as evenly together as possible, and hold them in this state, until the surgeon has secured them in this condition by strips of adhesive plaster applied across the line of the wound. In general, it is deemed advisable to leave a small interspace of about a quarter of an inch between each two strips of plaster, by which means any matter which forms, will not be confined. Over these first strips a little lint, wet or dry, is applied, and kept in its place with one or two pieces of adhesive plaster, or a roller.

The use of pledgets, compresses of tow, &c. is now very much relinquished. Mr. Liston finds great fault with the usual mode of dressing wounds:—"A sort of routine practice (says he) has been long pursued in dressing wounds. They are put together without delay, and their edges squeezed into apposition, and retained so by various means, such as sutures, plasters, compresses, and bandages. They are carefully covered up, and concealed from our view for a certain number of days. Then the envelopes of cotton and flannel, the compress cloths, the pledgets of healing ointment, and plasters, are taken away, loaded with putrid exhalations, and a profusion of bloody, ill-digested, fetid matter. A basin is forthwith held under the injured part, and the exposed and tender surface is deluged with water from a sponge, and then well squeezed and wiped. Then comes a re-application of retentive bandage, of the plaster, of the grease mixed with drying powder, and surmounted by some absorbent stuff, as charpie, or tow, to soak up the discharge. This is not unaccompanied with pain, often more complained of than that attendant upon the original injury or operation. This process is repeated day after day; the patient is kept in a state of constant excitement, and often falls a victim to the practice, worn out by suffering, discharge, and hectic fever." (*On Pract. Surg.* p. 28.)

In the above manner, the fresh-cut surfaces are brought into contact: and to preserve them quietly in this state is the next great aim which the surgeon should have in view. The wounded part should be laid in the posture which was found the most favourable for approximating the sides of the cut at the time of applying the dressings, and the patient should be directed to keep the part in a perfectly quiet state.

When attention is paid to these circumstances, it often happens that the two opposite surfaces of the wound grow together again in the course of forty-eight or sixty hours, without any degree of suppuration. The process by which this desirable event is accomplished, is well known among surgeons by the name of *union by the first intention*. Besides the advantage of the cure being

effected in this way with the greatest expedition possible, there is another consideration highly in favour of constantly promoting this method of healing wounds, which is, that the scar is much less than after any other mode of cicatrization, and the part is covered with original skin, which is always stronger than any which can be formed as a substitute for it.

It is wonderful with what celerity union by the first intention takes place under favourable circumstances. In the course of, three days, the whole of the large wound made in the operation of amputation, is frequently healed, except just where the ligatures are situated.

When the two sides of the wound have been brought together before the oozing of blood has entirely ceased, Mr. Hunter conceives, that blood itself becomes the first bond of union; but, on this point, Professor Thomson, of Edinburgh, entertains a doubt; and all the best practical surgeons now agree, that the lodgment of blood on the surface of a wound is more likely to prevent, than promote, the union of the parts. It is on this account that modern surgeons deem it advantageous to let the oozing of blood cease, before the fresh-cut surfaces are brought together. In this way, the distention of the cavity of the wound with blood is prevented, the surfaces remain nearer together, and the chances of union by the first intention are materially increased. Mr. Liston thinks, that "the surfaces are not disposed to unite for many hours after the division and separation has occurred. So long as the oozing continues, there is no good end to be achieved by their close apposition. It is only when reaction has occurred; when the vascular excitement around the solution of continuity has taken place, and the circulation has been roused; when plastic matter begins to be secreted and thrown out; that the process can be expected to commence." The edges of a large wound, as that resulting from amputation of the extremities, may be approximated in part so soon as the bleeding from the principal vessels and larger branches has been arrested; but the close apposition, and the application of all retentive means, had better be delayed for six or eight hours at least. In the interval, the extreme sensibility of the injured parts may be abated, the oozing moderated, and the chance of secondary hemorrhage much diminished, by covering the parts with lint, dipped in cold water, and frequently renewed." In accidental wounds, which are fresh and bleed freely, Mr. Liston advocates the same plan, and, after hemorrhage has entirely ceased, he prefers a warm poultice of bread and water, or thick lint soaked in tepid water, covered with a piece of oiled silk to prevent evaporation. The limb, if the patient be in the recumbent position, should be well raised above the level of the bed with pillows, or an inclined plane. Support may be given in some stages of the treatment with bandage, or plasters. (See *Liston's Pract. Surgery*, p. 29.) Perhaps these doctrines may not sufficiently insist upon the advantages of closing the wound early; and, from the comparative success which I have seen attend the plan of bringing wounds together, at so late a period as six or eight hours after operations, and the plan of closing them at a much earlier period, and as soon as the oozing of blood has ceased, I should say that the last is decidedly followed by less suppuration, and a greater chance of union by

the first intention. However, I see every reason to think favourably of Mr. Liston's preference of isinglass plaster to the common sticking plaster, and of his mode of using it. It is composed of a solution of isinglass in spirit, and may be spread for use; as occasion requires, on slips of oiled silk, or the unglazed side of silk. It is cut in strips, and the adhesive matter dissolved, when required for use, by the application of a hot moist sponge. "This composition becomes sufficiently adherent: it keeps its hold often to the end of the cure; and it is quite unirritating. Being transparent, the plaster does not prevent any untoward process that may be going on underneath, from being observed; and if any fluid collects, an opening can be snipped for its escape. If, as often may be deemed necessary, a few points of suture have been made, these can be removed by cutting the thread shortly after the fixing of the plasters, and within twenty-four hours. No other dressing need be employed in the first instance, no compress, no pledget, no bandage. A roller may be applied in a few days after some amputations, &c. The discharge that does take place in the light and simple mode of managing wounds here recommended, is wiped from the surrounding skin as it flows out, and from the taffeta, or glazed cloth, on which the parties. A great deal of suffering is thus saved to the patient, and he enjoys much comfort and cleanliness." (*Liston, Op. cit.* p. 31.) It is right to state, that Mr. Liston approves of departing, in some cases, from the rule of deferring the immediate closure of the wound, as when the entire surface can be brought into close apposition, without any clots of blood being interposed, as in penetrating wounds of the mouth, wounds of the lip, &c., where the surfaces can be intimately joined by sutures only. In all common instances, what Mr. Hunter calls the adhesive inflammation takes place. In this process, conglutinating lymph, or what at present is more properly named fibrine, either issues from the half-closed mouths of the vessels, or from the surface of the opened cells of the cellular tissue. This becomes the first uniting medium, and very soon afterwards, in some inexplicable manner, a vascular intercourse is established between the opposite sides of the wound.

The power, which parts of the animal body have of thus growing together, is strikingly evinced by the possibility of removing a part of one body, and then uniting it to some part of another. In this latter case, there can be no assistance given to the union on one side, since the detached part, as Mr. Hunter observes, can hardly do more, than just preserve its own living principle, and accept of union. In this way, says he, the spurs of the young cock can be made to grow on its comb, or on that of another cock; and its testicles, after having been removed, may be made to unite to the inside of any cavity of an animal.

Every one initiated in surgery has heard of the feats of Taliacotius, Garengeot, and others, who are said to have succeeded in effecting the union of parts, which were completely severed from the body. Several other not less extraordinary performances by modern surgeons are recorded. (*See Obs. on Adhesion, with two Cases, demonstrative of the Power of Nature to reunite Parts which have been by accident totally separated from the Animal System, by P. A. Balfour, 8vo. Edinb. 1814; also Dubl.*

Journ. of Med. Science, Nos. 14. and 15.) Indeed, the well-known practice of transplanting the teeth, the experiments of Duhamel and Hunter, and the number and respectable character of the testimonies upon this subject, fully convince me of the occasional success which may attend the endeavour to bring about such an union. Experience also fully proves the frequent success of an endeavour to unite a part, which retains only the slight connexion of a small piece of flesh, or even a few fibres. My friend Mr. Lawrence attended a case, which illustrates the truth of this statement. A man, on the top of a stage coach, was carried under a gateway, which did not leave sufficient room for him to pass without injury, and his head was so much wounded, that one of his ears was entirely separated, with the exception of an attachment by a trivial piece of integuments. Mr. Lawrence assented to the man's wish of not having the separation completed, and fixed the part in its situation with a few sutures. The ear soon united again, and the patient escaped all disfigurement. Baron Larrey gives a case; in which one side of the face, with the bones, was nearly detached, yet united again. Of the knowledge of the disposition of living cut surfaces to grow together with considerable expedition, surgeons, both of ancient and modern times, have availed themselves, not only in the treatment of accidental wounds, but also in the removal of deformity, as exemplified in the cure of fissures in the palate, or lips (see HARELIP), but, most particularly, in the curious and interesting art of forming new underlips and noses, and closing large deficiencies in the urethra with flaps of flesh, raised from the adjacent parts, shaped according to circumstances, and laid directly down upon a fresh cut surface purposely prepared, where it is steadily confined for a certain time with sutures, or simple adhesive plaster and pressure, as the nature of the case may indicate. Nay, sometimes, the flesh for the formation of the organ to be restored, has even been taken from a distant part, as, for instance, from the arm, for the restoration of parts of the face. When this was done, the limb was confined in close contact with the raw surface formed on the face, until a union between them had been effected; a division was now performed with the scalpel, and the opportunity taken to shape the portion of the limb, which was to be left behind, according as the part to be restored might be the ear, nose, or lip. At the present day, the flesh is usually taken from the adjacent parts; a connexion of the flap with the rest of the body is retained, so as to insure some circulation of blood in it, and it is turned into any position which the circumstances may demand.

*See Gaspar Taliacotius, Chirurgia Nova de Narium, Aurium, Labiorumque Defectu, per Institutionem Cutis ex Humero sanctiando, &c. 8vo. Francof. 1698. J. C. Carpus, An Account of Two successful Operations for restoring a lost Nose from the Integuments of the Forehead, 4to. Lond. 1816. * Giuseppe Baroni, Degli Innesti Animal, 8vo. Milan. C. F. Graef, De Rhinoplastice, sive Arte curatum Nasum ad Vivum restituendi, Commentatio, quæ prisca illius ratio iterum experimentis illustratur novisque methodis ad majorem perfectionem perducitur, 4to. Berol. 1818. Sir A. Cooper, On Unnatural Apertures in the Urethra; Surgical Essays, part II. H. Esrie, On the Re-establishment of a Canal in the Place of a Portion of the Urethra, in Phil. Trans. for 1821. A Case of restored Nose, by A. C. Hutchinson. A Case of artificial Anus cured by G. F. Collier, in Med. and Physical Journ. for June, 1820. Delpech, Chir. Clin. t. II. Paris, 1828. Liston's Elements of Surgery, &c. Also the article Nose.*

Mr. John Bell describes the process of adhesion to be this: either the arteries of the opposite surfaces inosculate mouth to mouth, or rather each cut surface throws out a gluten; the gluten fills up the intermediate space; into that gluten the lesser arteries of each cut surface extend themselves, and it is thus, perhaps, by the generation of a new intermediate substance, that the continuity and entireness of the part are so quickly restored. If any one point fail to adhere, there the wound must run into suppuration; because, says Mr. J. Bell, at that point there is a separation of parts, which is equivalent to a loss of substance.

The same writer observes, that doubtless there are accidents both of the constitution, and the wound, which will prevent adhesion. If the patient be of a bad habit of body; if he be lying in a foul hospital, in the midst of putrid sores, and breathing a contagious air; if he be ill of a fever, or flux, or any general disease; then the properties of the body being less perfect, the wound will not adhere. Mr. J. Bell also notices, that if the wound be foul, made with a poisoned weapon, or left with foreign bodies lodged in it; or if a considerable quantity of blood be poured out into the cavity of the wound, or if there be a wounded lymphatic or a wounded salivary duct, a wounded intestine, or a bleeding artery or vein, the immediate adhesion of the whole of the wound may be prevented. However, I cannot help remarking, that though Mr. John Bell, in imitation of most surgical writers, sets down the wound of a lymphatic, as preventive of the union of wounds, I cannot say, that I ever saw such an effect imputable to the cause here mentioned. Also, when an artery or vein is cut, and requires to be tied, the adhesion of the wound would be prevented only just where the ligature lies, and at no other point.

There is no wound, observes Mr. John Bell, in which we may not try with perfect safety to procure this adhesion; for nothing can agree better with one surface of the wound, than the opposite one which has been just separated from it. They may immediately adhere together; and even if they should not do so, no harm is done, and the wound will yet suppurate as favourably as if it had been roughly dressed with dry cassis, or some vulnerary balsam, or acrid ointment. If one part should suppurate, while one half adheres, then, says Mr. John Bell, one half of our business is done. In short, this simple duty of immediately closing a wound is both natural and safe. (*On the Nature and Cure of Wounds*, vol. i.)

Upon this interesting topic of the advantages of union by the first intention, the surgeons of all quarters of the globe now begin to entertain only one opinion. The practice is generally adopted, both in the treatment of accidental cuts and in that of wounds resulting from surgical operations. Thus Assalini, one of the best surgeons in Italy, begins his *Manual of Surgery* with the following axiom: "Wounds and injuries of the soft parts, produced by cutting instruments, from the trifling wound of a vein, made for the purpose of discharging a few ounces of blood, to the incision in the uterus for the extraction of the fœtus, inclusively, should all be united by the first intention." (See *Manuale di Chirurgia; Discorso Primo*. Milano, 1812.)

British surgeons have, indeed, been accused by M. Roux of indiscriminate partiality to the plan of uniting all incised wounds by the first intention;

and his countryman, Baron Larrey, wishes the method to be discontinued after amputation, in order (as he says) to lessen the chance of tetanus. But, the exceptions which these surgeons desire to make are few; and few as they are, they are not likely to be established, since several of the circumstances, alleged as reasons for limiting so beneficial a practice, are hypothetical, and far from being clearly proved. (See Roux, *Mémoire et Observations sur la Réunion immédiate de la Plaie après l'Amputation circulaire des Membres*, 8vo. Paris, 1814. Larrey, *Mém. de Chir.* Mil. tome iv. 8vo. 1812.—1817.)

I know that Baron Dupuytren, the most eminent of all the surgeons of France, is to be ranked only as a moderate advocate for union by the first intention:—"I am convinced," (says he) "that more patients are lost by the exclusive adoption of it, than by following the practice to which I give the preference. I have compared the results of a very considerable number of amputations. Of thirty patients, treated in my way, six died, while nine died out of twenty-nine, in whom immediate union had been attempted." (*Dupuytren, Clin. Chir.* t. iv. p. 418.) This great surgeon admitted, however, that the latter method might be advantageous after amputation performed for mechanical injuries, or primary amputations on the field of battle; because here the surgeon has to deal with individuals who have met with accidents or injuries, at a moment when they were in good health, and whose constitutions have not been broken by a prior disease, or a suppuration of greater or lesser duration, to which the system is quite habituated. "On the other hand," (says he) "in civil hospitals, almost all the unfortunate persons who present themselves, are suffering from organic lesions; almost all of them are more or less weakened by abscesses and suffering of long standing. By amputating the diseased member, we abruptly put a stop to a cause of irritation, which had modified the whole economy, and this can rarely accommodate itself to so sudden a change. Hence, some visceral inflammation almost immediately takes place."

Dupuytren seems to me, however, to fail completely in proving what he attempts. In London, it is familiarly known to all hospital surgeons, that no amputations are more successful, than those performed for the removal of incurably diseased joints; and that, in such cases, if the lungs be sound, the success of the operation is far greater, generally speaking, than that of amputations undertaken for compound fractures, wounds, and other mechanical injuries, though, in each class of cases, the attempt be made to procure union by the first intention. Then, what a counterbalance to Dupuytren's statement is the report of the results of twenty-eight amputations, in which union by the first intention was attempted in the *Maison Royale de Santé*, where only three patients died out of the whole twenty-eight, as cited by Dupuytren himself. It is not because complete union was not effected at every point, or because a portion of the wound was, in some instances, re-opened for the discharge of matter, that any valid argument can be urged against this invaluable practice. No surgeon contends, that union at every point is to be expected; and all will coincide with Dupuytren, respecting the advantage of leaving in a depending situation an outlet for any matter which may form in the stump.

Sometimes the attempt to procure union by the first intention fails, even in cases of incised wounds; but, in this circumstance, no harm arises from the kind of practice that has been followed. The case, in fact, now falls into nearly the same state as would have occurred had no attempt at union been made at all. The patient has taken the chance of a quicker mode of cure; but he has not been successful, and he must now be cured by a process, which on account of its slowness he at first wished to avoid. It is to be observed also, that union by the first intention, if not spoiled by sutures, rarely fails so completely, that there is not a partial adhesion of some points of the wound. The moment when we observe pain, inflammation and swelling of the wound, a separation or gaping of its lips, the stitches tense (when these have been used), and the points where the stitches pass particularly inflamed, Mr. John Bell advises us to undo the bandages, draw out the sutures, and take away every thing acting like a stricture on the wound. These prudent measures, he observes, may abate the rising inflammation, and prevent the total separation of the skin, while an endeavour may still be made to keep the edges of the wound tolerably near each other by the more gentle operation of sticking-plasters.

However, when the inflammation rises still higher, and it is evident that a total separation of the sides of the wound cannot be avoided, Mr. John Bell wisely recommends leaving the parts quite loose, and applying a large soft poultice; for, says he, should you, in this critical juncture, persist in keeping the parts together with sutures, the inflammation, in the form of erysipelas, would extend over the whole limb, attended with a fetid and bloody suppuration. After the wound has been brought into a favourable state, another attempt may be made to bring the edges towards one another, not with sutures, but strips of adhesive plaster, or the gentle application of a bandage.

Mr. John Bell concludes with remarking, that the suppuration, production of granulations, and all that follows, are the work of nature. The only thing that the surgeon can usefully do, is to take care of the health. When the wound does not suppurate favourably, the discharge generally becomes profuse, thin, and glaucous. This state is to be amended by bark, wine, rich diet, and good air.

I shall conclude this subject of union by the first intention, with an extract from the writings of Mr. Hunter, who observes that,

"It is with a view to this principle of union, that it has been recommended to bring the sides (or lips) of wounds together; but as the natural elasticity of the parts makes them recede, it has been found necessary to employ art for that purpose. This necessity first suggested the practice of sewing wounds, and afterwards gave rise to various inventions in order to answer this end, such as bandages, sticking-plasters, and ligatures. Among these, the bandage, commonly called the uniting bandage, is preferable to all the rest, where it can be employed; but its application is very confined, from being only adapted to parts where a roller can be used. A piece of sticking-plaster, which has been called the dry suture, is more general in its application than the uniting bandage, and is therefore preferable to it on many occasions.

"I can hardly suppose (says Mr. Hunter), a wound in any situation, where it may not be applied, excepting penetrating wounds, or where we wish the inner portion of the wound to be closed equally with the outer, as in the case of hare-lip. But even in such wounds, if the parts are thick, and the wound not large, the sides will seldom recede so far as to make any other means necessary. The dry suture has an advantage over stitches by bringing a larger surface of the wound together, by not inflaming the parts to which it is applied, and by neither producing in them suppuration nor ulceration, which stitches always do. When parts, therefore, can be brought together, and especially where some force is required for that purpose, from the skin not being in large quantity, the sticking-plaster is certainly the best application. This happens frequently to be the case after the removal of tumours, in amputation, or where the sides of the wound are only to be brought together at one end, as in the hare-lip; and I think the difference between Mr. Sharp's cross-stitch, after amputation, as recommended in his Critical Inquiry, and Mr. Alanson's practice shows strongly the superiority of the sticking-plaster (or dry suture). In those parts of the body where the skin recedes more than in others, this treatment becomes most necessary; and as the scalp probably recedes as little as any, it is therefore seldom necessary to apply any thing in wounds of that part; the practice will certainly answer best in superficial wounds, because the bottom is in these more within its influence.

"The sticking-plasters should be laid on in strips, and these should be at small distances from each other, viz. about a quarter of an inch at most, if the part requires close confinement; but when it does not, they may be at greater distances. This precaution becomes more necessary if the bleeding is not quite stopped; there should be passages left for the exit of blood, as its accumulation might prevent the union, although this does not always happen. If any extraneous body, such as a ligature, should have been left in the wound, suppuration will take place, and the matter should be allowed to vent at some of those openings, or spaces between the slips of plaster. I have known a very considerable abscess formed in consequence of this precaution being neglected, by which the whole of the recently united parts have been separated.

"The interrupted suture, which has generally been recommended in large wounds, is still in use, but seldom proves equal to the intention. This we may reckon to be the only one that deserves the name of suture; it was formerly used, but is now in a great measure laid aside in practice, not from the impropriety of uniting parts by this process, but from the ineffectual mode of attempting it. In what manner better methods could be contrived, I have not been able to suggest. It is to be understood, that the above methods of bringing wounded parts together, in order to unite them, are only to be put in practice in such cases as will admit of it; for if there was a method known, which in all cases would bring the wounded surfaces into contact, it would in many instances be improper, as some wounds are attended with contusion, by which the parts have been more or less deadened: in such cases, as was formerly observed, union cannot take place

according to our first principle, and therefore it is improper to attempt it.

"In many wounds, which are not attended with contusion, when we either know or suspect that extraneous bodies have been introduced into the wound, union by the first intention should not be attempted, but they should be allowed to suppurate, in order that the extraneous matter may be expelled. Wounds which are attended with laceration, although free from contusion, cannot always be united by the first intention; because it must frequently be impossible to bring the external parts, or skin, so much in contact, as to prevent that inflammation which is naturally produced by exposure. But, even in cases of simple laceration where the external influence is but slight, or can be prevented (as we observed in treating of the compound fracture), we find that union by the first intention often takes place; the blood, which fills up the interstices of the lacerated parts, having prevented the stimulus of imperfection in them, and prevented suppuration, may afterwards be absorbed.

"Many operations may be so performed as to admit of parts uniting by the first intention; but the practice should be adopted with great circumspection: the mode of operating with that view should in all cases be a secondary and not a first consideration, which it has unluckily been too often among surgeons. In cases of cancer, it is a most dangerous attempt at refinement in surgery.

"In the union of wounded parts by the first intention, it is hardly or never possible to bring them so close together at the exposed edges, as to unite them perfectly by these means; such edges are therefore obliged to take another method of healing. If kept moist, they will inflame as deep between the cut surfaces as the blood fails in the union, and there suppurate and granulate; but if the blood be allowed to dry and form a scab between, and along the cut edges, then inflammation and suppuration of those edges will be prevented, and this will complete the union; as will be described by and by.

"As those effects of accidental injury, which can be cured by the first intention, call up none of the powers of the constitution to assist in the reparation, it is not in the least affected or disturbed by them; the parts are united by the extravasated blood alone, which was thrown out by the injury, either from the divided vessels or in consequence of inflammation, without a single action taking place, even in the part itself, except the closing or insinuation of the vessels; for the flowing of the blood is to be considered as entirely mechanical. Even in cases where a small degree of inflammation comes on, it is merely a local action, and so inconsiderable that the constitution is not affected by it; because it is an operation, to which the powers belonging to the parts themselves are fully equal. The inflammation may produce a small degree of pain, but the operation of union gives no sensation of any kind whatever." (*Hunter, On the Blood, Inflammation, and Gun-shot Wounds.*)

Contused and Lacerated Wounds. — *Lacerated* wounds are those in which the fibres, instead of being divided by a cutting instrument, have been torn asunder by some violence capable of overcoming their force of cohesion. The edges of such wounds, instead of being straight and regular, are jagged or unequal?

The term *contused* is applied to wounds, occasioned by some blunt instrument, or surface, which has violently struck a part of the body.

These two species of wounds greatly resemble one another, and as they require nearly the same kind of treatment, writers usually treat of them together.

Lacerated and contused wounds differ from simple incised ones in appearing, at first view, less alarming than the latter, while in reality they are infinitely more dangerous. In simple cut wounds, the retraction of the parts, and the hemorrhage, are generally much more considerable than in a lacerated wound of the same size. However, notwithstanding these circumstances, they commonly admit of being healed with far greater ease. It is worthy of particular notice, that lacerated and contused wounds are not in general attended with any serious effusion of blood, even though large blood-vessels may be injured. I say, in general, because in the year 1813, I saw a soldier whose death was occasioned by a sudden effusion of a very large quantity of blood from the internal jugular vein, which vessel had been injured by a musket-ball, that first entered the integuments behind the mastoid process, and passed obliquely downwards and forwards towards the sternum. The blood did not issue externally, but formed betwixt the integuments and the trachea, a large dark-coloured swelling, which produced almost immediate suffocation. At the memorable siege of Saragossa, Professor Assalini saw a surgeon, whose left carotid artery had been injured by a musket-ball, perish of hemorrhage in a few seconds. (*See Assalini's Manuale di Chirurgia*, p. 32. Milano, 1812.)

In most cases, however, there is at first no hemorrhage of consequence from lacerated or contused wounds, and it is a circumstance that often leads inexperienced practitioners to commit great mistakes, by inducing them to hold out too favourable a prognosis. Surgeons versed in practice, however, do not allow themselves to be deceived by the absence of hemorrhage, and, in proportion as there is little bleeding, they apprehend that the violence done to the fibres and vessels has been considerable. What is it but the contused and lacerated nature of the wound that prevents hemorrhage from the umbilical arteries, when animals divide the navel-string with their teeth? Whole limbs have frequently been torn from the body, without any hemorrhage of consequence taking place. In the *Phil. Trans.* Cheselden recorded a remarkable case, in which a man's arm was suddenly torn from his body. Samuel Wood, a miller, had put round his arm a rope, which got entangled with the wheel of the mill. He was lifted off the ground, and then stopped by a beam, which prevented his trunk from passing further; at this instant, the wheel, which was moving with immense force, completely tore and carried away his arm and scapula from his body. The appearance of a wound, occasioned in this manner, must of course be horrible, and the first idea thence arising must naturally be that the patient cannot possibly survive. Samuel Wood, however, escaped with his life. The limb had been torn off with such velocity, that he was unaware of the accident, till he saw his arm moving round on the wheel. He immediately descended by a narrow ladder from the mill, and even walked some paces

with a view of seeking assistance. He now fell down from weakness. The persons who first came to his assistance, covered the wound with powdered sugar. A surgeon, who afterwards arrived, observing that there was no hemorrhage, was content with bringing down the skin, which was very loose, so as to make it cover the surface of the wound. For this purpose, he used two cross stitches. The patient was conveyed the next day to St. Thomas's Hospital, and put under the care of Mr. Fern. This practitioner employed the usual means for preventing the bad symptoms most to be expected in this sort of case. The first dressings came away without any bleeding; no alarming consequences ensued; and the patient, in two months, completely recovered.

When the arm was examined, it was found that the muscles, attached to the scapula, were torn through near their insertions; while other muscles arising from this bone, were carried away with it. The skin, covering the scapula, had remained in its natural situation, and seemed as if it had been divided precisely at the insertion of the deltoid muscle.

In La Motte's *Traité des Accouchemens* may be found an account of a little boy, who, while playing near the wheel of a mill, got his hand, forearm, and arm, successively entangled in the machinery, and the limb was violently torn away at the shoulder-joint, in consequence of the lad's body not being able to pass in the direction in which the arm was drawn. The bleeding was so trivial, that it was stopped with a little lint, and the boy soon recovered.

In the fifth vol. of the *Edinb. Med. Commentaries*, may also be perused the history of a child, three years and a half old, whose arm was torn off by the wheel of a mill. Mr. Carmichael, who saw the child about an hour after the accident, found it almost in a dying state, with cold extremities, small faltering pulse, and all the right side of the body convulsed. However, there was hardly any bleeding. The arm was broken about an inch and a half above the elbow; the stump had a dreadful appearance; all the soft parts were in a contused and lacerated state, and the humerus was laid bare as high as the articulation, which was itself exposed. The skin and muscles were lacerated to a much greater extent, and in different directions. The remainder of the humerus was removed from the shoulder-joint by amputation, only as much skin and muscle being left as was sufficient to cover the wound. In two months, the child was well.

In the *Mém. de l'Acad. de Chir.* t. ii. is an account of a leg being torn away at the knee-joint by a cart-wheel. The patient was a boy about nine or ten years of age. This accident, like the foregoing ones, was accompanied with no hemorrhage. The lower portion of the os femoris, which was exposed, was amputated, together with such portion of the soft parts as was in a contused and lacerated state. The patient experienced a perfect recovery.

The preceding cases strikingly confirm the observation which I have already made, in regard to the little bleeding usually arising from contused and lacerated wounds. The changes and condition of the torn arteries of magnitude, explaining the reason of there being no hemorrhage of importance, are noticed in the article HEMORRHAGE.

In contused and lacerated wounds, the pain is in an inverse ratio to the cause of the accident; it is generally very severe when the wound is only moderately contused; and on the other hand, when there has been so violent a degree of contusion, as at once to destroy the organisation of the part, the patient suffers scarcely any pain at all.

When the bruised fibres have not been injured above a certain degree, the part suppurates; but such portions of the wound as have suffered greater violence inevitably die, and are cast off in the form of sloughs. Granulations are afterwards formed, and the breach of continuity is repaired by the process of cicatrisation. (See this word.)

When a still greater degree of violence has been done, and especially when arteries of a certain magnitude have been at the same time injured, mortification is too frequently the consequence. However, if the constitution be good, and the mischief not too extensive, the case may still end well. But in other instances, the event is a just cause of apprehension; for the mischief is then not limited to the wounded parts, which have suffered the greatest degree of contusion, but too frequently extends over such parts as were not at all interested by the wound itself.

The mortification, arising directly from the impaired organisation of parts, is not the most alarming circumstance. A still more dangerous kind of mortification is that which originates from the violent inflammation produced by the accident. This consequence demands the utmost attention on the part of the surgeon, who must let no useful means be neglected, with the view of diminishing the inflammation before it has attained too high a degree, and threatening symptoms have commenced. In the first instance, he should not be afraid of letting the wound bleed a little, if it should be disposed to do so. The edges of the wound should then be gently drawn towards each other, with a few strips of adhesive or isinglass plaster, so as to lessen the extent of the exposed surface; but sutures are improper. Indeed, the plan of diminishing the exposed surface of a contused wound with strips of adhesive plaster, is not invariably right; because their application creates a hurtful degree of irritation. The method is chiefly advisable when there is a large loose flap of skin, which can be conveniently brought over the wound. In other cases, it is best to leave the parts free, uncompressed, and unconfined by any adhesive plaster, because if it were applied, its irritation would do harm, and could not possibly procure any union of the parts. Under the most favourable circumstances, hardly any part of the wound can be expected to unite by the first intention: the whole or the greater part of it will necessarily suppurate, after the detachment of the sloughs. The surface will then granulate, new skin will be formed, and the part heal, just like a common wound. Perhaps, until the sloughs separate, the best application is a soft poultice, or lint, dipped in tepid water, and covered with oiled silk.

Many surgeons prefer cold applications in cases of contused, lacerated wounds. In general, says Professor Assalini, the treatment of contused wounds, whether they be simple and slight, or complicated and severe, requires the active employment of debilitating means in order to prevent inflammation. Cold water and ice, and

general and topical bleeding, are the things usually resorted to with success. Vulnerary lotions, camphorated spirit, and other spirituous applications are improper; and if their pernicious effects are not always very evident, it is only because the contused injuries have been trifling, and in their nature perfectly easy of cure. In these cases, as well as in those of extravasations and glandular swellings, Assalini gives the preference to cold applications. The internal remedies and regimen (says he) should also be adapted to the condition of the patient. A cannon-ball, at the end of its course, may come into contact with a limb, and fracture the bones, while the integuments have the appearance of being uninjured. Such cases are often attended with dreadful mischief in the soft parts around the bone, which generally sphacelate. This is an accident for which immediate amputation is mostly indispensable (see GUNSHOT WOUNDS); but, if any thing be capable of preventing inflammation and gangrene, it is an active debilitating plan of treatment, assisted with cold applications to the injured part. In such cases, the internal and external use of stimulants is approved of by many surgeons. But Assalini prefers considering the state of the injured limb, just like what it is when affected with frost; and he thinks that the employment of stimulants will necessarily produce the same effect as caloric prematurely applied to parts denuded with cold. On the contrary, from the outward employment of ice and cold lotions in these cases, and in contused injuries in general, he has seen the greatest benefit derived.

Assalini conceives, that reason will be found to support this practice. The operation of cold, he says, retards the course of the blood, which meeting with only damaged vessels, augments the extravasation as it continues to flow. By lessening the temperature of the part, cold applications likewise diminish the danger of inflammation and sphacelus, at the same time that they have the good effect of rendering the suppuration, which must ensue, less profuse than it would be, were not the extravasation of blood, and violence of the inflammation, lessened by such applications, and a lowering plan of treatment.

Why, says Assalini, should not this method, which is so generally adopted to prevent the effects of concussion of the brain after blows on the head, be, for analogous reasons, employed in examples of extravasation and commotion in other parts of the body. (*Manuale di Chirurgia*, Parte Prima, p. 17.) Cold applications, however, to contused wounds, are chiefly to be preferred for the first day or two, in order to check the increase of extravasation and inflammation. After this period, I give a decided preference to an emollient poultice, or the tepid water dressing, which will be found to afford most relief during those processes, by which the sloughs are detached, the surface of the wound cleansed, and the origin of granulations established. When these changes have happened, the remaining sore is to be treated on the same principles as ulcers in general. See ULCER.

Punctured Wounds.—A punctured wound signifies one made with a narrow-pointed instrument, the external orifice of the injury being small and contracted, instead of being of a size proportionate to its depth. A wound, produced by the thrust

of a sword, or bayonet, affords us an example of a punctured wound.

Wounds of this description are in general infinitely more dangerous than cuts, notwithstanding the latter have the appearance of being by far the most extensive. In stabs, the greatest degree of danger always depends on the injury and rough violence which the fibres have suffered, in addition to their mere division. Many of the disagreeable consequences are also to be imputed to the considerable depth to which these wounds extend, whereby numerous textures, and important parts and organs are frequently injured. Sometimes the treatment is rendered perplexing by the difficulty of removing extraneous substances, as for instance a piece of the weapon which has been left in the wound. Lastly, experience proves, that punctured wounds and stabs are particularly liable to be followed by a great deal of inflammation, fever, deep-seated abscesses, sinuses, &c.

A strange notion seems to pervade the writings of many systematic authors, that all the danger and disagreeable consequences of punctured wounds depend entirely upon the narrowness of their orifices, so that suitable applications cannot be introduced to their bottom. Hence, it is absurdly recommended to dilate the opening of every stab, with the view, as is generally added, of converting the accident into a simple incised wound. Some of these writers are advocates for making the dilatation with a cutting instrument, while others, with equal absurdity, propose to enlarge the opening with tents.

Certain authors regard a punctured wound as a recent sinus; and, in order to make the inner surfaces unite, they recommend exciting a degree of inflammation in them, either by means of setons or injections.

In the earliest edition of *The First Lines of the Practice of Surgery*, I took particular pains to expose the folly and errors, which prevail in numerous writings on this part of practice. In the above work, I have remarked, that if the notion were true, that an important punctured wound, such as the stab of a bayonet, could be actually changed into a wound partaking of the mild nature of an incision, by the mere enlargement of its orifice, the corresponding practice would certainly be highly commendable, however painful. But the fact is otherwise: the rough violence done to the fibres of the body by the generality of stabs is little likely to be suddenly removed by an enlargement of the wound: nor can the distance to which a punctured wound frequently penetrates, and the number and nature of the parts injured by it, be at all altered by such a proceeding. These, which are the grand causes of danger, and of the collections of matter that often take place in the cases under consideration, must exist, whether the mouth and canal of the wound be enlarged or not. The time when incisions are proper, is, when there are foreign bodies to be removed, abscesses to be opened, or sinuses to be divided. To make painful incisions sooner than they can answer any end, is both injudicious and hurtful: they are sometimes rendered quite unnecessary, by the union of the wound throughout its whole extent, without any suppuration at all.

Making a free incision in the early stage of these cases, undoubtedly seems a reasonable me-

thod of preventing the formation of sinuses, by preventing the confinement of matter, and, were sinuses an inevitable consequence of all punctured wounds, for which no incisions had been practised at the moment of their occurrence, it would undoubtedly be unpardonable to omit them. Fair, however, as this reason may appear, it is only superficially plausible, and a small degree of reflection soon discovers its want of real solidity. Under what circumstances do sinuses form? Do they not form only where there is some cause existing to prevent the healing of an abscess? This cause may either be the indirect way, in which the abscess communicates with the external opening, so that the pus cannot readily escape; or it may be the presence of some foreign body, or carious bone; or, lastly, it may be an indisposition of the inner surface of the abscess to form granulations, arising from its long duration, but removable by laying the cyst completely open. Thus it becomes manifest, that the occurrence of suppuration in punctured wounds is followed by sinuses only when the surgeon neglects to procure a free issue for the matter after its accumulation; or when he neglects to remove any extraneous bodies. But, as dilating the wound at first can only tend to augment the inflammation, and render the suppuration more extensive, it ought never to be practised in these cases, except for the direct objects of giving free exit to matter already collected, and of being able to remove extraneous bodies palpably lodged. I shall once more repeat, that it is an erroneous idea to suppose the narrowness of punctured wounds to be so principal a cause of the bad symptoms with which they are often attended, that the treatment ought invariably to aim at its removal.

Recent punctured wounds have absurdly had the same plan of treatment applied to them as old and callous fistulæ. Setons and stimulating injections, which, in the latter cases, sometimes act beneficially, by exciting such inflammation as is productive of the effusion of coagulating lymph, and of the granulating process, never prove serviceable when the indication is to moderate an inflammation, which is too apt to rise to an improper height. The counter-opening, that must be formed in adopting the use of a seton, is also an objection. However, what good can possibly arise from a seton in these cases? Will it promote the discharge of foreign bodies, if any are present? By occupying the external openings of the wound, will it not be more likely to prevent it? In fact, will it not itself act with all the inconveniences and irritation of an extraneous substance in the wound? Is it a likely means of diminishing the immoderate pain, swelling, and extensive suppuration, so often attending punctured wounds? It will undoubtedly prevent the external openings from healing too soon: but cannot this object be effected in a better way? If the surgeon observe to insinuate a piece of lint into the orifice of the sinus and pass a probe through its track once a day, the danger of its closing too soon will be removed.

The practice of enlarging punctured wounds by incisions, and of introducing setons, is often forbidden by the particular situation of these injuries.

In the first stage of a punctured wound, the indication is to guard against the attack of violent inflammation. When no considerable quantity

of blood has been lost, general and topical bleeding should be practised and repeated according to the urgency of the case. In short the antiphlogistic plan is to be followed. As no man can pronounce, whether such a wound will unite; or not, and as no harm can result from the attempt, the orifice ought to be closed, and covered with simple dressings. Whether gentle compression might be made to promote the adhesive inflammation, or not, may be doubtful: I confess, that I should not have any reliance upon its usefulness. Perfect quietude is to be observed, and if the pain is severe, opium is to be administered.

Sometimes, under this treatment, the surgeon is agreeably surprised to find the consequent inflammation mild, and the wound speedily united by the first intention. "Numerous are the examples of wounds which penetrate the large cavities, being healed by the first intention, that is, without any suppuration. Even wounds of the chest itself, with injury of the lungs, ought to be united by the first intention." (*Assalini, in Manuale di Chirurgia, Parte Seconda, p. 13.*) More frequently, however, in cases of deep stabs, the pain is intolerable; and the inflammatory symptoms run so high as to leave no hope of avoiding suppuration. In this condition, emollient poultices and fomentations are the best local applications; and when the matter is formed, the treatment is like that of abscesses in general. See SUPPURATION.

Poisoned Wounds: Bite of the Viper.—If we exclude from present consideration the bites of mad dogs, and other rabid animals, which subject is fully treated of in the article HYDROPHOBIA, wounds of this description are not very common in this kingdom. In dissection, pricks, or cuts of the fingers, or other parts of the hand sometimes occur, and some of them are believed to be a species of poisoned wound, frequently causing considerable pain, and irritation in the course of the absorbents; swelling and suppuration of the lymphatic glands of the arm or axilla; phlegmonous erysipelas; and severe fever, and constitutional irritation.

In many instances, however, surgeons wound their fingers in dissecting bodies, and no particular ill consequences ensue. The healthy and robust are thought to suffer less frequently after such accidents, than persons whose constitutions have been weakened by hard study, excesses, pleasure, or previous disease. It is remarked, also, that pricks of the fingers, met with in opening the bodies of persons who have died of contagious diseases, and where a virus, or infectious matter, might be expected to exist in such bodies, do not communicate the infection. Doubtless, (observes Richerand) the activity of certain animal poisons, from which the venereal and several other diseases arise, is extinguished with life. (*Nosographie Chir. t. i. p. 102, 103. ed. 4.*) This is a point, however, that does not seem completely established; and that the small-pox can be communicated from a corpse to a person, who does not even touch the body, was exemplified in the spring of 1829 in the cases of two students at St. Bartholomew's, one of whom was my own nephew. The disease was caught by merely attending a lecture, in the anatomical theatre, where the body of a black, who had died of confluent small-pox, was produced.

It is a question with some writers whether the

pricks and cuts received in dissection, are really poisoned wounds? The considerations in support of many of them being of this nature, are the following:—1. Severe and dangerous constitutional disturbance, resulting from such injuries, is noticed with remarkable frequency, after punctures and small wounds, received in examining recent bodies, and especially those of females who have died of puerperal fever (i. e. uterine phlebitis) or of other persons who have been destroyed by peritonitis. 2. The diminished risk, when the wound is an open freely bleeding one: but, though the wound bleed freely, the patient is not always safe. Dr. Godman, of the United States, has related the case of a student, who received a wound, about one-third of an inch in length, across the last joint of his left middle finger, which bled freely, yet he died on the sixth day after the injury. (See *Amer. Journ. of Med. Sciences*, vol. i.) 3. The frequent occurrence of similar effects in nurses who have pricks, or abrasions on their hands while they are washing linen, contaminated with purulent discharges. It is true, however, that in certain constitutions, similar consequences sometimes follow slight pricks and other trivial mechanical injuries, where all possibility of the action of infectious matter is out of the question. It is certain, also, that the pricks and cuts, received in dissection, cause bad symptoms only in a small proportion of instances. The constitutional disturbance and danger are likewise generally noticed to be in a ratio to the extent of the diffuse inflammation, or other local mischief.

The ill consequences are known to differ considerably in different examples. 1. Sometimes a small pustule arises, which is not very painful, and disappears in a few days. 2. Sometimes chronic inflammation of a point under the skin takes place, causing a small hard tumour, lasting for months, but at length subsiding. 3. In other instances, the inconveniences commence with erysipelatous inflammation situated around the injury, and creeping about the hand even after the wound has healed. 4. The complaints may begin with violent inflammation of the wounded part, attended with intense pain and followed by sloughing of the skin and cellular tissue near the prick. 5. In other instances, inflammation of the hand, particularly implicating the sheaths of the tendons, comes on, as in the severest forms of whitlow. 6. Frequently the inflammation is not confined to the part, but runs up the superficial absorbents, and the glands in the axilla swell, and often suppurate, attended with great local and constitutional suffering. 7. In other cases, the deep absorbents are involved. 8. It is alleged, that, in particular instances, the constitutional disturbance precedes any local symptoms. There is typhoid fever, without any active inflammation about the wound, but merely a vesicle or pustule. The absorbents are not inflamed, but diffuse inflammation of the cellular tissue, or phlegmonous erysipelas, in the pectoral, or axillary regions, ensues, followed by abscesses, and even sloughing of the subcutaneous cellular texture. This last case is suspected by Dr. Benson to depend on a peculiar animal poison, generated at or about the period of death, and losing its specific virulence, when putrefaction occurs. All the other instances are supposed by him to arise from the operation of some irritating matter of no specific nature, but producing different

effects according to the textures involved, or the state of the health or constitution. (See *Dublin Hospital Reports*, vol. iv.; and *Dublin Journ. of Med. Science*, No. 20.) With respect to the kind of constitutional disturbance in severe cases, we find, that the patient almost always has an attack of shivering, generally followed by vomiting, intense headach, anxiety, and despondence. In the early stage, the pulse is frequent and full, and the tongue covered with white fur. Afterwards, patients get into a typhoid state; and the pulse becomes quick and weak; delirium comes on; dark discharges take place from the bowels; the tongue is brown; and the patient sinks. I have known patients recover from the immediate dangers of phlegmonous erysipelas, the abscesses, and sloughing, and then die of inflammation of the brain, or other viscera, seemingly brought on by too early a recourse to stimulating medicines and diet.

An interesting paper on the wounds received in dissection, was published by Dr. Colles. (See *Dublin Hospital Reports*, vol. iii.) This gentleman is in favour of the immediate application of caustic in a solid or liquid form; and, if this be objected to, he recommends plunging the finger without delay into a cup of oleum terebinthinæ. "The irritation (he thinks), may counteract the power of infection, or alter the mode of inflammation in the wound." (*Op. et vol. cit. p. 222.*)

With regard to the treatment of the pricks of dissecting scalpels, the surgeons of the Continent recommend the immediate cauterisation of the little wounds with caustic potassa, or the liquid muriate of antimony. Tonic remedies, particularly wine, are prescribed, and great attention paid to emptying the bowels.

I think, that the wound should be first well washed with a syringe and warm water, or what is better, sucked directly after its occurrence; it should then be touched with the nitrate of silver, and the whole hand enveloped in linen, kept constantly wetted with a cold evaporating lotion. The arm is to be kept at rest in a sling, and the body emptied with a dose of calomel and the senna mixture; the patient should abstain from study, and take the benefit of pure air. If much inflammation of the part ensue, leeches should be freely applied. The phlegmonous erysipelas, abscesses, and constitutional disturbance, are to be treated according to rules explained in the articles SUPPURATION and Erysipelas.

The stings of bees, wasps, and hornets, are strictly poisoned wounds, though they are seldom important enough to require the assistance of a surgeon. The hornet is not found in Scotland; but it is an inhabitant of several of the woods in England. Its sting, which is more painful than that of a bee, or wasp, is not, however, often the occasion of any serious consequences. The stings of all these insects are attended with a sharp pain in the part, very quickly succeeded by an inflammatory swelling, which after a short time generally subsides of itself. When the eye is stung, as sometimes has happened, the effects may be very severe, as is elsewhere noticed. (See ORNITHALMY.) It has been lately observed, that the pain of the stings of venomous insects, like the bee, depends less upon the introduction of the sting into the part, than upon that of the venomous fluid. The experiments of Professor Duméril tend

to prove, that, when the little poison-bladder, situated at the base of the sting, has been cut off, a wound with the sting then produces no pain. The poison flows from the vesicle through the sting, at the instant when this passes into the flesh. The exact nature of the venomous fluid is not known. When applied to mucous surfaces, or even to the surface of the conjunctiva of the eye, it causes no disagreeable sensation; but when it is introduced into the skin, by means of a needle, it immediately excites very acute pain.

Oil, honey, spirit of wine, the juice of the plantain, and a variety of other local applications, have been extolled as specifics for the relief of the stings of insects. Modern experience, however, does not sanction their claim to this character. In fact, none of these applications either neutralise the poison, or appease with superior efficacy the pain of the sting.

These cases should all be treated on common antiphlogistic principles, and the most rational plan is to extract the sting, taking care, in the first instance, to cut off the little poison-vesicle with scissors, lest in the attempts to withdraw the sting, more of the virus be compressed into the part. The stung part should then be immersed for a time in ice-cold water, and afterwards covered with linen wet with the liquor plumbi acetatis dilutus. Were the inflammation to exceed the usual degree, leeches and aperient medicines would be proper. In short, as there is no specific for the cure of these cases, they are to be treated with common antiphlogistic means.

With regard to the bites of *serpents*, those inflicted by the rattle-snake of America, and the cobra di Capello of the East Indies, are the most speedily mortal. Indeed, this is so much the case, that sometimes there is scarcely an opportunity of trying any remedies; and even when the patient is not destroyed thus rapidly, there is such general disorder of the nervous system, with repeated faintings and sickness, that medicines cannot well be retained in the stomach, at least for some time.

Mr. Catesby, in the Preface to his *Natural History of Carolina*, informs us, that the Indians, who, by their constant wanderings in the woods, are liable to be bit by snakes, know, as soon as they receive the injury, whether it will prove mortal or not. If it be on any part at a distance from large blood-vessels, or where the circulation is not vigorous, they apply their remedies; but if any vein of considerable magnitude be hurt, they quietly resign themselves to their fate, knowing that nothing can then be of service. Amongst the remedies on which they chiefly depend, are seneka root, ammonia, and particularly, strong doses of arsenic.

If we put out of consideration the bites of animals affected with rabies, the viper inflicts the worst poisoned wound ever met with in these islands. In fact, it is an animal that inserts into the part, which it bites, a poison capable of exciting very serious consequences. The jaws of the viper are furnished with teeth, two of which, in the upper jaw, are very different from the rest. These, which are about three lines long, are covered, for about two thirds of their length, with a membranous coat, or sheath, are of a curved shape, and articulate with the jaw-bone. When the animal is its mouth shut, they lie down with

their points turned backwards; but they instantly project forwards when it is irritated, and about to bite. In them are canals, which terminate by a narrow fissure, on their convex sides, a little way from their points. The rest of these fangs is very hard and solid; and the canal is usually filled with a transparent, yellowish fluid, the poison of the viper.

This venomous fluid is secreted by two glands, or rather by two clusters of glands, one on each side of the head, placed on the front of the forehead, directly behind the eyeball, under the muscle which serves to depress the upper jaw. Thus the muscle cannot act without pressing upon them, and promoting the discharge of the fluid, which they are destined to prepare. A little bag, or vesicle, connected to the base of the first bone of the upper jaw, as well as to the end of the second, covers also the roots of the curved fangs, and forms a receptacle for the venom.

The viper is chiefly found in hilly stony, and woody districts, and seldom in flat or marshy places. It is not its nature to attack man, or large animals, except when provoked. Its venom is only employed for the destruction of smaller animals, such as mice, frogs, &c. which are usually swallowed whole, and to the digestion of which the venomous secretion is by some writers supposed to contribute. When, however, a viper is pursued, trod upon, taken hold of, or hurt, it immediately bites, and were it only on account of the shape of the fangs, the wound might be attended with very unpleasant effects; but it is certain of being so, by reason of the species of inoculation which complicates it, and of which the mechanism is as follows:—

When a viper is about to bite, it opens its mouth very wide. The two curved fangs, which had previously lain flat down in the cavity of the membrane attached to their base, now project, and become perpendicular to the lower jaw. When the bite takes place, the poison is propelled through the fangs, by the contraction of the muscles, and the closure of the mouth, and is injected into the wound with a force proportioned to its accidental quantity at the time, and the vigour of the animal.

The bite of a viper is quickly followed by severe effects, some of which are local, and the others general; but it is with the former that the disorder invariably commences. At the instant of the bite, the bitten part is seized with an acute pain, which rapidly shoots over the whole limb, and even affects the viscera and internal organs. Soon afterwards, the wounded part swells and reddens. Sometimes, the tumefaction is confined to the circumference of the injury; but, most frequently, it spreads extensively, quickly affecting every part of the limb, and even the trunk itself. A sanious fluid is often discharged from the wound, around which phlyctenæ arise, similar to those of a burn. After a short time, however, the pain abates considerably; the inflammatory tension changes into a doughy, or cedematous softness; the part grows cold; and the skin exhibits large livid spots, like those of gangrene. The general symptoms also come on with celerity; the patient is troubled with anxiety, prostration of strength, difficulty of breathing, and cold profuse sweats. Vomiting frequently occurs, and sometimes copious bilious evacuations from the bowels. These symptoms are almost

constantly attended with an universal yellowness, and excruciating pain about the navel.

The effects occur in the same way in nearly all subjects, with some differences depending upon the particular irritability and constitution of the patient; the high or low temperature of the atmosphere; the greater or lesser auger of the viper; the number of its bites; the size of the reptile itself; the depth to which the fangs have penetrated; and whether the bitten part happens to be one of great sensibility, or was naked, or not, at the time of the accident. In general, weak, pusillanimous persons, of bad constitutions, and loaded stomachs, suffer more sudden and alarming ill consequences than strong, healthy subjects, who view the danger without fear. Several bites are, of course, more dangerous than a single one; and lastly, it has been remarked, that the venom of the viper is more active in summer, than the spring.

Not long ago, however, the newspapers recorded the death of a servant, from the inadvertent application of the poison to a scratch on his hand, as he was examining the fangs and venomous organs of a viper, perfectly torpid, in the winter season.

Severe, however, as the effects of the bite of a viper may be, they are far from being so perilous as they are commonly supposed to be. Indeed, the injury rarely proves fatal to an adult, even when inflicted by a viper in the middle of summer, the period when the animal is most active and vigorous. Exceptions to this common belief, however, are upon record. Thus, in the year 1816, a woman in France, aged sixty-four, was bit on the thigh by a viper, and died in thirty-seven hours, notwithstanding the internal use of the liquor ammoniac, and the enlargement of the wound, and cauterisation of it with this fluid. In this case, it is to be observed, that an hour elapsed before any thing was done. (*See Annales du Cercle Médicale*, t. i. p. 44. 8vo. Paris, 1820.)

Fontana, therefore, was not exactly correct in concluding, that the bite of an ordinary viper will not prove fatal to a full-grown person, nor even to a large dog, though it does so to smaller animals. Five bites from three strong and healthy vipers were not able to kill a dog weighing sixty pounds; and, as this dog was little more than a third part of the weight of an ordinary man, Fontana supposed that a single bite could never be fatal to an adult. He says, that he had seen a dozen cases himself, and had heard of fifty more, only two of which ended fatally. Concerning one of these cases he could get no information; the other patient perished of gangrene, twenty days after the bite. The mortification began three days after the accident, the bitten place having been deeply scarified almost as soon as the injury was received. Fontana believes that much of the faintness, &c. which ensues upon the bite of a viper, is the mere effect of terror. "Upon a person being bit (says he) the fear of its proving fatal terrifies him and the whole family: From the persuasion of the disease being mortal, and that not a moment is to be lost, they apply violent or hurtful remedies. The fear increases the complaint. I have known a person, that was imperceptibly bit in the hands or feet, and who after seeing the blood, and observing a viper very near him, suddenly fainted away; one in particular continued in a swoon for upwards of an hour, until he was accidentally observed, and

recovered out of it by being suddenly drenched in cold water. We know that death itself may be brought on by violent affections of the mind, without any internal disease. Why may not people, who are bit, die from a disease, produced entirely by fear, and who would not otherwise have died from any complaint produced by the venom?" Although it must be owned, that Fontana bestowed a great deal of attention upon this subject, the above reasoning is hypothetical and erroneous. If it were to be granted, that some very timid, delicate, or nervous people, die from fear alone, it could not be admitted, that the generality of people, bit by snakes, perish also from the violent effect of mental alarm.

Whenever the patient dies, the catastrophe is always ascribable to the quantity of venom inserted in the wound; the number of bites; their situation near important organs; and the neglect of proper means of relief. In ordinary cases of a single bite upon the extremities, the patients would get well even without any assistance; but the symptoms would probably be more severe, and the cure slower.

From some facts recorded by Sir Everard Home, and observations made on the operation of the poisons of the black spotted snake of St. Lucia, the cobra di Capello, and the rattle-snake, it appears, that "the effects of the bite of a snake vary according to the intensity of the poison. When the poison is very active, the local irritation is so sudden, and so violent, that its effects on the general system are powerful, and death soon takes place. When the body is afterwards inspected, the only alteration of structure met with is in the parts close to the bite, where the cellular membrane is completely destroyed, and the neighbouring muscles very considerably inflamed. When the poison is less intense, the shock to the general system does not prove fatal. It brings on a slight degree of delirium, and the pain in the part bitten is very severe; in about half an hour, swelling takes place, from an effusion of serum in the cellular membrane, which continues to increase with greater or less rapidity, for about twelve hours, extending, during that period, into the neighbourhood of the bite. The blood ceases to flow in the small vessels of the swollen parts; the skin over them becomes quite cold; the action of the heart is so weak, that the pulse is scarcely perceptible, and the stomach is so irritable that nothing is retained by it. In about sixty hours, these symptoms go off; inflammation and suppuration take place in the injured parts; and when the abscess formed is very great, it proves fatal. When the bite has been in the finger, that part has immediately mortified. When death has taken place, under such circumstances, the absorbent vessels and their glands have undergone no change similar to the effects of morbid poisons, nor has any part lost its natural appearance, except those immediately connected with the abscess. In those patients who recover with difficulty from the bite, the symptoms produced by it go off more readily, and more completely, than those produced by a morbid poison, which has been received into the system." (*Sir E. Home, Case of a Man who died in consequence of the Bite of a Rattle-snake, in Phil. Trans.* 1810.)

Sir Everard Home mentions that the intellectual powers of the patient were materially affected.

This, however, is only an occasional circumstance in cases of poisoning from venomous animals. Mr. A., of New-York, who was in 1812 seriously bitten in the arm by a rattle-snake, that had been kept in confinement for a public show. The action of the poison, according to Dr. Francis, began to manifest its effects as in the instance of Soper (Home's case), within the first half hour, and its local changes, such as great swelling, pain, &c., were also similar. But, in another case, the patient's mind preserved its wonted functions, throughout his whole illness. When the bite is inflicted in a large vein, its effects seem to be more immediate, and its fatality more certain than under other circumstances. (See Francis, *On Med. Jurisprud.* New York Med. and Phys. Journal, vol. ii.—Reese.)

Numerous remedies for the bites of common vipers have obtained celebrity. According to certain writers, each of these remedies has effected wonderful cures; and yet, as Boyer well remarks, every one of them has been in its turn relinquished for another, the sole recommendation of which has frequently consisted in its novelty. Any of these boasted medicines, though of opposite qualities, cured, or at least seemed to cure, the patients, and the partisan of each considered that he had a right to extol his own remedy as a specific, when the patient, to whom he administered it, was seen to recover perfectly, after suffering a train of severe symptoms. But the reason of this pretended efficacy becomes obvious, when one knows that the bite of a viper is of itself rarely mortal to the human subject, and that the severity of the symptoms materially depends upon the quantity of the venom in the wound. (Boyer, *Mal. Chir.* t. i. p. 428.)

The treatment of the bite of a viper is divided into local and general means.

The local treatment has for its principal object the destruction of the venom; the prevention of its entrance into the vessels, or the removal of it from the wound.

Of scarifying the wound, I can only say, that it promises no utility, if it be practised with the view of letting such dressings be applied, as are extolled as specifics; for we now know, that no local application is entitled to this character. Fontana was an advocate for applying a ligature round the limb, in order to check the ingress of the venom into the circulation; and he thought, that he had seen much good result from this practice. Sir Everard Home is also of opinion, that "the only rational local treatment, to prevent the secondary mischief, is applying ligatures above the tumefied part, to compress the cellular membrane, and set bounds to the swelling, which only spreads in the loose parts under the skin, and scarifying freely the parts already swollen, that the effused serum may escape, and the matter be discharged as soon as it is formed. Ligatures (he says) are employed in America, but with a different view, viz. to prevent the poison being absorbed into the system." (*Phil. Trans.* for 1810. p. 87.) At all events, if compression be employed, it should be so regulated as not to create any risk of gangrenous mischief, by its interruption of the circulation. With respect to scarification of poisoned wounds, the investigations of Sir David Barry led him to entertain a different view of them from that adopted by the former writer, as will be presently ex-

plained. Suction of the wound has been proposed, and seems now to be supported both by reason and experience, as I shall explain in noticing the valuable researches of Sir David Barry.

One of the most certain methods of removing the virus consists in the excision of the bitten part. This operation, however, would hardly be proper, unless done immediately after the injury, before much inflammation had come on. It is likewise a practice, to which many patients would not assent, and even some surgeons might deem the proceeding too severe, in relation to the bite of the viper of this country. The bite might also be inconveniently situated for the excision of the parts. Excision, as Sir David Barry observes, can only be of use in proportion to its extent. If it reach beyond the poison it will certainly save; but not otherwise; and owing to the wider mouths of the vessels being now exposed to the atmospheric pressure, the particles of poison, beyond the boundary of the excision, will pass with increased rapidity to the heart. (Barry's *Researches*, &c. p. 159.)

Another plan, more commonly preferred, is that of destroying the envenomed part with caustic, or the actual cautery. When this is done in time, it is said that the poison will be prevented from extending its irritation over the system. The caustic, and cautery, it is conjectured, may also have the effect of chemically destroying the venom itself, while they tend to hinder its passage into the circulation, inasmuch as they destroy the neighbouring absorbent vessels. The caustic, which Fontana preferred, was potassa. But, as Boyer sensibly remarks, every caustic, of equal strength, must infallibly have the same effect, as its mode of operating is that of destroying the point of irritation, viz., the seat of the venom. In France, liquid caustics are preferred, the fluid muriate of antimony, the liquor ammonia, or the sulphuric, or nitric acid, because their action is quicker, and they more certainly penetrate to the bottom of the wound. (*Mal. Chir.* t. i., p. 429.) Either of these liquids may be applied by means of a slender-pointed bit of wood, which is to be dipped in it, and then introduced into the puncture made by the fangs of the reptile. The piece of wood should be withdrawn, dipped once more, and applied again. If a drop of the caustic can be inserted so much the better. When the bite is very narrow and deep, the caustic cannot well be introduced before the mouth of the wound is somewhat enlarged with a lancet. A little bit of lint may then be wet in one of the above fluids, and be pressed deeply into the wound. The actual and potential cautery, like excision, will only succeed, when their action extends beyond the limits of the poison.

After the caustic has produced an eschar, the best application is an emollient poultice.

It is not, however, every bite of a viper, that requires local treatment, even of this degree of severity. When the wound is superficial; the viper benumbed with cold; its poison considerably exhausted by its having previously bitten other animals; the swelling inconsiderable; and the patient neither affected with prostration of strength, nor pain about the præcordia; a few drops of ammonia may be introduced into the wound, and a small compress, wet with the same fluid, applied. Formerly, olive oil was consi-

dered, in England, one of the best applications for the bites of snakes; and its virtues were afterwards extolled in France by Pouteau; but, says Boyer, it possesses no specific efficacy, as the experiments of Hunaud and Geoffroi have decidedly proved. (*Mal. Chir. t. i. p. 431.*)

Suction of poisoned wounds, and especially of that occasioned by venomous snakes, is an ancient proposal, and one, the principle of which has been rendered exceedingly important by the experiments and researches of Sir David Barry. Several dogs and rabbits were bitten by vipers. To the bites of some, he applied the cupping-glass; to the bites of others nothing; and all the animals abandoned did not ultimately perish; yet when the cupping-glass was applied for half an hour to such as had been bitten by one, two, and sometimes three vipers, they suffered no symptom whatever of constitutional poisoning; whilst those which were left to nature, were invariably attacked with convulsions and stupor, and the dogs with vomiting. (See *Exp. Researches on the Influence of Atmospheric Pressure upon the Blood in the Veins*, &c. p. 121. 8vo. Lond. 1826.) From the experiments detailed in this work, Sir David Barry deduces the following inferences, in relation to our present subject. First, That neither sound nor wounded parts of the surface of a living animal can absorb when placed under a vacuum. Secondly, That the application of the vacuum by means of a piston cupping-glass, placed over the points of contact of the absorbing surface, and the poison, which is in the act of being absorbed, arrests or mitigates the symptoms caused by the poison. (*Exp. No. 4.*) Thirdly, That the application of a cupping-glass for half an hour deprives the vessels of the part, over which it is applied, of their absorbent faculty, for an hour or two after the removal of the glass. (*Exp. No. 5.*) Fourthly, That the pressure of the air forces into the vacuum, even through the skin, a portion of the matter introduced into the cellular tissue by injection, that is, if the skin of the animal be not too dense, as in the dog. (*Exp. No. 16—20. Barry Op. cit. p. 134.*) Another important remark, made by this author, is, that, when the soft parts about a wound, however minute, are forced into the vacuum of a cupping-glass, the point, which offers the least resistance to the exit of the fluids contained in these parts, is the little wound itself. But, if scarifications have been made around it, this is no longer the case. "Therefore, the balance between the vacuum within the glass, and the pressure without, will tend to be established by a discharge from the scarifications, and not from the original wound. Hence, the probability of the poison being forced out of the wound, and the vessels around it, will be diminished in proportion to the magnitude of the scarifications. If these scarifications extend beyond the area of the vacuum, the contents of the vessels thus divided will cease to be influenced by it, and therefore, whatever portion of the poison may have passed beyond the point of division, will be carried to the heart, just as if no vacuum had been applied. (*Op. cit. p. 156.*) According to Sir David Barry, if actual, or potential cauteries are used, and any portion of the poison remain beyond the depth, to which their action may extend, the application of the vacuum will be perfectly useless, because the openings, through which the poison might

have been pressed out, are sealed up. He thinks that the ligature recommended by Celsus, to be placed between the wound and the heart, but not so tightly as to deprive the limb of sensation, should, with simple ablution of the part, and protecting it from the contact of air, be the only remedial measures ever suffered to precede the application of the vacuum; and even these, only when a cupping-glass, or suction by the mouth cannot be immediately commanded.

It is further remarked by Sir David Barry, that when the cupping-glass has been applied for an hour to the poisoned part, previously to excision, the contents of all the vessels will have acquired a retrograde direction; and from not being permitted to flow freely into the vacuum, a perfect stagnation of the fluids is established. Hence, the loss of the absorbing faculty of the cupped surface. (*Exp. 5. and 7.*) Thus, says he, by allowing the first cupping to precede the excision of the part, not only is there a greater quantity of the poison removed, but the danger of a more rapid absorption is avoided; whilst the certainty of extracting a still further portion, or perhaps the whole of what may have remained, constitutes an additional and important advantage to be obtained by the second cupping. The advantage of the actual cautery, after excision and the second cupping, depends upon its hermetically closing the mouths of the small vessels, and rendering their tubes for a certain extent incompressible. Their absorbing powers are therefore suspended, because, as Sir David Barry argues, the pressure of the atmosphere can neither force any thing into them, nor compress them upon their own contents. (See *Barry's Researches on the Influence of Atmospheric Pressure upon the Blood in the Veins*, &c. p. 157, 158.) These observations relate to poisoned wounds in general, and more especially to the treatment of hydrophobia, and of other cases, where the symptoms, resulting from the poison, are of an exceedingly dangerous description.

With respect to the general treatment of the bite of a viper, or of any other venomous snake, if we exclude emetics, of which Dr. Mead had a high opinion, when the patient was much jaundiced, the favourite medicines are cordials, ammonia, and arsenic. The ancients employed theriaca, Mithridates, salt, and the carbonate of ammonia. Of all stimulants, however, the liquor ammoniac is that which now obtains the greatest confidence; or else, the *eau de luce*, which only differs from the fluid ammonia, in containing a small quantity of the oleum succinatum. In France, this remedy is even at the present time regarded, as having the best claim to the title of a specific for the bite of a viper. (*Boyer, Op. cit.*)

In France, Bernard de Jussieu first tried ammonia, in the year 1747 (see *Hist. de l'Acad. des Sciences*, 1747.); since which time it has been extensively employed for the cure of the bites of vipers, both as an internal and external remedy. It had, however, been highly praised by Dr. Mead, at a much earlier period.

A few drops of the remedy are to be exhibited every two hours; but, as it is very powerful, it must always be diluted with tea, or some other drink, or the *mistura camphoræ*. The dose, however, must depend upon the age and constitution of the patient, and the intensity of the symptoms. Four or five drops suffice for a person

of weak, delicate, irritable habit; but twelve or fifteen may be given to stronger subjects, when the symptoms are violent. With ammonia, some practitioners order wine.

In St. George's Hospital, the man, who was bit by the rattlesnake kept for exhibition, took aperient medicines, the liquor ammoniac, ether, the spiritus ammoniac comp., opium, and other stimulants; but without any apparent benefit. The disease followed that course, which Sir E. Home has described as usual when the shock on the system is not directly fatal, and the mischief in the arm ultimately produced the man's death. (See *Phil. Trans.* 1810.)

From the following passage, in relation to the bites of snakes in general, it seems that Sir Everard Home, in 1810, had no confidence in any medicines which had then been duly tried. "The violent effects, which the poison produces on the part bitten, and on the general system, and the shortness of their duration, where they do not terminate fatally (says he) have frequently induced the belief, that the recovery depended on the medicines employed; and, in the East Indies, *eau de luze* is considered as a specific.

"There does not appear to be any foundation for such an opinion; for when the poison is so intense as to give a sufficient shock to the constitution, death immediately takes place; and when the poison produces a local injury of sufficient extent, the patient also dies, while all slighter cases recover. The effect of the poison on the constitution is so immediate, and the irritability of the stomach so great, that there is no opportunity of exhibiting medicines, till it has fairly taken place, and then there is little chance of beneficial effects being produced." (Sir E. Home, in *Phil. Trans.*, 1810.)

Fontana also had little faith in reputed antidotes; but it is to be noticed, that his observations refer only to the bites of vipers. "In no country (says he) through which I passed, could I ever find any two people or persons, bit by the viper, either in the mountains or valleys, that used the same remedies. Some used theriaca alone, either externally or internally applied; others common oil; a third set used stimulants, such as the strongest spirituous liquors; whilst others, on the contrary, tried every different kind of sedative. In short, there is hardly any active kind of medicine, that has not been tried as a cure in this disease; while at the same time it is certain that, under all the varieties of application, none of the patients died." Hence, Fontana concluded, that none of the remedies had any effect in curing the disease.

Later observations, however, tend to raise our hopes, that a medicine is now known, which really seems to possess considerable efficacy against the bite even of a very formidable kind of snake. From some facts, recorded in Dr. Russell's *History of Indian Serpents*, on the authorities of Mr. Duffin and Mr. Ramsay, it appears, that the Tanjore pill, of which arsenic is the chief ingredient, is exhibited with considerable success in India, after the bites of venomous serpents: this information led Mr. Chevalier to propose the fair trial of arsenic.

Mr. Ireland, surgeon to the 60th regiment, had formerly heard Mr. Chevalier recommend the trial of arsenic; and he was resolved to make the experiment whenever an opportunity offered. On his arrival in the island of St. Lucia, he was in-

formed, that an officer, and several men, belonging to the 68th regiment, had died from the bites of serpents, supposed to be the coluber carinatus of Linnæus.

The reader will find some interesting account of the serpent, here alluded to, in a tract, which I have lately read, entitled *Monographie du Trigonocephale des Antilles, ou Grand Vipère Fer-de-Lance de la Martinique*, par A. Moreau des Jonnés, 8vo. Paris, 1816.

Mr. Ireland also learnt, that every thing had been tried by the attending medical men to no purpose, as all the patients had died, some in six, and others in about twelve hours, from their receiving the wound.

A case, however, soon came under Mr. Ireland's own observations, and, as nothing that had been done before seemed to have been of any service, he was determined to give arsenic a full trial.

"Jacob Course, a soldier in the York Light Infantry volunteers, was bitten in the left hand, and the middle finger was so much lacerated, that I found it necessary to amputate it immediately at the joint with the metacarpal bone.

"I first saw him about ten minutes after he had received the wound, and found him in a torpid, senseless state; the hand, arm, and breast of the same side were much swelled, mottled, and of a dark purple, and livid colour. He was vomiting, and appeared as if much intoxicated. Pulse quick and hard: he felt little or no pain during the operation.

"The wound being dressed, and the patient put to bed, I ordered a cathartic clyster, and the following medicine to be taken immediately:—℞. Liquor. Arsenic. ʒij. Tinct. Opii gr. x. Aq. Ment. Pip. ʒiiss; which was added to half an ounce of lime-juice; and as it produced a slight effervescence, it was given in that state; this remained on his stomach, and was repeated every half hour for four successive hours. In the mean time, the parts were frequently fomented with common fomentations, and rubbed with a liniment composed of Ol. Terebinth. ʒss. Liquor. Aumom. ʒss. and Ol. Oliv. ʒiiss. The cathartic clyster was repeated twice, when the patient began to be purged; and the arsenical medicine was now discontinued. He had become more sensible when touched, and from that time he gradually recovered his faculties; he took some nourishment, and had several hours sleep.

"The next day, he appeared very weak and fatigued; the fomentation and liniment were repeated. The swelling diminished gradually; the natural colour and feeling returned, and, by proper dressings to the wound and attention to the state of his bowels, he soon recovered and returned to his duty."

Mr. Ireland recites about four other examples, in which arsenic was exhibited with similar success.

It deserves particular notice, that the liquor arsenicalis, employed by Mr. Ireland, was prepared according to Dr. Fowler's prescription, which directs sixty-four grains of arsenic, and as many of the fixed vegetable alkali to be dissolved in a sand heat, and the solution to be made an exact pint, so that two drachms contain one grain of arsenic in solution. (See *Med. Chir. Trans.* vol. ii. p. 393., &c.) Whatever may be the constitutional treatment of poisoned wounds, the local management of them on their first occurrence, accord-

to the principles explained by Sir David Barry, and already noticed in this article, should never be neglected; as it is certainly most deserving of confidence. It operates as a preventive of symptoms, which, after they have come on, sometimes prove fatal. In hydrophobia, this is too often proved.

The following recital, I think, will make the credulity of British surgeons recoil:—

"A singular case of poisoned wound from the bite of a rattlesnake occurred some years since, under the observation of Dr. S. T. Barstow, of Wilkesbarre, Pennsylvania, and in some respects is perfectly anomalous.

"A lady, in the fourth or fifth month of her pregnancy, was bitten by a rattlesnake, but, under the appropriate treatment, she at length recovered from the symptoms usually consequent upon such wounds. At the full period of gestation, she was safely delivered of a fine healthy-looking child; but immediately on its being applied to the breast and allowing it to suck, the child assumed the peculiar hues of the rattlesnake, swelled exceedingly, and soon died. She then procured a puppy to relieve her breasts, which died in two days of the same symptoms. A lamb was then tried; and in succession, one puppy and three lambs shared the same fate. Another puppy was then procured, which escaped with its life, but exhibited some of the symptoms which had been fatal to its predecessors. The lady remained all this time without any symptom of disease, and had as rapid a convalescence from parturition as is usually observed.

"The poison seems to have been excreted by the process of lactation; for the second year afterward she had another child; and though she applied it to her breasts, not without fearful forebodings, yet no evil consequences resulted." (Reese.)

Wounds of the Thorax.—The greater diaphragm is not stretched across, in a straight direction, from one side of the chest to the other; but, on the contrary, descends much further in some places than in others. If the cavity of the thorax be opened, by a transverse section, about the middle of the sternum, the diaphragm appears, on examination, to be very prominent and convex towards its centre, while it sinks downward at its edges, towards all the points to which the muscle is attached. At its anterior, and most elevated part, it is fixed to the ensiform cartilage, whence, descending obliquely to the right and left, it is inserted, on both sides, into the seventh rib, all the lower ribs, and lastly, into the ligamentum arcuatum. According to this description, it is obvious, that the cavity of the thorax has much greater depth and capacity behind than in front; a circumstance which surgeons ought to be well aware of, or else they will be liable to give most erroneous opinions concerning wounds of the chest. For instance, a practitioner, deficient in anatomical knowledge, might imagine, that a weapon pushed from above downward into the front of the chest could never reach the lungs, after having penetrated the cavity of the abdomen. It is a fact, however, that no instrument could pass in this direction, even some inches below the highest part of the abdomen, without entering the chest.

The whole cavity of the thorax is lined by a membrane, named the pleura, which is every where adherent to the bones which form the parietes of this cavity, and to the diaphragm. Each side of the thorax has a distinct pleura. The two

membranes meet in the middle of the chest, and extend from the sternum to the vertebrae. In this manner, two cavities are formed, which have no sort of communication with each other. By the two pleura, touching and lying against each other, a middle partition is formed, called the mediastinum. These two membranes leave in front of them the space behind the sternum, called the anterior mediastinum; while behind, where they approach the vertebrae, they separate from each other, so as to leave a space, termed the posterior mediastinum, for the aorta, oesophagus, &c. The heart, enclosed in the pericardium, occupies a considerable space on the left of the mediastinum; and all the rest of the chest is filled with the lungs, except behind, where the large blood-vessels, nerves, thoracic duct, and oesophagus are situated. In the perfectly healthy state, the lungs do not adhere to the pleura; but, in the majority of subjects, at least in this climate, who are examined after death, such adhesions are found in a greater or lesser degree. The disease may be occasioned by a very slight degree of inflammation; and as the surface of the lungs is naturally destined to be always in close contact with the pleura, and patients are frequently not suspected to have any thing wrong in the thorax, this morbid change being often accidentally discovered after death, in looking for something else, it may be concluded that it does not produce any serious effects.

The thorax is subject to all kinds of wounds; but their importance particularly depends on their depth. Those which do not reach beyond the integuments, do not differ from common wounds, and, when properly treated, are seldom followed by any bad consequences. On the contrary, those which penetrate the cavity of the pleura, even by the slightest opening, may give rise to alarming symptoms. Lastly, wounds, injuring any of the thoracic viscera, are always to be considered as placing the patient in a state of considerable danger.

From what has been said, it appears, that wounds of the thorax are divisible into three kinds: viz. 1. Such as affect only the skin and muscles; 2. Such as enter the cavity of the chest, but injure none of the viscera; 3. Others which injure the lungs, or some other viscus.

Superficial Wounds of the Thorax.—Immediately a surgeon is called to a recent wound of the chest, his first care should be to ascertain whether the weapon has penetrated the pleura or not. In order to form a judgment on this circumstance, surgical writers recommend, 1. Placing the wounded person in the same posture in which he was when he received the wound, and then carefully examining with the finger, or probe, the direction and depth of the stab. 2. The examination, if possible, of the weapon, so as to see how much of it is stained with blood. 3. The injection of fluid into the wound, and attention to whether it regurgitates immediately, or lodges in the part. 4. The colour and quantity of the blood discharged from the wound are to be noticed, and whether any is coughed up. 5. We are to examine whether air escapes from the wound in respiration, and whether there is any emphysema. 6. Lastly, the state of the pulse and breathing must be considered.

In wounds of the chest, however, surgeons should not be too officious with their probes, merely for the sake of gratifying their curiosity, or appearing to be doing something. No judicious surgeon can

doubt, that authors have dwelt too much on the subject of probing wounds of the abdomen and thorax; for they would really lead their readers to believe, that, until the wound has been traced with the finger or probe to its very bottom and termination, surgeons are not qualified to institute any mode of treatment. The only advantage of knowing that a wound penetrates the chest is, that the practitioner immediately feels himself justified in having recourse to bleeding and other antiphlogistic means, with the view of preventing inflammation of the pleura and lungs, which affection, if not controlled in time, often proves fatal. However, there can be little doubt that, if the nature and depth of the wound cannot be readily detected with the eye, the finger, or a probe, or by the discharge of air or blood, it is much safer to bleed the patient than to put him to useless pain with the probe, and waste opportunities of doing good, which too frequently can never be recalled. In short, generally speaking, it is better and more advantageous, for all patients, that some of them should lose blood, perhaps unnecessarily, than that any of them should die, in consequence of the evacuation being omitted or delayed.

Almost all writers who have taken pains to direct how wounds of the thorax should be probed, conclude with remarking, that, however advantageous a knowledge of the direction and depth of the wound may be, much harm has frequently been done by carrying the attempts to gain such information too far. It is, perhaps, of greater importance to learn, by some kind of examination, the extent of a wound, which does not reach beyond the integuments, or intercostals, than to know whether the wound extends into the cavity of the chest. For, even when the pleura is found to be divided, but the wound attended with no urgent symptoms, the information is of no practical use, if we make it a rule to adopt, without the least delay, a strict antiphlogistic plan of treatment in all cases in which there is any suspicion or chance of the parts within the chest being wounded, and likely to inflame. Besides, frequently, the symptoms are more urgent and alarming than they could be, were only parts on the outside of the thorax injured; and, under such circumstances, it is manifest, that a probe cannot be necessary for discovering that the wound extends into the chest.

With respect to the injection of tepid water, or any other fluid, and the circumstance of its regurgitation, as a criterion of the wound being only superficial, the plan is more objectionable than the employment of a probe; for, if the liquid be propelled with force, it may be injected into the cellular tissue, and seem to be passing through the track of the wound into the chest, while, in reality, not a drop does so. Besides, is it a warrantable proceeding to try to insinuate any quantity or kind of liquid whatever between the pleura and lungs, into a situation, in which it must necessarily obstruct the important function of respiration, and cause serious inconvenience?

When air issues from the wound in expiration, there is ground for suspecting that the lungs are wounded. But, I believe, that such authors as represent this circumstance as an infallible criterion of the nature of the accident, labour under a mistake; for when there is simply an opening in the chest, without any injury of the lungs whatever, the same symptom may occur. The air, which is

discharged through the wound in expiration, has previously entered the bag of the pleura through the same wound in inspiration. In order to remove all doubt, the patient may be requested to expire as strongly as he can, so as to force out whatever air may have accumulated in the chest. At the end of each expiration of this kind, care must be taken to bring the skin closely over the orifice of the wound, and to keep it thus applied, during each following inspiration, for the purpose of preventing the external air from entering. In this way, if there be no wound of the lungs, all the air will soon be expelled; but if it still continues to be discharged in expiration, the lungs must be wounded.

Sometimes an emphysematous swelling takes place round wounds of the thorax, in consequence of a quantity of air diffusing itself in the cellular substance. In wounds which are straight and ample, this symptom is very uncommon, but, in cases of narrow oblique stabs, and where the lungs are wounded by the points of broken ribs, it is by no means unfrequent. (See EMPHYSEMA.) When a considerable quantity of blood flows from the wound, there is reason for conjecturing, not only that the weapon has penetrated the cavity of the thorax, but that some of the thoracic viscera are injured. Excepting the intercostal arteries, which run along the edges of the lower ribs, the internal mammary, and the trunks of the thoracic arteries, all the other vessels, in or near the parietes of the chest, are very inconsiderable. The effects of compression will indicate, whether the blood escapes from an artery on the outside of the cavity of the pleura; and sometimes the situation and direction of a wound at once denotes that the hemorrhage cannot proceed from the trunks of the thoracic arteries.

Even the appearance of the blood which comes from the wound, may lead to some conjectures concerning the depth of the injury. The blood, which flows from wounds of the lungs, is of a brighter scarlet colour, and more frothy, than that which is discharged from the vessels of any other part.

Although Baron Dupuytren refers to cases, in which a spitting of blood immediately followed the concussion produced by gun-shot wounds of the chest, which did not touch the lungs, there can generally be but little doubt of the lungs being wounded, when the patient has this symptom; but the absence of it is not a positive proof of their being untouched, though unquestionably a very important circumstance in the diagnosis, and, generally speaking, a correct criterion of the lungs having escaped injury. At all events, when no blood is spit or coughed up, the lungs can never be deeply penetrated. The state of the pulse, and that of respiration, ought to be particularly attended to by the practitioner. Neither one nor the other seems altered, at least at first, when wounds do not reach more deeply than the integuments: but those which penetrate the cavity of the thorax, and, especially, such as injure the viscera, may frequently be distinguished, from the very first moment of their occurrence, by their effects on the sanguiferous system, and the function of respiration. When the lungs are wounded at a point where they adhere to the pleura, no air can be effused in the thorax, and the functions of those organs may on this account suffer less disturbance than would be the consequence of an equal degree of injury at some other unadherent portion of the lungs.

Experiences proves, that when either air or blood insinuates itself between the lungs and the pleura the lungs become immediately oppressed, the breathing is attended with great difficulty, the pulse is weak, contracted, and intermittent.

Wounds of the integuments and muscles of the thorax are not attended with any particular danger; they heal with the same readiness, and by the same means, as common superficial wounds in any other part of the body.

When the case is a punctured, or a gun-shot wound, some writers are advocates for laying open the track of the injury, from one end to the other, if its course should not be too extensive; and they then recommend dressing the cavity down to its bottom. When the track of the wound was too extensive, a seton was sometimes introduced. The aim of such exploded practices was to prevent the outer part of the wound from healing too soon, and thus give time for the whole of it to heal in an equal degree. When a seton was used, the thickness of the skin of silk was gradually diminished, and after the whole of it had been removed, a slight compression was kept up for a few days, with the view of completing the cure.

The French surgeons of the last century have the discredit of having brought setons into fashion in this branch of surgery; and I am particularly glad, that a talented writer has well exposed the absurdity of the practice. "We find (says Mr. John Bell) the history of it to be plainly this: that as Guy de Chauliac, Paré, and all the older surgeons, did not know how to dilate gun-shot wounds, they found these same setons useful in bringing the eschar sooner away, and in preserving an open wound; and, as they believed the wounds to be poisoned, they took the opportunity of conducting, by these setons, whatever acrid medicines might, according to the prevailing doctrines of that time, have any chance of correcting the poison." Mr. J. Bell notices, how surprising it is to see the cruelty and perseverance with which some practitioners, particularly French, drew these cords through wounded limbs; and when the roughness of such a cord, or the acrimony of the drugs conveyed by it, produced a copious suppuration, these men were delighted with such proof of their success. The setons have been introduced by the French surgeons, across the thickest parts of the limbs, along the whole length of the fore-arm, and, at the same time, frequently through the wrist-joint. The setons have also been covered with stimulating applications. Profuse suppurations, and dreadful swellings of course ensued; still, as Mr. J. Bell has remarked, these cruelties were continued till the wound healed almost in spite of the pain; or till the coming on of very dreadful pain, great suppurations, convulsions, &c. made the surgeon discontinue the method, or even amputate the limb. The French at one period had become so familiarised to setons, that they did not restrict their use to flesh wounds; they passed them quite across the thorax, across the abdomen, and even through wounds of the knee-joint.

When we wish to excite inflammation, in the cavity of the tunica vaginalis, for the purpose of radically curing a hydrocele, we either pass a seton through the part, lay it open with an extensive incision, cram a tent into it, or inject some irritating fluid into it. While the animal machine continues the same, says Mr. John Bell, the same

stimuli will produce the same effects, and a seton, injection, or long tent, if they produce pain or inflammation in the scrotum, will not be easy in the chest; and unless we can use them in the chest, with the same intentions with which we use them in the hydrocele (in other words), unless we are justified in inflaming the chest, and causing an adhesion of all the parts, we cannot use them with any consistency or good sense.

With regard to the cases which the French adduced in confirmation of the good effects of their plans, I am entirely of opinion with Mr. J. Bell, that the facts only prove, that the patients recovered in spite of the setons. "It is like (adds this author) what happened to a surgeon, who was dabbling in the thorax with a piece of caustic, which fell directly into the cavity of the chest, where it caused very large suppurations, and yet the patient was saved. The patient recovered, in spite of the caustic, just as M. Guerin's patient, and many other poor unhappy souls, who lived in spite of the setons. One would think, that people took a pleasure in passing setons across the eyeball, the chest, the knee-joint, &c. merely to make fools stare, when the business might be as effectually done with an abscess lancet."

Mr. John Bell, in his usual lively style, makes the employment of tents, in wounds of the chest, seem equally ridiculous and improper. Indeed, he says, *he knows of no occasion in all surgery, in which tents can be useful, except in the single one of a narrow opening, which we desire to dilate, in order to get at the bottom of the wound; and where, either on account of some great artery, or the fearful temper of our patient, we dare not use the knife.* (See J. Bell, *On Wounds*. Discourse 2, vol. ii.)

Having hitherto been engaged rather in pointing out what ought not to be done, than what ought, I shall next make some remarks on the line of conduct, which should be adopted in cases of wounds of the parietes of the chest.

When the wound is a common cut, the sides of the division are to be brought into contact, and maintained in this position with strips of adhesive plaster, compresses, and a bandage, until they have grown together. If the surgeon take care to relax such muscles as happen to be cut, and are situated immediately under the wound of the integuments, there will rarely be any need of sutures.

As cut wounds seldom or never penetrate the chest, and there is generally no reason why they should not unite by the first intention, without being followed by extensive inflammation, and abscesses, antiphlogistic means should be employed with moderation. Bleeding will not often be requisite. The grand objects are to keep the patient in a quiet state, on rather a low diet, and to hinder him from taking wine, porter, spirits, or any other stimulating beverages.

If the wound, instead of healing favourably, should inflame, the treatment must be regulated by the principles laid down in the article INFLAMMATION. If it suppurate over its whole surface, but without a great deal of surrounding swelling and inflammation, one or two strips of sticking-plaster may still be used with advantage; for, in this way, the cavity which must now be filled up by granulations, will be rendered much smaller than it otherwise would be. Soft lint may be laid

in the cavity of the wound, which the sticking-plaster does not entirely remove, and over the whole a pledget of some mild unirritating ointment; or, if the surgeon prefer, the tepid water dressing, covered by a piece of oiled silk, may be applied. No pressure is now proper, until the inflammation diminishes; and if the discharge be profuse, or the surrounding inflammation considerable, the best application is an emollient poultice. While a great deal of inflammation exists, the patient should be bled, and leeches applied.

When the case is a stab, or punctured wound, the fibres of the divided parts are not simply cut, they are also considerably stretched, bruised, and otherwise injured. Hence, generally they will not admit of being united so readily as the sides of a clean incision, made with a sharp instrument. However, the possibility of uniting the opposite sides of punctured wounds, must depend very much on the shape of the weapon, and the suddenness, roughness, and violence with which it was driven into the part. A prick with a needle is a punctured wound; so is that often made by surgeons with their lancets; yet these injuries do not frequently bring on violent inflammation, and abscesses, as other wounds frequently do, which are inflicted with bayonets and pikes.

Let us suppose a man to have received the thrust of a bayonet, which has entered the skin and muscles covering one side of the thorax: what plan can the surgeon follow, with the greatest advantage to his patient?

Instead of laying open the whole track of such a wound with a knife, as is barbarously recommended in many works on surgery; instead of drawing a seton through its whole course, or of cramming into the part a hard, irritating tent; the practitioner should take whatever chance there may be of uniting the wound without suppuration. For this purpose, he should recollect, that the great degree of violence done to the parts in punctured wounds is the reason why they are so apt to inflame and suppurate. Hence, the expected inflammation is to be counteracted in the very first instance; and immediately the wound has been dressed, the patient should be freely bled, and take some saline purgative medicines. With regard to the dressings, the orifice of the wound may be lightly closed with sticking-plaster, or covered with any mild superficial applications, one of the best of which is the tepid water dressing. All pressure is more likely to do harm than good. Thus the inflammation of the wound will be moderated; the extravasation of blood prevented; the chance of union by the first intention taken; and all painful operations avoided. And nothing is more certain than the fact, that, if antiphlogistic means be strictly employed, many stabs heal without abscesses, or any severe symptoms whatever, when no hope could be entertained of their doing so under other treatment. But, if suppuration should happen, and a collection of matter take place, would the patient suffer more, or be put into greater danger, by having a proper depending opening, of just sufficient size, now made into the abscess in an eligible place, than if he had submitted to have the formidable operation of laying open the whole extent of a stab performed in the first instance? In the first case, he will be suffering half so much, be half so long in bed, or have to encounter half the danger. With all the advantages, he will have taken

a certain chance, which attends all these cases, of the wound becoming united by what is called the first intention, that is to say, without any suppuration. I need not enlarge upon this subject, but refer the reader to what has been said in the preceding columns on the subject of PUNCTURED WOUNDS, and to the treatment of abscesses, in the article SUPPURATION. Gun-shot wounds, merely injuring the parietes of the chest, are to be treated according to principles elsewhere explained. (See GUN-SHOT WOUNDS.)

Of Wounds penetrating the Cavity of the Thorax.

—Penetrating wounds of the chest are always dangerous, and claim the utmost attention of the practitioner. I shall first treat of such wounds as enter the cavity of the thorax, but without injuring the viscera.

In the healthy state, the lungs so completely fill the thorax, that, both in inspiration and expiration, they are always in close contact with the pleura; and whenever air, blood, or any other matter, insinuates itself between the pleura costalis and pleura pulmonaris, more or less oppression and difficulty of breathing immediately take place. In all wounds, attended with a division of the pleura costalis, and occurring in a situation where there happens to be no adhesion between this membrane and the lungs, some of the external air, or a small quantity of blood, or both, can hardly fail to get into the cavity of the thorax. If one of the intercostal arteries be wounded, and the external orifice be very narrow, the blood, furnished by this vessel, may pass into the chest, and immediately produce oppression of the breathing, and other symptoms of pressure on the lungs.

When a wound is known to have entered the pleura, and there is no symptom leading to a suspicion that the lungs, or any large vessel, is wounded, the injury is to be dressed according to common principles, and the more superficially the better. Authors also usually direct us, just before we close the opening, to tell the patient to make a deep inspiration, for the purpose of expelling as much of the air as possible, which may have passed into the cavity of the pleura; but this is an error, since it is in expiration, when the dimensions of the chest are lessened, that such air would be disposed to find an outlet through the wound. The edges of the wound in the skin are to be brought together, and kept so, with sticking-plaster, compresses, and a roller. The other indications are to prevent inflammation of the pleura and lungs, by rigorous antiphlogistic remedies, particularly bleeding, which should be copious and repeated, as circumstances may require.

Penetrating wounds of the chest may be complicated with: 1. Foreign bodies. 2. Injury of one of the intercostal arteries. 3. Protrusion of a portion of the lungs. 4. Emphysema. 5. Extravasation of blood in the thorax.

1. Almost all these wounds occasion pain and difficulty of breathing. Many of them are also followed by an emphysematous swelling around the wound; the patient frequently coughs up blood; and, after having had, for some time, a small, contracted, irregular pulse, with a pallid countenance, and cold extremities, he is too often seized with severe febrile symptoms, the effect of inflammation of the lungs and parts within the chest. These symptoms should be counteracted

by bleeding, a very low regimen, saline antimonial medicines, the use of leeches, or cupping, and the strict observance of quietude. If such indisposition should continue longer than a few days, without diminution, writers inform us, that there is ground for suspecting that they depend upon the presence of some foreign body. However, it may be doubted, whether Sabatier's advice, to make immediate search for the extraneous substance, is proper under these circumstances. For my own part, I cannot think the symptoms above related by any means unequivocal; and even were they so, the practice would still be questionable. (See *Méd. Opératoire*, t. ii. p. 244.)

Sabatier has quoted the two following cases, for the purpose of showing what may be attempted in these cases:—"A man, twenty-seven years of age, was struck very violently with a knife, on the outer part of the fourth true rib. Simple dressings were applied for the first few days; but a considerable coughing, and spitting of blood ensuing, M. Gerard was consulted, who found, that the symptoms depended on the presence of a piece of the knife, which had pierced the rib, and was projecting some way into the thorax. So little of the foreign body was on the outside of the rib, and it was so fixed in the bone, that it could neither be extracted with any kind of forceps, nor even moved in the least with a leaden mallet, &c. Although the only expedient seemed now to be that of sawing or cutting out the portion of the rib, Gerard conceived that an attempt might first be made to extract the foreign body, by pushing it from within outward. For this purpose, having put a steel thimble on his index finger, he introduced it into the cavity of the thorax, and thus succeeded in pushing out the piece of the knife.

A spicula of the bone was afterwards felt; but it was too firmly connected with the rest of the rib to admit of being completely taken out. Gerard was absurd enough to surround the whole rib, at the splintered part, with a ligature. To these ingenuous proceedings, as the French term them, was imputed, not only the cessation of all the bad symptoms, but a speedy recovery. (See *La Faye's Notes to the Traité des Opérations de Dionis*.)

An officer was shot in the left side of the chest. The ball entered about where the bone and cartilage of the seventh true rib unite, and came out in the situation of the angle of the same bone, which was broken in two places. The posterior part of the first false rib was also broken. Incisions were made, which enabled the surgeon to take away several splinters of bone, and facilitated that mischievous practice, the introduction of a seton. Soft mild dressings were applied. The patient was bled twenty-six times, with the view of relieving the fever, difficulty of breathing, and spitting of blood. On the fifth day, suppuration commenced, and the seton could be easily drawn. In about a fortnight, the patient's sufferings considerably abated, and he passed some of the ensuing days in a tolerably easy state. Circumstances, however, made it necessary to move him to another place, and, on the twenty-fourth day, he had a bad night; febrile symptoms came on; and the discharge was not of its usual consistence. He was bled twice more, and his critical state led the surgeon to examine the wounds again. On passing a finger into the posterior wound, a foreign body

was felt, and easily extracted. It was a piece of the patient's coat. A spicula of bone was also felt more deeply lodged, which required the wound to be dilated. Partial relief followed the removal of these extraneous substances.

On the thirtieth day, the bad symptoms recurred, two more bleedings were practised, and as fears were entertained that the seton was doing harm, it was suppressed. The patient now first made complaint of feeling something, which pricked him, in a deep situation, between the two openings of the wound. It was therefore determined to divide all the parts intervening between the two orifices, and occupying an extent of seven or eight inches. Guerin cut the parts between the two ribs, from within outward, under the guidance of his finger introduced into the posterior wound, care being taken not to cut near the lower edge of the upper rib. In this way, the whole track of the ball was laid open, and in the middle of it a very sharp splinter was found, projecting into the substance of the lungs. It was removed, and the wound dressed with simple applications. From this day all the bad symptoms ceased. (*Obs. de Guerin, in Mém. de l'Acad. de Chir.* t. ii. 4to.)

Mr. John Bell has taken notice of the preceding case: he observes, that some of Guerin's steps were bold and good, as well as successful; but that the employment of the seton was wrong. The example teaches us several important circumstances: 1. The propriety of making very free dilations for the extraction of splinters of bone. 2. The utility of repeated copious bleedings, which, in the above case, indeed, had the greatest effect both in preventing such hemorrhage in the chest, as would probably have produced suffocation, and also in averting a degree of pulmonary inflammation, which would have proved fatal.

Mr. John Bell judiciously condemns the seton: "Had M. Guerin (says he) been asked what good it was to do, it would have been difficult for him to have invented even a plausible apology for the practice which, if it was not doing good, could not fail to do harm. Was this seton necessary for keeping the wound open? No, surely; for the wound could not have closed, while it was irritated, and kept in suppuration by splinters of bone, and a piece of cloth within the breast. Was it to draw the piece of cloth out? Surely, in the course of twenty days, a piece of cloth would have had some chance, at least, of being floated towards the wound, either by the natural flux of the matter, or by the help of a mild injection. Was it useful in supporting the discharge? This would have been a sore question for M. Guerin; for it supported the suppuration only by inflaming the chest; and where inflammation of the chest, or high cough, or bloody expectoration, or a profuse discharge, were the chief dangers, a great seton could hardly be a comfortable inmate in the breast. I think one might very boldly promise to produce bloody expectoration and terrible cough, profuse suppurations, and oppression to any degree, by drawing such a cord across a sound thorax."

Mr. John Bell next censures M. Guerin for not having discovered the pricking piece of bone before the thirty-eighth day; a disadvantage which he partly ascribes to the seton, the pain of drawing which across the chest deadened every lesser pain, and, consequently, the patient could not feel.

the trifling pricking of the bone, till his greater sufferings from the seton were allayed. "In short (says Mr. John Bell), M. Guerin passes a great strap of coarse linen across the cavity of the chest, and when it causes inflammation, he thinks to subdue it by bleeding; when M. Guerin continued for thirty days drawing a coarse seton through the breast every morning, and bleeding for the cough every night, what did he do, but raise inflammation with his left hand, to show how well he could cure it with his right." (See *John Bell, On Wounds*, vol. ii. p. 36—38.)

The liability of wounds of the chest to be complicated with the lodgment of foreign bodies is a circumstance, of which the practitioner should ever be mindful. "In the examination of the bodies of soldiers, who have died from these injuries (says Dr. Hennen), I have frequently found pieces of wadding or clothes, spiculae of bone, and balls, and, in one case, some charpie used as a dressing, either loose in various parts of the lungs, or lying in sacs, which the exertions of the constitution to free itself had thrown round them by the medium of the coagulating lymph. In the more fortunate few who have recovered, these matters have been discharged from the wounds, or extracted from them by the surgeon. In some lucky cases, they have been ejected by the convulsive efforts to cough, which their irritation has occasioned." (*On Military Surgery*, ed. 2. p. 367.) For an account of the dexterity with which Larrey has sometimes traced balls in the chest, and extracted them by bold operative proceedings, I must refer to his valuable writings. (See *Mém. de Chir. Mil.* t. iv. p. 250, &c.) Balls have sometimes lodged and remained encysted in the lungs, for upwards of twenty years, without the health being at all disturbed by their presence. (See *Percy, Manuel*, &c. p. 125.; *Boyer, Mal. Chir.* t. vii. p. 310, &c.)

2. When one of the intercostal arteries is wounded by a narrow oblique stab, the accident cannot at first be known. In this case, the blood may make its way into the cavity of the chest, where it will cause a more or less considerable extravasation. But when the wound is ample and direct, the effused blood, which has all the characters of arterial blood, leaves no doubt concerning the injury of an intercostal artery. However, if any uncertainty prevail, it may easily be dispelled, by introducing a finger into the wound, and making pressure with it on the lower edge of the rib, which corresponds to the vessel suspected to be injured.

Gerard proposed to stop hemorrhage from the intercostal artery, by means of a ligature. His plan was to enlarge the external wound, as far as the upper edge of the rib, corresponding to the wounded intercostal artery, and then to introduce into the chest a common curved needle, armed with a ligature, to which was attached a dossil of lint. The needle was passed behind the rib, rather higher than the superior edge of the bone. The point of the instrument was then pushed, from within outward, and brought out through the external wound, together with the bone. When the dossil had come into contact with the artery, the two ends of the ligature were tied over a thick compress, placed on the outside of the rib. In this manner, the bone was surrounded with the ligature, and the artery compressed.

Goulard, of Montpellier, having found difficulty in passing a common needle, whose shape little corresponded to the track through which it had to pass, being curved towards its point, and straight towards the eye, invented one expressly for this operation. He also objected to the common bent needles, as he conceived that they might wound the lungs with their sharp points and edges. Goulard's needle formed three-fourths of a circle, and was fixed on a long handle, which facilitated its introduction. The eye, in which the ligature was put, was situated near the point, which was a little blunted, and the ligature lay in a groove, in the convexity of the instrument. When the needle had passed through the intercostal muscles, and its point had made its appearance over the rib which was above the artery, the ligature was untied, and held, while the needle was withdrawn at the place where it had entered. The ligature was then tied, as in Gerard's method.

It was afterwards thought, that compression might answer better, than the foregoing use of the ligature. Löttery, professor of anatomy in the university of Turin, constructed for this purpose a steel plate, which is described and engraved in the second volume, 4to., of the *Mémoires de l'Acad. de Chir.* This plate was narrow at one end, broad at the other, and curved in two directions at its narrow part, where there were some holes, by means of which a compress for the artery was fastened on the instrument. The broad end of the plate had two long parallel slits, through which a riband was passed, with which the instrument was secured.

When the wound, corresponding to the intercostal artery, was sufficiently extensive in the transverse direction, the narrow bent end of the instrument was so introduced, that the lower edge of the rib above was placed in the concavity of the curvature, while the compress acted on the edge of the bone, and, of course, on the artery. The rest of the instrument applied itself to the side of the thorax, in which situation it was fastened. When the wound was not ample enough, a sufficient dilatation of it was first made for the introduction of the instrument.

Quesnay employed a piece of ivory, which he covered with lint, &c., and introduced within the chest. The instrument was then drawn from within outward, by means of a riband, and thus the necessary compression was produced.

Quesnay's plan is somewhat like that invented by Löttery: but, to have introduced the compress entirely into the thorax, together with the ivory which was the basis of it, and then to have drawn the contrivance from within outward, as was probably intended, a very large wound would have been indispensable. This was also one of the many strong objections to Löttery's instrument, which, in fact, could only be employed, when there was a free and ample opening.

Belloque, seeing the inefficacy of all the compressing means used before his time, and their inconveniences, invented an instrument, which, he says, is calculated for making proper pressure, and following the motion of the ribs, without hindering the escape of extravasated blood. The machine is engraved and described in the second volume of *Mém. de l'Acad. de Chir.* 4to. It is composed of two plates, which are wadded, and capable of being brought towards each other by means of a screw.

This instrument, as Sabatier observes, may indeed answer; but it is complicated and awkward; and its utility is founded on the supposition of the wound being larger than wounds are which are made with common weapons.

Justly averse to any unnecessary multiplication of surgical instruments, modern practitioners reject all particular contrivances for stopping hemorrhage from the intercostal arteries. Indeed, as the accident is very rare, it is probable that, if the best instrument possible were devised, it would hardly ever be at hand when required.

Professor Assalini joins all the best modern surgeons in reprobating the introduction of the preceding contrivances and extraneous substances into the chest, in order to stop hemorrhage from the intercostal artery. All these methods, he remarks, are calculated to excite a dangerous degree of inflammation in the chest. Hence, he prefers simply cutting the artery across, so as to allow it to retract, and, if this plan fail, he recommends the wound to be closed. Should the blood find its way into the chest, it is true, the consequences will be serious, but not fatal; and if the symptoms require it, the operation of empyema may afterwards be done. A small quantity of effused blood, however, may be absorbed, and no such proceeding be requisite. (*Manuale di Chirurgia*, p. 58, 59.)

Dr. Hennen conceives that, whenever the tenaculum can be used for an injured intercostal artery, the practice should be adopted. He states, that cases are reported in which the vessel was thus secured, but that he has never seen the method adopted himself. "Unfortunately (says he), we but too often are disappointed in finding the source of the hemorrhage, and here judicious pressure is our only resource. In some very slight cases I have used the graduated compress with success; but if the sloughing is extensive, nothing but the finger of an assistant, relieved as often as occasion may require, and pressure direct upon a compress placed along the course of the vessel, or so disposed as to operate upon its bleeding orifice, will be of any avail. (*Military Surgery*, ed. 2. p. 377.)

About four years ago, I attended with Mr. Frogley, of Hounslow, and Mr. Broxholm, of Sunbury, a young gentleman, one of whose middle intercostal arteries had been wounded with a penknife, about two inches from the vertebral column. About eight ounces of blood immediately flowed from the external wound, followed by an enormous extravasation of blood under the muscles of the back, intense pain, and high symptomatic fever. In a few days, in consequence of suppuration having taken place, I made an opening, and discharged about a gallon of fluid, composed partly of pus, but chiefly of putrid blood. The case proved tedious, in consequence of the formation of deep sinuses, and frequently life was in great danger; but, in the end, the young gentleman recovered. This case was also seen by Mr. Lane.

3. The protrusion of a portion of the lungs, in consequence of wounds penetrating the chest, is a very unusual case; but there are some instances recorded by writers, and one case I attended myself after the battle of Waterloo. Schenckius relates an example, taken from Rolandus. The latter was called to a man who had been wounded

in the thorax six days before. A portion of the lung protruded in a state of mortification. Rolandus extirpated it, and the patient soon recovered.

Tulpius has recorded a similar fact. A man received an extensive wound, just below his left nipple. His naturally gay disposition, however, led him to neglect the injury; and on the third day a piece of the lungs, three inches in length, protruded. The patient went to Amsterdam, whence he was distant two days' journey, for the purpose of receiving succour in one of the hospitals of that city. The protruded piece of lung, which was already mortifying, was tied, and cut off with scissors. It weighed three ounces. The wound healed in a fortnight, and the patient experienced no complaint afterwards, except a slight cough, with which he was occasionally troubled. He survived the accident six years, leading a wandering, drunken life. After death, nothing particular was observed in the thorax, except that the lungs had become adherent to the pleura, in the situation of the wound. Hildanus relates another case: a man was wounded with a knife between the fifth and sixth ribs, near the sternum. As a piece of lung protruded at the opening, and was of a livid colour, it was extirpated with the actual cautery. The wound was then dilated, and the ribs kept apart with a wooden wedge, under which plan, the portion of lung, girt by the opening, shrunk within the chest. The patient was soon completely well.

A fourth example of a protrusion of a piece of lung through a wound in the thorax, is among the cases recorded by Ruysch. The servant of a seafaring man was wounded in the anterior and inferior part of the chest, and was immediately attended by a surgeon, who mistook the protruded piece of lung for a portion of omentum; and applied a tight ligature round it. Ruysch, who was consulted, soon detected the mistake which had been made, but he delivered his opinion, that the wound would heal very well as soon as the tied piece of lung had been detached. The event justified his prognosis, and the patient recovered.

When the protruded portion of lung is sound, the reduction ought to be made without the least delay. It should be done on the same principles as those, on which protruded pieces of intestine or omentum are reduced. (See WOUNDS OF THE ABDOMEN.) A recurrence of the accident is to be prevented by closing the wound, and placing a compress over it. But when the piece of lung is already in a mortified state in consequence of the constriction which it has suffered, or when its large size prevents reduction, Sabatier is of opinion that the only resource is to extirpate the part, after applying a ligature round its base. If the latter step were not taken, a dangerous hemorrhage might follow, or even an extravasation in the thorax. (*Médecine Opératoire*, tom. ii. p. 224.) However, the practice recommended by Sabatier appears questionable in the instance of mortification, because the dead part will naturally be thrown off by a spontaneous process; and, when the wound is too small to allow the part to be returned, its dilatation might be more advisable than the removal of a considerable portion, or even any of the lung.

After the battle of Waterloo, I had a patient with a protrusion of a piece of lung, four or five

inches in length. The part was much bruised, and could not be easily reduced. I therefore applied a ligature round its base, and cut it off. Previously, however, I made an incision in it, in order to ascertain whether it would bleed freely, which being the case, induced me to use a ligature. I was afterwards informed by my friend Mr. Collier, that the man died.

4. Emphysema is another symptom, with which penetrating wounds of the chest are frequently complicated, especially when they are small and indirect. When such wounds are narrow, and not straight in their course; when their track is rendered impervious either by change in the situation of the muscles, the swelling of the parts, clots of blood, or any extraneous substance, air may insinuate itself into the cellular tissue, so as to cause a great deal of tumour and distension. Emphysema is easily distinguishable by the swelling of the part, being without any pain or change of colour in the skin, and by the crepitation which is perceptible, on pressing the air from one part of the cellular substance into another. Emphysema may take place where the lungs are not wounded, but in this case it can never be of much extent. Here the emphysematous swelling is caused by the air, which insinuates itself into the cavity of the thorax through the wound, during the first inspirations which follow the accident, and the same air is expelled in the subsequent acts of expiration. But when the lungs are wounded, the emphysema arises from the escape of air from those organs during inspiration, first into the cavity of the thorax, and thence, in expiration through the inner opening of the external wound, into the cellular substance.

I should have deemed it unnecessary to have said any thing in this part of the work on the present subject, and have contented myself with referring to the article EMPHYSEMA, were not the cause of this symptom rather perplexing, and did I not hope that the following extract from Sir A. Halliday's publication will tend to facilitate the comprehension of these cases. This gentleman mentions the following circumstances, under which air may escape from the lungs, or emphysema arise.

1st. "An injury or disease of the pleura pulmonalis, causing a wound or ulceration of that membrane, and thus allowing the air to escape from the lungs, as in oblique external wounds, where the outer opening, and that of the pleura costalis have healed, or closed up, and in ulcers of the surface of the lungs.

2dly. "The pleura pulmonalis and pleura costalis may be wounded or ulcerated, when there is no external opening, as when the ends of fractured ribs penetrate through both into the substance of the lungs; and it is from this accident, &c. that emphysema most commonly takes place.

3dly. "The common integuments of the parietes of the chest, the intercostal muscles, and the pleura costalis, may be wounded, while the pleura pulmonalis and the lungs remain uninjured, so that the air admitted from without, and collected in the cavity of the thorax, may be pressed into the cellular membrane, so as to occasion emphysema."

The same writer remarks, "that the lungs in the thorax have often, and not unsparingly, been compared to a bladder in a close pair of bellows; but if we suppose the bellows to be divided into two com-

partments, and each of these to contain a bladder, which mutually communicate with each other, and with the external air, by means of a tube, which is exactly adapted to the nozzle of the bellows, and which admits the air only into the cavity of the bladders, and not into the space betwixt the bladders and bellows, we shall then have a perfect representation of the mechanical structure of the thorax. The bellows will represent the thorax, divided in the middle by the mediastinum; the bladders will represent the lungs of the right and left sides; and the tube, which communicates with the bladders and with the external air, will represent the trachea. The only thing, which is wanting to render this mechanical representation perfect, is, that the bladders should exactly fill the bellows, so as to leave no air betwixt them and the bellows."

It is explained by Sir A. Halliday, that when the handle of the bellows is lifted up, the bladders become filled by the external air, which rushes in through the tube, which communicates with both of them. When the handle is depressed, the air is expelled again. In the like manner, the lungs are filled with air, and emptied again when the capacity of the chest is enlarged by the inspiratory muscles, and then diminished by the expiratory ones.

When emphysema arises from a wound or ulceration of the pleura pulmonalis, on one side of the thorax, the case is nearly the same as if an opening were made in one of the bladders, which opening would form a communication, as the same gentleman observes, with the bellows and bladder on one side. If this should happen while the handle of the bellows is depressed, no sooner is the handle raised, than air rushes into the space, betwixt the bladder and bellows, and on keeping up the handle a little while, the bladder will become quite collapsed, and the place which it occupied while distended will now be occupied by the air. "If now (says Sir A. Halliday) we attempt to force out the air, by depressing the handle of the bellows, we shall find that this cannot be done; for there is no direct communication between the bellows and the external air; and, as the effused air presses equally on all parts of the collapsed bladder, it cannot escape through it."

When the thorax is expanded in inspiration, the pressure is taken off the surface of the wounded lung, and the air, which now enters this organ, instead of distending its cells, passes through its wound into the space between the pleura pulmonalis and pleura costalis. The lung will, indeed, be partially expanded, as long as inspiration on that side goes on; the more so, the smaller its wound is. At every expiration, however, when the thorax is diminished, the effused air will be compressed against the wounded lung; but none of the air, which has escaped, can re-enter the lung again; "because (as the preceding writer accurately remarks) the whole of the air contained in the lung must be forced out, and then the pressure (of the air) against every part of the collapsed lung being equal, will prevent its separating any part, so as to make a passage for itself into the trachea." Thus fresh air accumulates at every inspiration in the space between the pleurae, while none can escape from the same situation during expiration, and the quantity accumulated will, at last, equal that which is received into

the other lung; during the most powerful inspiration.

When the pleura pulmonalis and pleura costalis are both wounded, the same effusion of air between them continues from the above-mentioned causes till the lung collapses. When an attempt is now made to expire, the injured side of the thorax must continue distended, notwithstanding every effort of the patient. In this expiratory act, however, if the capacity of the thorax be diminished, and the air compressed, a part of it finds its way through the wound in the pleura costalis, into the common cellular substance of the parietes of the chest.

The passage of air into the cavity of the thorax during inspiration is, as Sir A. Halliday observes, now more easy than the return of that already effused in the cellular membrane, and, consequently, the *subcutaneous emphysema* continues to increase with a rapidity which is remarkable.

To explain the origin of emphysema in cases of wounds which only enter the chest, and do not injure the lungs at all, this writer has recourse to the simile of the bellows and bladders. Were an opening made into the bellows, without injuring the contained bladders, and the access of air by this opening more free than that by the nozzle, communicating with the cavity of the bladder, more air would enter by the opening than by the pipe, on the handle being raised, so that the bladder would not rise as usual, when no opening in the side of the bellows existed. If the latter opening be smaller than that of the pipe, the bladder will only be partially filled; and, on depressing the handle of the bellows, the air contained in the bladder, and that between the bladder and the bellows, will be expelled, in the same proportion to each other, as that in which they were formerly filled. This process would continue to go on in the same way, did not the bladder naturally collapse more and more from its gravitation. Let us now stop the mouth of the pipe, while the handle of the bellows is raised, and the bladder partially filled. On trying next to depress the handle, it results that, as no air can escape from the pipe, the air contained between the bladder and the bellows must be first evacuated, while that contained in the bladder of the sound side will be forced into the bladder on the injured side, and either distend it, so as to rupture it, or cause it to protrude.

Hence, in the case of a wound penetrating the chest, without injuring the lungs, if the air can enter more freely by the wound than by the trachea, more of it will enter, in the act of inspiration, into the cavity of the thorax, than into the lungs. On the contrary, when the opening of the wound is not so large as that of the trachea, less air will enter the thorax than the lungs.

In expiration the air will be forced from the two different situations, in proportion to the quantity which enters each of them in inspiration, and no air at all would accumulate in the thorax, did not the lungs always tend to collapse from their gravitation. Should, however, the patient, in making an effort to expire, contract the glottis, the air contained in the lungs of the sound side may be propelled into the bronchi and air cells of the lungs on the same side as the wound,

so as to distend them, and even make them protrude.

Dr. Halliday remarks, that such a protrusion often happens, when wounds are made in dogs, and has been erroneously adduced as an argument against the collapse of the lungs, when an opening is made into the thorax of the human subject. (See *Obs. on Emphysema*, by Sir A. Halliday, 1807.)

For information on the treatment, see EMPHYSEMA.

5. I have already noticed, that wounds of the thorax may injure one of the intercostal arteries, and when the blood cannot flow outward, it may be extravasated in the chest. The same consequence may follow wounds of the pulmonary vessels, those of the heart, or of the heart itself. And here I may take the opportunity of remarking, that sometimes wounds of the heart do not prove instantaneously fatal. A case, in which a bayonet passed through the colon, stomach, diaphragm, part of the lungs, and the right ventricle of the heart, and yet the patient lived nine hours after the receipt of the injury, is recorded by Dr. Babington. (See *Med. Records and Researches*, Lond. 1798; also a case by Chastenet, in *Journ. de Méd. Mil. t. ii.*) In almost all cases, however, such injuries prove instantly fatal; and the same remark will extend to cases of hemorrhage from vessels above a certain size; but when they are less considerable, the patient may live for a greater or less time, and receive the aid of surgery.

The following are the symptoms which denote an extravasation of blood in the thorax. The patient feels great oppression, and such uneasiness as will not let him long continue in one position. Unless he bend his body very much forward, in which position the diaphragm is relaxed, and not so much dragged by the weight of the extravasated fluid, he feels great difficulty in standing or sitting up. When the thighs are bent, the patient can lie with tolerable ease on his back; he is also not averse to lying on the side on which the wound is situated; but he cannot place himself on the opposite side without feeling very acute pain in the situation of the mediastinum.

His respiration is short, frequent, and interrupted by sighs; his veins become empty; a cadaverous paleness spreads over his countenance; his extremities become cold; a viscid perspiration covers his neck and temples; his teeth chatter; his pulse becomes weak; and if, as most frequently happens, the lungs are wounded, he spits up frothy blood, and air issues from the wound.

Though one might suppose the above class of symptoms always attendant on a considerable effusion of blood in the thorax, this is not the case. Wounded persons have been known to die of such an extravasation, whose respiration was tolerably free, and who did not complain of suffering more inconvenience in one posture than another. Sabatier says, that several facts of this kind have fallen under his own observation. Other wounded persons, also, who suffered most of the complaints ascribable to extravasation of blood in the thorax, have been cured by ordinary means. Mery gives an account of a young man wounded in the anterior and superior part of the chest, about two o'clock in the morning, who had

such difficulty of breathing, and fever, five hours afterwards, that an extravasation was supposed to exist, and Mery was thinking of making an opening for its evacuation. A tumour near the great pectoral muscle, presenting neither the feel of fluctuation, nor that of emphysema, made him suspend his decision. The tumour was dispersed by bleeding, and the application of compresses, dipped in a mixture of spirit of wine and water.

However, even the assemblage of the above symptoms did not deceive Petit. Having been requested to assist at an operation, which was about to be done upon a wounded man, about whose armpit, pectoralis major, and latissimus dorsi muscles, a prodigious emphysematous swelling had taken place, whose respiration was painful and difficult, and who spit up frothy blood, Petit gave it as his opinion, that it was unnecessary to make an opening into the chest. He thought it would be sufficient to enlarge the wound, which was at a little distance from the armpit, near the edge of the latissimus dorsi, so as to give vent to the effused air. This advice was followed, the emphysema soon dispersed, and the patient recovered.

The equivocal nature of the symptoms of extravasation of blood in the thorax, has induced practitioners to pay the most scrupulous attention to every circumstance attendant on these cases. In several instances Valentin remarked, that an ecchymosis occurred at the angle of the false ribs, and spread towards the loins. The ecchymosis is described as being of a clear purple colour, like the spots which sometimes form on the abdomen a little while after death. In a case, in which most of the symptoms of extravasation were combined with the above sort of ecchymosis, Valentin advised a counter-opening to be made. The advice was overruled, and the patient soon afterwards died; more than six pints of blood were found extravasated in the thorax.

Sabatier remarks, that we cannot too highly applaud the zeal of those practitioners, who endeavour to dispel the doubts which still prevail in several parts of surgery. At the same time he thinks, that all who take interest in the improvement of this science should endeavour to ascertain the truth of any new observations which are offered. Hence, he deems it proper to relate a case, which was communicated to him by M. Saucerotte (the father), an eminent military surgeon, and which shows, that the ecchymosis, observed by Valentin, is, at least, not invariably attendant on extravasations of blood in the chest. A light-horseman, who had received a thrust with a sabre in the right side of the thorax, above the tendon of the pectoralis major, appeared to be going on very well for the first four days after the accident. On the fifth, he complained of difficulty of breathing, uneasiness, and an inability of lying on the left side, without aggravating his complaints. He complained of a great deal of pain in the region of the liver, and at the top of the shoulder. His pulse was small and contracted, and rather hard than weak. The right side of the chest seemed larger than the left. On the eighth and ninth day, the symptoms became more urgent, and the patient found no ease, except in leaning on his right arm. When he was sitting on a chair placed in the assemblage of symptoms in the right cavity of blood in the right cavity

Valentin has described, was not apparent, doubts were entertained about the real nature of the case. When a counter-opening was made on the dead body, a pint of putrid blood flowed out.

It rarely happens that any attempt to discharge blood from the chest, can be made in the early stage of a case, complicated with extravasation. The following account will let the reader know what expedients have been resorted to for this purpose. But, for reasons hereafter given by Larrey and others, it is generally best to avoid the practice of making any opening for the discharge of blood from the sac of the pleura.

Authors mention five methods of discharging blood from the thorax; viz. 1st. By placing the patient in a posture which favours the escape of the blood; 2dly. By introducing a syringe for the purpose of sucking it out, or a mere cannula, through which it is to flow; 3dly. By enlarging the wound; 4thly. By employing injections; 5thly. By making an opening in a depending part of the thorax.

1. Success cannot be expected from merely placing the patient in a posture which is favourable to the escape of the extravasated blood, except when the wound is situated at the inferior part of the chest, and is large and direct in its course. Paré successfully adopted this method in the case of a soldier, who was stabbed in three places with a sword, one of the wounds, which entered the chest, being situated under the right nipple. The man was first dressed by a surgeon who made several sutures. The patient was soon afterwards attacked with considerable difficulty of breathing, fever, coughing, spitting of blood, and acute pain in the side. Paré, who was consulted the next day, suspected that an extravasation had happened: consequently he cut out the sutures, and placed the patient in a position, in which his feet were much more raised than the head. Paré also recommended him to hold his breath, and then introduced his finger into the wound, in order to take away some clots of blood which appeared at its orifice. By these steps, the discharge of seven or eight ounces of fetid, conglutinated blood was effected.

2. The idea of drawing out of the thorax extravasated blood with a syringe, is rather ancient. Mere tubes, containing a stilet, have also been employed. Scultetus relates a case, in which an instrument of the latter sort was successfully employed. No syringe, or any suction with the mouth, was requisite; it was found necessary merely to introduce the tube, and then withdraw the stilet.

Lamotte used only a simple cannula, which he introduced into the centre of the extravasation. Then having placed the patient in what he conceived to be the most favourable posture, and requested him to hold his breath, he drew off the collection of fluid. His cases, numbered 216, 217, 218, show the success which attended this method. Although it might also have answered very well in case 219, Lamotte saw that the high situation of the wound would not have allowed all the blood to be discharged, and therefore he made a counter-opening. Thus the thorax was completely emptied, and a recovery ensued. When a cannula is employed, authors recommend it to be introduced every day, till the bad symptoms cease, and no more fluid escapes through the cavity of

the instrument. After having given vent to blood, it allows a bloody serous fluid to escape, and at a latter period pus, which becomes of a thicker and thicker consistence, the nearer the patient is to a recovery.

3. The cases in which a wound, complicated with an extravasation in the chest, should be dilated, are those in which the situation of the opening is favourable to the escape of the blood. The operation is performed with a curved bistoury and a director. The integuments and external muscles are to be divided in a perpendicular direction, and the intercostal muscles in a line parallel to the ribs. Care is also to be taken, not to cut too near the lower edge of the upper rib, lest the intercostal artery be wounded. Dionis practised such an operation on a soldier who was wounded at Befort, in 1703, with a sword, below the right nipple, whereby a direct opening was made into the thorax. When the extravasated fluid had been let out, Dionis made the patient lie on the wounded side during the night, and in proportion as the blood continued to be thus evacuated, the breathing became free from oppression.

4. The methods above explained may be of use, when the blood retains its natural state of fluidity; but, when it is coagulated, as often happens, they can be of no avail. In this circumstance most authors direct a proper opening to be made, and tepid water then to be thrown into the chest, with the view of loosening and dissolving the coagula, and washing them out of the wound. Some French writers, even of recent date (*Sabatier*), most absurdly recommend the injection of various detergent vulnerary decoctions, and of solutions of honey of roses, soap, salt, &c. What idea these authors can entertain of the great tendency to inflammation of the lungs and pleura, or what good they can expect from such applications, is difficult of conception. I am firmly convinced, that the meanest scribbler on surgery, in this country, would be ashamed of offering such advice.

5. When the wound is narrow and situated at the upper part of the chest, the extravasated blood cannot be discharged, unless a counter-opening be made at the lower part of this cavity. The best place for making the opening, and the proper manner of executing the operation, are described under the head of *PARACENTESIS*. As soon as the opening has been made, the blood flows out. Its discharge is then to be promoted, by such a posture as will render the opening depending.

The old surgeons, who had much more fear than the moderns, of letting the opening heal up, sometimes employed tents for the purpose of preventing this event, until all danger of another collection of blood or matter seemed to be over. However, as in these cases tents are apt to bring on inflammation of the pleura and lungs, hinder the escape of whatever fluid is contained in the chest, and cause great irritation, pain, and even exfoliations from the ribs, their use is now relinquished.

As large tents had the effect of hindering the discharge of blood or matter from the cavity of the chest, some of the old French surgeons employed a kind of wick; but, in the present state of surgery, I do not consider that it would be at all edifying to enter into a comparison of these contri-

vances. If any means be ever requisite for keeping the opening from closing, there cannot be a better thing for the purpose than a short cannula, with a rim to keep it from slipping into the thorax, and two little rings for confining it in its situation with a riband. This should only just enter deeply enough to have its inner orifice on a level, or a very little further inward, than the pleura costalis, so that it may not irritate the lungs.

When the patient has been dressed, he is to be kept in bed, with his head and chest somewhat elevated, and his thighs bent, in which position the breathing will be least oppressed. It is usual also to recommend him to lie, as much as possible, on the side on which the operation has been done. He is to keep himself in as quiet a condition as he can. He is to be put on very low diet, and, if his strength allows, he is to be bled from the arm, and this evacuation must be repeated with other antiphlogistic means as often as the urgency of the fever and inflammatory symptoms indicate, and the strength allows. Bleeding from the arm, besides counteracting inflammation in the chest, which is a principal source of danger, does good by lessening the force of the circulation in the wounded vessels, and thus diminishing the tendency to internal hemorrhage.

The old practice of keeping wounds of the chest open is now nearly exploded; but, if it ever be advisable, particular caution must be used not to let the tents, and pieces of the dressings, glide into the cavity of the pleura. *Tulpius* speaks of a Danish gentleman, who had been under a careless surgeon, on account of a wound in the thorax, and who coughed up, six months afterwards, a large tent. A similar fact is recorded by *Hildanus*. A man was stabbed in the right side of the chest, near the axilla, between the second and third ribs. For a fortnight, a great deal of blood was discharged both from the wound and the mouth. The wound healed; but the patient continued to be afflicted with considerable difficulty of breathing, an incessant cough, and to spit up a greenish fetid matter. Three months afterwards, he coughed up two tents, which had slipped into the cavity of the thorax.

A relaxation of the antiphlogistic regimen must be made with very great circumspection. Too much nourishment, talking too frequently, and any exertion, are circumstances which may induce a renewal of the hemorrhage, and extravasation. *Vesalius* saw an accident of this nature happen a fortnight after the wound, and eleven days after the operation for empyema. A soldier, who had been stabbed in two places with a sword above the right nipple, was attacked with fever, difficulty of breathing, restlessness, and acute pain at the bottom of the chest. These symptoms induced *Vesalius* to infer, that an extravasation had taken place; but he was afraid of making an opening in the chest, for fear the hemorrhage should still continue from the wounded vessels. However, as the patient remained in the same state, the fourth day after the receipt of the wounds, and he still had strength enough, *Vesalius* undertook the operation, by which a considerable quantity of extravasated blood was discharged. The patient felt great relief at the instant. The oozing of blood continued for a few days, after which a favourable suppuration took place in all the three wounds, and the case was expected to end well.

But the patient having regained his strength and taken too much food, the recurrence of hemorrhage caused his death. Lombard saw a soldier die, instantaneously of internal hemorrhage, brought on by throwing a bowl at some nine-pins, two months after he had been cured of a wound of the lungs.

When the edges of a penetrating wound of the chest are to be brought together, writers state, that the patient should be requested to make a strong inspiration with the wound closed, and then a long, slow expiration with it open, and so on, till as much of the air is discharged from the thorax as possible, and then the wound is to be accurately closed with sticking-plaster. From what has been observed, however, in the article *EMPHYSEMA*, it will appear, that when there is a direct opening into the thorax, so as to admit the external air, the lungs on one side collapse, and remain so till the wound is healed, and the air absorbed. When one of these organs is wounded, a collapsed state is, indeed, the best condition in which it can possibly be for a certain time, that is, till the breach of continuity in it is healed. Schemes for making the lung expand, by exhausting the air from the cavity of the pleura, may be amusing on paper, but, I apprehend, they will never be of real use in practice.

Fistulae sometimes continue a long while after wounds of the thorax. Platner mentions an instance, in which a fistulous opening remained out of which the air rushed with sufficient force to blow out a candle. The patient lived a long while in this state, without suffering any particular inconvenience.

Another occasional consequence of a wound of the chest is a hernia of the lungs; of which Sabatier met with an example. A soldier, thirty years of age, was wounded with a bayonet in the right side of the chest, between the middle part of the fifth and sixth true ribs. The wound healed; but as the intercostal muscles had been divided to a great extent, and could not be approximated with precision, an empty space was left under the integuments, which allowed a piece of the lungs, as large as a walnut, to protrude between the ribs. The swelling enlarged at the time of inspiration, and grew smaller when expiration took place, occasioning merely a slight pain without any oppression in the chest.

Though so much has been written on the subject of discharging blood from the chest, in cases of extravasation within that cavity, the operation is very rare. During the whole period that I have been in the profession, I have never heard of its being done by any of the surgeons in London. In military surgery, however, the practice is occasionally exemplified. (*Larrey, Mém. de Chir. Mil. t. ii. p. 158. &c.*) No doubt, the true reason of the operation being uncommon, is the obscurity in the diagnosis, the symptoms being all of an equivocal nature. Even Larrey, generally so partial to operations, recommends the immediate closure of all wounds of the chest, excepting such as are complicated with injury of the intercostal artery, because (says he) unless very considerable vessels of the lungs are injured (in which case, nothing can be of any use), either no extravasation, or only a trivial one, happens, which, under the employment of rigorous antiphlogistic treatment, may be dissipated by absorption. (*P. 127.*) Respecting the general propriety of closing all wounds of the

chest, I entirely concur with Larrey, Pelletan, Boyez, and Dr. Hennen. (*On Military Surgery*, ed. 2. p. 373.)

Consult *Sabatier, Médecine Opératoire*, t. ii. *Journ. de Méd. Militaire*, 7 tomes. *Schnucker, Wahrnehmungen*, 2 b. Berlin, 1774—89. *J. Bell, On the Nature and Cure of Wounds*, ed. 3. *D. J. Larrey, Mém. de Chir. Militaire*, 8vo. Paris, 1812—1817. In various places. *John Hennen, Principles of Military Surgery*, ed. 2. 8vo. Edinb. 1820. *Wm. Maidcn, An Account of a Case of Recovery after an extraordinary Accident*, 4to. Lond. 1812. The injury here referred to is one of the most extraordinary on record; the shaft of the gig having been driven with the greatest violence between the sternum and lungs. *Sir A. Halliday*, in *Edinb. Med. and Surg. Journ.* vol. xi. p. 140; a recovery from a gunshot injury, in which a great part of the shoulder was carried away, and the lungs and pericardium were exposed: to the authenticity of this case I can bear witness myself, having been at the field hospital, when the soldier arrived from the trenches, near Antwerp.

Wounds of the Abdomen.—Here one of the chief causes of danger is the tendency of the peritoneum to inflame. Every penetrating wound of the belly is apt to excite this inflammation, which too often extends itself to the viscera, and terminates in the death of the patient.

There are (says Mr. John Bell) a thousand occasions, on which the delicacy of the peritoneum may be observed. The wound of the small sword, and the stab of the stiletto, explain to us how quickly the peritoneum, and all its contained bowels, inflame from the most minute wound, although the injury be almost too small to be visible on the outside, and scarcely within; for often, upon dissection, no intestines are discovered wounded, and no feces have escaped into the abdomen. In subjects who die after lithotomy, we find the cavity of the peritoneum universally inflamed. The operation of the Cæsarean section is fatal, not from any loss of blood, for there is little bleeding; nor from the parts being exposed to the air, for patients also die, in whom the womb bursts, and where the air has no possible opportunity of insinuating itself; but the case proves fatal from the inflammation, which is always disposed to originate from wounds of the peritoneum, small as well as great. (*Discourses on the Nature and Cure of Wounds*, p. 310. edit. 3.)

But, although there can be no doubt that the wound, abstractedly considered, is the most frequent occasion of this dreadful inflammation, yet it sometimes happens, that the inflammatory consequences must be ascribed to another kind of cause. If an intestine be wounded, its contents may, under certain circumstances, be effused in the abdomen; if the liver, spleen, kidney, or any large vessel be injured, blood may be poured out amongst the viscera; if the gall-bladder be wounded, bile may be effused; and if the bladder be pierced, the urine may escape into the abdomen. Now, all these fluids are extraneous substances, with respect to the surfaces with which they often come into contact, and, as such, they give rise to inflammation of the peritoneum and viscera. It is the nature of a serous membrane to inflame from the contact of almost any substance or liquid, except that of its proper secretion, or that of mere water.

Wounds of the belly are divided by almost all writers, into such as penetrate the cavity of the peritoneum; and into others, which only interest the skin and muscles.

The former differ very much in their nature and

degree of danger, according as they do, or do not, injure parts of importance, contained in the peritoneum. The latter are not remarkably different from the generality of other superficial wounds. The chief indications are to lower inflammation, and to prevent collections of matter. A few particularities, however, in the treatment of superficial wounds of the abdomen, merit attention.

Superficial Wounds.—The most ancient surgeons and their successors, down to the present day, record, that wounds of tendinous parts frequently give rise to very unpleasant consequences. Almost the whole front of the abdomen is covered with tendinous expansions, and, on this account, it is not unusual to see punctured wounds in this situation followed by extensive inflammation, and the formation of deep-seated abscesses. At the same time, the patient is affected with a great deal of inflammatory fever. He suffers acute pain, sickness, hiccough, and considerable disturbance of the nervous system. (*Callisen, Syst. Chirurg. Hodiernæ*, vol. i. p. 698. Hafniæ, 1798.)

When the tension and swelling of the abdomen abate, shiverings sometimes occur, and indicate the occurrence of suppuration. The matter sometimes accumulates in the tendinous sheath of the rectus muscle, and, when the collection in this situation remains undiscovered until a pointing appears, no sooner does the abscess burst, or it is opened, than an extraordinary quantity of matter is discharged. The surgeon should carefully remember the nature of this kind of case, as there is frequently not sufficient alteration in the appearance of the integuments to denote, either the existence, or the extent, of the suppuration.

Such an abscess forms one remarkable example, in which the necessity for making an early opening in an abscess is evinced. Here there is a fibrous texture intervening between the abscess and the skin, and nothing retards the natural progress of the matter to the surface of the body so powerfully as the interposition of such a structure. But, even in this circumstance, the propensity of pus to make its way outward is seen to have immense influence for, though there are only two thin membranes (viz. the fascia transversalis and peritoneum), between matter so situated, and the cavity of the abdomen behind the lower third of the sheath of the rectus, the abscess, after a time, mostly points externally.

The proper treatment of this case is to prevent the surprising accumulation of matter and rapid increase of mischief, by making a depending opening, sometimes at the very lowest part of the sheath of the rectus muscle, and this, as soon as the lodgment of matter is clearly ascertained.

Sometimes the matter is formed between the external and internal oblique muscles, and spreads to a great extent. The pus may even insinuate itself into the abdomen, and the case end fatally. Such an example is recorded by Dr. Crowther, of Wakefield. In this instance, however, the disease proceeded from a contusion, not a wound. (See *Edinb. Med. and Surgical Journal*, vol. ii. p. 129.)

Superficial wounds of the abdomen are to be treated on the same principles as similar wounds in other situations. The indications are to prevent inflammation by all possible means, and if suppuration should be inevitable, to let out the matter by a depending opening, as soon as the abscess is known to exist. The inflammation is to be checked

by general and topical bleeding, low diet, emollient clysters, diluent beverages, quietude, opening medicines, cold applications, or fomentations and poultices, and the mildest, and most simple dressings. (See INFLAMMATION.)

Whenever the abdominal muscles are wounded, they should be relaxed, and the patient kept quiet in bed. One important point in the treatment of wounds of the parietes of the abdomen, is to afford a degree of support to the wounded parts, so that the pressure of the viscera may be resisted. The sides of the abdomen are almost wholly composed of soft parts which easily yield. No part of the front or sides of the abdomen is supported by a bony structure, and as the viscera are, for the most part, more or less moveable, and closely compressed by the abdominal muscles and diaphragm, they are liable to protrude, whenever the resistance of the containing parts is not sufficiently powerful. Hence, all wounds of the abdomen, especially those in which both the integuments and muscles have been cut, demand strict attention to the precaution of supporting the wounded part, and this, though the peritoneum itself should not happen to be divided. The patient ought to keep as much as possible in a horizontal position, and suitable compresses and bandages should be applied. And, in order to guard against hernia, the parts should be supported in this way, a considerable time after the wound has been healed.

The peritoneum, with the intervention of the fascia transversalis, being connected, by means of cellular tissue, with the inner surface of the abdominal muscles, there is always some risk of the inflammation of these parts extending to that membrane. The danger must be averted by the rigorous employment of antiphlogistic treatment. What renders the event still more dangerous is, that when one point of the peritoneum is affected, the inflammation usually spreads with immense rapidity over its whole extent, and too often proves fatal.

As superficial wounds of the abdomen are to be treated on the general principles, applicable to all resembling wounds in other situations, it is hardly necessary to state, that union by the first intention, if possible, is always to be attempted.

Of Wounds penetrating the Cavity of the Abdomen.—The first thing which the surgeon is generally anxious to know, when he is called to a wound of the belly is, whether the wound penetrates the cavity of the abdomen, and whether any of the viscera are injured.

When the wound is extensive, and the bowels protrude, the first part of the question is at once decided. But when the wound is narrow, and the viscera do not protrude, it is more difficult to know whether the cavity of the abdomen is penetrated or not. An opinion, however, may be formed, by carefully examining the wound with a finger, or a probe; by observing, if possible, how much of the weapon is stained with blood; considering the direction, in which it was pushed; the quantity of blood lost, the state of the pulse, and whether any bile, feces, or other fluids, known to be naturally contained in some of the abdominal viscera, have been discharged from the orifice of the injury.

When the wound is sufficiently large to admit the finger, a surgeon can always learn whether the injury extends into the abdomen, because the

smooth lining of that cavity and the contained bowels may be easily felt. There is one chance of deception, however, arising from the possibility of mistaking the inside of the sheath of the rectus muscle for the cavity of the peritoneum; and when the examination is made with a probe, particular caution should be used in forming a judgment of the nature of the case; for the parts are so soft and yielding, that a very little force will make the instrument pass a considerable way inward. Every examination of this kind should always be undertaken, if possible, when the patient is exactly in the same position, in which he was at the time of receiving the wound. Formerly, injections were sometimes employed as tests of the penetration of the cavity of the abdomen. This absurd experiment is now very rightly abandoned. It is well known to the moderns, that the space, termed the cavity of the abdomen, is in fact completely filled with the various viscera, and that, in general, an injected fluid would not so easily find its way into the bag of the peritoneum, as an unreflecting person might suppose. And if it were propelled with much force, it would be quite as likely to insinuate itself into the cellular tissue of the parietes of the abdomen, or perhaps, into the sheath of the rectus muscle. The least tortuosity of the wound, or a piece of bowel, or omentum, lying against the internal orifice of the injury, would also completely prevent an injection from passing into the abdomen.

When a considerable quantity of blood issues from a wound of the abdomen, we may pronounce, almost with certainty, that some large vessel within its cavity is injured. Excepting the epigastric artery, which runs on the forepart of the abdomen, along the inner surface of the rectus muscle, no large vessel is distributed to the muscles and integuments. At the same time it is deserving of particular notice, that a large artery may be opened in the abdomen, and not a drop of blood be discharged from the wound. In such cases, the consequent symptoms quickly lead to a suspicion of what has happened. The patient complains of extreme debility and faintness; he is sick; his skin and extremities are cold; his countenance is pale and ghastly; his pulse falters; he has cold sweats; and if the bleeding should not speedily cease, these symptoms are soon followed by death.

Sometimes the extension of the wound into the cavity of the abdomen is, from the first, quite manifest, being indicated by the escape of chyle, bilious matter, feces, or other fluids. The vomiting up of a considerable quantity of blood, or its discharge by stool, affords also the same information. The urine, however, may flow from a wound, which does not actually penetrate the abdomen; for the kidneys, ureter, and bladder, may be said to be out of the abdomen, because they are really on the outside of the cavity of the peritoneum.

When none of the above symptoms occur; when neither the finger nor the probe can be introduced; when none of the fluids, known to be contained in the various receptacles in the abdomen, are discharged from the wound; when the pulse remains natural, and the pain is not excessive, there is reason to hope, that the wound has not injured parts of greater consequence than the integuments and muscles.

I have now taken a survey of the criteria, commonly noticed by writers, for the purpose of enabling surgeons to discriminate a wound, which penetrates the abdomen, from one which is more superficial. My next duty is to warn the practitioner, that too much solicitude to determine this point is frequently productive of serious harm. It may be set down, as an axiom in surgery, that, in general, whenever the probing of a wound is not rendered absolutely necessary by some particular object in view, it may be judiciously omitted. A narrow, oblique wound may enter the cavity of the abdomen, without there being any particular method of ascertaining whether it has done so, or not. However, this want of positive information is of no practical importance; for, when there are no urgent symptoms, evincing the nature of the case, the treatment ought obviously to resemble that of a simple wound; and, whether the wound be deep, or superficial, antiphlogistic remedies are indicated.

The edges of a wound, penetrating the abdomen, but unattended with injury of the viscera, are to be brought together with sticking-plaster, in the same way as common wounds. Sutures may also be employed, if necessary. Numerous cases may be found in the records of surgery, proving that wounds of the abdomen may be easily united without sutures, provided the surgeon take care to avail himself of the assistance which may be derived from a suitable position and a proper bandage. But such cases are less decisive than relations of the Cæsarean operation, the extensive wound of which admits of being healed by the same simple means. It is not my intention to assert that, in the majority of these examples, sutures were altogether dispensed with; but the ligatures frequently cut their way through the skin and muscles, and the application of others was impossible, either on account of the particular state of the case, or the patient's aversion to them. Still the union of such wounds was accomplished. (See Pibrac, in *Mém. de l'Acad. de Chir.* t. iii. 4to.)

However, there are circumstances in which it would be impossible to dispense with sutures. If, for instance, the belly were torn open from one side to the other by a bullock's horn; or if it were extensively divided with the tusks of a wild boar, a stag's horn, a razor, &c. and the inflated intestines could not be kept from protruding, some stitches would be absolutely necessary; but, even then, they should be as few as possible.

"Our good old surgeon Wiseman (observes Mr. John Bell) has said with great simplicity, as a great many have said after him, 'it frequently happeneth, that a sword passeth through the body without wounding any considerable part.' He means, that a rapier, or ball, often passes quite across the belly, in at the navel, and out at the back, and that, without one bad sign, the patient recovers, and, as has very often happened, walks abroad in good health in eight days; which speedy cure has been supposed to imply a simple wound, in which all the bowels have escaped. But we see now, how this is to be explained; for we know that, in a thrust across the abdomen, six turns of intestine may be wounded,—each wound may adhere; adhesion, we know, is begun in a few hours, and is perfected in a few days; and, when it is perfect,

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all danger of inflammation is over; and, when the danger of inflammation is over, the patient may walk abroad; so that we may do, just as old Wiseman did in the case here alluded to (p. 98. the case of a man, who was wounded across the belly, and well and abroad, in seven days), 'Bleed him, and advise him to keep his bed and be quiet.' In short, a man thus wounded, if he be kept low, has his chance of escaping by an adhesion of the internal wounds." (*On the Nature and Cure of Wounds*, p. 329, 330, ed. 3.) The truth of these observations is well illustrated in a case mentioned by Dr. Hennen, in which a soldier recovered, whose abdomen was pierced with a ramrod, which stuck so fast in the vertebra, that some force was required to disengage it. (*On Military Surgery*, p. 402. ed. 2.)

When a man is stabbed, or shot in the belly, and none of the bowels protrude, the wisest plan is to keep the patient as quiet as possible; and, as soon as he has rallied from the first collapse, and the pulse rises, have recourse to copious and repeated bleeding, anodynes, the lowest fluid diet, and light superficial dressings, such as the tepid water dressing, covered with a piece of oiled silk. In the event of severe pain and swelling of the belly coming on, leeches, fomentations, and emollient poultices, will be necessary, and nothing will now avail, except the most rigorous employment of antiphlogistic remedies. As Dr. Hennen observes, the best means of emptying the bowels are oleaginous clysters, and, if any internal medicine be given, as a purgative, it should be of the mildest nature. (*On Military Surgery*, p. 402. ed. 2.) Castor oil is perhaps the best; but, on the whole, for some few days, I would hardly venture beyond the use of clysters for procuring evacuations from the bowels.

Suppuration in the Abdomen in consequence of Wounds.—Abscesses within the sac of the peritoneum are far from being common. As a late writer well observes, the containing and contained parts of the abdomen present to each other an uniform and continuous surface of membrane. This membrane is of the serous class, and the species of inflammation, to which it is especially subject, is that which has been denominated the adhesive. The membrane lining the intestinal canal is of the mucous class, and the ulcerative inflammation is the species to which this class is liable. This beneficent provision is an irresistible evidence of the operation of a salutary principle in disease. If the inflamed peritoneum had run directly into suppuration, ulceration of surrounding parts would have been required for an outlet; and, if the internal surface of the irritated bowel had tended to form adhesions, the canal would have been in constant danger of obliteration. (*Travers, on Injuries of the Intestines*, &c. p. 10.)

That collections of matter, however, do sometimes take place in the cavity of the abdomen, in consequence of wounds, is a fact of which there are too many proofs on record, for the possibility of the case to be doubted. At this moment, be it sufficient to refer to two examples of the occurrence, as related by Mr. B. Bell. (*System of Surgery*, vol. v. p. 256.)

If the abscess were in any other part of the body, and did not readily point, the wisest practice would undoubtedly be to make an opening sufficient for the evacuation of the matter. But suppuration in the abdomen can seldom be known

with certainty in an early stage of the case, for the abscess is so deep, that no fluctuation, nor swelling, is perceptible, until the quantity of pus is considerable. Nor would it be judicious to expose the patient to the hazard, which might arise, from making an opening into the abdomen, merely for the sake of discharging a small quantity of matter.

Many writers impute much of the danger of wounds of the abdomen to the entrance of air into the cavity of the peritoneum. In inculcating such opinions, however, they betray an inaccuracy of observation, which a very little reflection would have set right. Too much stress has long been laid on the introduction of air into the abdomen, as being a cause of inflammation. The fact is, the cavity of the belly is always so completely occupied by the several viscera, that the whole inner surface of the peritoneum is invariably in close contact with them, and, therefore, air cannot easily diffuse itself from the wound throughout the abdomen. After tapping in dropical cases, inflammation seldom arises, though here the air has quite as good an opportunity of entering the abdomen, as in any case of wounds. The peritoneum in animals has been inflated, without any inflammation being excited. In cases of tympanitis, the peritoneum is distended with air, and yet both this membrane and the bowels are quite uninfamed. In the human subject, it seems probable that, if a wound were made in a vacuum, the breach of continuity itself would be an adequate cause of inflammation. It may also be remarked, that collections of matter in the abdomen are almost always completely circumscribed, and separated from the general cavity of the peritoneum by the adhesion of the viscera to each other, and to the inside of the peritoneum.

I am of opinion, that no surgical writer has succeeded so well, as Mr. John Bell, in exposing the absurd apprehensions, not uncommonly entertained by practitioners, respecting the entrance of air into the abdomen and other cavities of the body. He inquires, 1st, Whether air can really get into the cavity of the abdomen? and, 2dly, Whether, if it were there, it would produce the dreadful effects ascribed to it?

Upon the first question, his arguments run thus:—"Suppose a wound of an inch in length:—suppose the bowel to have sunk, in some strange way, into the pelvis, for example, so as to have left a mere vacuum; what should happen with the flexible parietes of the abdomen? Should they stand rigid, while the air rushed into the cavity to fill it? No surely. But, on the contrary, the walls of the abdomen would fall together, and the pressure of the outward air, far from making the air rush in by the outward wound, would at once lay the belly flat, and close the wound. But, since the walls of the abdomen are not flaccid, nor the cavity empty, but the abdomen full, and the flat muscles, which cover it, acting strongly, the effect must be much more particular; for, the moment that the belly is wounded, the action of the muscles would force out part of the bowels; the continuance of that action is necessary to respiration; the respiration continues as regular after the wound, as before; and the continual pressure of the abdominal muscles, and the diaphragm against all the viscera of the abdomen, prevents the access of air so effectually, that, though we should hold

such a wound open with our fingers, no air could pass into the abdomen, further than to that piece of gut which is first touched with the finger, when we thrust it into the abdomen. Nothing is absolutely exposed to the air, except that piece of intestine which is without the abdomen, or that which we see when we expose a small piece of the bowels, by holding aside the lips of the wound. The pressing forward of that piece, and the protrusion of a portion of the gut, proportioned always to the size of the wound; the pressure from behind keeping that piece protruded, so that, it is with difficulty we can push it back with our finger; this incessant pressure, in all directions, is an absolute security against the access of air. The intestine comes out, not like water out of a bottle, the place of which must be supplied by air entering into the bottle, in proportion as the water comes out, but the gut is pushed down by the action of the muscular walls of the abdomen, and that action follows the intestine, and keeps it down, and prevents all access of the air whether the gut continue thus protruding, or whether it be reduced; for, if it be reduced, the walls of the abdomen yield, allowing it to be thrust back, but admitting no air. Those who want to know the effect of air, diffused within the cavity of the abdomen, must make other experiments than merely cutting open pigs' bellies; they must give us a fair case, without this unnecessary wound. We will not allow them to say, when they cut open the belly of any creature with a long incision, that the inflammation arises from the air; much less shall we allow them to say, when they open the belly with a smaller incision, that, by that little incision, the air gets into the abdomen, and that all the bowels are exposed to the air." (*Discourses on the Nature of Wounds*, p. 343, 384.)

In adverting to the question, whether air is so irritating to the cavities of the body, as many have supposed, Mr. John Bell criticises, with much spirit and success, the opinions published on this subject by Dr. A. Monro, in his account of the *Bursæ Mucosæ*, as the annexed quotations will show. "That the vulgar should believe the first superficial impression that strikes them, of air hurting a wound or sore, is by no means surprising; but it is not natural that men, bred to philosophy, should allow so strange an assertion as this, without some kind of proof. That the air which we breathe, and which we feel upon the surface so bland and delightful, should have so opposite a relation to the internal parts, that it should there be a stimulus, more acrid and more dangerous than the urine, is not to be believed upon slight grounds. I do affirm (says Mr. John Bell), that it remains to be proved, that this fluid, which seems so bland and pleasant to all our senses, and to the outward surface, is yet a horrible stimulus when admitted, as a celebrated author grandly expresses it, 'into the deep recesses of our body.'" (*Monro's Bursæ Mucosæ*.)

With how much reason Mr. John Bell objects, that this doctrine is unfounded, will be manifest to every man of any discernment, or impartiality.

The air, for instance, escapes from the lungs, in a fractured rib, and first goes abroad into the thorax; thence into the cellular substance, then the emphysematous tumour appears; but often, without

any scarifications, with very little care and assistance on our part, the air is absorbed, the tumour disappears, and, without inflammation of the chest, or any particular danger, the man gets well. Here, then, is the air, within the cavity of a shut sac, filling the thorax, and oppressing the lungs, without any dangerous inflammation ensuing.

"That the air may be pushed under the cellular substance over all the body, without causing inflammation, is very plain from the more desperate cases of emphysema, where the patients, after living eight or ten days, have died, not from inflammation, but from oppression merely, the body being so crammed with air, that even the eyeballs have, upon dissection, been found as tense as blown bladders. We have also many ludicrous cases of this kind, which prove this to our perfect satisfaction. Soldiers and sailors sometimes touch the scrotum with a lancet, introduce a blow-pipe, and blow it up to an enormous size, imitating herniæ, by which they hope to escape from the service. The old story of a man, who was so wicked as to make a hole in his child's head, and blow it up, that he might show the child in the streets of Paris for a monster, is well authenticated; and I have little doubt, that a fellow, who knew how to do this, would blow it up every morning, and squeeze it out when he put the child to bed at night. Some villanous butchers, having a grudge at a soldier, found him lying drunk under a hedge; they made a little hole in his neck, and blew him up, till he was like a bladder, or, as Dr. Hunter describes the disease of emphysema, like a stuffed skin." (*P. 388, 389.*)

After many other pertinent observations, blended with appropriate satire on the extravagant notions professed by Monro, on the bad effects of the air in lithotomy, operations for hernia and hydrocele, the Cæsarean section, &c., Mr. John Bell most justly holds up to ridicule the proposition of Dr. Aitken, to perform this last operation under the cover of a warm bath, in order to exclude the air. "This, though it may seem to be a scurvy piece of wit, was really proposed in sober serious earnest. But (adds Mr. John Bell) the admission of atmospheric air, as a stimulus, when compared with the greater incisions of lithotomy, of hernia, of hydrocele, of Cæsarean section, of the trepan, is no more than the drop of the bucket to the waters of the ocean. And it is just as poor logic to say, that, after such desperate operations, these cavities are inflamed by the admission of air, as it would be to say (as Monro did), that, when a man is run through the pericardium with a red-hot poker, that the heart and pericardium are inflamed by the admission of the air." (*P. 347. ed. iii.*)

Enough, I conceive, has been said, to dispel all the idle fears and prejudices which have prevailed concerning the bad effects of the air in wounds of the abdomen, as well as several other cases. When so justly eminent a man as Dr. Alexander Monro, senior, was disturbed by such apprehensions, it is not wonderful that many a poor ordinary member of the profession should have been terrified nearly out of his wits upon the subject; and, for quieting this alarm, and exposing its absurdities, I think Mr. John Bell deserving of particular praise.

In general, in all cases of wounds of the abdomen, it is an excellent rule, never to be officious about abscesses which may take place, nor to

exhibit a partiality to such experiments as have been devised for learning precisely what bowel is wounded. It is quite time enough to interfere when the urgency of the symptoms confirms any suspicions which may be entertained. A great deal of harm is frequently done by handling and disturbing the wounded parts more than is necessary; and it is well known that wounds, at first attended with alarming symptoms, frequently have a favourable termination. Swords, balls, and other weapons, sometimes pass completely through the body, without the patient suffering afterwards any threatening symptom, or, indeed, any effects which, abstractedly considered, would authorise the inference, that the viscera had been at all injured. Severe inflammations may not end in suppuration; and when pus is formed, it is sometimes absorbed again. Nothing then indicates the necessity for the discharge of purulent matter in the abdomen, unless the fluctuation and situation of the abscess be very distinct, and the quantity and pressure of the matter clearly productive of inconveniences. Under these circumstances, the surgeon should make a cautious puncture.

Protrusion of the Viscera.—The omentum and small intestines are the parts most liable to protrusion; but, in large wounds, the great intestines, the stomach, and even the liver and spleen, may project through the opening. The general symptoms, indicating a protrusion of the parts, are sufficiently obvious; but it deserves attention, that, in fat subjects, the adipose substance may project from the wound, and put on somewhat of the appearance of omentum. The special symptoms are to be collected from a knowledge of the natural situation of the parts, and reflecting what region of the abdomen is wounded. (*Callisen, Syst. Chir. Hodierna*, t. i. 702 and 703. edit. 1798.)

From penetrating wounds considerable portions of the bowels, or omentum, sometimes protrude; and, though these viscera may not have received injury, yet their being displaced is sometimes productive of fatal consequences.

The best mode of preventing such mischief, is to return the viscera into the cavity of the abdomen as speedily as possible. Numerous authors recommend fomenting the displaced parts, previously to the attempt at reduction; but, in giving this advice, they seem to forget that, while time is lost in this preparatory measure, the protruded bowels suffer much more harm from exposure, than is to say, from the very circumstance of their being out of their natural situation, than they can possibly receive good from any application made to them. No kind of fomentation can be half so beneficial as the natural warmth and moisture of the cavity of the abdomen. In order to facilitate the return of a protruded piece of intestine, or omentum, the abdominal muscles should be relaxed by placing the patient in a suitable posture, and the large intestines emptied with a clyster. In mentioning the last measure, it is not meant that the surgeon should delay the attempt to reduce the part, until the clyster has operated. No, this means is only enumerated as one that may become serviceable, in case the surgeon cannot immediately accomplish the object in view. The resenterly ought always to be reduced before the intestine, the intestine before the omentum; but the last protruded portion of each of these parts ought to be the first reduced.

It is only when the intestine and omentum are

free from gangrene and mortification, that they are invariably to be returned into the cavity of the belly without hesitation. *Also, when the protruded parts are recovered with sand, gravel, or other extraneous matter, they should be tenderly washed with a little tepid water.

For the reduction of the parts, the forefingers are the most convenient, and it is a rule, to keep the portion first returned from protruding again, by one finger, until it has been followed by another portion, introduced by the other finger. The second piece is to be kept up in the same way, by the finger used to return it; and so on, till the displaced parts have all been put into their natural situation.

In attempting to reduce a piece of protruded intestine, the patient should be placed in the most favourable posture; the head and chest should be elevated, and the pelvis raised with pillows. Nothing can be more absurd, than the advice to put the thorax rather lower than the pelvis, in order that the weight of the viscera may tend to draw inward the protruded parts. This is another erroneous idea, arising from the ridiculous supposition, that a great part of the abdomen is actually an empty cavity. The relaxation of the abdominal muscles is a much more rational and useful object. When this is properly attended to, the above directions are observed, and the wound is not exceedingly small in relation to the bulk of the protruded viscera, the parts may generally be reduced. But, in addition to what has been already stated, it is necessary to remark, that the pressure should be made in a straight direction into the abdomen; for, when made obliquely, towards the edges of the wound, the parts are liable to suffer contusion, without being reduced, and even to glide between the layers of the abdominal muscles, and become strangulated. When the wound is in the front of the abdomen, pressure made in this unskilful way may force the viscera into the sheath of the rectus muscle, and cause the same perilous symptoms as arise from an incarcerated hernia. (See HERNIA.)

When the reduction seems complete, the surgeon should assure himself of it, by introducing his finger into the cavity of the abdomen, so as to feel that the parts are all actually reduced, and suffer no constriction between the edges of the wound and the viscera in the abdomen.

A difficulty of reduction may arise from the protruded intestines being distended with feces or air. In this circumstance, the contents of the gut may frequently be made to pass, by degrees, into that portion of the intestinal canal, which is within the abdomen. In order to accomplish this purpose, the surgeon must press the contents of the bowel towards the wound, and if he succeeds in emptying the part, he will commonly experience equal success in his next attempt to replace it in the abdomen.

Sometimes, in cases of narrow stabs, considerable pieces of intestine protrude, and cannot be reduced without doing immoderate violence to the bowel. Under these circumstances, the dilatation of the wound is indispensable. However, when the reduction seems almost a matter of impossibility, on account of the smallness of the wound, if the surgeon be careful to relax the abdominal muscles, draw a little more intestine out of the wound, and gently press the contents of the bowel through the constriction in the abdomen, he will frequently succeed in reducing the parts, without using the knife.

When such operation is unavoidable, the dilatation should be made in a direction, which will not endanger the epigastric artery, and, if possible, in the same line as the muscular fibres.

We are also advised to make the incision upward, rather than downward, when it can be done with equal convenience, because it is supposed the first direction will be followed by less danger of hernia. (*Sabatier, Médecine Opératoire*, t. i. p. 220, ed. ii. *Callisen, Syst. Chir. Hod.* t. i. p. 705.) If, however, the upper angle of the wound correspond to the direction of the suspensory ligament of the liver, we are advised to make the dilatation at the lower angle, in order to incur no risk of hemorrhage from the umbilical vein. In the adult, this vessel is generally obliterated, and turned into a ligamentous substance; though it would appear that, in a few instances, it remains pervious to the navel. Hildenus saw a young man die instantly in consequence of a stab in the belly between the false ribs and the umbilicus, and, on opening the body, he found blood effused from a wound of the umbilical vein. It has been feared, also, that cutting the suspensory ligament of the liver, might give rise to such a displacement of that viscus, as would interrupt the freedom of respiration, or obstruct the circulation of the blood in the vena cava. But the apprehension is unfounded; for Riola found this ligament ruptured and retracted towards the liver in a nimble Ethiopian female dancer, whose respiration had not suffered any particular disturbance during her lifetime.

The incision should never be larger than absolutely requisite, as hernia is much disposed to occur, wherever the peritoneum has been divided. The operation may be performed with a probe-pointed bistoury and a director, much in the same way as is practised in strangulated ruptures. (See HERNIA.)

After the battle of Waterloo, many cases presented themselves, in which the bowels and omentum protruded, and in several of these examples the reduction could not be effected before the wounds had been enlarged. So tightly also were the parts girt, that the operation was sometimes far from being easy.

Instead of enlarging wounds of the abdomen, it has been proposed to let out the air from the protruded intestines, by making small punctures with a needle, so as to lessen their volume sufficiently to make them reducible. The suggestion first originated with Paré, who declares that he had practised the method with success. Roussel, his contemporary, also informs us, that the plan was adopted by another surgeon, in an instance where the epigastric region was wounded, and a large portion of the intestines protruded in a strangulated state. Peter Lowe, an English surgeon, likewise assures us, that he frequently adopted the practice, when other means failed. Garengeot, Sharp, and Van Swieten, are all advocates for Paré's proposal; but they recommend the employment of a round needle, which will merely separate the fibres of the intestinal canal, without cutting them, as a flat, triangular, sharp-edged needle would unavoidably do. These last writers, however, only sanction the practice, when the quantity of protruded intestine is great, and the bowel is so much distended with air, that it would be impossible to reduce the part, though the wound were enlarged, and every thing else put in practice,

likely to bring about the reduction. But, as Sabatier remarks, the punctures must be entirely useless, if made with a fine needle, since they will be immediately stopped up with mucous secretion, with which the bowel is constantly covered; and if the punctures are made with a broad triangular needle, or a very large round one, as Desault and Chopart advise, they must be highly dangerous, inasmuch as they are likely to give rise to inflammation, and even to extravasation within the abdomen.

That small punctures in the bowel would not answer the purpose, but be obstructed by the villous, or mucous coat, is a fact which has been for a long time well known to surgeons. Callisen, amongst others, has particularly noticed it; "*acu puncturæ enim flatus exitum parare nequeunt, siquidem tunica villosa foraminula obstruit*," &c. (*Syst. Chir. Hod.* t. ii. p. 704.)

It was the circumstance of small punctures being unavailing, that led Desault and Chopart to recommend the use of a large round needle, "*pour que l'ouverture ne soit point bouchée par les mucosités dont les intestins sont enduits*." But they were also aware of the danger of employing such an instrument, since they gave us directions how to proceed, in order to prevent extravasation and inflammation: "*On prévient l'épanchement des matières stercorales en passant, avant de réduire l'intestin, une anse de fil dans la portion de mésentère qui répond à la piqure pour la fixer contre les bords de la plaie extérieure, et l'on combattra par les remèdes généraux l'inflammation que cet piqure peut attirer*." (*Traité des Maladies Chirurg.* t. ii. p. 135.) Richerand is perhaps the only modern advocate for puncturing the bowel, for which operation he boldly recommends a small hydrocele trocar. (*Novogr. Clin.* t. iii. p. 336, ed. 4.)

Mr. Travers, one of the latest and best writers upon this subject, most properly joins in the condemnation of the plan of pricking the protruded bowels. "Blancard and others protested against this practice, on the very sufficient ground of its inefficacy. La Faye very truly says, it is a useless, as well as a dangerous, practice; for the opening made by a round needle cannot give issue to the contained air." Mr. Travers then cites two cases, showing that even small stabs in a bowel, will not prevent its becoming distended with air.

"A man was brought to St. Thomas's Hospital, on Saturday, the 30th of June last (1811), who had been stabbed in the direction of the epigastric artery, on the left side of the abdomen, by a case-knife. He died in eighteen hours, apparently from the sudden and copious hemorrhage, which had taken place within the belly. About half a yard of ileon was protruded. The gut was highly discoloured, and so much distended, notwithstanding it was pierced in three places, that the wound of the integuments required to be freely dilated, before it could be returned. *The apertures were in fact obliterated by the mucous coat.*"

"It appeared upon the trial of Captain Sutherland (*Ann. Reg.* June, 1809) for the murder of his cabin-boy, that the intestines had been extensively protruded through a wound near the left groin, and had lain exposed for four or five hours—that the dirk had pierced through one fold of intestine, and entered another—that the wound of intestine was half an inch long, that the reduc-

tion could not be accomplished until the parietal wound was dilated; and that the intestine was then returned, and the integuments sewed up." (*Travers, On Injuries of the Intestines*, p. 174. 176.)

With respect to this last case, however, perhaps it does not satisfactorily prove, what it is intended to do, namely, that the bowel was distended with air, though there was a wound in it half an inch long, for the evidence does not inform us, that the difficulty of reduction was owing to this cause. I have seen a very small portion of omentum protrude through a wound, and baffle all endeavours to reduce it for nearly an hour. The first case, adduced by Mr. Travers, however, is more explicit and interesting; and we are to infer from it and the observations of Haller, Callisen, &c., that the punctures made in an intestine are not closed by mucus, as Sabatier and Desault have asserted, but by the mucous coat itself.

As the above expedient has been recommended by writers of some weight, I thought that the subject should not be passed over in silence, and without a caution to the reader, never to put any confidence in the method. The plan does not facilitate the business of the operator; there is not even this solitary reason in favour of the practice; and though it may have answered when large needles were used, and some patients so treated may have recovered, every person, who has the least knowledge of the animal economy, will easily comprehend how even the smallest opening, made in parts so irritable and prone to inflammation as the bowels, must be attended with greater danger than would result from enlarging a wound of the skin and muscles. Besides, the air may frequently be pressed out of the intestine in a safer way, as I have already described.

A wound of the abdomen, attended with one of the most considerable protrusions of the viscera that I have ever read of, is recorded by Mr. Hague, surgeon at Ripon: "August 30th, 1808, (says this gentleman), I went to Norton Mills, about four miles from hence, to see John Brown, æt. 12 years, who had received a wound in the abdomen from a pair of woollshears. On my arrival, which was little more than an hour after the accident, I found the poor lad in a very distressing situation; the great arch of the stomach, and the whole of the intestinal canal (duodenum excepted), contained within the abdomen, having protruded through the wound. The incision was on the left side of the body, commencing at about two inches below the scrobiculus cordis, and extending in a straight line near four inches in length, distant from the navel two inches, and he was quite sensible, and had vomited so as to empty the stomach; very little blood was lost. I immediately proceeded very carefully to examine the protruded viscera, none of which were wounded, and reduced them as quickly as possible, beginning with the stomach, and following the regular course of the intestines, in the latter portion of which I distinctly felt faeces of rather firm consistence. He complained of some pain during the reduction, though not much, and expressed great relief when the parts were completely returned. I now desired an assistant to lay the palm of his hand over the wound, and make some pressure upon it; for I found that, without this, the parts would soon have protruded again by the action of respiration,

which was oppressed and laborious. I brought the sides of the wound together by five sutures, beginning from above downwards, and passed the needle, on each side, quite through the integuments with the peritoneum, &c. The wound was also dressed with adhesive plaster, and covered with a bandage." (*See Edin. Med. and Surgical Journ.* vol. v. p. 129, &c.)

This case is interesting; for, notwithstanding so unlimited a protrusion of the viscera, and the circumstance of the parts being left unreduced for more than an hour, a recovery ensued, under the judicious employment of bleeding, purging, anodynes, &c.

In La Caserne de St. Elizabeth, at Brussels, after the battle of Waterloo, the number of protrusions of the viscera, which fell under my notice, was much more considerable than what I previously had any idea of ever meeting with. I well remember, in my own part of the hospital, two protrusions of a large portion of the stomach, three of the bladder, and ten or twelve of the mesentery, omentum, or intestines.

Whether a suture should be used, when the protruded intestine is wounded, is a subject which will be noticed in considering wounds of the intestines.

Some of the exposed intestine may have mortified before the arrival of surgical assistance. In cases of wounds, this event is rare; but, in those of strangulated herniæ, it is not uncommon. The treatment is explained in the article HERNIA. When the protruded intestine is in a state of inflammation, its immediate reduction is, beyond all dispute, the means most likely to set every thing right. Even when the inflammation is considerable, the timely reduction of the displaced part, and the employment of antiphlogistic means, will often prevent gangrenous mischief. The dull, brown, dark-red colour of the intestine may induce the practitioner to suppose, either that the part is already mortified, or must inevitably become so, and, consequently, he may delay returning it into its natural situation. But, notwithstanding this suspicious colour of the intestine, its firmness will evince that it is not in a state of gangrene. The ultimate recovery of a portion of intestine, so circumstanced, is always a matter of uncertainty; but, the propriety of speedily replacing the part in its natural situation is a thing most certain. "Partes egressæ sanæ (observes Callisen) citissime sunt reponendæ, neque obstat mutatio coloris nativi in rubrum subfuscum." (*Syst. Chir. Hod.* t. i. p. 703. edit. 1798.) In case the bowel mortify after its reduction, all hopes of the preservation of life are not to be abandoned; as I have noticed in the articles ANUS ARTIFICIAL, and HERNIA, in which last part of the book, many things necessary to be known, concerning the mode of reducing protruded omentum, will also be found.

When a piece of intestine cannot be reduced, granulations and new skin sometimes grow over it, and a cure follows, as the experience of Callisen confirms. (*Op. cit.* p. 706.)

The protruded viscera having been reduced, the next object is to retain them in the abdomen until the wound is completely healed. When the wound is small, this is a matter of no difficulty; for it is enough to put the patient in a position which will relax the fibres of the wounded muscles,

while the edges of the wound are maintained in contact with sticking-plaster, and supported by a compress and bandage. Costiveness is to be removed by the mildest purgatives, such as the oleum ricini, or by laxative glysters, which are still preferable. But in extensive wounds, even when the treatment is conducted with all possible judgment, it is occasionally difficult, and even impossible, to hinder the protrusion of the bowels by common dressings and a bandage. In this circumstance, the edges of the wound must be sewed together.

When the omentum protrudes, and is stangulated by the narrowness of the opening, it soon contracts adhesions to it, unless speedily reduced. Should such connection be already formed, when the surgeon is first consulted, we are advised to cut off the portion, which exceeds the level of the integuments, and to leave the rest in the wound. The latter will block up the opening, and have the good effect of preventing hernia. (*Richerand, Nosogr. Chir. t. iii. p. 339. ed. 4.*) When the protruded omentum is sound and free from adhesions, it ought to be reduced without delay. But, when the protrusion is large, and there is reason to fear, from the vomiting and the pains shooting from the wound to the epigastric region, that the stomach is dragged, the displaced part must be made free, and, if sound, reduced. Should it be in a mortified state, the dead part must be previously cut away, and any vessels which bleed, tied separately with a piece of fine thread, and the remainder either reduced, if adhesions do not exist as they usually do, or what is preferable, it may be allowed to remain in the wound, where it will often shrink and gradually waste away. The latter plan has the advantage of being attended with no risk of bleeding into the cavity of the peritoneum. If reduced, one end of the silk may be left out of the wound, and the other cut away.

Sometimes very complicated cases happen, in which, together with a protrusion of a small knuckle of intestine into the deeper part of a narrow wound, there is also a wound of such portion of bowel and other parts, and also copious extravasation of blood in the cavity of the peritoneum. Such a case, from the stab of a bayonet, was received under me into University College Hospital, in the winter of 1837-38. On making pressure, the protrusion receded; but, on the return of vomiting, made its appearance again, at a period when the patient was sinking from the effects of peritonitis and three pints of blood extravasated in the peritoneum, from a large vein that had been penetrated by the bayonet. The rectum was likewise wounded. Now this case shows the advantage of studying the pathology of surgery, a subject in which the mere quill-driving, inexperienced pretender to an acquaintance with practical and scientific surgery, is sure to prove himself only worthy of a fool's-cap. In fact, had it not been for the ignorance of surgical pathology displayed by the editor of a certain notorious journal, in an attack made upon me, he might possibly have led a few individuals to suppose, that the above patient died of the consequences of a strangulated bowel, and not of the effects of peritonitis, caused by this complicated penetrating wound, and the extravasation of three pints of blood in the abdomen. For an exposure of the ignorance and misrepresentations of the writer alluded to, I refer to one of my

clinical lectures, published in a periodical work. (*See Lond. Med. Gazette, vol. for 1837-38.*)

Extravasation in the Abdomen.—Wounds of the abdomen may be complicated with extravasation of blood, chyle, excrement, bile, or urine. None of these complications, however, are half so frequent as an inexperienced practitioner would apprehend. The employment of the phrase, *cavity of the abdomen*, has paved the way to much erroneous supposition upon this subject, and has induced many absurd notions, which even the sensible observations, long ago published by J. L. Petit, have scarcely yet dispelled.

As a modern writer has observed: "There is not truly any cavity in the human body, but all the hollow bowels are filled with their contents, all the cavities filled with their hollow bowels, and the whole is equally and fairly pressed. Thus, in the abdomen, all the viscera are moved by the diaphragm and the abdominal muscles upwards and downwards, with an equable continual pressure, which has no interval; and one would be apt to add, the intestines have no repose, being kept thus in continual motion: but, though the action of the diaphragm, and the reaction of the abdominal muscles are alternate, the pressure is continual; the motion, which it produces, is like that which the bowels have when we move forwards in walking, having a motion with respect to space, but none with regard to each other, or to the part of the belly which covers them; the whole mass of the bowels is alternately pressed, to use a coarse illustration, as if betwixt two broad boards, which keep each turn of intestine in its right place, while the whole mass is regularly moved. When the bowels are forced down by the diaphragm, the abdominal muscles recede; when the bowels are pushed back again, it is the reaction of the abdominal muscles that forces them back and follows them; there is never an instant of interruption of this pressure, never a moment in which the bowels do not press against the peritoneum; nor is there the smallest reason to doubt, that the same points in each are continually opposed. We see, that the intestines do not move, or, at least, do not need to move in performing their functions; for in hernia, where large turns of intestines are cut off by gangrene, the remaining part of the same intestines is closely fixed to the groin, and yet the bowels are easy, and their functions regular. We find the bowels regular, when they lie out of the belly, in hernia, as when a certain turn of intestine lies in the scrotum or thigh, or in a hernia of the navel; and where yet they are so absolutely fixed, that the piece of the intestine is marked by the straightness of the rings. We find a person, after a wound of the intestine, having free stools for many days; and what is it that prevents the fæces from escaping, but merely this regular and universal pressure? We find a person on the fourth or fifth day, with fæces coming from the wound! a proof, surely, that the wound of the intestine is still opposite, or nearly opposite, to the external wound. We find the same patient recovering, without one bad sign! What better proof than this could we desire, that none of the fæces have exuded into the abdomen.

"If, in a wound of the stomach, the food could get easily out by that wound, the stomach

would unload itself that way, there would be no vomiting, the patient must die; but, so regular and continual is this pressure, that the instant a man is wounded in the stomach, he vomits, he continues vomiting for many days, while not one particle escapes into the cavity of the abdomen.

- The outward wound is commonly opposite to that of the stomach, and, by that passage, some part of the food comes out; but, when any accident removes the inward wound of the stomach from the outward wound, the abdominal muscles press upon the stomach, and follow it so closely, that if there be not a mere laceration extremely wide, this pressure closes the hole, keeps the food in, enables the patient to vomit, and not a particle, even of jellies or soups, is ever lost, or goes out into the cavity of the belly.

"How (proceeds Mr. J. Bell), without this universal and continual pressure, could the viscera be supported? Could its ligaments, as we call them, support the weight of the liver? Or, what could support the weight of the stomach when filled? Could the mesentery, or omentum, support the intestines; or could its own ligaments, as we still name them, support the womb? How, without this uniform pressure, could these viscera fail to give way and burst? How could the circulation of the abdomen go on? How could the liver and spleen, so turgid as they are with blood, fail to burst? Or what possibly could support the loose veins and arteries of the abdomen, since many of them, e. g. the splenic vein, are two feet in length, are of the diameter of the thumb, and have no other, than the common pellucid and delicate coats of the veins? How could the viscera of the abdomen bear shocks and falls, if not supported by the universal pressure of surrounding parts? In short, the accident of hernia being forced out by any blow upon the belly, or by any sudden strain, explains to us how perfectly full the abdomen is, and how ill it is able to bear any pressure, even from its own muscles, without some point yielding, and some one of its bowels being thrown out. And the sickness and faintness, which immediately follow the drawing off of the waters of a dropsy, explain to us, what are the consequences of such pressure being even for a moment relaxed. But, perhaps, one of the strongest proofs is this, that the principle must be acknowledged, in order to explain what happens daily in wounds; for, though in theory we should be inclined to make this distinction, that the hernia, or abscess of the intestines, will adhere and be safe, but, that wounded intestines, not having time to adhere, will become flaccid, as we see them do in dissections, and so, falling away from the external wound, will pour out their faces into the abdomen, and prove fatal; though we should settle this, as a fair and good distinction in the theory, we find that it will never answer in practice. Soldiers recover daily from the most desperate wounds; and the most likely reasons, that we can assign for it, are the fullness of the abdomen; the universal, equable, and gentle pressure; and the active disposition of the peritoneum, ready to inflame with the slightest touch. The wounded intestine is, by the universal pressure, kept close to the external wound, and the peritoneum and the intestine are equally inclined to adhere. In a few hours that adhesion is begun, which is to

save the patient's life, and the lips of the wounded intestine are glued to the lips of the external wound. Thus, is the side of the intestine united to the inner surface of the abdomen; and, though the gut casts out its faces, while the wound is open; though it often casts them out more freely, while the first inflammation lasts; yet the faces resume their regular course, whenever the wound is disposed to close." (*John Bell's Discourses on Wounds*, p. 323. 327. edit. 3.)

The foregoing observations are well calculated to make the reader understand, that the abdomen is in reality not a cavity, but compact mass of containing and contained parts; that the close manner in which the various surfaces are constantly in contact, most powerfully oppose extravasations; and that, in fact, it often entirely prevents them. The passage cited impresses us with the utility of that quick propensity to the adhesive inflammation, which prevails throughout every peritoneal surface, and which not only often has the effect of permanently hindering effusion of the contents of the viscera, by agglutinating the parts together, but which, even when an extravasation has happened, beneficially confines the effused blood in one mass, and surrounds it with such adhesions of the parts to each other, as are rapid in their formation, and effectual for the purposes of limiting the extent of the effusion, and preventing the irritation of the extravasated matter from affecting the rest of the abdomen.

It is to Petit that surgeons are indebted for more correct modes of thinking upon the foregoing subject; and it is with great pleasure, that I here refer to his valuable observations. (See *Mém. de l'Acad. de Chir.*)

But, notwithstanding the reciprocal pressure of the containing and contained parts against each other, and the useful effect of the quickly arising adhesive inflammation, in all penetrating wounds of the belly, complicated with injuries of the viscera, we are not to suppose, that extravasation never happens; but only that it is much less frequent than has been commonly supposed. Mr. Travers, with much laudable industry, has endeavoured to trace more minutely, than any preceding writer, the particular circumstances under which effusions in the abdomen are likely or unlikely to happen. "It being admitted (says he) that there are cases in which effusion does take place, it is easy to conceive circumstances which must considerably influence this event. If, for example, the stomach and bowels be in a state of emptiness, the nausea which follows the injury will maintain that state. If the extent of the wound be considerable, the matter will more readily pass through the wound than along the canal. A wound of the same dimensions in the small and large intestines, will more readily evacuate the former than the latter, because it bears a larger proportion to the calibre. Incised and punctured wounds admit of the adhesion of the cut edges, or the eversion of the internal coat of the gut, so as to be in many instances actually obliterated; whereas, lacerated, or ulcerated openings, do not admit of these salutary processes. Again, in a transverse section of the bowel, contraction of the circular fibre closes the wound; whereas, in a longitudinal section, the contraction

of this fibre enlarges it. Such (says Mr. Travers) are the circumstances, which combined in a greater or less degree, increase or diminish the tendency to effusion." (*On Injuries of the Intestines, &c.* p. 13, 14.) After the details of some experiments and cases, the preceding author makes, among other conclusions, the following:—

1. That effusion is not an ordinary consequence of penetrating wounds.

2. That, if the gut be full and the wound extensive, the surrounding pressure is overcome by the natural action of the bowel tending to the expulsion of its contents.

3. That, if food has not recently been taken, and the wound amounts to a division of the gut, or nearly so, the eversion and contraction of the orifice of the tube prevent effusion.

4. That, if the canal be empty at the time of the wound, no subsequent state of the bowel will cause effusion, because the supervening inflammation agglutinates the surrounding surfaces, and forms a circumscribed sac: nor can effusion take place from a bowel at the moment full, provided it retain a certain portion of its cylinder entire, the wound not amounting nearly to a semi-division of the tube; for, then, the eversion and contraction are too partial to prevent an extravasation.

5. That when, however, air has escaped from the bowel, or blood has been extravasated in quantity within the abdomen at the time of the injury, the resistance, made to effusion, will be less effectual, although the parietal pressure is the same, as such fluids will yield more readily, than the solids naturally in contact. (P. 25, 26, 100.)

6. That though extravasation is not common in penetrating wounds, it follows more generally in cases, where the bowel is ruptured by blows, or falls upon the belly, while the integuments continue un wounded. (P. 36.)

7. That when the bowels are perforated by ulceration, there is more tendency to effusion than in cases of wounds. (P. 38, &c.)

Mr. Travers attempts to explain the reason of the greater tendency to effusion, in cases of intestine burst by violence, than in those of ulceration, "by the difference in the nature of the injury which the bowel sustains, when perforated by a sword or bullet, as in one case, or burst or ulcerated in the other. A rupture by concussion could only take place under a distended state of the bowel, a condition most favourable to effusion, and from the texture of the part, a rupture, so produced, would seldom be of limited extent. The process of ulceration, by which an aperture is formed, commences in the internal coat of the bowel, which has always incurred a more extensive lesion than the peritoneal covering. The puncture, or cut, is merely a solution of continuity in a point, or line; the ulcerated wound is an actual loss of substance. The consequence of this difference is, that while the former, if small, is glued up by the effusion from the cut vessels, or, if large, is nearly obliterated, by the full eversion of the villous coat, the latter is a permanent orifice." (P. 46.)

How much Mr. Travers and Mr. John Bell differ in opinion upon these latter points will appear from the following passage. After advert- ing to the adhesion which takes place between the

viscera and the peritoneum, under a variety of circumstances attending disease, Mr. John Bell observes:—"This it is which makes the chief difference, in point of danger, betwixt an ulcerated and a wounded intestine; for, in a wound, there is, as we should suppose, no time for adhesion, nothing to keep the parts in contact, no cause by which the adhesion might be produced. But, in an ulcer, there is a slow disease, tedious inflammation, adhesion first, and abscess and bursting afterwards; sometimes a fistula remains discharging feces, and sometimes there is a perfect cure. If a nutshell, a large coin, a bone, or any dangerous thing be swallowed, it stops in the stomach, causing swelling and dreadful pain: at last, a hard firm tumour appears, and then it suppurates, bursts, the bowel opens, the food is discharged at every meal, till the fistula gradually lessens, and heals at last. But, where the stomach is cut with a broad wound of a sabre, the blood from the wounded epiploic vessels, or the food itself, too often pours out into the abdomen, and the patient dies, &c." (*Discourses on Wounds*, p. 321, ed. 3.) The author afterwards proceeds to explain how, in cases of penetrating wounds, the compact state of the containing and contained parts, and the incessant and equable pressure, which the viscera sustain, frequently hinder effusion.

Which of these gentlemen is most correct, I cannot presume to determine; and whether Mr. Travers's cases are deviations from what is most common, can only be decided by a comparative examination of a greater number of facts. When the intestines ulcerate, and thus rid themselves of foreign bodies, the general tenor of the cases on record undoubtedly affords us little reason to be apprehensive of extravasation. Yet with respect to ulceration of the intestines from other causes, circumstances may be very different. And it is but justice to state, that Mr. Travers's opinions have received some confirmation from an interesting case, published by Dr. J. Crampton, of Dublin. It is an instance of rupture of the stomach, and fatal effusion of its contents into the cavity of the abdomen. The patient was a young lady, aged 29. She was suddenly taken ill with spasm in her stomach, and other severe symptoms, and died in about twelve hours. "On opening the abdomen, the stomach was observed to be pale, flaccid, and empty. Its contents, amongst which were recognised oatmeal and castor oil, had escaped into the cavity of the abdomen, through a round aperture situated on its anterior surface, at the union of the cardiac and pyloric portions. This perforation of the stomach was perfectly circular, about the size of a pea, and appeared to be the result of an ulcer on the mucous surface, which had gradually penetrated the other coats. This ulcer was hollow and circular, nearly the size of a shilling, and had the appearance as if it had been made with caustic, with the orifice in its centre." (*J. Crampton, Med. Chir. Trans.* vol. viii. p. 230.) To the preceding, Mr. Travers has annexed some additional facts: one is an example of a rapidly fatal effusion of the intestinal contents, through an ulcerated opening about a finger's breadth below the pylorus. The foramen had a peritoneal margin, and proved to be the centre of an irregular superficial ulcer of the mucous coat. Another case is that of a similar ulceration of the

small intestines, and fatal extravasation of their contents. In another example, a circular aperture of the peritoneum, large enough to admit a crow's quill, was found after death at the junction of the duodenum and stomach. It also was the centre of an ulcer, that had destroyed the villous and muscular coats of the bowel to the extent of half an inch. For many other ingenious observations, I must refer the reader to Mr. Travers's paper, who concludes with remarking, that the chief diagnostic symptoms of these hopeless cases appear to be :

1. Sudden, most acute, and unremitting pain, radiating from the scrobiculus cordis, or the navel, to the circumference of the trunk, and even to the limbs. A peculiar pain, the intensity of which, like that of parturition, absorbs the whole mind of the patient, who, within an hour from the enjoyment of perfect health, expresses his serious and decided conviction, that, if the pain be not speedily alleviated, he must die.

2. Coeval with the attack of pain, remarkable rigidity and hardness of the belly, from a fixed and spastic contraction of the abdominal muscles.

3. A natural pulse for some hours, until the symptoms are merged in those of acute peritonitis, and its fatal termination in the adhesive stage. (*Med. Chir. Trans.* vol. viii. p. 231. *et seq.*)

Blood is more frequently extravasated in the abdomen than any other fluid, but it does not always take place, unless the wounded vessels be above a certain magnitude. The compact state of the abdominal viscera, in regard to each other, and their action on each other, oppose this effect. The action alluded to, which depends on the abdominal muscles and diaphragm, is rendered very manifest by what happens, in consequence of operations for herniæ, attended with alteration of the intestines, or omentum. If these viscera burst, or suppurate, after being reduced, the matter which escapes from them, or the pus, which they secrete, is not lost in the abdomen, but is propelled towards the wound in the skin, and there makes its exit. The intestinal matter, effused from a mortified bowel, has been known to remain lodged the whole interval between one time of dressing the wound and another, in consequence of the surgeon stopping up the external wound with a large tent. When the above-mentioned action, or pressure of the muscles, is not sufficient to keep the blood from making its escape from the vessels, still it may hinder it from becoming diffused among the convolutions of the viscera, and thus the extravasation is confined in one mass. The blood, effused and accumulated in this way, is commonly lodged at the inferior and anterior part of the abdomen, above the crista of the os pubis, and by the side of one of the recti muscles. The weight of the blood may propel it into this situation, or perhaps there may be less resistance in this direction than in others. In opening the bodies of persons, who have died with such extravasations, things may put on a different aspect, and the blood seem to be promiscuously extravasated over every part of the abdomen. But, when such bodies are examined with care, it will generally be found, that the blood does not insinuate itself among the viscera till the moment when the abdomen is opened, and that the mass previously lies in a kind of pouch. This pouch is frequently circumscribed, and bounded by thick membranes, especially when the extra-

vasation has been of some standing. (*Sabatier, Méd. Opér.* t. i. p. 28—30.)

Every practical surgeon should remember well, that all the abdominal viscera closely touch either each other, or the inner surface of the peritoneum. This is one grand reason why extravasations are seldom extensively diffused, but commonly lie in one mass, as Petit, Sabatier, and all the best moderns have noticed. The pressure of the elastic bowels, diaphragm, and abdominal muscles, not only frequently presents an obstacle to the diffusion of extravasated matter, but often serves to propel it towards the mouth of the wound. The records of surgery furnish numerous instances, in which persons have been stabbed through the body, without fatal consequences, and sometimes without the symptoms being even severe. In Mr. Travers's publication many cases exemplifying this observation, are quoted from a variety of sources: *Fab. Hildan. Obs. Chirurg.* cent. v. obs. 74. *Œuvres de Paré*, liv. x. c. xxxv. *Whistman's Surgery*, p. 371. *La Motte's Traité Complet de Chirurgie*, &c. &c. — In such cases, the bowels have been supposed to have eluded the point of the weapon, and, perhaps, in a few instances, this may actually have been the fact; but, in the generality of such examples, the bowels must have been punctured, and the extravasation of intestinal matter prevented by the pressure of the viscera against each other.

The pouch, or cyst, in which the extravasated blood or matter lies, as mentioned by Sabatier, is formed by the same process, which circumscribes the matter of abscesses. (See SUPPURATION.) It is, in short, the adhesive inflammation. All the surfaces in contact with each other, and surrounding the extravasation, and track of the wound, generally soon become so intimately connected together by the adhesive inflammation, that the place in which the extravasation is lodged, is a cavity entirely destitute of all communication with the cavity of the peritoneum. The track of the wound leads to the seat of the effused fluid, but has no distinct opening into the general cavity of the abdomen. The rapidity, with which the above adhesions frequently form, is almost incredible.

It should be known, however, that extravasations are occasionally diffused in various degrees among the viscera, owing to the patient being subjected to a great deal of motion, or affected with violent spasmodic contractions of the intestines. Urine and bile are also generally dispersed to a great extent. As for blood, its disposition to coagulate must often tend both to stop further hemorrhage, and confine the extravasation in one mass.

Symptoms and Treatment of Extravasations in the Abdomen.

1. *Blood.* — Wounds of the spleen, and of large veins and arteries in the abdomen, usually soon prove fatal from internal hemorrhage; the blood generally makes its way downwards, and accumulates at the inferior part of the abdomen, unless the presence of adhesions happen to oppose the descent of the fluid to the most depending situation. The belly swells, and sometimes a fluctuation is perceptible, as was exemplified in one of my patients, in University College Hospital, who died with a vast effusion of blood in the belly from a laceration of the liver. The patient grows pale, loses his strength, is affected with syncope, and hi-

pulse becomes weak and scarcely distinguishable. In short, the symptoms usually attendant on profuse hemorrhage are observable.

In cases, where the wounded vessel is under a certain size, the bleeding goes on slowly, and some time elapses before the extravasation is considerable: here the symptoms, which perhaps had disappeared under the employment of bleeding and anodyne medicines, now recur. A soft fluctuating tumour may be felt at the lower part of the abdomen; sometimes on the right side; sometimes on the left; but, occasionally, on both sides. The pressure, made by the effused blood on the urinary bladder, excites distressing inclinations to make water; while the pressure, which the sigmoid flexure of the colon suffers, is the cause of obstinate constipation. In the mean time, as the quantity of extravasated blood increases, the peritoneum inflames; the pulse grows weaker; debility ensues; the countenance becomes moistened with cold perspirations; and, according to some writers, unless the surgeon practise an incision for the discharge of the fluid, the patient falls a victim to the accident.

In the year 1733, Vacher adopted this treatment with success. Petit afterwards tried the same plan, though it did not answer (as is alleged), in consequence of the inflammation having advanced too far before the operation was performed. Long before the time of Vacher and Petit a successful instance of similar practice was recorded by Cabriole, in a work which this author published under the title of *Ἀναστροφὴ ἀνατομικὴ*, id est, *Anatomies Elenchus accuratissimus, omnes humani Corporis Partes ed qui solent secari Methodo, delineans. Accessere Osteologin, Observationesque Medicis ac Chirurgicis peritiles*. Geneva, 1604. The method, pursued by Vacher, was therefore not so new as Petit imagined.

Surgeons should recollect, however, that if no opening be made, a small extravasation of blood may not produce any considerable irritation. On the contrary, when the cavity, including the blood, is opened, the air then has access, and that part of the fluid which cannot be discharged, putrifies and becomes so irritating, as to be a true cause of inflammation. The bad symptoms are also sometimes chiefly owing to the injury done to parts within the abdomen, and still more commonly to inflammation within that cavity, arising as much from the wound as from the presence of effused blood. On the whole, I am disposed to join a late writer in the belief, that the practice of discharging extravasated blood from the abdomen can rarely be advisable. (See *Hennen's Mil. Surgery*, p. 412. ed. 2.) I have never seen an instance, in which the plan was adopted, or promised to be any thing but pernicious if it had been followed.

2. *Chyle and Fæces*.—These are not so easily extravasated in the abdomen as blood, because they do not require so much resistance on the outside of the stomach and intestines to make them continue their natural route through the alimentary canal, as blood requires to keep it in the vessels. However, when the wound is large, and the bowel distended at the moment of the injury, or when, as Mr. Travers has explained, air is extravasated, or blood effused in the abdomen, which fluids are incapable of making effectual resistance to the escape of the intestinal matter, the latter may be effused. (See *An Inquiry into the Process*

of Nature in repairing Injuries of the Intestines, &c. p. 26.) Nothing is a better proof of the difficulty, with which chyle and fæces are extravasated, than the operation of an emetic, when the stomach is wounded and full of aliment. In this instance, if the resistance to the extravasation of the contents of the stomach were not considerable, they would be effused in the abdomen, instead of being vomited up. A peculiarity in wounds of the stomach and intestines is, that the opening, which allows their contents to escape, may also allow them to return into the wounded viscous.

Extravasation of intestinal matter in the abdomen is attended with severe febrile symptoms; considerable pain and swelling of the belly; convulsive startings; and hiccough and vomiting, with which the patients are generally attacked the day after the receipt of the wound. (*Sabati. Méd. Opératoire*, t. i. p. 34.)

In these cases, only general means can be employed; venesection, leeches, fomentations, low diet, perfect rest, anodynes, &c. All solid food must be strictly prohibited. If pressure can be borne without inconvenience, as is sometimes the case in the early stage, the close state of the viscera may be increased by the application of a bandage round the body.

• If the symptoms are not speedily assuaged, the inflammation spreads over the whole cavity of the abdomen, gangrenous mischief takes place, and the patients die before the end of the second or third day.

3. *Bile*.—Bile, on account of its great fluidity, is more apt to be widely extravasated in the abdomen than either blood or the contents of the stomach and intestines. However, on account of the small size of the gall-bladder, and its deep-guarded situation, between the concave surface of the liver, and upper part of the transverse arch of the colon, wounds of it are uncommon.

Sabatier informs us, that he has only been able to find one example on record. This case was communicated to the Royal Society of London, by Dr. Stewart (No. 414. p. 341. *Abridg.* vol. ii. page 571, 572.). A wound penetrated the cavity of the abdomen, and entered the fundus of the gall-bladder, without doing any material injury to the adjacent parts. The abdomen was immediately distended, as if the patient had been afflicted with an ascites, or tympanitis; nor did the swelling either increase or diminish, till the patient's death, which happened in a week.

Though there was a great deal of tension, there was no rumbling noise in the abdomen. No stools, and very little urine were discharged, notwithstanding purgatives and clysters, and a good deal of liquid nourishment were given. Anodynes failed to procure one instant of sound sleep, and the patient was incessantly in a most restless state. There was no appearance of fever, and the pulse was always natural till the last day of the patient's life, when it became intermittent. After death, the intestines were found much distended, the gall-bladder quite empty, and a large quantity of bile extravasated.

Sabatier had an opportunity of noticing the symptoms of an extravasation of bile, in consequence of a wound of the gall-bladder. The patient's abdomen swelled very quickly; his respiration became difficult, and he soon afterwards complained of tension, and pain in the right hy-

pochondrium. His pulse was small, frequent, and contracted; his extremities were cold, and his countenance very pale. The bleedings, which were practised the first day, gave him a little relief; but the tension of the abdomen, and the difficulty of breathing, still continued. A third bleeding threw the patient into the lowest state of weakness, and he vomited up a greenish matter. On the third day, the lower part of the belly was observed to be more prominent, and there was no doubt of an extravasation. Sabatier introduced a trocar, and gave vent to a green blackish fluid, which had no smell, and was pure bile, that had escaped from the wound of the gall-bladder. After the operation, the patient grew weaker and weaker, and died in a few hours. On opening the body, a large quantity of yellow bile was found between the peritoneum and intestines; but it had not insinuated itself among the convolutions of the viscera. A thick gluten connected the bowels together, and they were prodigiously distended. The gall-bladder was shrivelled, and almost empty. Towards its fundus, there was a wound, about a line and a half long, corresponding to a similar wound in the peritoneum. The wound which had occurred at the middle and lower part of the right hypochondrium, between the third and fourth false ribs, had glided from behind forward, and from above downward, between the cartilages of the ribs, until it reached the fundus of the gall-bladder.

Sabatier takes notice, that the symptoms of the two cases, which have just now been related, were very similar. Both the patients were affected with an exceedingly tense swelling of the belly, unattended with pain, or hiccough, and they were both obstinately constipated. Their pulse was extremely weak in the latter days of their indisposition, and they were afflicted with hiccough, nausea, and vomiting.

Sabatier seems to think one thing certain, viz. that wounds of the gall-bladder, attended with effusion of bile, are absolutely mortal, and that no operation can be of any avail. (*Médecine Opératoire*, t. i. p. 34—37.)

A contrary inference, however, may be drawn from a case detailed by Paroisse, in which a bullet had lodged in the gall-bladder two years. (*Opusculs de Chir.* p. 255.) The recovery, published by Mr. Fryer, of Stamford, tends also to prove, that every effusion of bile is not unavoidably fatal. A boy, about thirteen years old, received a violent blow from one of the shafts of a cart, on the region of the liver. The injury was succeeded by pain, frequent vomiting of bilious matter, great sinking, coldness of the extremities, and a weak, small, fluttering pulse. The belly was fomented, and purging clysters thrown up. On the third day symptoms of inflammation began, attended with considerable pain about the liver, great tension and soreness of the abdomen, and frequent vomiting. The pulse was quick, small, and weak; the skin hot and dry; the tongue much furred; the urine high-coloured; and there was some difficulty of breathing; and great thirst. Eight ounces of blood were taken away, the fomentations continued, and a few grains of calomel given every four hours, until the bowels were properly opened. Afterwards, the effervescing mixture, with ten drops of laudanum, was exhibited every four hours.

On the following day, the patient had motions,

and was much better; but, as his sickness continued, he was ordered a grain of opium every four hours. About a week afterwards, he complained of a great increase of pain, which was somewhat relieved by a blister. He was now completely jaundiced, and his stools were white, but the tension, pain, and sickness were abated.

Two days afterwards, a fluctuation was perceived in the abdomen, which, in another week, became considerably distended with fluid. The patient now did not complain of much pain; but appeared to be sinking fast: a puncture was made in the swelling, and thirteen pints of what appeared to be pure bile were evacuated. The bowels then soon became regular and the appetite good. In twelve days, the operation was repeated, and fifteen pints of the same bilious fluid were drawn off. Nine days afterwards, another puncture was made, and thirteen pints more let out; and six were discharged in another fortnight. From this period, the boy went on well, and perfectly recovered under the use of light tonic medicines. (*See Med. Chir. Trans.* vol. v. p. 330.)

A previous accidental adhesion of the gall-bladder to the peritoneum might also prevent the extravasation of bile, and its dangerous effects. (*Calisen, Syst. Chir. Hodierna*, t. i. p. 718.)

According to Dr. Hennen, a deep wound of the liver is as fatal as if the heart itself was engaged. The slighter injuries are recoverable. He states, that the usual symptoms of a wound of the liver are yellowness of the skin and urine; derangement of the alimentary canal, and great and distressing itching of the skin. The discharge from the wound is generally yellow and glutinous; though sometimes either serous, or like unmix'd bile. (*On Military Surgery*, ed. 2. p. 429.) For some other interesting observations on wounds of the liver, I have great pleasure in referring to the latter work. (*See also Wedekind, de Vulnere Hepatis curato*. Janæ, 1735; and *Thomson's Report of Obs. made in the Military Hospitals in Belgium*, 8vo. 1816.)

4. *Urine*.—Urine may be extensively diffused in the abdomen, when the bladder is wounded at any part connected with the peritoneum; but mostly it gravitates towards the cul-de-sac of the latter membrane. In this kind of case, the urine is to be drawn off with a catheter, which is to be kept in the urethra; but the accident is mostly fatal. (*See BLADDER*.) Many instances are recorded of other parts of the bladder being injured even by gun-shot wounds, and of the patients getting well. I have seen various examples of this in the course of my professional experience.

Wounds of the bladder are attended with a discharge of bloody urine and a difficulty of making water. They are always dangerous cases, both on account of the risk of the effusion of so irritating a fluid in the abdomen, and of the chance of extravasation in the cellular tissue. Under proper treatment, however, if the urine does not get into the peritoneal cavity, they often admit of cure. (*See GUN-SHOT WOUNDS*.) If possible, the effused fluid should be discharged by a depending posture, or suitable incisions, and the recurrence of extravasation prevented by the introduction of a catheter, which is to be left in the urethra. The patient must also be allowed little drink. As for the tension and pain of the belly, the common attendants of a wounded bladder.

they may be greatly relieved by the use of the warm bath (*Callisen*, t. i. p. 719.), or, rather, fomentations, which would not require the patient to be moved; bleeding, low diet, and other antiphlogistic means, not being omitted.

Wounds of the Stomach.—As Dr. Hennen has observed, these cases are extremely dangerous, though not always mortal. “Baron Percy calculates, that, of twenty cases, four or five only have escaped; this, however, is a most favourable average.” Two cures of wounds of the stomach are reported by Dr. Thomson. (*Obs. made in the Military Hospitals in Belgium, &c.*) With respect to the chances of recovery, Dr. Hennen justly remarks, that the histories of the Bohemian, Prussian (*D. Beckher de Cultivora Prussico*, 12mo. Lugd. 1638.), and English “Cultivores,” from some of whom the knives have been cut out, and, in others, discharged spontaneously through the coats of the stomach; and the parietes of the abdomen, are very encouraging. In France, a silver fork was extracted from a young man’s stomach, by M. Renaud, of Romans, in the department of the Drôme, who performed gastronomy for the purpose, with complete success. (See *Quarterly Journ. of Foreign Med.* No. xviii. p. 301.) Hevin has collected many instances of recovery, both from incised and gun-shot wounds of the stomach. (*Mém. de l’Acad. de Chir.* t. i.) But, according to Dr. Hennen, Plouquet, in the articles “Ventriculus” and “Pantophagi,” has brought together the largest number of cases. Dr. Hennen also refers to *Louthorpe’s Abridgement of the Phil. Trans.* vol. vi. p. 192. for instances, in which the stomach of a horse was wounded, and sewed up; and the same practice extended to the human subject, with success. It appears also from the *Annales de Littérature, &c.*, t. ii., by Kluyskens, from *Schlichting’s Traumatologia*, and the *Bulletin de la Faculté, &c.*, t. v. p. 386, that wounds of the human stomach have been stitched with success in various cases of recent date. (See *Hennen’s Military Surgery*, ed. 2. p. 438.) As the latter author observes, wounds of the stomach not unfrequently become fistulous, and remain open. In a case, recorded by Richerand, the fistula continued open nine years; and in another instance related by Ettmüller, ten years. (*De Vulnere Ventriculi Programma*, Lip. 1730.) And Wencker has detailed a case, in which the opening continued twenty-seven years. (See *Halleri Dissert. Chir.* vol. v. art. 19.) For farther information connected with this subject the reader may also consult *Jungen de Lethalitate Vulnerum Ventriculi*, Helmst. 1751; and *Ludov. Horn de Ventriculi Ruptura*, 8vo. Berol. 1817. Also *Med. Chir. Journ.* vol. v. p. 72.)

Wounds of the Intestines.—The vomiting of blood, or discharge of it by stool; the escape of fetid air, or of intestinal matter from the mouth of the wound; an empty collapsed state of a portion of bowel, protruded at the opening in the skin, are the common symptoms attending a wound of this kind. When the wound is situated in the protruded portion, it is obvious to the surgeon’s eye; but when it affects a part of the intestinal canal within the abdomen, the nature of the case can be known only by a consideration of other symptoms. In addition to such as I have already described, there are some others, which ordinarily accompany wounds of the bowels; as, for instance, oppression

about the precordia, acute or griping pain in the belly, cold sweats, syncope, &c. But, unless the wounded intestine protrude, there is no practical good in knowing whether the bowel is injured or not, since, if it be in the abdomen, the treatment ought not to be materially different from that of a simple penetrating wound of the belly, unattended with a wound of any of the viscera. Large wounds of the small intestines, particularly of the duodenum and jejunum, are attended with acute fever, anxiety, paleness of the countenance, syncope, cold perspirations, a small, intermitting, tremulous pulse, and they frequently prove fatal. Injuries of the small intestines are also more often, than those of the large ones, followed by extravasation. A total division of the upper part of the intestinal canal, towards the pylorus, will deprive the body of the nourishment requisite for its support. If the chyle escape from the wound, the patient will die of a slow marasmus; and if it become extravasated, it will be likely to excite such irritation as will prove fatal. The escape of excrement or of fetid air from the wound indicates an injury of one of the large intestines. In these cases, the symptoms are generally milder, and the passage of the intestinal contents outward through the wound more easy, on account of the bowel being less moveable. For the same reason, the wounded intestine more readily contracts an adhesion to the adjacent parts.

A wounded intestine presents some particular appearances, to which the generality of writers have paid no attention:—“If a gut be punctured, the elasticity of the peritoneum, and the contraction of the muscular fibres, open the wound, and the villous, or mucous coat, forms a sort of hernial protrusion, and obliterates the aperture. If an incised wound be made, the edges are drawn asunder, and everted, so that the mucous coat is elevated in the form of a fleshy lip. If the section be transverse, the lip is broad and bulbous, and acquires tumefaction and redness from the contraction of the circular fibres behind it, which produces, relatively to the everted portion, the appearance of a cervix. If the incision be according to the length of the cylinder, the lip is narrow, and the contraction of the adjacent longitudinal fibres, resisting that of the circular fibres, gives the orifice an oval form. This eversion and contraction are produced by that series of motions which constitutes the peristaltic action of the intestines.” (*Travers on Injuries of the Intestines*, p. 85.) According to this gentleman, some of these appearances were described by Haller, in *Element. Physiol.* lib. xxiv. sect. 2.; and *Opera Minora*, t. i. sect. 15.

Having witnessed the facility, with which considerable injuries of the intestinal tube were repaired, Mr. Travers was desirous of ascertaining more fully the powers of nature in the process of spontaneous reparation, and of determining under how great a degree of injury it would commence, as well as the mode of its accomplishment. For these purposes, he divided the small intestine of several dogs as far as the mesentery. All these animals died, in consequence of the intestinal matter being extravasated, if they had been lately fed; or, if they had been fasting, in consequence of inflammation, attended with a separation of the ends of the divided bowel, eversion of the mucous coat, and obliteration of the cavity, partly by

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his eversion, and partly by a plug of coagulated chyle.

In one particular instance, in which Mr. Travers made a division of the bowel half through its diameter, a sort of pouch was formed round the injured intestine. "A pouch, resembling somewhat the diverticulum in these animals, was formed opposite to the external wound on the side of the parietes, by the lining peritoneum, on the other side, by the mesentery of the injured intestine, that intestine itself, and an adjacent fold, which had contracted with it a close adhesion. The pouch thus formed and insulated, included the opposed sections of the gut, and had received its contents, &c. The tube at the orifices was narrowed by the half eversion, but offered no impediment to the passage of fluids." (P. 96.) Whether, under these circumstances, the functions of the alimentary canal could have been continued, Mr. Travers professes himself incapable of deciding. Among the inferences, which this gentleman has drawn from the experiments detailed in his publication, the tendency of the two portions of a divided bowel to recede from each other, instead of coalescing to repair the injury, merits notice, inasmuch as it tends to prove, that the only means of spontaneous reparation consist in the formation of an adventitious canal, by the encircling bowels and their appendages. The everted mucous coat, which is the part opposed to the surrounding peritoneum, is also indisposed to the adhesive inflammation.

When, however, the wound of the intestine is smaller, the obstacles to reparation are not absolutely insurmountable. Here, retraction is prevented, and the processes of eversion and contraction modified by the limited extent of the injury. If, therefore, the adhesive inflammation unite the contiguous surfaces, effusion will be prevented, and the animal escape immediate destruction. But union can only take place through the medium of the surrounding parts.

According to Mr. Travers, it is the retraction immediately following the wound, that is a chief obstacle to the reparation of the injury; for, if the division be performed in such a way, as to prevent retraction, the canal will be restored in so short a time, as but slightly to interrupt the digestive function. In confirmation of this statement, a ligature was tightly applied round the duodenum of a dog, which became ill, but entirely recovered, and was killed. "A ligature fastened around the intestine, divides the interior coats of the gut, in this effect resembling the operation of a ligature upon an artery. The peritoneal tunic alone maintains its integrity. The inflammation which the ligature induces on either side of it, is terminated by the deposition of a coat of lymph, which is exterior to the ligature, and quickly becomes organised. When the ligature thus enclosed, is liberated by the ulcerative process, it falls, of necessity, into the canal, and passes off with its contents." (P. 103, 104.)

It appears, also, from Mr. Travers's experiments and observations, that longitudinal wounds of the bowels are more easily repaired, than such as are transverse. In a dog, a longitudinal wound, of the extent of an inch and a half, was repaired by the adhesive inflammation. Here the process of eversion is very limited; the aperture bears a smaller proportion to the cylinder of the bowel;

and the entire longitudinal fibres resist the action of the circular which are divided, and can only slightly lessen the area of the canal. (P. 108.)

We come now to the consideration of the treatment of wounds of the intestines; a subject, in which much difference of opinion has prevailed; principally, however, concerning the circumstances in which sutures are necessary, and the most advantageous way of applying them.

When the wounded bowel lies within the cavity of the abdomen, no surgeon of the present day would have the rashness to think of attempting to expose the injured intestine, for the purpose of sewing up the breach of continuity in it. In fact, the surgeon seldom knows, at first, what has happened; and when the nature of the case is afterwards manifested, by the discharge of blood per anum, an extravasation of intestinal matter, &c., it would be impossible to get at the injured part of the bowel, not only because its exact situation is unknown, but, more particularly, on account of the adhesions, which are always formed with surprising rapidity. But, even if the surgeon knew to a certainty, in the first instance, that one of the bowels was wounded, and the precise situation of the injury, no suture could be applied, without considerably enlarging the external wound, drawing the wounded intestine out of the cavity of the abdomen, and handling and disturbing all the adjacent viscera. Nothing would be more sure than such proceedings to render the accident, which might originally be curable, unavoidably fatal. I entirely agree upon this point with Mr. John Bell, who says, "When there is a wounded intestine, which we are warned of only by the passing out of the faeces, we must not pretend to search for it, nor put in our finger, nor expect to sew it to the wound; but we may trust, that the universal pressure, which prevents great effusion of blood, and collects the blood into one place, that very pressure which always causes the wounded bowel and no other to protrude, will maintain the two wounds, the outward wound and the inward wound of the intestine, opposite each other, point to point; and if all be kept there quiet, though but for one day, so lively is the tendency to inflame, that the adhesion will be begun, which is to save the patient's life." (*Discourses on Wounds*, p. 361. ed. 3.)

When the extravasation, and other symptoms, a few days after the accident, show the nature of the case, a suture can be of no use whatever, as the adhesive inflammation has already fixed the part in its situation; and the space, in which the extravasation lies, is completely separated from the general cavity of the abdomen, by the surrounding adhesions.

When the bowel does not protrude, and the opening in it is situated closely behind the wound in the peritoneum, a suture is not requisite; for the contents of the gut not passing onward, will be discharged from the outer wound, and not be diffused among the viscera, if care be taken to keep the external wound open. There is no danger of the wounded bowel changing its situation, and becoming distant from the wound in the peritoneum, for the situation which it now occupies, is its natural one. Nothing but violent motion, or exertions, could cause so unfavourable an occurrence; and these should always be avoided. The adhesions, which take place in the course of a day

or two, at length render it impossible for the bowel to shift its situation.

Things, however, are far different when the wounded part of the bowel happens to protrude. Here we have the authority of all writers, in sanction of the general employment of a suture. No enlargement of the outer wound is requisite to enable the practitioner to adopt such practice; there is no disturbance of the adjacent parts; there is no doubt concerning the actual existence of the injury; no difficulty in immediately finding out its situation.

But, though authors are so generally agreed about the propriety of using a suture, in the case of a wounded and protruded bowel, they differ exceedingly, both as to the right object of the method, and the most advantageous mode of sewing the injured part of the intestine. Some, having little apprehension of extravasation, advise only one stitch to be made, and use the ligature chiefly with the view of confining the injured bowel near the external wound, so that, in the event of an extravasation, the effused matter may find its way outward. Other writers wish to remove the possibility of extravasation, by applying numerous stitches, and attach little importance to the plan of using the ligature principally for the purpose of keeping the intestine near the superficial wound.

When the wound of a bowel is so small, that it is closed by the protrusion of the villous coat, the application of a suture must evidently be altogether needless; and since the ligature would not fail to cause irritation, as an extraneous substance, the employment of it ought unquestionably to be dispensed with.

Supposing, however, the breach in the intestine to be small, yet sufficient to let the fæces escape, what method ought to be adopted? The following practice seems rational. As Sir Astley Cooper was operating on a strangulated hernia, at Guy's Hospital, an aperture, giving issue to the intestinal contents, was discovered in a portion of the sound bowel, just when the part was about to be reduced. The operator, including the aperture in his forceps, caused a fine silk ligature to be carried beneath the point of the instrument, firmly tied upon the gut, and the ends cut off close to the intestines. The part was then replaced, and the patient did well. Mr. Travers, who has related this fact, approves of the plan of cutting away the extremities of the ligature, instead of leaving them hanging out of the external wound. It appears that, when the first practice is followed, the remnant always makes its way into the intestine, and is discharged with the stools without any inconvenience. But, when the long ends are drawn through the outer wound, and left in it, they materially retard the process of healing. (*On Injuries of the Intestines, &c.* p. 112, 113.)

Let us now inquire what ought to be the conduct of a surgeon, should he be called to a patient, whose bowel is divided through its whole cylinder, and protruded out of the external wound.

Various have been the schemes and proposals, for the treatment of this sort of accident; and since experience has furnished few practitioners with an opportunity of seeing such a case in the human subject, a variety of experiments have been made on animals, in order to determine what treatment would be the most successful. Ramdohr, indeed, is credited by Meibius to have had occasion

to try on the human subject a plan, of which a vast deal has been said and written. He cut off a large part of a mortified intestine, and joined the two sound ends together, by inserting the upper within the lower one, and fixing them in this position with a suture, the ligature being also employed to keep them at the same time near the external wound. The patient recovered, and the fæces continued to pass entirely by the rectum in the natural way. (*See Haller's Disput. Anat.* vol. vi. *Obs. Med. Miscellan.* 18.)

About a year after the operation, the patient died, when the anatomical preparation of the parts was sent to Ramdohr by Heister. They were preserved in spirit of wine, and exhibited, according to the latter author, an union of the two ends of the bowel together, and their consolidation with a part of the abdomen. Now it has been questioned by a late writer, whether the union here spoken of ever really happened. When the upper end of the bowel is introduced into the lower, the external surface of the former is put in contact with the inner one of the latter; a serous membrane is placed in contact with a mucous one. These heterogeneous structures, he alleges, are not disposed to unite. The mucous membrane, when inflamed, more readily secretes a kind of mucus, which would be an invincible obstacle to adhesion. He thinks it therefore more than probable, that, in the case related by Heister, the invagination was maintained by the union of the intestine with the corresponding part of the abdominal parietes. Several experiments on living animals have convinced him that this happens, and that the mucous membrane will not unite with the external peritoneal coat. This impossibility of producing an immediate union between the mucous and serous membranes may, of course, be urged as an objection to Ramdohr's practice. Another equally strong objection is, that the upper end of the bowel cannot be put into the lower one, unless it be separated from a part of the mesentery. Here the division of the mesenteric arteries may cause a dangerous bleeding. In vain did Boyer tie seven or eight of these vessels: his patient died with an extravasation in the abdomen. (*Richerand, t. iii. p. 343. 345, ed. 4.*)

Meibius attempted to repeat Ramdohr's operation upon a dog; but he could not succeed in insinuating the upper part of the divided bowel into the lower one, on account of the contraction of the two ends of the intestinal tube, and the smallness of the canal. Meibius, therefore, was obliged to be content with merely bringing the ends of the bowel together with a suture; the animal soon afterwards died of an extravasation of the fæces.

Dr. Smith, of Philadelphia, also tried to repeat Ramdohr's method, but could not succeed. He divided the intestine of a dog transversely, and having inserted a piece of candle into that portion of the bowel, which was supposed to be uppermost, he endeavoured to introduce the superior within the inferior; but the ends became so inverted, that it was found utterly impossible to succeed. The scheme was therefore given up, and only one stitch made, the ligature being then attached to the external wound, in the manner advised by Mr. John Bell. The dog died, and on examination there was found a considerable quantity of fæces, and water in the abdominal cavity.

Two more trials were made of Mr. John Bell's plan by Dr. Smith, on the intestines of dogs: in both instances, the animals died, the intestines being much inflamed, and fæces effused in the abdomen. (See *Dr. Smith's Thesis*.)

Mr. Travers likewise tried the same experiment:—"I divided the small intestine of a dog, which had been for some hours fasting, and carried a fine stitch through the everted edges, at the point opposite to their connection with the mesentery. The gut was then allowed to slip back, and the wound was closed. The animal survived only a few hours.—*Examination*. The peritoneum appeared highly inflamed. Adhesions were formed among the neighbouring folds, and lymph was deposited in masses upon the sides of the wounded gut. This presented two large circular orifices. Among the viscera were found a quantity of bilious fluid and some extraneous substances, and a worm was depending from one of the apertures. By the artificial connection of the edges in a single point of their circumference, and their natural connection at the mesentery, they could recede only in the intervals, and here they had receded to the utmost." In another experiment, Mr. Travers increased the number of points of contact, by placing three single stitches upon a divided intestine, cutting away the threads, and returning the gut. The animal died on the second day.—*Examination*. Similar marks of inflammation presented themselves. The omentum was partially wrapped about the wound; but one of the spaces, between the sutures, was uncovered, and from this the intestinal fluids had escaped. On cautiously raising the adhering omentum, the remaining stitches came into view. Here, again, the retraction was considerable, and the intervening elliptical aperture proportionably large. On the side next to the peritoneum, however, the edges were in contact, and adhered, so as to unite the sections at an angle.

From such experiments, the conclusion drawn by Mr. Travers is, that apposition, at a point, or points, is, as respects effusion, more disadvantageous than no apposition at all; for it admits of retraction, and prevents contraction, so that each stitch becomes the extremity of an aperture, the area of which is determined by the distance of the stitches. (P. 116, 119.) This gentleman, therefore, maintains, *that the absolute contact of the everted surfaces of a divided intestine, in their entire circumference, is requisite to secure the animal from the danger of abdominal effusion.* (P. 121.) The species of suture employed (says Mr. Travers) is of secondary importance, if it secures this contact. (P. 134.) And among other observations, I find "wounds amounting to a direct division of the canal are irreparable, and therefore invariably fatal." (P. 133.)

These inferences do not appear to me satisfactorily established. We are told, that apposition at a point, or points, is, as respects effusion, more disadvantageous than no apposition at all, and that the absolute contact of the divided surfaces, in their entire circumference, is requisite to secure the animal from the danger of abdominal effusion. The foundation of these conclusions is five experiments, made on dogs; in four of which experiments, the divided bowel was brought together with one stitch, on Mr. John Bell's plan, while,

in another, three stitches were made; and yet, in all these instances, the animals died with the contents of the bowels effused. So far the inferences seem established. Unfortunately for their stability, however, Mr. Travers immediately afterwards proceeds to relate other experiments, instituted by Sir Astley Cooper, Dr. Thomson, and Dr. Smith, which, though Mr. Travers seems unaware of the fact, tend most completely to overturn the conclusions, which he had been previously making.

"Sir A. Cooper repeated the experiments of Duverger, who had succeeded in uniting, by suture, the divided intestine of a dog, including in it a portion of the trachea of a calf. In place of the uninterrupted suture, three distinct stitches were inserted. On the sixteenth day, the animal was killed, and the union was complete." (P. 123.)

Here are two facts, proving that a wounded intestine may be united, though the suture was not such as to maintain the divided surfaces in contact, in the whole of their circumference.

Sir Astley Cooper then made the experiment, without including the foreign substance. The animal recovered; being a third fact tending to prove, that the absolute contact of every point of the ends of the divided bowel is not essential to the cure. (See *A. Cooper, On Inguinal and Congenital Hernia*, chap. ii.)

After dividing the small intestine of a dog, Dr. John Thomson, of Edinburgh, applied five interrupted stitches, at equal intervals; the ends of the ligatures were cut off, and the external wound was closed with a suture. This animal did not die of the operation, and, when he was afterwards killed, it appeared that the threads had made their way into the interior of the intestinal canal. Dr. Thomson repeated this experiment, and did not kill the animal till six weeks afterwards, when the same tendency of ligatures to pass into the bowels, and be thus discharged, was exemplified.

These two last cases make five, in proof that the absolute contact of every part of the ends of a divided bowel, is not essential to prevent effusion, or the consequences of the wound from proving fatal; and several other experiments were made by Dr. Smith of Philadelphia, who employed four stitches, with similar success.

So far, then, as the majority of such facts ought to have weight, we are bound to receive the conclusions of Mr. Travers as incorrect and unestablished. I am only surprised, that Mr. Travers himself, who has cited the particulars of all these last experiments, did not perceive, that they struck directly at his own inferences. They are not only irresistible arguments against the conclusion, that the union of a divided bowel requires the contact of the cut extremities in their entire circumference; but they are a plain denial of another position, advanced by this author, viz. that wounds, amounting to a direct division of the canal, are irreparable, and therefore invariably fatal.

With respect to the species of suture being of secondary importance, provided it secure the complete contact of every part of the everted ends of the divided bowel, I regret that Mr. Travers has omitted to institute experiments, in order to prove, that any such suture can be practiced, and, if any body has the ingenuity to apply it, whether

the result would be for or against the conclusions which he has formed. The fact of the sutures always making their way into the cavity of the bowel, and being thus got rid of, appears to me highly interesting, since it shows the safety of cutting away the ends, instead of leaving them hanging out of the external wound, so as to create the usual irritation and inconveniences of extraneous substances. It seems, that Mr. Benjamin Bell first recommended cutting the ends of the ligatures away, and reducing the bowel in this state into the abdomen, as he says, a considerable part of the remainder of the ligature will fall into the cavity of the gut. (*System of Surgery*, vol. ii. p. 128. ed. 7.) We have seen, that the experiments of Dr. Thomson confirm the observation, and those, instituted by Mr. Travers, tend to the same conclusion.

According to the latter writer, the following is the process, by which a divided intestine is healed when sutures are employed:—"It commences with the agglutination of the contiguous mucous surfaces, probably by the exudation of a fluid, similar to that which glues together the sides of a recent flesh wound, when supported in contact. The adhesive inflammation supervenes, and binds down the everted edges of the peritoneal coat, from the whole circumference of which, a layer of coagulable lymph is effused, so as to envelop the wounded bowel. The action of the longitudinal fibres being opposed to the artificial connexion, the sections mutually recede, as the sutures loosen by the process of ulcerative absorption. During this time, the lymph deposited becomes organised, by which further retraction is prevented, and the original cylinder, with the threads attached to it, is encompassed by the new tunica."

"The gut ulcerates at the point of the ligatures, and these fall into its canal. The fissures left by the ligatures are gradually healed up; but, the opposed villous surfaces, so far as my observation goes, neither adhere, nor become consolidated by granulation, so that the interstice, making the division internally, is probably never obliterated." (*Travers, On Injuries of the Intestines*, &c. p. 128.)

Notwithstanding I have carefully read all the arguments, adduced by Mr. Travers in favour of stitching a divided bowel at as many points as possible, I still remain unconvinced of the advantage of such practice, for reasons already suggested. If a case were to present itself to me, in which a bowel, partly cut through, protruded, I should apply only a single suture, made with a small sewing needle, and a piece of fine silk. If the bowel were completely cut across, I should have no objection to attach its ends together by means of two or three stitches of the same kind. I coincide with Mr. Travers, respecting the advantage of cutting off the ends of the ligature, instead of leaving them in the wound, as I believe he is right in regard to the little chance there is of the injured intestine receding far from the wound; and, if the ends of the ligature are then of no use in keeping the bowel in this position, they must be objectionable, as extraneous substances.

As confirming some of the foregoing advice delivered by me on this subject, I refer to the valuable writings of Scarpa, Larrey, and Dr. Hennen. The remarks of Scarpa, and a most convincing

case which occurred to Larrey, in the Egyptian Campaign, to which I allude, being contained in the last edition of the *First Lines of Surgery*, need not here be repeated. "The older practitioners (says Dr. Hennen) were very much averse from leaving any thing to nature in cases of abdominal injuries, although their universal employment of sutures ought to have convinced them, how much she could bear with impunity; for there can be very little doubt, that their uniform performance of the operation of gastrotomy was at least superfluous, if not positively hurtful. In the course of a very extensive practice, two cases only have come under my notice, where it was required to a wounded intestine, though frequently it may be needed for injuries to the parietes." (*On Military Surgery*, ed. 2. p. 411.)

When the protruded intestine is mortified, which must be a very rare occurrence in cases of wounds, the treatment should be the same as that of a mortified enterocoele. (See HERNIA.)

As Dr. Hennen observes, in the treatment of wounds of the abdomen, the violence of symptoms is to be combated more by general means, than by any of the mechanical aids of surgery. The search for extraneous bodies, unless superficially situated, or they can be felt with a probe, is entirely out of the question. "Enlargement, or contraction of the wound, as the case may require, for retarding protruded intestine, securing the intestine itself, and promoting the adhesion of the parts, is all that the surgeon must do in the way of operation; and even in this, the less he interferes the better." (*On Military Surgery*, ed. 2. p. 401.)

The principal indication is to prevent a dangerous degree of inflammation. Hence bleeding and the antiphlogistic treatment are highly indispensable. Let not the surgeon be deterred from such practice by the apparent debility of the patient, his small concentrated pulse, and the coldness of his extremities; symptoms common in acute inflammation of the bowels, and, in fact, themselves indicating the propriety of repeated venesection. Wounds of the small intestines are attended with more dangerous symptoms than those of the large ones. All flatulent, stimulating, and solid food, is to be prohibited. The bowels are to be daily emptied with clysters, by which means, no matter will be suffered to accumulate in the intestinal canal, so as to create irritation and distention.

When excrementitious matter is discharged from the outer wound, it is highly necessary to clean and dress the part very frequently. Gentle pressure should also be made with the fingers, at the circumference of the wound, at each time of applying the dressings, for the purpose of promoting the escape of any extravasated matter. For the same reason, the patient should always lie, if convenient, in a posture that will render the external opening depending.

After a day or two, the surgeon need not be afraid of letting the outer wound heal up; for the adhesive inflammation, all around the course of the wound, will now prevent any extravasated matter from becoming diffused among the viscera. If the case should end well, the intestine generally undergoes a diminution in its diameter at the place where the wound was situated. When this contraction is considerable, the patient occasionally experiences colic pains at the part, especially after

WOUNDS.

eating such food as tends to produce flatulence. As these pains usually go entirely off after a certain time, and no inconvenience whatsoever remains, the intestine may possibly regain its wonted capacity again. A more considerable constriction of the above sort has been known to occasion a fatal misere. Even the intestine itself has been known to burst in this situation, after its contents had accumulated behind the contracted part. Patients, who have recovered from wounds in the intestines, should ever afterwards be particularly careful not to swallow any hard substances, or indigestible flatulent food. On this subject, the writings of Scarpa are particularly interesting.

In some instances, intestinal matter continues to be discharged from the outer wound, either in part or entirely, so that either a fistula, or an artificial anus, is the consequence. A fistula is more apt to follow when an intestine has been injured by a ball, has been quite cut through, or has mortified. But numerous cases prove, that this is not invariably the consequence, and that a perfect cure has frequently followed each of these occurrences. (See ANUS, ARTIFICIAL.)

When an intestine is completely cut through, and the lower portion of the canal lies inaccessiblely concealed in the abdomen, writers insist upon the necessity of promoting the formation of an artificial anus. In this particular case, they recommend fixing the extremity of the intestine, with a fine suture, to the edges of the outer wound. In order to distinguish the upper end of the intestine from the lower, the proposal is sometimes made to give the patient a little milk, and to observe whether the fluid, after a time, issues from the mouth of the protruded gut. In the mean while, fomentations are employed. If the upper end of the intestine be in the abdomen, these speculative authors even deem it justifiable, when the accident is quite recent, to dilate the outer wound, search for the hidden continuation of the bowel, and then sew the two ends together.

Practical surgeons, I believe, are right in attaching little value to such directions. "Indeed (says a modern writer), the surgical world have long since dismissed their fears about the intestine falling inwards, and about the difficulties of distinguishing between the right and the wrong end of it. The apprehensions of abdominal effusions are now all pretty well subdued. The occurrence is extremely rare, and when it does happen, we leave the poor wretch to die in peace, without searching after effused fluids, the nature of which cannot be known, or, if known, the information cannot, in the most remote degree, lead to recovery. I have never witnessed a case where any possible good effects could follow the paracentesis; for peritonitis, in its most exquisite form, has always preceded the symptoms, which would lead to the performance of that operation." (Hennen, *On Military Surgery*, ed. 2. p. 411.)

In some instances, musket-balls pass into the abdomen, lodge there a considerable time, and are then voided through the intestinal canal; while, in other examples, they become encysted, and continue lodged the rest of the patient's life, without producing much, or, indeed, any inconvenience.

Contusions and other Injuries of the Abdomen.—

A violent contusion of the abdomen may injure the contained viscera, without the occurrence of

any external wound. It was in this way, that the liver, or gall-bladder, was ruptured in the boy mentioned by Mr. Fryer (*Med. Chir. Trans.* vol. iv.); that the liver was lacerated in several patients brought to University College Hospital; that the duodenum, and two bladders, contained in the Museum of the same college, were burst; and that the vena cava was lacerated in the case, which fell under the observation of Richerand, where a cart-wheel passed over a child's belly. (*Nosographie Chir.* t. iii. p. 353.) The stomach and intestines, the liver, and the gall-bladder, when inflamed from a blow upon the front of the belly, contract adhesions to the corresponding portion of the parietes, which has been also bruised, and is itself inflamed. When such inflammations suppurate (and, according to Richerand, it is their most usual course), on opening the abscess, the pus is found blended with the matter, which the viscera contain or secrete. Thus, the alimentary matter, and even intestinal worms, have been discharged with the pus on opening certain abscesses, which communicated with the cavity of the stomach or bowels; and bile has been found blended with the matter of abscesses in the right hypochondrium. The frequency of abdominal abscesses from inflammation, consequent to external violence, I should not rate so high as M. Richerand has done.

When, in consequence of a blow upon the anterior part of the belly, the patient experiences in the situation of the injury a deeply seated pain; when a tumour forms, and the symptoms indicate violence done to some of the adjacent viscera; the inflammation is to be opposed by every possible antiphlogistic means. But when, notwithstanding such treatment, the swelling increases and suppurates, the abscess is not to be opened until it is perfectly mature. The inflammatory symptoms which precede its formation, indicate that there is an adhesion between the injured organ and the parietes of the abdomen. Without this adhesion, opening the abscess would be attended with more risk, because the pus or other matter might become extravasated in the cavity of the peritoneum. For the same reason, in the examples of tumours, caused by bile in the gall-bladder, J. L. Petit recommends deferring the operation of opening them, until the inflammatory symptoms evince that an adhesion has taken place between the fundus of the gall-bladder, and the corresponding point of the parietes of the abdomen.

An adhesion of the abdominal viscera to the inner surface of the peritoneum may be induced by other causes, besides the action of contusing bodies. A knife, a fork, a shoemaker's awl, a needle, and other extraneous substances, incapable of passing throughout the alimentary canal, have been known to irritate the stomach or bowel, and to bring on adhesion of them to the parietes of the abdomen, where a tumour has formed, which, on being opened, has discharged the foreign body. The records of surgery abound in facts of this kind. A fistula succeeds the opening of the abscess; the alimentary matter escapes; and, if the aperture admit not of being healed by methodical compression, the intestinal canal between the fistula and the anus contracts; most of the contents of the bowels pass out at the preternatural opening, and the patient falls into a state of marasmus, the more quickly fatal, the

nearer the injury of the intestinal canal is to the stomach.

A long-continued pressure on the epigastric region may cause an adhesion of the stomach to the peritoneum, and suppuration taking place at the part, a fistula, communicating with the cavity of that organ, may be formed, and allow the vicinals to escape externally. (See *Richerand, Physiologie*, t. i. *Chymification: Nosographie Chirurgie*, t. iii. p. 353—356. ed. 4.)

I shall conclude with repeating, that, in the generality of injuries of the abdomen from external violence, whether wounds or contusions, the principal danger depends upon inflammation of the peritoneum. In the treatment, therefore, the most necessary thing is to prevent and oppose this perilous affection. Copious and repeated venesection, the application of leeches, mild aperient clysters, a low fluid diet, perfect rest, fomentations, and the warm bath, are amongst the remedies, which, in such cases, are entitled to praise and confidence.

For information on wounds of the abdomen, see *Playani, Osservazioni*, &c. t. iii. *A. Malavai, Quæstio*, &c. an tennium intestinum vulnus lethale? Paris, 1734. *Wucher, Virgine* per viginti septem annos ventriculorum perforatum habentis Historia et Sectio. Argent. 1743. *Haller, Diss. Chir.* 5—19. *Calisen, Systema Chirur. Modernæ*, t. i. p. 697, &c. ed. 1798. *Isidius, Richerand, Nosogr. Chir.* t. iii. p. 327, &c. ed. 4. *Ivyer, Med. Chir. Trans.* vol. iv. p. 330. *J. Crampson's* Case of Rupture of the Stomach and Escape of its Contents, &c. with Obs. by *B. Travers*, in *Med. and Chir. Trans.* vol. vii. p. 228. &c. *Richter, Anfangsgründe der Wundarzneikunst*, b. v. kap. 1. Discourses on the Nature and Cure of Wounds, by *John Bell*, ed. 3. *L. Nannoux, De Simillium Partium humanarum Corpus constitutum Regeneratione*. Mediolani, 1782. *Encyclopédie Méthodique, Partie Chir.*, art. Abdomen et Intestins. *Dr. Smith's* Inaugural Thesis. *B. Travers*, An Inquiry into the Process of Nature, in repairing Injuries of the Intestines, 8vo. 1812. *J. Hunter*, On Gun-shot Wounds. *Sir A. Cooper's* Work, On Inguinal and Congenital Hernia, chap. 2. fol. 1804. *Sabatier, Médecine Opératoire*, t. i. *Petit, Essai sur les Epanchemens*, et Suite de l'Essai sur les Epanchemens, in *Mém. de l'Acad. de Chir.* Clinical Lecture, by *S. Cooper*, in *Lond. Med. Gaz.* vol. for 1837-8.

For information on wounds in general, see *Cæs. Nagatus, De Rara Medicatione Vulnorum*, seu de Vulneribus raro tractandis, fol. Ven. 1616. *A. Read*, his works, containing: 1. Lectures on Tumours and Ulcers. 2. A Treatise of the First Part of Chirurgery, which teacheth the Reunion of the Parts of the Body, disjointed, and the methodical Doctrine of Wounds, &c. ed. 2. 8vo. Lond. 1630. *Werner, De Vulnerebus absolute et per accidens lethalibus*, Regom. 1650. *J. Bohn, De Resuscitatione Vulnorum*, seu Vulnorum Lethalium, in *Examen*, 12mo. Lips. 1689. *P. Ammannus, Præcis Vulnorum Lethalium*, &c. 12mo. Francof. 1690. *J. Colbatch*, New Light of Surgery, showing a more safe and speedy Way of curing Wounds, than has hitherto been practised, 12mo. Lond. 1695. *Ph. Conr. Fabricius, Programma quo Causa Infrequentius Vulnorum lethaliæ, præ minus lethiferi sexfabrica Corpus humani anatomica, et Situ Partium præcipue eruntur*. Helmstadt. 1753. *John Hunter, A Treatise on the Blood, Inflammation, &c.* *John Bell's* Principles of Surgery, and his Discourses on Wounds. *W. Balfour*, Observations on Adhesion, with Two Cases, demonstrative of the Powers of Nature to reunite Parts, which have been totally separated from the Animal System, 8vo. Edin. 1814. *Larrey, Mém. de Chir. Militaire*. 4 tomes, 8vo. 1812-17. *Mémoires et Prix de l'Académie Royale de Chirurgie*. *Sabatier, Médecine Opératoire. Assiinti, Manuale di Chirurgia*; Milano, 1812. *Richerand, Nosogr. Chir.* ed. 4. *Boyer, Traité des Maladies Chir.* t. i. *Delpech, Précis des Maladies Réputées Chirurgicales*, t. i. *Schwenker, Wahrnehmungen und Chirurgische Schriften*. *Leinhardt, Instruction Seminaire sur l'Art des Pansements*, 8vo. Strasbourg, 1797. Also, *Clinique Chirurg. relative aux Plaies*, 8vo. Strasb. an 6. *Guthrie, On Gun-shot Wounds*, edit. 2. *Jones, On Hemorrhage*. *Wagner, Chirurgische Versuche*, b. ii. p. 290, &c. 8vo. Nürnberg, 1818. *Thompson's* Lectures on Inflammation, 8vo. 1812. And his Report and Obs. made in the Military Hospital at Belgium, 8vo. 1816. *J. Hennen's* Military

Surgery, ed. 2. 8vo. Edin. 1820; and the various works cited in the course of this article, and at the conclusion of that on Gun-shot Wounds.

For information on poisoned wounds, consult *F. Redi, Osservazioni intorno alle Vipere*. Firenze, 1664. *M. Charas, Nouvelles Expériences sur la Vipère*, 4to. Paris, 1669. Also, A Reply to Redi's Letter concerning Vipers, 12mo. Lond. 1673. *Stanford Wolferstan*, Inquiry into the Causes of Diseases in general, &c. Also, of the Venom of Vipers, 12mo. Lond. 1692. *A. Mourreau de Jommes, Monographie du Trigonocéphale des Antilles*, ou Grand Vipère Fer de Lance de la Martinique. Par. 8vo. 1816. *A. Vater et F. Genster, De Antidoto Novo adversus Viperarum Morsum*, presentissimo in Anglia haud ita pridem detecto; Wittemb. 1736. (*Haller, Disp. ad Morb.* 6. 593.) *J. E. Bertrn et J. F. C. Morand, Thesis in hæc verba, ergo Specificum Vipere Morsum Antidotum Alkali Volatile in Haller's Disp.* ad Morb. 6. 611. Paris, 1749. *Catesby's* Hist. of Carolina. *Mead, On Poisons*. *Fopiana, On the Venom of the Vipera*. *Arctel, De Morsura Serpente*, 4to. Upsal, 1762. *Russel, On Indian Serpents*. *Ireland, in Med. Chir. Trans.* vol. ii. *Sir F. Home*, in *Phil. Trans.* 1810. *Sir David Barry*, Exp. Researches on the Influence of Atmospheric Pressure on the Blood in the Veins, &c.; and on the Prevention and Cure of the Symptoms caused by the Bites of Rabid or Venomous Animals; 8vo. Lond. 1826.

WRY-NECK. (*Caput Optimum; Torticollis.*) An involuntary and fixed inclination of the head towards one of the shoulders; a disorder not spoken of by the ancients. It should not be confounded with a mere rheumatic tension and stiffness of the neck, nor with the faulty position of the head, arising from deformity of the cervical vertebra.

Tulpius, about the middle of the seventeenth century, recorded the cure of a boy, twelve years old, who, from his earliest infancy, had had his head drawn down towards the left shoulder, by a contraction of the scalenus muscle. Fomentations were applied in vain. The head could not be brought into the right posture, even with the aid of steel collars. A consultation was therefore held, in which it was decided to put the boy under the care of Minnius, a surgeon who had performed several operations with success in similar cases. A large eschar was first made with caustic; and the muscle which drew the head to one side, was then divided with a knife. Tulpius, who has left a very confused account of the operation, observes that it was performed with great slowness, and circumspection, for fear of wounding the carotid artery, and jugular vein. Considering the relation of the scalenus muscle to the phrenic nerve, it seems to me impossible to credit the foregoing statements, and, if any muscle was divided, it must have been the mastoid.

Job a Meecken also treats of the operation for the cure of a wry-neck. He states, that he had seen it performed on a boy fourteen years old. The tendon of the sterno-cleido-mastoideus muscle was skilfully divided with one stroke of a sharp pair of scissors, by a surgeon named Flurians, and as soon as the incision had been made, the head resumed its right position. (*Obs. Med. Chir.* c. 33.) Mr. S. Sharp believed, that the wry-neck mostly arose from a contraction of the sterno-cleido-mastoideus muscle, which he proposed the division of whenever the disorder seemed to proceed from this kind of cause. However, he made an exception of cases, in which the disorder had existed a considerable time, or from infancy. He remarks, that, if the cervical vertebrae have grown in a distorted direction, the position of the head cannot be rectified. With these restrictions, the following is the operation which he recommends—a transverse incision is to be made through the skin and

fat, of a size somewhat more extensive than the breadth of the muscle, and about one third of its length from the clavicle. A probed razor is then to be passed underneath the muscle, and to be drawn out, so as to make the requisite division of the part. After the incision has been made, Mr. Sharp recommends the wound to be filled with dry lint, and to be always dressed in a way best calculated to keep the extremities of the muscle from growing together again. For this purpose, he directs the cut ends to be separated from each other as much as possible, with the assistance of a bandage to support the head, during the whole time of the cure, which, he says, will generally be about a month. (*On the Operations of Surgery*, chap. 35.)

According to Mr. Sharp's account, this operation ought to be common. However, if attention be paid to the nature and causes of the disease, and to the differences, resulting from whether the disorder be recent, or of long standing; constant, or periodical; idiopathic, or sympathetic; dependent on spasm, or merely on paralysis of the antagonist muscles; and lastly, if it be recollected, that the affection may be produced by other muscles, besides the sterno-cleido-mastoideus, it will appear, that cases, in which the foregoing operation can be judiciously undertaken, are not frequent.

Perhaps, the most prudent method of operating, is to divide the clavicular portion of the contracted muscle, near the clavicle, and even to cut out a sufficient piece to remove all chance of the two ends uniting again. This step would weaken the muscle considerably, and, perhaps, might answer every purpose. It might easily be accomplished, by means of a director, and curved bistoury, after making the requisite division of the skin with a common scalpel. Were this proceeding to produce only partial amendment, the sternal portion of the muscle might afterwards be divided. A director should be passed under it, and the division made with the probe-pointed curved knife. In operating on a female patient, it might be advisable, with the view of avoiding a large scar, to make only a puncture, and pass the knife flatly against, and close behind the sternal portion of the muscle, the posterior part of which could be divided by then turning the edge of the instrument forwards. In this manner, Dupuytren operated in one instance with success. (*See Quarterly Journ. of Foreign Med.* No. xx. p. 623.)

Any cause, destroying the equilibrium between the sterno-cleido-mastoidei muscles, will produce a wry-neck. Thus, when one of them is affected with spasm, and acts more forcibly than the other, it draws the head towards the shoulder of its own side; but when one sterno-cleido-mastoideus is paralytic, while the other retains only its natural power, the balance of action is equally destroyed, and the sound muscle inclines the head towards the nearest shoulder. In paralytic cases, electricity (*Phil. Trans.* vol. lxxviii. p. 97; *Gilby*, in *London Med. Journ.* vol. iv. 1790.), blisters, stimulating liniments, the shower-bath, sea-bathing, issues, setons, the application of moxa, or the nitrate of silver over the part, the cautious external use of strychnia, and attention to the health in general, are the means affording the best chances of relief.

Although a wry-neck sometimes depends on

the state of the sterno-cleido-mastoidei muscles, it is frequently owing to a shortening of the integuments. M. Louis often successfully divided contractions of the skin, which had kept the head drawn to one side for many years, and had been occasioned by burns. Some of these contractions, he says, might easily have been mistaken for a part of the sterno-cleido-mastoideus itself. See *BURNS*.

Mr. Gooch relates a case of wry-neck, which was caused by a contraction of the platysma myoides muscle. The patient was a young gentleman, fourteen years of age, who had always enjoyed very good health in every other respect. For several months his head had been strongly drawn to one side by a constant contraction of the platysma myoides muscle, which was exceedingly rigid, especially about its insertion at the basis of the jaw; and from the angle of the os maxillare inferius to the chin, the skin presented an appearance like that of the cicatrix of a burn. The same side of the face, quite from the point of the chin, was much shrunk, and distorted by the contraction of the muscle; and the corner of the mouth, in particular, was so drawn to one side and downwards, when the patient turned his head, that a vast deal of deformity was the consequence. From the inferior part of the eyebrow, at the internal angle of the eye, to near the top of the head, there was a kind of furrow upon the skin, about half an inch broad, with a shining, polished appearance, like the cicatrix of a wound, and destitute of hair, which had fallen off. From the corner of the eye downwards, there was the same kind of appearance in a less degree. The patient was subject to repeated attacks of spasm, which began at the insertion of the muscle, and terminated at the eye, attended with a great deal of pain. The ear and also the temporal and frontal muscles were sometimes affected in a similar manner. The parts in the course of the insertion of the muscle into the jaw-bone were considerably thickened, without being in the least inflamed externally, and when touched, but not stretched, they were little painful. The subjacent muscles did not seem at all affected.

It appears from the account given by Mr. Gooch, that, in the treatment of this affection, every known means had been tried, by the advice of the most eminent practitioners, but without effect. Mr. Gooch determined to try what benefit would be produced by the division of the muscle. He first divided the integuments a little below the jaw, and thus exposed the whole breadth of the platysma myoides muscle, the fibres of which seemed to be in a state of violent extension, especially when the patient's head was inclined towards the opposite side. Mr. Gooch then divided the muscle completely across, by a very careful dissection, until the fasciæ of the subjacent muscles were exposed. The patient was then directed to turn his head towards the opposite side, and Mr. Gooch had the satisfaction of observing, that the patient could perform this motion, without the face and corner of the mouth being affected, as they used previously to be. The wound was treated in the ordinary way, and no particular symptoms arose. As soon as the inflammation had subsided, the patient was directed frequently to move his head about, in order to prevent any kind of stiffness, which might ensue from the contraction of the

muscular fibres, and the inelasticity of the cicatrix. The patient was perfectly relieved by the foregoing operation, and had no return of the painful spasms, to which he had been previously subject. The side of his face, however, never recovered its proper degree of plumpness. (*Chir. Works of B. Gooch*, vol. ii. p. 1.)

I lately visited an elderly gentleman, who was afflicted with a wry-neck, for which several of the most eminent surgeons had been consulted; but they did not advise an operation, nor were any of their prescriptions of service. The case was complicated with a constant, tremulous motion of the head, and great weakness and unsteadiness of the upper extremities, so that the patient could not hold a glass or cup to his mouth, without using both hands for the purpose. Here, it is manifested the disorder was not restricted to any particular muscle, and consequently that an operation could have afforded no relief.

Whenever an attempt is made to cure a wry-neck, by dividing any of the muscles, or merely the integuments, it becomes necessary to take some measures, afterwards, for keeping the head in a proper position, during the treatment of the wound, lest, in consequence of the head inclining in the direction, in which it was before the operation, the divided parts should grow together again, and bring the patient into the same condition, in which he was before any thing had been done. With the view of preventing this unpleasant circumstance, Mr. Sharp recommends filling the wound with lint, and making it suppurate. Mr. B. Bell, on the other hand, advises the employment of a proper machine for keeping the head in a due position. Some writers think the use of a bandage sufficient for the purpose. In Dupuytren's case, the cut edges of the muscle were kept asunder by depressing the clavicle, and inclining the head to the opposite side. The first object was fulfilled by holding the hand on the same side as the operation firmly to the foot, the knee being bent; the last, by means of a roller, applied round the head, and under the axilla of the opposite side. (See *Quarterly Journ. of Foreign Med.* No. xx: p. 623.) Sometimes, the removal of a small portion of the affected muscle may be necessary in the operation.

I have never seen an instance, in which the division of the mastoid muscle was considered advisable; and I observe, that Mr. Liston expresses his belief, that such operations are not likely to be followed by much advantage. (See *Elem. of Surgery*, part ii. p. 292.)

Boyer met with a paralysis of the extensor muscles of the head, attended with a constant approximation of the chin to the sternum. The disease resisted every plan of treatment, and an apparatus for supporting the head was the only thing found of any use. (See *Traité des Mal. Chir.* t. vii. p. 61. 8vo. Paris, 1821.)

M. Andral records an instance of the transformation of the right sterno-mastoid muscle, through morbid action, into a fibrous structure, perfectly resembling the broad tendon at its lower part. The patient had been afflicted many years with a permanent contraction of

the left sterno-mastoid muscle, had long been compelled to keep the right one in a state of perfect inactivity. (See *Anat. Pathol.* t. i. p. 274. 8vo. Paris, 1829.)

Sharp, on the Operations, chap. 35. *Blasius*, Obs. Med. Rar. p. 2. No. 1. cure effected by operation. *Mansueti*, De Capitis Obstituto. Tub. 1787. *Chirurgical Works of B. Gooch*, vol. ii. p. 81. *A. Bell's System of Surgery*. *Roonhuyzen*, *Heylicuren*, p. 1. No. xxii. and xxxiii.: successful operation. *Encyclopédie Méthodique*, Partie Chirurgicale. t. ii. art. *Torticollis*. *Joh. Christ. Gottfr. Jörg*, über die Verrückungen des Menschlichen Körpers, und eine rationelle und sichere Heilart derselben; Leipzig, 1810. The ingenious apparatus, recommended by this author, is described and engraved in the "First Lines of the Practice of Surgery," ed. 5. *Baron Boyer*, *Traité des Mal. Chir.* t. vii. p. 48, &c. 8vo. Paris, 1821. *Andral*, *Anat. Pathol.* t. i. p. 274. 8vo. Paris, 1820.

ZINC. The preparations of this metal are of considerable use in surgery. With respect to the sulphate of zinc, it may be said to be generally the best emetic, in cases where it is desirable to empty the stomach without the least delay, as in cases of poison, for which purpose, the common dose is ℥j. "As an external application, this salt dissolved in rose-water, in the proportion of gr. iiss. to ʒj. of rose-water, forms an excellent collyrium in the latter stage of ophthalmia, after the inflammatory action has subsided; it is a good injection in a similar stage of gonorrhœa: and a lotion in some kinds of superficial inflammations. Of double strength, this solution is the best application that can be used in scrofulous tumours, after they have suppurated, and the abscess has been discharged." (*A. T. Thomson*, *London Dispensatory*, ed. 2, p. 559.) A gargle of sulphate of zinc is often advisable for ulcerations of the mouth, tongue, or throat. R. *Zinci Sulphatis* ℥j. *Aq. Rosæ* ʒviij. *Oxymellis* ʒj. M. ft. *Gargarisma* frequenter utendum. The unguentum zinci, composed of an ounce of the oxide of zinc, and six ounces of prepared lard, is an useful astringent, mildly stimulant application; and is frequently employed in various cutaneous diseases, sore nipples, and chronic inflammation of the conjunctiva of the eyelids.

Both in scirrhus and medullary cancer, albumen is the principal component of the new adventitious substance. In a paper, inserted by Dr. Ure, in the *Med. Gaz.* of Dec. 1835, it was shown that chloride of zinc (a means employed by Dr. Canquoin, of Paris, in the treatment of cancer) has a very powerful affinity for albumen; and Dr. Ure ascribes a part of its efficacy in eradicating the ultimate ramifications of cancerous tumours to its powerful action on albumen. "In this way (he thinks) numerous minute points, undetectable by the surgeon, and inaccessible to his knife, are searched out and destroyed." The cases, to which the chloride of zinc seems to him best adapted, are subcutaneous and cutaneous cancers, and cases of *noli me tangere*. To its great use in destroying the tubercles, which form in the latter disease, I can bear testimony, having tried it with great success in several instances. Dr. Ure prefers a paste composed of one part of chloride of zinc, and of two parts of recently calcined sulphate of lime. Dr. Canquoin mixes the chloride of zinc with flour. (See *Lond. Med. Gaz.* vol. xviii. p. 287.)

